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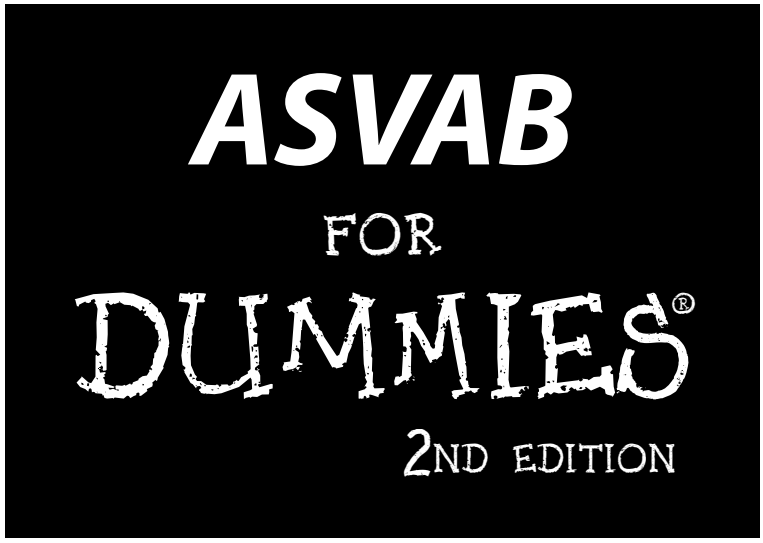
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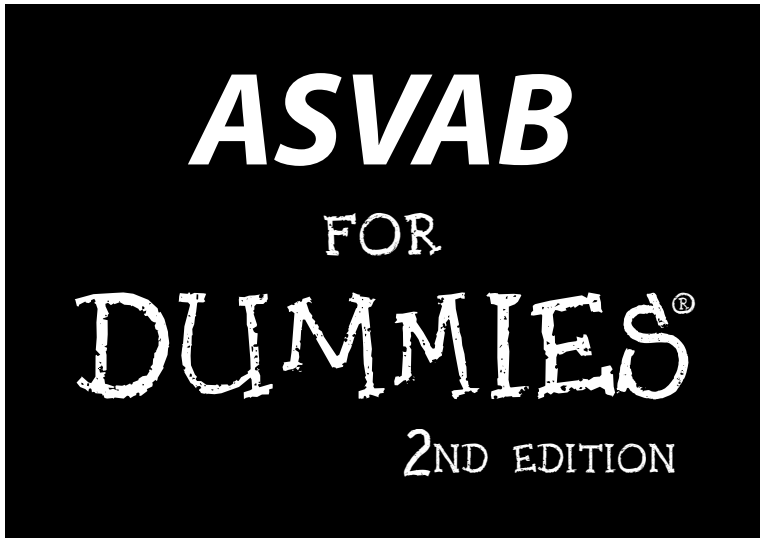
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ASVAB For Dummies®, 2nd Edition
Published by
Wiley Publishing, Inc.
111 River St.
Hoboken, NJ 07030-5774
www.wiley.com

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Published simultaneously in Canada

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Library of Congress Control Number: 2007925977

ISBN: 978-0-470-10671-6

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1



About the Authors

Rod Powers joined the United States Air Force in 1975 intending to become a spy. He was devastated to learn that he should've joined the CIA instead because the military doesn't have that particular enlisted job. Regardless, he fell in love with the military and made it both a passion and a career, retiring with 23 years of service. Rod spent 11 of those years as a first sergeant, helping to solve the problems of the enlisted corps.

Since his retirement from the military in 1998, Rod has become a world renowned military careers expert. Through his highly popular U.S. Military Information Web site on About.com (`http://usmilitary.about.com`), Rod has advised thousands of troops about all aspects of the U.S. Armed Forces career information.

Rod is the proud father of twin girls, both of whom enjoy successful careers in the United State Air Force. Rod currently resides in Daytona Beach, Florida, where he attempts to prove that there's no such thing as too much sunshine. Even today, Powers tries to run his life according to long-lived military ideals and standards, but he gets a bit confused about why nobody will obey his orders anymore.

Jennifer Lawler has published nearly 20 books on topics ranging from country music to kick-boxing. One of her books, *Martial Arts For Dummies,* was published by Wiley. A former college English teacher, she taught test-prep skills to students before leaving the teaching profession to become a full-time writer — not that teaching made her tear her hair out or anything.

Lawler never made it to boot camp, but she can do more pushups than a lot of people her age. She teaches martial arts to children with special needs and lives with her daughter and two rambunctious dogs.

Dedication

To Jeanie and Chrissy — because everything is for you. Always.

— Rod Powers

Authors' Acknowledgments

The authors want to thank SFC Thomas Johnson, test control officer/guidance counselor for the Indiana Army National Guard, for reviewing the final manuscript for technical accuracy. We would also like to thank Brian "Chip" Anderson, math teacher extraordinaire, for editing the math chapters and reminding us how to solve for *x*.

Special thanks goes out to Tracy Boggier, our Acquisitions Editor; Kristin DeMint, our wonderful Project Editor; and our top-notch Copy Editor, Carrie Burchfield, who dotted our i's and crossed our t's.

Finally, we send more special thanks to the recruiting commands of the United States Army, Air Force, Navy, Marine Corps, and Coast Guard for providing invaluable resource information.

Publisher's Acknowledgments

We're proud of this book; please send us your comments through our Dummies online registration form located at www.dummies.com/register/.

Some of the people who helped bring this book to market include the following:

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Introduction

If you're reading this book, there's a very good chance that you want to join the United States military. Perhaps it's been your lifelong dream to drive a tank, fire a machine gun, or blow things up (legally). Maybe you've always wanted to learn how to cook for 2,000 people at a time. Possibly you were attracted to the military because of education and training opportunities, the chance of travel, or huge enlistment bonuses.

In any event, by now you've discovered that you can't just walk into a recruiter's office and say, "Hey, I'm here. Sign me up!" You've found out that the military requires you to pass an entrance exam. Gone are the good old days when the entrance exam consisted of "Is he breathing?" These days you have to pass something called the *ASVAB*.

The ASVAB (short for Armed Services Vocational Aptitude Battery) is unlike any test you've ever taken. Sure, the test covers standard academic areas, such as math and English, but it also measures your knowledge of other areas, such as mechanics, electronics, science, and assembling objects. When was the last time your high school or college professor tested you on putting a jigsaw puzzle together?

The good news is you need to do well on some of the subtests but not all of them. (When was the last time you heard someone say, "Don't bother studying for *that*"?) But we can't tell you which subjects and subtests are most important for your preparation. It's a highly classified military secret. Okay, not really. The order of importance of the subtests depends on you and your career goals. You find out what you need to know to do well on all the subtests and then get the info to determine which subtests are important to you.

We include charts and tables in this book to help you figure out the subtest scores that individual military jobs require (see the Appendix). In fact, this study guide is the first to include this information. So you can use *ASVAB For Dummies,* 2nd Edition, to ace the subtests that make up the ASVAB *and* determine what subtests are important for your military-career goals.

About This Book

The paper versions of the ASVAB have eight subtests, and the CAT-ASVAB has nine, each of which are covered in its own chapter in this book. This book shows you what to expect on each subtest, offers strategies and tactics for studying each subject area, gives you test-taking (and guessing) tips, and provides three full-length sample tests that help you determine your strengths and weaknesses. These sample tests also help you prepare mentally for taking the real test — you can use them to get in the zone. We've thrown in an extra test, covering the four most important subtests of the ASVAB that make up the AFQT score (covered in Chapter 1) at no extra cost.

Although much of the material covered on the ASVAB is taught in practically every high school in the country, you could've slept through part of the info or performed a major brain-dump as soon as the ink was dry on your report card. So you also get some basic review of the relevant subject areas to help refresh your memory and include pointers on where to find more information if you need it.

Conventions Used in This Book

The following conventions are used throughout the text to help point out important concepts and to help make the text easier to understand:

- All Web addresses appear in `monofont`. ***Note:*** Some Web addresses may extend to two lines of text. If you use one of these addresses, just type the address exactly as you see it, pretending that the line break doesn't exist.
- New terms appear in *italic* and are closely followed by an easy-to-understand definition.
- **Bold** text highlights important points and the action parts of numbered steps or processes.

What You're Not to Read

This book has a number of sidebars (the shaded gray boxes) sprinkled throughout. They're full of interesting information about the ASVAB, but you don't have to read them if you don't want to — they don't contain anything you simply *must* know in order to ace the test.

You also run across special icons, titled *Technical Stuff,* from time to time. These sections include concise, detailed information (interesting but unessential) about the topic at hand, but the info probably can't help your ASVAB scores. You can safely skip these tidbits, if you wish.

If you're taking the ASVAB for the purpose of enlisting in the U.S. Military, you may even wish to skip entire chapters, depending on your military career goals. For example, if the military careers you're interested in don't require a score on the General Science subtest, you may wish to skip that chapter and concentrate your study time on chapters that are required for your particular job choices. For more about scores and how they relate to military job eligibility, check out Chapter 2 and the Appendix.

Foolish Assumptions

While revising this book, we made a few assumptions about you — namely, who you are and why you picked up this book. We assume the following:

- You aren't a dummy. You just need a little help in passing the ASVAB.
- You may be a nervous test taker and have come here for help with test-taking tips and other helpful information.
- You want a chance to take a few ASVAB practice tests to measure your current knowledge in various subject areas in order to help you develop a study plan.
- You want the military job of your dreams and passing the ASVAB (or certain sections of it) is of utmost importance.

How This Book Is Organized

There is a method to the madness . . . a reason why this book is organized the way you see it today. We've organized this book according to subject matter. Material having to do with words is all grouped together, material having to do with math is all grouped together, and so on.

This book is *not* organized to reflect the order in which the subtests appear on the actual ASVAB — rather, we organized it in the most logical fashion to help you study. For the order of the tests on the ASVAB, check out the Cheat Sheet in the front of this book or in Chapter 1.

Part I: Forewarned is Forearmed: Understanding the ASVAB

If you have no clue as to how the ASVAB is organized or what it covers, turn to this part. This part also tells you how scores are calculated and how the military bigwigs use the scores to determine whether you qualify to join the military and what jobs you qualify for. Chapter 3 also contains some great study and test-taking tips.

Part II: Words to Live By: Communication Skills

If you already know that you need help on a particular language arts-related subtest, turn to Part II where you can pump up your vocabulary and reading comprehension skills.

Part III: All's Fair in Math and War: Arithmetic Skills

Maybe math wasn't your best subject in school. Maybe you love math, but you've forgotten all of those equations. In either case, this section is all about math. So if you know that you need to bone up on your mathematical skills, flip to Part III.

Part IV: The Whole Ball of Facts: Technical Skills

If you're interested in pursuing a military job that emphasizes science and technology (see the Appendix of this book), and you want to make sure that you're going to nail the corresponding sections of the ASVAB, turn to Part IV.

Part V: Practice ASVAB Exams

This part gives you three different tests to figure out what areas you need to brush up on. Each test is a full-length sample test. Take the first one, and after that, check your answers, and then you can determine which subtests are a piece of cake for you and where you need the most help. Taking this approach lets you tailor a study plan to your individual needs. (Even if you don't have a lot of time for studying, taking the sample tests helps you prepare for the real ASVAB exam.)

Part VI: The Part of Tens

This book is a *For Dummies* book, so it's not complete without a Part of Tens. If you want to get right down to it and find out some of the most important information for doing well on the ASVAB and you like your info presented in easily digestible lists, turn to Part VI. This part gives you test-taking tips and directs you to additional resources if you need them.

If you want to check out different military jobs and see which subtests you need to do well on, turn to the Appendix. It shows you what subtest scores different military careers require.

Icons Used in This Book

Throughout this book you find icons that help you use the material in this book. Here's a run-down on what they mean to you:



This icon alerts you to helpful hints regarding the ASVAB. Tips can help you save time and avoid frustration.



This icon reminds you of important information you should memorize (or at least read carefully).



This icon flags information that may prove hazardous to your plans of conquering the ASVAB. Often, this icon accompanies common mistakes or misconceptions people have about the ASVAB or questions on the ASVAB. Pay special attention to the Warning icon so you don't fall into one of the many pitfalls designed by the ASVAB creators.



This icon points out information that is interesting, enlightening, or in-depth but info that isn't necessary for you to read. You may or may not find these concepts on the ASVAB, but knowing the info may make you a better-informed test taker.



This icon points out sample questions that appear in the review chapters.

Where to Go from Here

You don't have to read this book from cover-to-cover in order to score well on the ASVAB. People have different strengths and weaknesses and the format of this book is designed to read in the manner that best suits you. You may be a wiz in math and choose to skip the math sections entirely and use your study time in areas you feel you need to improve.

If you do choose to skip chapters, we highly recommend you skim through those chapters anyway, taking note of Tip, Warning, and Remember icons, because these morsels of info include important factors for your ASVAB score.

We suggest that you begin with Chapters 1 and 2, however. That way you can get a feel for how the ASVAB is organized (along with the most up-to-date changes on the test) and what particular subtests may be important for the military service branch and job of your choice. This plan of attack helps you set up logical and effective goals to maximize your study efforts.

You may wish to start by taking one of the practice tests in Part V. By using this method, you can discover which subjects are easier and which subjects you need to work on. If you choose this technique, you can use the other practice tests to measure your progress after reading through and studying the subject chapters.

No matter where you start, we wish you luck on taking this test, and if you're one of the folks who wants to join the military, we hope your journey is successful!

Part I

Forewarned Is Forearmed: Understanding the ASVAB



"Excuse me. I'm a dog. Can I still take the CAT-ASVAB?"

In this part . . .

An ancient military proverb goes something like this: "Understand your enemy, and you will avoid getting shot in the buttocks." Okay, that's not a real ancient military proverb. (In fact, we just made it up.) The point is that understanding how the ASVAB is organized, how it's scored, and what those scores mean to you and your potential military career, help you study for this nine-part test more efficiently.

Even if you can't control yourself and you want to jump right in by reviewing the principles of algebra and memorizing word lists, chill out and take a few minutes to read through Part I. This part gives you an overview of the ASVAB, describes what each part of the exam tests, tells you when and where to take the test, and fills you in on how the scores are calculated. We even throw in some proven study techniques and test-taking strategies at no extra cost.

Chapter 1

The ASVAB in a Nutshell

In This Chapter

- Checking out the different versions of the ASVAB
- Figuring out what each subtest covers
- Computing the Armed Forces Qualification Test (AFQT) score
- Taking the ASVAB again

The Armed Services Vocational Aptitude Battery (ASVAB) consists of nine individual tests that cover subjects ranging from general science principles to vocabulary. Your ASVAB test results determine whether you qualify for military service (that part is so important it has its own name — the AFQT) and, if so, what jobs you qualify for. The ASVAB isn't an IQ test. The military isn't trying to figure out how smart you are. The ASVAB specifically measures your ability to be trained to do a specific job.

The famous Chinese General, Sun Tzu said, "Know your enemy." In order to develop an effective plan of study and score well on the ASVAB, it's important to understand how the ASVAB is organized and how the military uses the scores from the nine subtests. This chapter describes the different versions of the ASVAB, the organization of the subtests, how the AFQT score is calculated, and the various service policies for retaking the ASVAB.

An ASVAB by Any Other Name: Different Faces of the ASVAB

The ASVAB comes in many flavors, depending on where and why you take it. You would think that after more than 25 years in existence, the test could've been whittled down to one single version by now. But don't get too confused about the different versions, though. The bullets that follow boil down to choices:

- **Institutional version:** You take this pencil-and-paper version of the ASVAB as a junior or senior in high school; it's administered through a cooperative program between the Department of Education and the Department of Defense at high schools all across the United States (U.S.).

  Although the results of this version can be used for military enlistment purposes (if taken within two years of enlistment), its primary purpose is to provide a tool for high school guidance counselors to use when recommending possible civilian career areas to high school students. For example, if a student scores high in electronics, the counselor can recommend electronic career paths. If a student is interested in military service, the counselor then refers her to the local military recruiting offices.

- **Production version:** If you take the ASVAB through a military recruiter, you're taking the production version. This version of the ASVAB is used by all of the military branches for the sole purpose of enlistment qualification and to determine which military jobs a recruit can successfully be trained in. The production version is available in two formats: paper and computerized. The vast majority of applicants are processed

through a Military Entrance Processing Station (MEPS), where they take the computerized version of the ASVAB (called the CAT-ASVAB, short for *computer-adaptive testing ASVAB*), undergo a medical physical, and run through a security screening all in one trip. However, in a few cases, testers are offered the paper version, which is given by MEPS personnel at several remote testing sites throughout the U.S.

- **Computer Adaptive Screening Test (CAST) or Enlistment Screening Test (EST):** These tests are sort of mini-ASVABs you may take in the recruiter's office. The EST and CAST aren't qualification tests; they're strictly recruiting tools. These tests are management screening tools that may be administered at the discretion of the recruiter. The EST and CAST contain questions similar to, but not identical with, questions appearing on the ASVAB. They're used to help estimate an applicant's probability of obtaining qualifying ASVAB scores.



If you take one of these mini-tests and score low, you probably don't want to take the actual ASVAB until you've put in some extensive study time (and this book can help with that).

- **Armed Forces Classification Test (AFCT):** This version is given in-house to those people already in the military. At some point during your military career, you may wish to retrain for a different job. If you need higher ASVAB scores to qualify for such retraining, you can take the AFCT. Except for the name of the exam, the AFCT is exactly the same as the other versions of the ASVAB. This version is currently available only in pencil-and-paper format, but the military plans to replace it with a computerized version in the near future.

Mapping Out the ASVAB Subtests

The computerized format of the ASVAB contains nine separately timed subtests. The paper format of the test only has eight subtests. The Assembling Objects (AO) subtest isn't included on any of the paper versions (for information on the AO subtest, see Chapter 14). In Table 1-1, the nine ASVAB subtests are outlined in the order that you take them; you can also see what chapters to turn to when you want to review that content.

Table 1-1 The ASVAB Subtests in Order

Subtest	*Questions*	*Time (Minutes)*	*Content*	*Chapter*
General Science (GS)	25	11	General principles of biological and physical sciences	Chapter 10
Arithmetic Reasoning (AR)	30	36	Simple word problems that require simple calculations	Chapter 7
Word Knowledge (WK)	35	11	Correct meaning of a word; occasionally antonyms (words with opposite meanings)	Chapter 4
Paragraph Comprehension (PC)	15	13	Questions based on several paragraphs (usually a few hundred words) that you read	Chapter 5
Mathematics Knowledge (MK)	25	24	High-school math, including algebra and geometry	Chapter 8
Electronics Information (EI)	20	9	Electrical principles, basic electronic circuitry, and electronic terminology	Chapter 13

Subtest	*Questions*	*Time (Minutes)*	*Content*	*Chapter*
Mechanical Comprehension (MC)	25	19	Basic mechanical and physical principles	Chapter 12
Auto & Shop Information (AS)	25	11	Knowledge of automobiles, shop terminology, and tool use	Chapter 11
Assembling Objects (AO)*	16	15	Spatial orientation	Chapter 14

**Only included on the CAT-ASVAB*

The AFQT: Your Most Important Score

The ASVAB doesn't have an overall score. When you hear someone say, "I got an 80 on my ASVAB," that person is talking about the Armed Forces Qualification Test (AFQT) score, not an overall ASVAB score. The AFQT score determines whether you qualify to even enlist in the military, and only four of the nine subtests are used to compute it: Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, and Mathematics Knowledge.

Doing well on some of the other subtests is a personal-choice type of issue. Some of the subtests are used only to determine the jobs you qualify for. (See Chapter 2 for more information on how the military uses the individual subtests.) So you have to figure out which areas to focus on based on your career goals. Here's an example: If you're not interested in a job requiring a score on the Mechanical Comprehension subtest, you don't need to worry about doing well on that subtest. So, as you're preparing for the ASVAB, remember to plan your study time wisely. If you don't need to worry about mechanical comprehension, don't bother with that chapter in this book. Spend the time on word knowledge or arithmetic reasoning.

Tracing the testing trail

In 1948, Congress made the Department of Defense develop a uniform screening test to be used by all the services. The Defense Department came up with the Armed Forces Qualification Test (AFQT). This test consisted of 100 multiple-choice questions in areas such as math, vocabulary, spatial relations, and mechanical ability. The military used this test until the mid-1970s. Each branch of the service sets its own minimum score.

When the military decides to do something, it often acts with the lightning speed of a snail carrying a backpack. In the 1960s, the Department of Defense decided to develop a standardized military selection and classification test and administer it in high schools. That's where your old buddy, the ASVAB, came from. The first ASVAB test was given in 1968, but the military didn't use it for recruiting purposes for several years. In 1973, the draft ended and the nation entered the contemporary period in which all military recruits are volunteers. In 1976, the ASVAB became the official entry test used by all services.

The ASVAB remained unchanged for several years until in 1980 when the ASVAB underwent its first revision. The subtest areas remained the same, but several of the questions were updated to keep up with changes in technology.

In 1993, the computerized version was released for limited operational testing, but it didn't begin to see widescale use until 1996. The questions on the computerized version of the ASVAB were identical to the questions on the paper version. It wasn't until the end of 2002 that the ASVAB finally underwent a major revision. Two subsets (Coding Speed and Numerical Operations) were eliminated and a new subtest (Assembling Objects, Chapter 14) was added to the computerized version. Also during the 2002 revision, all of the questions were updated, and the order in which the subtests were given was changed. The revised ASVAB was first rolled out in the computerized format, and the paper versions of the test were updated during the next year.



If you don't know what kind of job you want to do in the military, the ASVAB helps you and the military determine your potential ability for different types of jobs. If you're in this situation, review all the chapters in this book, brushing up on the basic principles of everything from science to electronics, but focus on the four subtests that enable you to qualify for enlistment: Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, and Mathematics Knowledge. Following this plan ensures a relatively accurate appraisal of your aptitude for various military jobs.

Interpreting the Multitude of Scores

The Department of Defense is an official U.S. Government agency, so (of course) it can't keep it simple. When you receive your ASVAB score results, you won't see just one score; you'll see several. Figure 1-1 shows an example of an ASVAB score card used by high school guidance counselors. (For those people who take the institutional version — see "An ASVAB by Any Other Name: Different Faces of the ASVAB" for details.)

ASVAB Summary Results Sheet

ASVAB Results	Percentile Scores: 11th Grade Females	11th Grade Males	11th Grade Students	11th Grade Standard Score Bands (20 30 40 50 60 70 80)	11th Grade Standard Score
Career Exploration Scores					
Verbal Skills	62	64	63	X	55
Math Skills	44	45	45	X	46
Science and Technical Skills	66	43	54	X	51
ASVAB Tests					
General Science	56	43	49	X	49
Arithmetic Reasoning	36	34	35	X	44
Word Knowledge	75	74	75	X	57
Paragraph Comprehansion	44	56	50	X	51
Mathematics Knowledge	49	56	53	X	48
Electronics Information	77	52	65	X	53
Auto and Shop Information	68	35	51	X	48
Mechanical Comprehension	76	48	62	X	52
Military Entrance Score (AFQT) 39				20 30 40 50 60 70 80	

Figure 1-1: A sample ASVAB score card used by high-school guidance counselors.

Figure 1-2 depicts an example of an ASVAB score card used for military enlistment purposes.

So, what do all these different scores actually mean? Check out the following sections to find out.

Defining all the scores

When you take a test in high school, you usually receive a score that's pretty easy to understand — A, B, C, D, or F. If you do really well, the teacher may even draw a little smiley face on the top of the page. If only your ASVAB scores were as easy to understand.

SAMPLE CAT-ASVAB TEST SCORE REPORT

Testing Site ID: 521342 Service: AF

Testing Session: Date: 2007/02/24 Starting Time: 15:30

Applicant: Jane P. Doe SNN: 333-33-3333

Test Form: 02E Test Type: Initial

Standard Scores:	GS	AR	WK	PC	MK	EI	AS	MC	AO	VE
	63	59	60	52	56	81	64	62	52	58

COMPOSITE SCORES:

Army:	GT	CL	CO	EL	FA	GM	MM	OF	SC	ST
	118	121	128	130	127	132	134	129	128	125

Air Force:	M	A	G	E
	91	76	83	96

Navy/CG:	GT	EL	BEE	ENG	MEC	MEC2	NUC	OPS	HM	ADM
	117	259	234	120	185	173	235	225	177	114

Army:	MM	GT	EL
	139	122	134

SAMPLE CAT-ASVAB TEST SCORE REPORT

Figure 1-2: A sample ASVAB score card used for military enlistment purposes.

In the following list, you see how your ASVAB test scores result in several different kinds of scores:

- **Raw score:** This score is the total number of points you receive on each subtest of the ASVAB. Harder questions on the ASVAB are worth more points than easier questions. While you won't see your raw scores on the ASVAB score cards, they're used to calculate the other scores.
- **Standard scores:** The various subtests of the ASVAB are reported on the score cards as standard scores. A standard score is calculated by converting your raw score based on a standard distribution of scores with a mean of 50 and a standard deviation of 10.

  Don't confuse a standard score with the graded-on-a-curve score you may have seen on school tests — where the scores range from 1 to 100 with the majority of students scoring between 70 and 100. With standard scores, the majority score is between 30 and 70. That means that a standard score of 50 is an average score and a score of 60 would be an above average score.
- **Percentile scores:** These scores range from 1 to 99. They express how well you did in comparison with another group called the *norm.* On the institutional version's score card, the norm is fellow students in your same grade (except for the AFQT score).

  On the production and institutional versions' score cards, the AFQT score is presented as a percentile score with the score normed by using the *1997 Profile of American Youth,* a national probability sample of 18- to 23-year-olds who took the ASVAB in 1997. For example, if you receive a percentile score of 72, you can say you scored as well as or better than 72 out of 100 of the norm group who took the test. (And by the way, this statistic from 1997 isn't a typo. The ASVAB was last "re-normed" in 2004, and the sample group used for the norm was those folks who took the test in 1997.)



- **Composite scores (also referred to as line scores):** Composite scores are individually computed by each service branch. Each branch has its own particular system when compiling various standard scores into individual composite scores. These scores are used by the different branches to determine job qualifications. Much more about this in Chapter 2.



You can't use the practice tests in this book (or any other ASVAB study guide) to calculate your probable ASVAB score. ASVAB scores are calculated by using raw scores, and raw scores aren't determined simply from the number of right or wrong answers. On the actual ASVAB, harder questions are worth more points than easier questions.

Understanding the big four: Your AFQT scores

The four scores that comprise your AFQT score include the Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, and Mathematics Knowledge subtests of the ASVAB. The military brass (or at least its computers) determines your AFQT score through a very particular process:

1. **Add the value of your Word Knowledge score to your Paragraph Comprehension score.**
2. **Convert the result of Step 1 to a scaled score, ranging from 20 to 62.**

   This score is known as your *Verbal Expression* or VE score.
3. **To get your *raw AFQT score,* the computer doubles your VE score and then adds your Arithmetic Reasoning (AR) score and your Mathematics Knowledge (MK) score to it.**

   The basic equation looks like this: Raw AFQT Score = 2VE + AR + MK
4. **Convert your raw score to a *percentile score,* which basically compares your results to the results of thousands of other ASVAB test takers.**

   For example, a score of 50 means that you scored better than 50 percent of the individuals the military is comparing you to.

The military's AFQT score requirements for enlistment

AFQT scores are grouped into five main categories based on the percentile score ranges shown in the following table. Categories III and IV are divided into sub groups because the services sometimes use this chart for internal tracking purposes, enlistment limits, and enlistment incentives. Based on your scores, the military decides how trainable you may be to perform jobs in the service.

Category	*Percentile Score*	*Trainability*
I	93–100	Outstanding
II	65–92	Excellent
III A	50–64	Above average
III B	31–49	Average
IV A	21–30	Below average
IV B	16–20	Markedly below average
IV C	10–15	Poor
V	0–9	Not trainable

Meeting supply and demand

The United States Congress sets the authorized size (called *strength ceilings*) for each of the service branches. The army is the largest branch by far. In order to maintain its strength ceiling, the active duty army has to recruit 80,000 new troops each year. Compare this number with the 36,000 for active duty navy, 30,000 for active duty air force, 32,000 for the Marine Corps, and 4,000 for the Coast Guard. Because of these higher recruiting requirements and because the army bears the brunt of deployments to such places as Iraq, Afghanistan, Bosnia, and Kosovo, the army has been forced to lower many of its recruiting standards. On the other hand, the army also offers higher enlistment bonuses and other incentives than do the other branches.

Congress sets the permissible ranges, but the individual services can act within those ranges based on its current recruiting needs. For example, Congress has set the maximum allowable enlistment bonus to $40,000. But, only the army offers the maximum, and then only for a few "hard-to-fill" jobs. The air force (and the other services) can also offer $40,000, if it felt it needed to, but it doesn't (the maximum bonus currently authorized by the air force is $16,000 for a six-year enlistment as a Linguist. The army, on the other hand, gives a $40,000 bonus to an applicant who's "trainable" for the linguist position for a 4-year enlistment).

The same is true on ASVAB Categories. Congress has said that the maximum number of CAT IVs that any service can accept per year is 4 percent. However, at this time, the army is the only service branch that feels that it has to allow a few of this category in to make its recruiting goals (right now, about one percent of army enlistments come from CAT 4A). The other services feel they can make their goals without allowing CAT IVs in.

To further complicate matters, in 2006, Congress increased the size of the active duty army by 30,000. In 2008, Congress plans to increase it by another 30,000 troops. In contrast, last year Congress decreased the size of the active duty air force and navy, so these two services are undergoing a downsizing for the next few years, which means they're accepting even fewer new recruits than usual.



The U.S. Congress has directed that the military can't accept Category V recruits or more than four percent of recruits from Category IV. If you're in Category IV, you must have a high-school diploma to be eligible for enlistment. Even so, if you're Category IV, your chances of enlistment are small and mostly limited to the army. See the nearby sidebar for details.

Depending on whether you have a high-school diploma or a GED, the military has different AFQT score requirements. Check out Table 1-2 for these requirements.

Table 1-2 AFQT Score Requirements

Branch of Service	*Minimum AFQT Score with High-School Diploma*	*Minimum AFQT Score with GED*	*Special Circumstances*
U.S. Air Force	36	65	In very rare cases, if the applicant possesses special skills (such as speaking a foreign language that the air force considers critical), the score of 36 can be waived to 31. The air force allows less than 1 percent of its enlistees each year who have a GED instead of a high school diploma.
Army	31	31	At the time of this writing, the army has been approving more and more waivers for those folks with scores as low as 26 (Category IVA). This is one of the standards the army has changed in order to meet its recruiting requirements.

(continued)

Table 1-2 ***(continued)***

Branch of Service	*Minimum AFQT Score with High-School Diploma*	*Minimum AFQT Score with GED*	*Special Circumstances*
Coast Guard	40	50	A waiver is possible if a recruit's ASVAB line scores qualify him/her for a specific job, and the recruit is willing to enlist in that job. Very few (about 5 percent) each year are allowed to enlist with a GED.
Marine Corps	32	50	Between 5 and 10 percent of recruits can enlist with a GED.
Navy	31	50	5 to 10 percent of recruits can enlist with a GED. Those with a GED must also be at least 19 and show a proven work history.

The military's AFQT requirements for special programs

Achieving the minimum required AFQT score established by the individual branch gets your foot in the door, but the higher you score the better. For example, if you need a medical or criminal history waiver in order to enlist, the military personnel who make those decisions are more likely to take a chance on you if they think you're a pretty smart cookie, than if you barely made the minimum qualifying score.

Individual branches of the military tie many special enlistment programs to minimum AFQT scores:

- The **army** requires a minimum AFQT score of 50 to qualify for most of its incentive programs, such as a monetary enlistment bonus, college-loan repayment program, or the Army College Fund.
- If you hope to be one of the very few people each year allowed to enlist in the **air force** with a GED, you'll need a minimum AFQT score of 65.
- Like the army, the **Marine Corps** requires a minimum AFQT score of 50 for most of its incentive programs, including the Geographic Area of Choice Program, the Marine Corps College Fund, and enlistment bonuses.
- The **navy** requires those folks with GEDs to have a minimum AFQT score of 50 to enlist. Additionally, applicants who wish to participate in the Navy College Fund or college loan repayment program need to achieve a minimum score of 50.

  Note: The navy has also been known to raise its minimum AFQT requirements to 50 for females (just to qualify for enlistment) when it receives too many female applicants. (Because of the limited number of females that it can house on ships, the navy restricts the number of females that can enlist each year.)



Enlistment programs are subject to change without notice based on the current recruiting needs of the service. Your recruiter should be able to give you the most up-to-date information, or visit `http://usmilitary.about.com`.

Failing to Qualify and Retaking the ASVAB

You can't actually "fail" the ASVAB, but you can fail to achieve a high enough score to enlist in the service branch you want. If this happens that means your AFQT score was too low, which in turn means you need to work on one (or more) of the four core areas: Math

Knowledge, Arithmetic Reasoning, Reading Comprehension, and Word Knowledge. Parts II and III of this book are specifically designed to help you improve your scores on these four subtests.

After you're sure that you're ready, you can apply (through your recruiter) for a retest. After you take an initial ASVAB test (taking the ASVAB in high school doesn't count as an initial test), you can retake the test after 30 days. After the retest, you must wait at least six months before taking the ASVAB again.



You can't retake the ASVAB on a whim or whenever you simply feel like it. Each of the services has its own rules concerning whether it's allowed a retest. Check out the following sections for more information.



ASVAB tests are valid for two years, as long as you aren't in the military. In most cases, after you join the military, your ASVAB scores remain valid as long as you are in. In other words, except in a few cases, you can use your enlistment ASVAB scores to qualify for retraining years later.

U.S. Army retest policy

The army allows a retest in one of the following instances:

- If the applicant's previous ASVAB test has expired
- The applicant failed to achieve an AFQT score high enough to qualify for enlistment
- When unusual circumstances occur, such as if an applicant, through no fault of his own, is unable to complete the test

  For example, an applicant is called away from test because of an emergency. This doesn't include the requirement for an applicant to leave a test session because of an illness that existed *before* the beginning of the session because applicants are routinely cautioned not to take the test if ill.

Recruiters aren't authorized to have applicants retested for the sole purpose of increasing aptitude area scores to meet standards prescribed for enlistment options or programs.

U.S. Air Force retest policy

The intent of retesting an applicant is for the applicant to improve the last ASVAB test so the enlistment options increase. Before any retest is administered, the recruiting flight chief must interview the applicant in person or by telephone and then give approval for the retest.



Here are a few other polices to remember:

- The air force doesn't allow retesting for applicants after they've enlisted in the Delayed Entry Program (DEP).
- Current policy allows retesting of applicants who aren't holding a job/aptitude area reservation and/or aren't in DEP but already have qualifying test scores.
- Retesting is authorized when the applicant's current line scores (mechanical, administrative, general, and electronic) limit the ability to match an air force skill with his or her qualifications.

U.S. Navy retest policy

The navy allows retesting of applicants whose previous ASVAB tests have expired or if the applicant fails to achieve a qualifying AFQT score for enlistment in the navy. In most cases, individuals in the DEP can't retest.

One notable exception is the navy's DEP Enrichment Program. This program provides for the provisional DEP enlistment of high-school diploma graduates with AFQT scores between 28 and 30. Individuals enlisted under the program are enrolled in academic enhancement training, retested with the ASVAB, and accessed to active duty provided they score 31 or higher on the subsequent ASVAB retest.

U.S. Marine Corps retest policy

The Marine Corps authorizes a retest if the applicant's previous test is expired. Otherwise, recruiters can request a retest as long as the retesting is required due to the initial scores (considering the applicant's education, training, and experience) don't appear to reflect his or her true capability. Additionally, the retest can't be requested *solely* because the applicant's initial test scores didn't meet the standards prescribed for enlistment options or programs.

U.S. Coast Guard retest policy

For the Coast Guard enlistments, six months must elapse since an applicant's last test before he or she may retest solely for the purpose of raising scores to qualify for a particular enlistment option. The Coast Guard Recruiting Center may authorize retesting after 30 days have passed from an initial ASVAB test if substantial reason exists to believe the initial test scores or subtest scores don't reflect an applicant's education, training, or experience.

Chapter 2

So, You Want to be a Tank Driver? What It Takes to Get Your Dream Job

In This Chapter

- Finding out there's more to life than the AFQT score
- Making sense out of line scores
- Discovering how each military branch uses line scores

The Armed Forces Qualification Test (AFQT) portion of the ASVAB is your most important score because it determines whether you can even join the service of your choice. However, qualifying to join is only part of the picture. Unless you want to spend your military career painting things that don't move, you need to understand how the ASVAB relates to various military job opportunities.

Civilian employers generally use a person's education and experience level when selecting candidates for a job position. In the military, 99 percent of all *enlisted* jobs are entry-level positions. The military doesn't require you to have a college degree in computer science before you're hired to become a computer programmer. You don't even have to have any previous computer experience, nor does the military care if you do. You're going to go to military school to study how to make computers stand at attention and fly right.

Sounds like a good deal, right? So, what's the catch? Well, believe us — the military spends big bucks turning high school graduates into highly trained and skilled aircraft mechanics, language specialists, and electronic doodad repair people. In an average year, the services enlist about 274,000 new recruits. Any way you look at it, that's a lot of combat boots! Each and every recruit has to be sent to a military school to train for a job. Uncle Sam needs a way to determine whether a wet-behind-the-ears high school graduate has the mental aptitude to succeed at that job — preferably before he spends your hard-earned tax dollars.

Enter the ASVAB. The services combine various ASVAB subtests scores into groupings called *composite scores* or *line scores.* Through years of trial and error, the individual military services have each determined what minimum composite scores are required to successfully complete its various job training programs. In this chapter, you discover how those test scores translate into finding the military job of your dreams.

Determining How Your ASVAB Scores Affect Your Enlistment in Job-Training Programs

Each service branch has its own individual system of scores. Recruiters and military job counselors use these scores, along with other factors such as job availability, security clearance eligibility, medical qualifications, and physical strength, to match potential recruits up with military jobs.



When you sit down with your recruiter to discuss your ASVAB scores, you may think he suddenly decided to speak in a foreign language. Don't get too confused about the terms used for various scores on the ASVAB. The lingo is explained in detail in Chapter 1 (so you can flip back to that chapter as needed). For job-qualification purposes, simple is better. Remember three key terms and their definitions:

- **Standard score:** A standard score refers to individual ASVAB subtest scores (that is, Verbal Expression, Arithmetic Reasoning, Mathematics Knowledge, and so on).
- **Line score:** A line score combines various standard scores that the services use for job qualification purposes.
- **AFQT score**: Calculated from the math and English subtests of the ASVAB, the Armed Forces Qualification Test (AFQT) score is used by the military to determine overall enlistment qualification. Chapter 1 explains exactly how this critical score is computed.



During the initial enlistment process your service branch determines your military job or enlistment program based on established minimum line scores. If you get an appropriate score in the appropriate areas, you can get the job you want — as long as that job is available and you meet other qualification factors.



For active duty, the army is the only service that offers a guaranteed job for all its new enlistees. In other words, every single army recruit knows what her job is going to be before she signs the enlistment contract.

The other active duty services use a combination of guaranteed jobs or guaranteed aptitude/career areas:

- **Air Force:** About 40 percent of active duty air force recruits enlist with a guaranteed job. The majority enlists in one of four guaranteed aptitude areas, and during basic training recruits are assigned to a job that falls into that aptitude area.
- **Coast Guard:** The Coast Guard rarely, if ever, offers a guaranteed job in its active duty enlistment contracts. Instead, new "Coasties" enlist as undesignated seamen, and spend their first year (or so) of service doing general work ("Paint that ship!") before finally applying for specific job training.
- **Marine Corps:** A vast majority of Marine Corps active duty enlistees are guaranteed one of several job fields, such as infantry, avionics, logistics, vehicle maintenance, aircraft maintenance, munitions, and so on. Each of these fields is further divided into specific subjobs, called Military Occupation Specialties (MOSs). Marine recruits usually don't find out their actual MOS until about halfway through basic training.
- **Navy:** Most navy recruits enlist with a guaranteed job, but several hundred people each year also enlist in a guaranteed career area, then "strike" (apply) for the specific job within a year of graduating boot camp.



All enlistment contracts for the reserve forces (regardless of branch), on the other hand, contain guarantees for a specific job. Why? Because reserve recruiters recruit for vacancies in specific reserve units, usually located within 100 miles of where a person lives.

Familiarizing Yourself with the Service Branches and Their Line Scores

Each of the military services computes its line scores differently:

- The army combines the various scores into nine separate areas by simple addition of the ASVAB standard scores.
- The Marine Corps computes its three line scores by adding subtest standard scores from various ASVAB subtests.
- The navy and Coast Guard use the standard scores directly from the ASVAB subtests.
- The air force combines various standard scores into four aptitude areas and converts each line score to a percentile score (just like the AFQT score).



As you read the following sections, you may notice that the Numerical Operations and Coding Speed subtests are still used in calculating some of the line scores, even though they were removed from the ASVAB (check out Chapter 1 for changes in the ASVAB). But hold your horses — the explanation for this inconsistency is really quite simple. When the ASVAB powers that be eliminated these subtests, the army, air force, and Marine Corps had a problem: These subtests were an intricate part of some of their line score calculations. To simply remove them would require changing the line score minimums for each job that was associated with the particular score, which would in turn require revising every single regulation, directive, manual, and instruction in which the particular line score was mentioned.

Those revisions seemed like a lot of work to the folks who write military regulations, and after all, the holidays were coming up. Instead of changing the score minimums, the services decided to insert a dummy score whenever the line score formula required the Numerical Operations or Coding Speed standard scores. The *dummy score* is the average score received for these two subtests by thousands of test takers, during the timeframe preceding when the subtests were eliminated. Because everyone gets the same dummy score addition(s), you can safely ignore this tidbit of information and pretend it doesn't exist.

Line scores and the army

The army adds various standard scores from the individual subtests of the ASVAB to compute line scores for job qualification. Table 2-1 shows the line scores and the ASVAB subtests that make them up:

Table 2-1 The U.S. Army's Ten Line Scores

Line Score	*Standard Scores Used*
Clerical Score (CL)	Verbal Expression (VE), Arithmetic Reasoning (AR), and Mathematics Knowledge (MK)
Combat Score (CO)	Arithmetic Reasoning (AR), Coding Speed (CS), Auto & Shop Information (AS), and Mechanical Comprehension (MC)
Electronics Score (EL)	General Science (GS), Arithmetic Reasoning (AR), Mathematics Knowledge (MK), and Electronic Information (EI)
Field Artillery Score (FA)	Arithmetic Reasoning (AR), Coding Speed (CS), Mathematics Knowledge (MK), and Mechanical Comprehension (MC)
General Maintenance Score (GM)	General Science (GS), Auto & Shop Information (AS), Mathematics Knowledge (MK), and Electronic Information (EI)
General Technical Score (GT)	Verbal Expression (VE) and Arithmetic Reasoning (AR)

(continued)

Table 2-1 *(continued)*

Mechanical Maintenance Score (MM)	Numerical Operations (NO), Auto & Shop Information (AS), Mechanical Comprehension (MC), and Electronic Information (EI)
Operators and Food Score (OF)	Verbal Expression (VE), Numerical Operations (NO), Auto & Shop Information (AS), and Mechanical Comprehension (MC)
Surveillance and Communications Score (SC)	Verbal Expression (VE), Arithmetic Reasoning (AR), Auto & Shop Information (AS), and Mechanical Comprehension (MC)
Skilled Technical Score (ST)	General Science (GS), Verbal Expression (VE), Mathematics Knowledge (MK), and Mechanical Comprehension (MC)

Line scores and the navy and Coast Guard

The navy and Coast Guard use the standard scores directly from the ASVAB:

- General Science (GS)
- Arithmetic Reasoning (AR)
- Word Knowledge (WK)
- Paragraph Comprehension (PC)
- Auto & Shop Information (AS)
- Mathematics Knowledge (MK)
- Mechanical Comprehension (MC)
- Electronics Information (EI)
- Assembling Objects (AO)
- Verbal Expression (VE; the sum of WK and PC)

Check out this example: The navy regulation, which lists the qualifications to become an Air Traffic Control Specialist, states that an ASVAB score of VE + AR + MK + MC = 210 is required. In order to qualify for an Air Traffic Control Specialist, you need a 210 or higher in these areas.

What a minute! If the navy and Coast Guard don't use line scores, what are the navy and Coast Guard scores on your ASVAB score sheet? Good question. The navy and Coast Guard got jealous over the other branches having line scores on the ASVAB score sheets, so these two branches invented their own, even though they don't use them. Actually, we're just kidding.

Although the navy and Coast Guard don't use their line scores for official job determination, the scores provide recruiters, job counselors, and recruits with a snapshot of which broad career areas they may qualify for. The navy and Coast Guard line scores shown on the ASVAB score sheet comprise the areas as listed in Table 2-2.

Table 2-2 The U.S. Navy and Coast Guard's Line Scores

Line Score	*Standard Scores Used*	*Formula Used*
Engineman (ENG)	Auto & Shop Information (AS) and Mathematics Knowledge (MK)	AS + MK
Administrative (ADM)	Mathematics Knowledge (MK), and Verbal Expression (VE)	MK + VE
General Technical (GT)	Arithmetic Reasoning (AR), and Verbal Expression (VE)	AR + VE
Mechanical Maintenance (MEC)	Arithmetic Reasoning (AR), Auto & Shop Information (AS), and Mechanical Comprehension (MC)	AR + AS + MC
Health (HM)	General Science (GS), Mathematics Knowledge (MK), and Verbal Expression (VE)	GS + MK + VE
Mechanical Maintenance 2 (MEC2)	Assembling Objects (AO), Arithmetic Reasoning (AR), and Mechanical Comprehension (MC)	AO + AR + MC
Electronics (EL)	Arithmetic Reasoning (AR), Electronic Information (EI), General Science (GS), and Mathematics Knowledge (MK)	AR + EI + GS + MK
Nuclear Field (NUC)	Arithmetic Reasoning (AR), Mechanical Comprehension (MC), Mathematics Knowledge (MK), and Verbal Expression (VE)	AR + MC + MK + VE
Engineering and E lectronics (BEE)	Arithmetic Reasoning (AR), General Science (GS), and two times Mathematics Knowledge (MK)	AR + GS + MK
Operations (OPS)	Arithmetic Reasoning (AR) and Mathematics Knowledge (MK)	2MK + AR

Line scores and the Marine Corps

The Marine Corps has only three line scores, which are shown in Table 2-3.

Table 2-3 The Marine Corps Line Scores

Line Score	*Standard Scores Used*	*Formula Used*
Mechanical Maintenance (MM)	General Science (GS), Auto & Shop Information (AS), Mathematics Knowledge (MK), and Mechanical Comprehension (MC)	GS + AS + MK + MC
General Technical (GT)	Verbal Expression (VE) and Arithmetic Reasoning (AR)	VE + AR
Electronics (EL)	General Science (GS), Arithmetic Reasoning (AR), Mathematics Knowledge (MK), and Electronic Information (EI)	GS + AR + MK + EI

Line scores and the air force

The U.S. Air Force uses standard scores from the ASVAB subtests to derive scaled scores in four aptitude areas called MAGE (Mechanical, Administrative, General, and Electronics). The air force MAGE scores are calculated as *percentiles,* ranging from 0 to 99, which show your relationship to thousands of others who've taken the test. In other words, a percentile score of 51 indicates you scored better in this aptitude area than 50 percent of the testers who were used to establish the "norm." Table 2-4 lays out the four areas, the subtests used, and the formulas used to calculate the percentile for a particular area. After the test scorer calculates the score for a particular area, she converts that score to a percentile.

Table 2-4 The U.S. Air Force's MAGE Scores

Line Score	*Standard Scores Used*	*Formula Used*
Mechanical	General Science (GS), Mechanical Comprehension (MC), and Auto & Shop Information (AS)	2AS + GS + MC
Administrative	Numerical Operations (NO), Coding Speed (CS), and Verbal Expression (VE)	NO + CS + VE
General	Arithmetic Reasoning (AR) and Verbal Expression (VE)	AR + VE
Electronics	General Science (GS), Arithmetic Reasoning (AR), Mathematics Knowledge (MK), and Electronics Information (EI)	GS + AR + MK + EI

Chapter 3

Test-Taking and Study Techniques

In This Chapter

- Choosing your weapon: Pencil or keyboard
- Developing multiple-choice strategies
- Making educated guesses
- Getting some studying and test tips
- Preparing down to the last detail

How many times have you heard someone say (or may have even said yourself), "I just can't take tests?" Well, of course you can't do well on tests if you keep telling yourself that! In basic training, your Drill Sergeant (hereafter known as "Sir" or "Ma'am") will convince you that the words "I can't" simply don't exist in the military. If you don't believe us, try telling your Drill Sergeant, "I just can't do push-ups." You will find that with sufficient practice (and your Drill Sergeant will ensure you get a lot of practice), you can do push-ups just as well as the next person. (Actually, we don't really recommend using this example to test this hypothesis, for reasons that should be obvious.) The truth is that those who do well on tests are those who've learned to study efficiently, along with a dash of test-taking psychology.

This chapter includes information on how to prepare for the test — how you study and how and why you should take the practice exams. In addition, you get some inside info like secrets for guessing when you don't know the answer to a question. (Although, if you study for the test, that will never happen, right?) The tips and techniques provided in this chapter can help you get a jump on the ASVAB and your military career.

Knowing What You're Up Against: The Pros and Cons of Paper versus Computer

As mentioned in Chapter 1, many versions of the ASVAB exist (although you probably won't get a choice of which one to take), but they primarily boil down to two basic differences: the paper version and the computerized version. Each version has its advantages and disadvantages.

- If you're taking the ASVAB as part of the Institutional Program in high school, or if you're already in the military and retaking the ASVAB for the purposes of qualifying to retrain into a different job, you'll take the paper version.
- If you're taking the ASVAB as part of the process of enlisting in the military, you'll take the Production ASVAB. This version is available in paper format and via computer, called the *CAT-ASVAB*. There's a 90 percent chance that you'll take the computerized version because to save time and money, the recruiting services like to send applicants to the nearest Military Entrance Processing Station (MEPS) for testing, medical examination, and enlistment (one-stop shopping). The computerized version is used exclusively at MEPS.



If you have your heart set on taking the paper version of the test but didn't do so in high school, ask your recruiter if a Mobile Examining Team (MET) site is nearby. Roughly 685 MET sites are located throughout the United States (U.S.). Most localities also have scheduled days when the paper version of the Production ASVAB is given (once or twice per month), usually at the local National Guard Armory. If you want to take the paper-based test at an armory or a similar site, a military recruiter must put you on the schedule.

The old-fashioned way: Advantages and disadvantages of the paper ASVAB

Modern technology isn't always better. Taking the pencil-and-paper version of the ASVAB can provide you with certain advantages:

- **You can skip questions that you don't know the answer to and come back to them later.** This option can help when you're racing against the clock and want to get as many answers right as possible. You can change an answer on the subtest you're currently working on, but you can't change an answer on a subtest after the time for that subtest has expired.
- **You can mark up the exam booklet as much as you want.** If you skip a question, you can circle the number of the question in your booklet to remind yourself to go back to it. If you don't know the answer to a question, you can cross off the answers that seem unlikely or wrong to you and then guess based on the remaining answers.

Killing trees isn't the only disadvantage of the paper-based test. Other drawbacks include

- **Harder questions are randomly intermingled with easier questions.** This means you can find yourself spending too much time trying to figure out the answer to a question that's too hard for you and may miss answering some easier questions at the end of the subtest, thereby lowering your overall score.
- **The paper answer sheets are scored by using an optical scanning machine.** The machine has a conniption when it comes across an incompletely filled-in answer circle or stray pencil marks and will often stubbornly refuse to give you credit, even if you answered correctly.
- **Getting your scores can take forever.** The timeline varies, but it may take a week or more (sometimes up to a month — remember, we're talking military efficiency here).

Modern technology: Advantages and disadvantages of the CAT-ASVAB

The computerized version of the ASVAB, called Computerized Adaptive Testing, or CAT-ASVAB, contains the same questions as the paper version, but the questions are presented to you in a different order. The CAT-ASVAB adapts the questions it offers you based on your level of proficiency (that's why it's called *adaptive*). Translation: The first test item is of average difficulty. If you answer this question correctly, the next question is more difficult. If you answer it incorrectly, the computer gives you an easier question. (By contrast, on the paper ASVAB, hard and easy questions are presented randomly.)



Maybe it's because young people today are more comfortable in front of a computer than with a pencil, but military recruiters have noted that among applicants who've taken both the paper-based and computerized versions of the ASVAB, recruits tend to score slightly higher on the computerized version of the test.

You don't have to be a computer guru to appreciate the advantages of the computerized version of the ASVAB:

- **Unlike the paper ASVAB, on the CAT-ASVAB, it's impossible to record your answer in the wrong space on the answer sheet.** Questions and possible answers are presented on the screen, and you press the key that corresponds to your answer choice before moving on to the next question.
- **The difficulty of the test items presented depends on whether you answered the previous question correctly.** If you're proficient in the subtest area, you get the harder questions (which are worth more points) out of the way first, which maximizes your score in the event that you don't complete all the questions on the subtest.
- **You get your scores right away.** The computer automatically calculates and prints your standard scores for each subtest and your line scores for each service branch. (For more on line scores, see Chapter 2.) This machine is a pretty smart cookie — it also calculates your AFQT percentile score on-the-spot. As emphasized in Chapter 1, the AFQT score determines whether you even qualify to join the service of your choice. With the computerized version, you usually know if you qualify for military enlistment on the same day you take the test, and if so, which jobs you qualify for.

On the downside, you can't skip questions or change your answers after you enter them on the CAT-ASVAB. This restriction can make taking the test harder for some people. Instead of being able to go through and immediately answer all the questions you're sure of and then coming back to the questions that require you to do some head scratching, you have to answer each question as it comes. This can make it difficult to judge how much time to spend on a difficult question before guessing and moving on. Also, if you have a few minutes at the end of the test, you can't go back and check to make sure you marked the correct answer to each question.

Attacking the Infamous Multiple-Choice Questions

Both the paper-based and the computerized ASVAB are multiple-choice tests. You choose the correct (or most correct) answer from among four choices. Here are some tips to keep in mind as you tackle the choices:



- **Read the directions carefully.** Each subtest has a paragraph or two describing what the subtest covers and instructions on how to answer the questions. Although instructing you to read the directions may seem obvious, when you're in a hurry, you can sometimes *misread* the directions, and that won't help you get the right answer. For example, if the directions on Paragraph Comprehension subtest informs you that a paragraph applies to questions number 3, 4, and 5, and you misread it as 4, 5, and 6, you're going to get at least one of those questions wrong.

  Most ASVAB test proctors agree — the majority of the time when there's an issue with an applicant's scores, the misreading of directions is the prime offender.
- **Make sure you understand the question.** If you don't understand the question, you're naturally not going to be able to make the best decision when it comes to selecting an answer. Understanding the question, though, requires attention to three particular points:
  - **Take special care to read the questions correctly.** Most questions ask something like, "Which of the following equals 2×3?" But sometimes, a question may ask, "Which of the following does *not* equal 2×3?" You can easily skip right over the word *not* when you're reading, assume that the answer is six, and get the question wrong.



- **On the math subtests, be especially careful to read the symbols correctly.** When you're in a hurry, the + sign and the ÷ sign can look very similar. And blowing right by a negative sign or another symbol is just as easy.
- **Make sure you understand the terms being used.** When a math problem asks you to find the product of two numbers, be sure you know what *finding the product* means. (It means you have to multiply the two numbers.) If you add the two numbers together, you arrive at the wrong answer.

- **Take time to review all the answer options.** On all the subtests, you select the correct answer from four possible answer options.

  Often, a person reads a question, decides on the answer, glances at the answer options, chooses the option that agrees with his or her answer, marks it on the answer sheet, and then moves on. Although this approach usually works, it can sometimes lead you astray.



  On the ASVAB, you're supposed to choose the answer that is *most* correct. (Now and then you do the opposite and choose the answer that is *least* correct.) Sometimes several answers are reasonably correct for the question at hand, but only one of them is the *best* answer. If you don't stop to read and review all the answers, you may not choose the one that is *most* correct. Or, if you review all the answer options, you may realize that you hastily decided on an incorrect answer because you misread it.

- **If you're taking a paper test, mark the answer carefully.** A machine scores the ASVAB paper-based answer sheets. You have to clearly mark the answer so that the machine knows what answer you've selected. This means carefully filling in the space that represents the correct letter answer. You've done this a million times in school, we know, but it's worth repeating. Don't use a check mark, don't circle the answer, and don't let your mark wander into the next space. If you must erase, make certain that all evidence of your prior choice is gone; otherwise, the grading machine can get confused and credit you with the wrong choice or, worse, disregard your answer and give you no credit at all.

  On the paper version, the very real possibility exists of incorrectly marking the answer sheet — answering Question 11 on the line for Question 12, Question 12 on the line for Question 13, and . . . you get the idea. (Don't laugh — this happens more often than you would guess.) Be especially careful if you skip a question that you're going to return to later.



  Incorrectly marking the answers can cause a real headache. If you fail to get a qualifying score, the minimum amount of time you must wait before retaking the ASVAB is 30 days — you have to wait a whole month to do it all over again. Even then, your journey to military glory through ASVAB torment may not be over. Regulations allow the testing-center commander to request *another* retest if a 20-point or greater difference between two test results pops up. So, if you're not careful, you'll be taking three ASVABs when all you really needed to take was *one*. Sound fun? Chapter 1 discusses how and when you can re-take the ASVAB.

Conundrum! When You Have to Guess

On the ASVAB, guessing is okay. In fact, it's encouraged. The reason is in the scoring of the test. Here's how the point system breaks down:

- If you choose the correct answer, you get one point (or more, depending on how the question is weighted).
- If you don't answer a question, you get nada.
- If you guess on a question and get the question wrong, you get nada — no worrying about losing points or getting any sort of penalty!

So, because each question has four possible answers, you have a 25 percent chance of guessing correctly, which means that you have more chances to increase your score by guessing than by leaving a question blank.



If you guess on more than one question throughout the test, always choosing the same answer for every guess is the smart way to go. For example, all your guesses could be the Answer (B). This technique slightly increases your chances of getting more guessed answers correct. This method doesn't hold true, though, if you can narrow down a guess by eliminating a couple of answer options — called making an *educated guess.* If you can eliminate Answer (B), then, by all means, choose a different answer option as your guess.

In each of the chapters in this book that reviews a particular subtest, you find hints for making educated guesses that are specific to that topic. But here are some general rules:

- Usually, an answer that has *always, all, everyone, never, none,* or *no one* is incorrect.
- If two choices are very similar in meaning, *neither of them* is probably the correct choice.
- If two answer options contradict each other, *one of them* is usually correct.
- The longer the answer, the more likely that it's the correct answer. The test makers have to get all those qualifiers in there to make sure that it's the correct answer and so you can't find an example to contradict it. If you see phrases like *in many cases* or *frequently,* that's a clue that the test takers are trying to make the answer *most correct.*
- There's always at least one answer that isn't even close to the correct answer. By using simple deduction, you can often narrow your choices down to two answers or less.
- Don't eliminate an answer based on the frequency of that answer coming up. For example, if Choice (B) has been the correct answer for the last five questions, don't assume that it must be the wrong answer for the question you're on just because that would make it six in a row.
- Don't change an answer after you select it. If you have to guess, never, ever go back and change the answer, unless you're absolutely, 100 percent, positively convinced that you're changing it to the correct answer *and* you only answered incorrectly because you had sweat in your eyes and didn't read the choices properly.

  The United Stated Air Force Senior NCO Academy conducted an in-depth study of several air force multiple-choice-test results, taken over several years, and found that when students changed answers on their answer sheets, they changed from a right to a wrong answer more than 72 percent of the time!



By taking the practice tests at the back of the book, you can get a sense of how long it takes you to complete each part of the ASVAB. This little nugget of info can help you know how much time you have to spend on educated guessing.

Training the Way You Fight: Study Tips and Practice Tests

The three full-length practice tests and the AFQT practice test at the back of this book are valuable study aids. Before you begin studying, take one of the tests. Try to duplicate the testing environment — take the entire exam at one time, time yourself, and don't allow interruptions. When you complete the first practice test, check your answers to see where you need improvement.



Don't forget, not all subtests are equally important. For instance, if you have no interest in pursuing a career in electronics, the Electronics Information subtest is irrelevant to you; so don't spend time studying for it. Instead, devote yourself to other areas that are important to your future career plans. (See Chapter 2 for lists of the subtests that affect your acceptance into the job area or areas you're pursuing.)

Train the way you fight is a standard saying in the military. When you study for the ASVAB, fall in line with these study habits to make the most of your time:

- **Try to reduce distractions.** Always study in a well-lit, quiet area away from pets, screaming babies, and the TV.
- **Keep study breaks to a minimum.** A few minutes every hour is sufficient.
- **Be a loner.** You may want to study with a partner now and then so the two of you can brainstorm answers and quiz each other, but most of your studying should be done on your own.
- **Study in long blocks of time.** Studying for an hour or two once or twice a day is much more effective than 15 minutes six times a day.
- **Concentrate on subject areas that need improvement.** It's human nature to find yourself spending your study time on subject areas that you have an interest in or that you're good at. If you're a wiz at fixing cars, don't waste your time studying auto and shop information. (You're already going to ace that part of the test, right?) On the other hand, if you had a hard time in math during your high school years, you need to spend extra time brushing up on your arithmetic skills.
- **Practice the actual act of test-taking.** Practice marking answers correctly on the answer key and time yourself to see how long it takes you to answer questions. See Chapter 1 for details about how long it should take you to complete each subtest.



After you do some additional studying, take the second practice exam. Again, try to duplicate testing conditions. Check your answers. Compare your scores to the scores from your first test. Have you improved? If so, continue studying as you have been. If not, you may need to reconsider how you're studying or if you're setting aside enough time to study. A school counselor or teacher can give you additional study pointers.

Finally, a week or two before the ASVAB, take the third practice test. Think of the third test as a final chance to brush up on any of those nagging areas that still give you fits. This third test also helps you calm your nerves before taking the ASVAB — how the test works will be fresh in your mind.



Don't waste time memorizing the practice questions in this guide or any other ASVAB study guide. You *will not* see the same questions on the ASVAB test. Use this guide and the sample tests for two purposes:

- **To determine the subject areas in which you need to improve:** Use the tips and techniques, along with standard study materials (like high-school textbooks), to improve your knowledge of that specific subject.
- **To familiarize yourself with the types of test questions and the way they're presented on the test:** Getting a good idea of what all the subtests look like and ask for will improve your test-taking speed. You won't have to spend time trying to figure out *how* a question works. You can spend your time answering the question.

24 Hours and Counting: Pretest Preparations

You want some good advice? On the night before the test . . . get some sleep. Give yourself time to get plenty of rest — at least eight hours of sleep. Don't drink alcohol the night before — headaches and the ASVAB don't work well together. And don't pull an all-night cram session the night before you're scheduled to take the ASVAB. If you don't know the material by then, it's too late. Staying up all night only guarantees that you'll do poorly on the test because you'll be too tired in the morning.



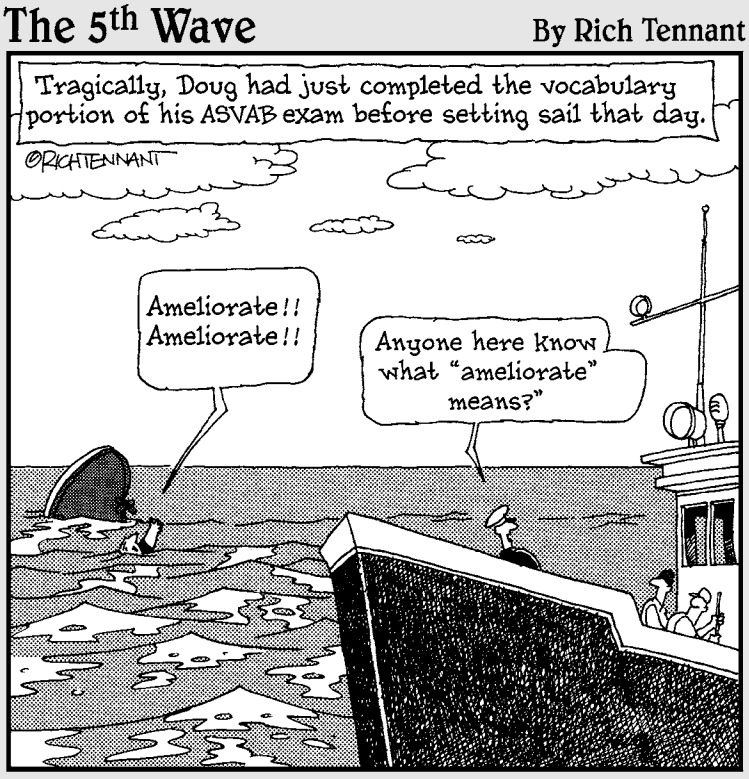
Here are some other suggestions:

- On the morning of the test, eat a light meal — anything too heavy will make you drowsy, but not eating enough will make it hard for you to concentrate.

  Try to avoid a breakfast high in carbohydrates. While the carbs will initially make you feel energetic, a couple of hours into the test, you may come crashing down. Select foods high in protein instead.
- Get exercise the day before and even the morning of the test to get your blood pumping and help you remain mentally sharp.
- If you're sick, upset, or injured, you may want to reschedule the test. Right before the test starts, the proctor will ask if there's anything, such as sickness or injury, which may affect your test performance. After the test actually starts, it's considered to be an "official test," and there will be a time period before any possibility of a retest. See Chapter 1 for complete details.
- Bring any supplies you need: pencils, pens, and erasers. Scratch paper will be provided for you. If you wear eyeglasses, bring them. If you wear contacts, bring your glasses as a backup.
- Bring a watch to help you keep track of time if you're taking the paper version (the computerized version has a clock on the screen).
- Don't bring calculators, personal CD players, backpacks, or a cooler of munchies to the testing site. You won't be allowed to have them with you.
- Don't drink a lot of liquids just before the test — you don't want to waste valuable test time in the bathroom!
- Make sure you arrive at the test site with plenty of time to spare. In the military, arriving *on time* means that you're five minutes too late. You should plan to be in your seat at least 10 minutes before the scheduled testing time. Unless your recruiter is driving you (which is often the case), you may wish to do a "test run" a day or two before your testing date to make sure you know where the location is, the availability of parking, and how to find the testing room.

Part II

Words to Live By: Communication Skills



In this part . . .

The ASVAB measures your communication skills through two subtests: Word Knowledge and Paragraph Comprehension. Together, these two subtests make up one-half of your Armed Forces Qualification Test (AFQT) score, which the military uses to predict whether you're teachable. If you don't achieve a qualifying score on the AFQT, you're not allowed to play alongside the other soldiers.

In this part, you discover why it's important to do well on the ASVAB vocabulary and reading subtests, and you find some useful tools to accomplish the mission. You review basic vocabulary and reading skills and find rock-solid advice like how to find the main idea of a paragraph and quick tips to understanding the definition of a vocabulary word based on context, roots, prefixes, and suffixes.

Chapter 4

Word Knowledge

In This Chapter

- Being well-spoken in the military
- Seeing some example questions from the ASVAB
- Keeping a word list
- Knowing the difference between synonyms and antonyms
- Improving your overall vocabulary

To make it to boot camp, you'd better know how to spell it, along with an army of other vocab words, to score well on the Word Knowledge section of the ASVAB. Not only do you have to know how to spell to some degree (so you can differentiate among words), but also you need to know what the words on the test mean. *Word Knowledge* just means *vocabulary,* which means *hard words no one uses in ordinary conversation.* (Well, not really.) If you're on a military base and you're hungry, don't bother looking for a sign that says *Chow Hall.* Instead, you need to find the *Enlisted Personnel Dining Facility.* If you want to work out after your big lunch, forget about the *Base Gym.* You're looking for the *Fitness and Wellness Center.*

So, what if you don't know the difference between a *carbine* and a *carbon*? Never fear — we're here to give you a helping hand (bestow upon you inestimable guidance and encouragement — that's Word Knowledge speak). With the help of this chapter (and a little brow-sweat on your part), your word knowledge skills will whip right into shape. (And then in Chapter 6, check out the practice questions to test your word knowledge skills.)

The Importance of Word Knowledge for Military Jobs

Word Knowledge isn't part of the ASVAB just because the military likes to use big words. It's included because words stand for ideas, and the more words you understand, the more ideas you can understand (and the better you can communicate with others). A decent vocabulary is essential in the military if you want to get ahead. The military operates on paperwork, and whether you're trying to get more supplies (submit necessary logistical requisitions) or get the assignment you want (application for personnel career-enhancement programs), you need to develop a good vocabulary. The military considers clear and concise communication so important that it's taught and graded at all levels of leadership training, including the Army, Navy, and Air Force War Colleges, which are requirements to be promoted to General officer.

The Word Knowledge subtest is one of the four most important subtests on the ASVAB (along with the Paragraph Comprehension, Mathematics Knowledge, and Arithmetic Reasoning). The Word Knowledge subtest comprises a significant portion of the AFQT score — the score that determines your eligibility for military service (see Chapter 1 for details).

You also need to do well on the Word Knowledge subtest in order to qualify for many military jobs such as air traffic controller, military intelligence, and even fire fighting. Table 4-1 shows the military job qualification line scores that are calculated by using your Word Knowledge subtest score.

Table 4-1 Military Line Scores that Use the Word Knowledge Score

Branch of Service	*Line Score*
U.S. Army	Clerical, General Technical, Operators and Food, Surveillance and Communications, and Skilled Technical
U.S. Air Force	Administrative and General
U.S. Navy/Coast Guard	Administrative, General Technical, Health, and Nuclear
U.S. Marine Corps	General Technical



Chapter 2 has more information about military line scores, and check out the Appendix for more information on the scores you need to get the job you want.

Checking Out the Word Knowledge Question Format

The Word Knowledge portion of the ASVAB measures your vocabulary knowledge. The section consists of 35 questions, which usually come in one of two flavors:

- The first type asks for a straight definition.
- The second type gives you an underlined word used in the context of a sentence.

When you're asked for a straight definition, your task is quite simple: Choose the answer closest in meaning to the underlined word. Look at the following example:



Abatement most nearly means:

(A) encourage

(B) relax

(C) obstruct

(D) terminate

Abatement means to *suppress or terminate.* In this case, the correct answer is Choice (D).

When you see an underlined word in a sentence, your goal is to choose the answer *closest in meaning* to the underlined word. For example:



His house was derelict:

(A) solid

(B) run-down

(C) clean

(D) inexpensive



Closest in meaning doesn't mean *the exact same thing.* You're looking for similar or related words. In case you're wondering, the answer is Choice (B).

When you take the Word Knowledge subtest, you have 11 minutes to answer the 35 questions, which means that you have slightly less than 20 seconds to answer each question. That's plenty of time, as long as you stay focused and don't waste time thinking about last night's date (sorry, we mean *social encounter*).



Keep in mind that although you may know the word in the question, you may not know one or more of the words in the multiple-choice answers. If this is the case, use the process of elimination to help you narrow down your choices. Eliminate the words that you know aren't correct, and guess which of the remaining words is most likely correct.

Building Words from Scratch: Strategies to Help You Decipher Word Meanings

Many English words are created from building blocks called roots, prefixes, and suffixes. These basic word parts generally have the same meaning in whatever word they're used. For instance, *pro* means something along the lines of *in favor of, forward,* or *positive* whether you use it in the word *pro*ton or the word *pro*ceed.

If you memorize some of these word parts, you have a better chance of figuring out the meaning of an unfamiliar word when you see it on the ASVAB. Figuring out the meaning of unfamiliar words is how people with large vocabularies make them even larger. (They look up words in the dictionary, too.)



Developing a large vocabulary takes time — often years. However, just because you have a limited amount of time to study doesn't mean you should give up hope. Instead, focus on the tips throughout this section to help you improve your Word Knowledge score.

From beginning to end: Prefixes and suffixes

Prefixes, roots, and suffixes are the main parts that make up words. Not every word has all three, but many have at least one. *Prefixes* are the parts that come at the front of a word, *suffixes* are the parts that come at the end of a word, and *roots* are the parts that lie in the middle of a word. Think of roots as the base of the word and prefixes and suffixes as word parts that are attached to the base. (Check out the "Determining the root of the problem" section later in this chapter for more info on — you guessed it — roots.)

Tables 4-2 and 4-3 list some common prefixes and suffixes. Each list has the word part, its meaning, and one word that uses each word part. Writing down additional words that you know for each word part helps you memorize the list.

Table 4-2 Prefixes

Prefix	*Meaning*	*Sample Word*
a	no, not	atheist
ab or abs	away, from	absent
anti	against	antibody

(continued)

Table 4-2 *(continued)*

Prefix	*Meaning*	*Sample Word*
bi	two	bilateral
con or contra	against	contradict
de	away from	deny
dec	ten	decade
extra	outside, beyond	extracurricular
fore	in front of	foreman
geo	earth	geology
hyper	excess, over	hyperactive
il	not	illogical
mal or male	wrong, bad	malediction
multi	many	multiply
nom	name	nominate
omni	all	omnibus
ped	foot	pedestrian
que, quer, or ques	ask	question
re	back	return
semi	half	semisweet
super	over, more	superior
tele	far	telephone
trans	across	translate
un	not	uninformed

Table 4-3 Suffixes

Suffix	*Meaning*	*Sample Word*
-able or -ible	capable of	agree: agreeable
-age	action, result	break: breakage
-al	characterized by	function: functional
-ance	instance of an action	perform: performance
-ation	action, process	liberate: liberation
-en	made of	silk: silken
-ful	full of	help: helpful
-ic	consisting of	alcohol: alcoholic
-ical	possessing a quality of	statistic: statistical

Suffix	*Meaning*	*Sample Word*
-ion	result of act or process	legislate: legislation
-ish	relating to	child: childish
-ism	act, practice	Buddha: Buddhism
-ist	characteristic of	elite: elitist
-ity	quality of	specific: specificity
-less	not having	child: childless
-let	small one	book: booklet
-man	relating to humans, manlike	gentle: gentleman
-ment	action, process	establish: establishment
-ness	possessing a quality	good: goodness
-or	one who does a thing	orate: orator
-ous	having	danger: dangerous
-y	quality of	taste: tasty

Determining the root of the problem

Root words are word parts that serve as the base of a word. If you recognize a root, you can generally get an idea of what the word means, even if you're not familiar with it. When you see an unfamiliar word on the Word Knowledge section, don't get upset and pound on the computer (they make you pay for those things if you break them). You may know the word after all . . . just in a different form.

In English, one root word can be changed slightly to perform all sorts of roles — it can act as a noun, a verb, an adjective, or an adverb with just a little modification. So, for example, if you know what the root word *attach* means, you can figure out what the word *attachment* means. If you know *adherent,* you can deduce what *adherence* means. As Mr. Miyagi said in *Karate Kid,* "Root strong, tree grow strong." All right, Daniel-san, in terms of your vocabulary — if your knowledge of word roots is strong, your vocabulary will be much stronger (larger).



Suppose you run across the word *beneficent* on the Word Knowledge portion:

Beneficent most nearly means:

(A) kind

(B) beautiful

(C) unhappy

(D) troubled

You sit there in the school-cafeteria chair and begin to sweat. You've never seen the word before, and it's all over for you, right? Well, maybe not. Take a closer look. What other word starting with the letters *benefi* do you know? How about the word *benefit?* A benefit is something that helps or aids. It would be a good bet that the word *beneficent* is related to helping or aiding. So when you look over the possible choices, you can choose the one that has something to do with helping.

But wait! None of the answers state *help* or *aid*. Now what? Just use the process of elimination. If something is helpful (beneficent), it probably isn't troubled or unhappy. It may be beautiful, but more likely, it's kind. So the best answer would be Choice (A).

Table 4-4 lists some common roots. Memorize them. When you sit down to take the ASVAB, you'll be glad that you did.

Table 4-4 Roots

Root	*Meaning*	*Sample Word*
anthro or anthrop	relating to humans	anthropology
bibli or biblio	relating to books	bibliography
brev	short	abbreviate
cede or ceed	go, yield	recede
circum	around	circumnavigate
chrom	color	monochrome
cogn or cogno	know	cognizant
corp	body	corporate
dic or dict	speak	diction
domin	rule	dominate
flu or flux	flow	influx
form	shape	formulate
frac or frag	break	fragment
graph	writing	biography
junct	join	juncture
liber	free	liberate
lum	light	illuminate
oper	work	co-operate
pat or path	suffer	pathology
port	carry	portable
press	squeeze	repress
sens or sent	think, feel	sentient
scrib or script	write	describe
tract	pull	traction
voc or vok	call	revoke



When you see an unfamiliar word, try dropping a couple of letters from the beginning and/or the end of the word to see if you recognize what's left — the root. If so, you can make a good guess as to the meaning of the word.

Ying and Yang: Understanding Synonyms and Antonyms

A *synonym* is a word that has the same meaning as or a very similar meaning to another word. *Smile* and *grin* are synonyms. They may not mean exactly the same thing, but their meanings are very similar. An *antonym* is a word that has an opposite or nearly opposite meaning as another word. *Smile* and *frown* are antonyms.



To help remember the definitions of synonym and antonym, think of a synonym as the *same* (both also start with an *s*) and an antonym as the *enemy.*

The ASVAB may ask you to find the word that *most nearly means the same thing* as a given word, which is a synonym. Or you may be asked to find the word that *most nearly means the opposite* of a given word, which is an antonym. Most of the questions on the Word Knowledge subtest ask you to find synonyms, although a few may ask you to find antonyms.



How can you study and find the synonym of a word (or the antonym, for that matter)? Take a look at these suggestions:

- Start in the dictionary. Many dictionary entries include the abbreviation *syn,* which means *synonym.* The words that follow this abbreviation are synonyms of the entry word. You may also see the abbreviation *ant* in an entry. This abbreviation stands for *antonym,* and the word or words that follow it mean the opposite of the entry word.
- Make a list of synonyms and antonyms of the words you learn. As you study vocabulary words for the Word Knowledge subtest, add them to your list.
- Use the root-word list from Table 4-4 (in the preceding section). Using your dictionary and thesaurus, come up with a list of synonyms and antonyms for each word listed in the *Sample Word* column. (Of course, not every word has synonyms and antonyms, but many do.)

You Are What You Speak: Improving Your Vocabulary, Improving Yourself

Having an extensive vocabulary can help you do well on the Word Knowledge subtest. But, even if you don't have a huge vocabulary, the strategies in this section can help you make up for that.



You can acquire vocabulary words in the short term as well as over a long period of time. Combining both approaches is best, but if you're pressed for time, focus on short-term memorization and test-taking skills.

Reading your way to a larger vocabulary

In a world of DVDs, video games, and 17 billion channels on TV, the pastime of reading for enjoyment is quickly fading. To build your vocabulary, you have to read — it's that simple. Studies consistently show that those who read for enjoyment have a much larger vocabulary than those who dislike reading. You have to see the words in print, not just hear someone say them. Besides, people can read and understand many more words than they could ever use in conversation.

That doesn't mean you have to start with *Advanced Astrophysics.* In fact, if you don't read much, you can start with your daily newspaper, a news magazine, or any type of reading material that's just a notch or two above what you ordinarily read. Choose topics that interest you. If you're interested in the subject matter, you'll enjoy reading more. Plus, you may just learn something new!



When you encounter a word you don't know, try to understand what it means by the context in which the word is used. For example, if you read, "The scientist *extrapolated* from the data," and you don't know what *extrapolated* means, you can try substituting words you *do* know to see if they would make sense. For example, the scientist probably didn't *hide* from the data. She probably used the data to make some sort of decision, judgment, or guess. To confirm your understanding of the word, check your dictionary. You may even consider keeping a running list of terms you come across as you read, along with their definitions (see the following section).



On the Word Knowledge section of the ASVAB, you often won't be able to guess what a word means from its context (because in many cases, there's no context in the test because the words aren't used in sentences). You also won't be able to look the word up in the dictionary. But considering context and consulting a dictionary are two great ways to *discover* vocabulary words during your test preparation.

Keeping a list and checking it twice

Not long ago, an 11-year-old girl went through the entire dictionary and made a list of all the words she didn't know. (The process took several months.) She then studied the list faithfully for a year and went on to win first place in the National Spelling Bee finales. You don't have to go to this extent, but even putting in a tenth of her effort can dramatically improve your scores on the Word Knowledge subtest.

One way to improve your vocabulary is to keep a word list similar to the girl's in the preceding example. Here's how that list works:

1. **When you hear or read a word that you don't understand, jot it down.**
2. **When you have a chance, look the word up in the dictionary and then write the meaning down on your list.**
3. **Use the word in a sentence that you make up.**

   Write the sentence down, too.
4. **Use your new words in everyday conversation.**

   Finding a way to work the word *zenith* into a description of last night's basketball game requires creativity, but you won't forget what the word means.



Arrange your list by related items so that the words are easier to remember. For example, list the words having to do with your work on one page, words related to mechanical knowledge on another page, and so on.



If you're looking for a few good resources to help you with vocabulary, check out these sources:

- **Internet keyword searches:** You can also find Web sites that offer lists of words if you spend a few minutes surfing. Try using search phrases, such as *vocabulary words* and *SAT words.*
- **`www.freevocabulary.com`:** Free Vocabulary offers a free list of over 5,000 collegiate words, along with brief definitions.

- **www.dictionary.com:** Dictionary.com includes a great online dictionary, thesaurus, and word of the day.
- **www.m-w.com:** Merriam Webster online is another useful site with a free online dictionary, thesaurus, and word of the day.
- **Books:** A ton of books exist to help build your vocabulary. Try these two on for size:
  - *Vocabulary For Dummies* by Laurie E. Rozakis (Wiley)
  - *SAT Vocabulary For Dummies* by Suzee Vlk (Wiley)

  These books are great resources designed to help you improve your word knowledge skills.

Sounding off by sounding it out

Sometimes you actually know a word because you've heard it in conversation, but you don't recognize it when you see it written down. For instance, the word *subtle* (pronounced *suh*-tle) could confuse anyone encountering it in writing for the first time. A student who'd heard the word *placebo* (pronounced plah-*see*-bow) knew that it meant an inactive substance, like a sugar pill. But, when she came across it in writing, she didn't recognize it. She thought it was a word pronounced "plah-*chee*-bow," which she had never heard before.

So when you see a word on the ASVAB that you don't recognize, try pronouncing it (not out loud, please) a couple of different ways. The following pronunciation rules can help you out:



- Sometimes sounds are silent (like the *b* in *subtle* or the *k* in *knight*). Often, a letter at the end of a word is silent. For instance, *coup* is pronounced *coo.*
- Some sounds have unusual pronunciations in certain contexts. Think of the *l* in *colonel,* which is pronounced like *kernel.*
- *C* can sound like *s* or *k* and sometimes like *ch* (especially if two *C*s are in a row).
- The letter *i* after a *t* can form a sound like *she.* Think of the word *initiate.*
- *X* can be pronounced like *z,* and it's sometimes silent.
- A vowel at the end of a word can change the pronunciation of letters in the word. The word *wag* has a different *g* sound than the word *wage.*
- When several vowels are right next to each other, they can be pronounced many different ways (consider *boo, boa,* and *bout*). Try a couple of different possibilities. For instance, if you see the word *feint,* you may think that it should be pronounced *feent* or *fiynt*, but in fact, it sounds like *faint*. It means fake or pretend.

Chapter 5

Paragraph Comprehension

In This Chapter

- Knowing what to expect of the Paragraph Comprehension subtest
- Pumping up your comprehension
- Maxing out your reading speed
- Improving your odds at test time

Any other organization would call this section of the ASVAB the Reading Comprehension subtest, but the Department of Defense is a stickler for precision. You'll be reading paragraphs, darn it, so you're being tested on how well you understand paragraphs! Not words, not sentences, not essays, but paragraphs! Don't you just love the military way?

One thing you get from military boot camp is comprehending the drill sergeant's orders and the information in your instruction manuals are important. The ability to read and understand the written directions in your basic training manual can save you and your buddies hundreds of pushups. Trust us on this one. The Paragraph Comprehension subtest measures your ability to understand what you read and to draw conclusions from that material. It contains a number of reading passages and questions about those passages.



After you enlist, you discover that the military runs on paperwork. If you can't read and understand a regulation that's buried within a pile of papers, how are you going to obey it?

The Importance of Paragraph Comprehension for Military Jobs

The Paragraph Comprehension subtest is an important part of your AFQT score — the most important score because it determines whether a particular branch of service lets you join. The score is so important that we plan to keep on repeating it until you're mumbling, "The AFQT is the most important score," in your sleep.

You would be surprised at how many diverse military jobs require a decent score on the Paragraph Comprehension subtest. But, think about it for a moment. If the directions in a military recipe make you rub your eyes and mumble to yourself, how are you going to cook a meal for 2,000 troops? (Assuming you want to become a military cook, that is.) Table 5-1 shows the military job qualification line scores that are calculated by using your Paragraph Comprehension subtest score.

Table 5-1 Military Line Scores that Use the Paragraph Comprehension Score

Branch of Service	*Line Score*
U.S. Army	Clerical, General Technical, Operators and Food, Surveillance and Communications, and Skilled Technical.
U.S. Air Force	Administrative and General
U.S. Navy and Coast Guard	Administrative, General Technical, Health, and Nuclear
U.S. Marine Corps	General Technical



Chapter 2 has more information about military line scores. See the Appendix for more information on the scores you need to get the job you want.

Eyeing the Physique of the Paragraph Comprehension Subtest

When you get to the Paragraph Comprehension subtest, you have several passages to read. Most passages are only one paragraph long, and rarely are they longer than two paragraphs. Each passage contains between 50 and 200 words. Look at it this way: At least you won't be required to read *War and Peace!*

The ASVAB test makers may ask you to answer only one question about a given reading passage, or they may ask you to answer as many as five questions about one passage. Unfortunately, this subtest doesn't consist of the most interesting passages you'll ever read. (You won't find paragraphs from your favorite spy or romance novel here.) So, it's important that you set your attention-span dial all the way to the maximum setting. You have 15 questions on this subtest and 13 minutes to read the passages and answer the questions.

The Four Flavors of Comprehension Questions

The Paragraph Comprehension questions on the ASVAB usually take one of four forms:

- Finding specific information
- Recognizing the main idea
- Determining word meaning in context
- Drawing an implication from a stated idea

Each type of question asks you to perform a different kind of analysis of the reading passage. If a passage has more than one question associated with it, chances are each question falls under a different category. The following sections spell out the differences between these four types of questions.

Treasure hunt: Finding specific information

This type of question asks you to pick out (you guessed it) specific information from a passage. Sounds easy, right? Remember, in the military, the only easy day was yesterday. At times, the information that a question asks about isn't directly stated in the paragraph, but you can infer this information from the text. To figure out what this means, first take a look at the following passage that clearly states the answer to the question that directly follows it:



An industry trade association found that more than 13,000 martial-arts schools exist in the United States with nearly 6 million active members. Of the 13,000 schools, nearly 7,000 offered tae kwon do lessons.

According to this passage, how many people actively participated in martial arts lessons?

(A) 13,000

(B) 7,000

(C) 6 million

(D) It can't be determined.

The correct answer is Choice (C).

Now, consider the next question, applied to the same passage:

According to this passage, how many schools didn't teach tae kwon do?

(A) 13,000

(B) more than half

(C) 6 million

(D) 6,000

The correct answer is Choice (D). Although the passage doesn't specifically state, "6,000 schools didn't teach tae kwon do," you can infer this information from the fact that 7,000 schools did teach tae kwon do. The remaining schools (of the 13,000 that offered martial arts) must, logically, not have offered tae kwon do.



When questions are phrased in the negative, like the one above, you may be easily confused about what the question is asking. (This fact is especially true when the information being sought isn't directly stated in the passage.) Misreading a negative question is also easy. Research has shown that people often skip over a negative when they read. A reader could easily glance at the above question and read "How many schools did teach tae kwon do?" and that mistake leads to the wrong answer.



Be aware that questions on this portion of the ASVAB are frequently stated in the negative. When you see one, an alarm should go off in your head that reminds you to read the question more carefully.

Cutting to the chase: Recognizing the main idea

Sometimes the Paragraph Comprehension questions ask you to identify the main point of a passage. The main point can be directly stated, or it can be implied. You can find the main idea in the first sentence of the passage, and sometimes it pops up in the last sentence. So if

you're not sure what the main point of a paragraph is, reread the first sentence and the last sentence. Chances are one of these two sentences contains the main point. (Flip to "What's the Big Idea? Determining the Main Idea in a Paragraph" later in this chapter for more information on identifying main ideas.)

If the shoe fits: Determining word meaning in context

Sometimes the Paragraph Comprehension subtest asks you to determine the meaning of a word when it's used in a passage. The correct definition that the question is looking for can be the most common meaning of the word, or it can be a less well-known meaning of the word.

In either case, you have to read the passage, make sure you understand how the word is being used, and select the answer option that's closest in meaning to the word as it's used in the passage. Consider this example:



In the 18th century, it was common for sailors to be pressed into service in Britain. Young men found near seaports could be kidnapped, drugged, or otherwise hauled aboard a ship and made to work doing menial chores. They weren't paid for their service, and they were given just enough food to keep them alive.

In this passage, *pressed* means:

(A) hired

(B) ironed

(C) enticed

(D) forced

The descriptions of the conditions these sailors found themselves in should help you decide that they weren't *hired* or *enticed; ironed* is one meaning of the word *pressed,* but it isn't correct in this context. The correct answer is Choice (D).



Since the 1980s, computers have become an indispensable part of American business. Computers can be used for thousands of applications from word processing and running spreadsheets to keeping one's checkbook updated.

In this passage, *applications* means:

(A) functions

(B) sizes

(C) requests

(D) types

Try putting the answer choices in this phrase: "Computers can be used for thousands of applications." You can see that *functions* is closest in meaning to *applications,* although in a different context, some of the other answer choices may be correct. So the correct answer is Choice (A).

Reading between the lines: Drawing an implication

You're also asked to draw an implication from a stated idea. This simply means that you may be asked to draw a conclusion about what you've read. This conclusion should always be based on the reading, not your own particular opinions about a subject.

The *conclusion* — which may be called an *inference* or *implication* — must be reasonably based on what the passage says. You have to use good judgment when deciding what conclusions can be logically drawn from what you've read. Give it a shot:



Twenty-five percent of all automobile thefts occur when the doors of a car are left unlocked. People often forget to lock their doors, find it inconvenient, or tell themselves, "I'll only be a minute." But it only takes a minute for an accomplished car thief to steal a car. And thieves are always alert to the opportunities that distracted or rushed people present them with.

To prevent auto theft, it's a person's responsibility to:

(A) leave the doors unlocked

(B) never be in a rush

(C) prevent the opportunity

(D) be willing to perform a citizen's arrest

Although the paragraph doesn't state, "To prevent auto theft, it's a person's responsibility to prevent the opportunity," this idea is certainly implied. The correct answer is Choice (C). There's no implication that people should be willing to (or can) perform a citizen's arrest. Leaving the doors unlocked is the opposite of what one should do, and never being in a rush is probably impossible.

An example of an unreasonable conclusion drawn from the above paragraph would be something like, "If everyone locked their doors, there would be no crime," or "All car thieves should be sentenced to 30 years in prison." Nothing in this particular passage supports such a conclusion.

One way to help determine if you've drawn a reasonable conclusion is to ask yourself, "Based on what I've just read, would the author agree with the conclusion I've reached?" If the answer is yes, your conclusion is probably reasonable. If the answer is no, it's time to think up a new conclusion.



Boiler technicians operate main and auxiliary boilers. They maintain and repair all parts, including pressure fittings, valves, pumps, and forced-air blowers. Technicians may have to lift or move heavy equipment. They may have to stoop and kneel and work in awkward positions.

According to this job description, a good candidate for this job would be:

(A) a person with joint problems

(B) an individual unaccustomed to heavy lifting

(C) a person who isn't mechanically minded

(D) a person who's physically fit

Although the passage doesn't state, "This job requires a physically fit person," the duties listed imply that this is so. The correct answer is (D). A person with joint problems may not be able to stoop or kneel or work in awkward positions. A person who's unaccustomed to

heavy lifting may not be able to lift or move the heavy equipment as needed. A person who isn't mechanically minded may not have the knowledge necessary to maintain and repair boilers and all their parts. This leaves Choice (D) as the answer, and it's true that a person who's physically fit would be a good choice for the job.

What's the Big Idea? Determining the Main Idea in a Paragraph

In order to understand what you read — which is what the Paragraph Comprehension subtest is all about — you need to develop several abilities:

- Finding the main idea or argument that the author is making
- Remembering specific details about the reading
- Drawing conclusions from what you've read
- Understanding relationships between ideas
- Paraphrasing (or summarizing) what you've read

Do you get my point?

Questions on the Paragraph Comprehension subtest frequently ask you to identify the main point of a reading passage. How do you get better at identifying main ideas? Practice. The *main idea,* which is the most important point the author is making, is sometimes stated and sometimes implied in a piece of writing. Often, the author begins or ends a paragraph or passage with the main idea, which is located in what's called a *topic sentence.* A topic sentence, reasonably enough, describes the topic that the author's writing about.

So, if you're looking for the main idea, start off by checking the first and last sentence of the passage. (No, this doesn't mean that you should skip the rest of the passage.) For example, suppose you read the following paragraph:

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

No, the primary theme of this passage isn't "schools in our area suck." The main point of this paragraph can be found in the opening sentence, "The local school district is facing a serious budgetary crisis." What follows are details regarding the budget crisis.

Sometimes, a passage builds up to its main idea, and sometimes the main idea is implied, instead of stated. Consider the following paragraph:

> The farmers' market reopened on the second weekend of May. Amid the asparagus and flowers, shoppers chatted about the return of temperatures in the 70s. Across the street, children (and their dogs) played Frisbee in the park. Finally, spring has come to town.

In this paragraph, you may think that the farmers' market reopening is the main point, but the other information about the temperature and the kids playing Frisbee tells you that the main idea is something a bit broader than the market opening. The main idea is stated in the last sentence: "Finally, spring has come to town."



In boot camp, your drill instructor may say, "Some of you better check to see that your bunks are properly made." Or he may rip your bunk bed apart and say, "Now make this $%*& bunk the right way, you moron!" Both comments mean the same thing. In the first statement, the drill instructor implies the meaning; the second statement is a bit more direct.

Extra, extra! Identifying subpoints

If a writer stuck to just one point, the Paragraph Comprehension subtest would be a breeze. However, an author usually doesn't just make one point in a piece of writing, so you also need to understand the other points the author makes. These details, or *subpoints,* may include facts or statistics, or they may be descriptions that support the main point of the passage. Subpoints help you see what the author's saying.

For instance, look at this passage (from the previous section):

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

The subpoints help you understand the main point — the school district is facing a severe budgetary crisis. The subpoints help you understand why: "The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million." You can see that the budgetary crisis is part of a larger problem, which is the state suffering a severe revenue shortfall. The subpoints also help you understand what this crisis means: "Already, 65 teachers have been laid off, and more layoffs are expected." By using these facts and figures, the author helps you grasp not only the main point but also the implications of that main point.

Word Psychology: Analyzing What You've Read

The Paragraph Comprehension subtest of the ASVAB also requires you to analyze what you've read. Analysis is more than simply picking out the point of text. Analyzing a passage requires you to draw conclusions from what you've read and understand relationships between the ideas presented in the text. To analyze a passage, you may need to put it into your own words by paraphrasing it.

Say what? Determining the meaning of word passages

By drawing conclusions about the meaning of a passage, you reach new ideas that the author implies but doesn't come right out and state. You must analyze the information the author presents in order to make inferences from what you've read.

For instance, look at the following paragraph:

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

Although the author doesn't say so, you can draw the conclusion that if the state revenue shortfall could somehow be corrected — by increasing state sales tax or income tax, for example — the local school district's budgetary crisis could be resolved. (The $18.7 million cut from the school budget could be restored.) The author never actually makes this point in the paragraph. But by using reason and logic, you can draw this conclusion from the facts presented.



Making inferences and drawing conclusions requires you to use your judgment. You don't want to read too much into a passage. For example, nothing in the above paragraph suggests that electing a new governor is necessary or that increasing federal income taxes would help the problem.

Look at the next paragraph:

> The farmers' market reopened on the second weekend of May. Amid the asparagus and flowers, shoppers chatted about the return of temperatures in the 70s. Across the street, children (and their dogs) played Frisbee in the park. Finally, spring has come to town.



Suppose you were asked the following question about this paragraph:

It can be inferred from the passage that:

(A) Frisbee playing in the park doesn't happen in winter.

(B) The warm weather is unusual for this time of year.

(C) The shoppers were disappointed in the farmers' market produce.

(D) Rain is imminent.

If the point of the passage is that spring has come to town, and the author uses Frisbee playing as evidence of the arrival of spring, then it's likely that Frisbee playing doesn't occur in the winter but does begin again in spring. The answer is Choice (A).

In other words: Rephrasing passages

One of the best ways to identify the main point of a paragraph is to put the paragraph into your own words (paraphrase it) or to sum up the basic idea of the paragraph (summarize it). By quickly doing this when you take the Paragraph Comprehension portion of the ASVAB, you can be confident that you're answering the question correctly. In other words (to paraphrase), you'll know you know what the paragraph is talking about.

You won't have time to write down the main point or to jot down your paraphrase or summary. Instead, as you're reading, simply try to mentally keep track of what's being said by putting it into your own words.



As you study for the ASVAB, practice paraphrasing reading passages. Read different passages from a book or magazine and then close the pages and get out a pencil and jot down your paraphrases. (Remember, you won't have time to do this on the ASVAB test itself, but the practice helps you mentally prepare for when you take the test.)

Look at the following paragraph. (This is the last time you see this paragraph in this chapter. We promise.)

> The local school district is facing a serious budgetary crisis. The state, suffering a revenue shortfall of more than $600 million, has cut funding to the district by $18.7 million. Already, 65 teachers have been laid off, and more layoffs are expected.

Now, close this book and spend a few moments paraphrasing the previous paragraph. Come on. Pick up that pencil, and get those brain cells pumping. When you're done, reopen to this page and compare your ideas to the passage. If you wrote something like the following, you're right on track:

> The school district has a budget crunch because the state has a budget crunch. The state cut funding to the school district. Some teachers have been laid off already. More may be laid off soon.

You can practice this technique as you study for the ASVAB. You can paraphrase or summarize any short passage you read — a few sentences or a paragraph or two.

Now if you wrote something like, "It's finally May, and shoppers and kids-at-play are out and about, enjoying the warmer temperatures of spring," then you're not paying attention. Turn off the TV and give it another try.

Faster than a Speeding Turtle: Tips for Slow Readers



Today's military is much more complex than attending boot camp, learning how to shoot a gun, and shipping off to war. After boot camp, you attend intensive classroom training to learn your military job. If you can't read well, you're going to have a very hard time. But the good news is that it's never too late to work on improving your reading skills.

For many people, 13 minutes is enough time to read all the passages, understand the 15 questions, and choose the correct answers. But slow readers may have more difficulty getting all the questions answered before time is up. Don't despair: Take the suggestions in this section to help you build your reading speed. Of course, they require work, but you knew the mission came with its challenges, right?

Read more, watch less

If you're a slow reader, chances are you don't do a lot of reading. If you have plenty of time before you're due to take the ASVAB, start reading more — right now — it's in your best interest.



You don't have to pick up *A Tale of Two Cities* or *War and Peace;* you can start with the newspaper, a biography of a person you admire, or magazines you find at the library. Sorry, but the instruction guide to your favorite video game doesn't count. You don't need to enroll in a speed-reading course. If you devote at least one hour a day to simply reading, you'll see your reading comprehension and speed increase within a month or so.



Several studies have shown that folks who enjoy reading as a pleasurable pastime score better on reading comprehension tests than individuals who dislike reading. Sounds obvious, right? So why study it? The idea is if you grow to enjoy reading, you'll become a better reader automatically and thereby score better on reading comprehension tests. How do you discover an enjoyment of reading? Simple — choose reading material in subject areas that interest you.

Become a lean, mean word machine

People sometimes read slowly because they don't have a large vocabulary and don't understand everything they read. If you can identify with this situation, improving your vocabulary is your first step toward increasing your reading comprehension and your reading speed. (Chapter 4 gives you info on building your word knowledge. Check it out.)



Keep a pocket dictionary handy while reading, so you can look up words you don't know. If you're reading articles on the Internet, keep a window open to one of the online dictionaries (such as `www.dictionary.com` to `www.m-w.com`), so you can quickly find the definition of words you find confusing. Your reading will become more enjoyable, and you'll be adding to your vocabulary knowledge to boot.

Build your confidence

Another reason people read slowly is that they don't have confidence in themselves. They're not convinced that they understand what they're reading, so they read a passage several times, trying to make sure they haven't missed anything. But just like people who check that the front door is locked 15 times before leaving for vacation and still lie awake at night wondering if they locked the door, reading and rereading a passage doesn't give you confidence that you understand the text. You get confidence from *proving* that you understand it.



How do you prove to yourself that you understand what you're reading? Here are a couple of tips:

- Get out a textbook or even an encyclopedia (preferably a volume that contains some subject matter that interests you) and read one or two paragraphs straight through without going back and rereading anything. Then close the book (keeping your place marked) and write, in your own words, a brief description of what you've read. Finally, turn back to the passage and compare your description to the information on the page.
- Play the 20-questions game. Read an article from a magazine, encyclopedia, or textbook. Then ask someone to pick out facts from the article and ask you questions.
- Create motivation and interest by reading the daily newspaper or news magazines. Discuss the news events with your classmates, friends, or co-workers. Stronger interest equals greater comprehension.

Is your written version of the article close in meaning to the original? Do you get most of the 20 questions correct? Do you feel comfortable discussing current events with others? If so, you understand what you're reading, and that should build your confidence. If not, don't toss the book or magazine aside in frustration or go ballistic on your mom for asking you tough questions. Keep working on it and your comprehension will improve. Do the above confidence-building drills a few times a day until you feel like you can read any paragraph or two and understand the content without having to reread the information.

The Paragraph Comprehension section tests your ability to understand what you read, not how quickly you can read it. When you sit down to take this subtest, try to go as quickly as you can without sacrificing accuracy. Being methodical in your reading isn't a bad thing as long as you're getting the answers right. Just try to read a little faster than normal without panicking or missing the point.



It's better to read the paragraphs carefully and answer the questions correctly on half of the questions and guess on the other half of the questions than it is to speed through all the reading and get none of the answers right.

Test-Taking Tips for Reading and Gleaning

Although no shortcuts exist to improving your reading comprehension skills (besides practice), you can do a few things on test day to make sure that you score as high as possible on this part of the ASVAB.



If you're running out of time on this subtest, or you're not sure if you can identify the main idea of a passage, take a guess. If you think that's a good piece of advice, check out these tried-and-true tactics for test day:

- **Read first, ask questions later.** Read the passage all the way through before glancing at the question and answer options.
- **Take it one question at a time.** Some passages have more than one question associated with them, but look at only one question at a time.
- **Understand each question.** What's the question asking you to do? Are you supposed to find the main point? Draw a conclusion? Find a word that's nearest in meaning? Make sure you know what the question asks before you choose among the answer options. This tip may seem obvious, but when you're in a hurry, you can make mistakes by misunderstanding the questions.
- **Read each answer option carefully.** Don't just select the first answer that seems right. Remember, on the Paragraph Comprehension subtest, one answer is often *most right* while others are *almost right.* You want to choose the *most right* answer, not the *almost right* answer. And to do that, you have to read *all* the answers.
- **Check your feelings at the door.** Answer each question based on the passage, not your own opinions or views on the topic.
- **Don't choose vague answer options.** They're incorrect 99.99 times out of 100. (Oh heck, call it 100 times out of 100.) If an answer strikes you as not quite true but not totally false, that answer is incorrect. Those nasty ASVAB test makers have put those answers in there to throw you off. Don't give them the satisfaction of falling for their trap!
- **Never select *never.*** For the most part, answer options that are absolute are incorrect. *Never, always,* and related words are often a sign that you should select a different answer. Words like *generally* and *usually* are more likely to be correct.



Chapter 6

All's Well That Tests Well: Communication Practice Questions

In This Chapter

- Proving your knowledge of word meanings
- Demonstrating that you can retain what you read

To help you hone your communication skills a little further, this chapter contains some Word Knowledge and Paragraph Comprehension practice questions to get you rolling. Don't sweat, this test is just for practice and doesn't count for a score. (Plus, sweating makes your answer sheet soggy and makes it harder to mark on).

The communications subtests of the ASVAB are very important as they comprise a significant portion of your AFQT score. (We promised we'd keep pounding this concept into your head — and we wouldn't lie to you, ever!)

On the ASVAB (and on the full-length practice tests later in this book), you see 35 Word Knowledge questions and 15 questions about paragraph comprehension. But in this chapter, you get 25 total questions just to help you warm up for the practice tests later on in this book.

Word Knowledge Practice Questions

In the stem of each of the following Word Knowledge practice questions, you see an underlined word. Select the choice that best answers the question in relation to the underlined word.



Pay attention to the wording of each question. Some questions ask you to select the choice *closest in meaning* to the underlined word. Some questions may ask you to select the word *most opposite* in meaning. On other questions you see the underlined word used in a sentence. In that case, your task is to select the choice *most similar* in meaning to the underlined word as it is used in the context of the sentence.

1. Community most nearly means:

   (A) society

   (B) money

   (C) date

   (D) bank

Community means *state* or *commonwealth,* so the correct answer is (A). The other choices are unrelated.

2. She thought that there was a conspiracy against her.

   (A) wall

   (B) plan

   (C) evil deed

   (D) ghost

   Conspiracy means *plot,* so the correct answer is (B). Choices (A) and (D) are unrelated, and although a conspiracy may be an evil deed, (C) isn't as close in meaning as (B).

3. Keen most nearly means:

   (A) sharp

   (B) small

   (C) simple

   (D) shiny

   Keen means *having a fine edge,* so the correct answer is Choice (A). Choices (B), (C), and (D) are unrelated.

4. Defer most nearly means:

   (A) change

   (B) reverse

   (C) deny

   (D) postpone

   Defer means *to put off,* so the correct answer is Choice (D). Choices (A), (B), and (C) are unrelated.

5. The mother chastised her child.

   (A) comforted

   (B) carried

   (C) lectured

   (D) supervised

   Chastised means *disciplined* or *punished,* so Choice (C) is the most correct choice. Choices (A), (B), and (D) are unrelated.

6. Obtrude most nearly means:

   (A) condition

   (B) absorb

   (C) prepare

   (D) impose

The correct answer is Choice (D). *Obtrude* means to *intrude or to impose oneself on another.* The other choices are unrelated.

7. We often wondered why Daniel lived in such an opulent apartment.

   (A) run-down

   (B) lavish

   (C) far away

   (D) hideous

   Opulent is an adjective that means *wealthy, rich*, or *affluent.* Choice (B) is the answer closest in meaning. The other choices are unrelated or opposite of the meaning.

8. Now that you've read through it once, it's time to recapitulate the World Knowledge chapter.

   (A) discuss

   (B) summarize

   (C) test

   (D) reread

   Used as a verb, *recapitulate* means to *briefly summarize.* The correct answer is Choice (B). Choice (A) is somewhat close, but Choice (B) is the closest in meaning.

9. Clemency most nearly means:

   (A) mercy

   (B) force

   (C) imprison

   (D) compliment

   Clemency means *forgiveness or leniency in punishing a person.* Choice (A) is the correct answer. The other choices are unrelated.

10. This year the Paris fashion industry has decided to eschew short skirts and high heels.

    (A) favor

    (B) manufacture

    (C) shun

    (D) sell

    Eschew is a verb that means *to avoid* or *keep away from.* Therefore, Choice (C) is the correct answer, and the other answers are unrelated.

11. Erudite most nearly means:

    (A) eliminate

    (B) poor

    (C) clean

    (D) educated

Erudite means *knowledgeable, learned*, or *scholarly.* The correct answer is Choice (D). The other choices are unrelated.

12. Latent most nearly means:

(A) hidden

(B) dull

(C) pretentious

(D) active

Latent means *present but not visible or noticeable,* so Choice (A) would be the correct answer. *Latent* can also mean *dormant,* but none of the answer choices relate to that definition.

13. Debbie had a penchant for joining the air force and the Marine Corps.

(A) appointment

(B) dislike

(C) interest

(D) reluctance

Penchant means a *strong inclination, taste, or liking for something.* Choice (C) is the correct answer. Choices (A), (B), and (D) are unrelated.

Paragraph Comprehension Practice Questions

The last half of the questions in this chapter are designed to present you with an opportunity to practice your paragraph comprehension skills. Read the short paragraph, followed by one or more questions regarding information contained in that passage. Make sure to read the paragraph carefully before selecting the choice that *most correctly* answers the question.

Passage one

Although the average consumer replaces the tires on his or her automobile every 50,000 miles, steel-belted radials can last for more than 60,000 miles. However, they must be properly maintained. The tires must be inflated to the correct air pressure at all times, and tires must be rotated and balanced according to a routine maintenance schedule. The tread should be checked for correct depth regularly.

14. How long can steel-belted radials last?

(A) 50,000 miles

(B) 60,000 miles

(C) No one knows.

(D) 25,000 miles

The correct answer is Choice (B). If you missed this one, read the passage more carefully.

15. According to the passage above, proper tire maintenance doesn't include:

(A) keeping tires properly inflated

(B) balancing and rotating tires

(C) checking the tread

(D) checking the lug nuts

This question is negative and requires extra care in answering — meaning, you have to figure out what proper tire maintenance *does* include so you can eliminate those answers before you select the correct answer. Choice (D) is the correct answer.

Passage two

Some people argue that baking is an art, but Chef Debra Dearhorn says that baking is a science. She says that if you follow a recipe carefully, assembling the ingredients accurately, cooking at the specified temperature for the specified period of time, your cookies will always turn out right. Chef Dearborn says the best baking is like the best experiment — anyone can duplicate it.

16. In this passage, the word *assembling* most nearly means:

(A) measuring

(B) putting together

(C) buying

(D) storing

Although *measuring* is something you do when baking, it doesn't *most nearly* mean the same thing as *assembling. Putting together* does. Therefore, Choice (B) is the correct answer.

17. According to the above passage, a person who's all thumbs in the kitchen:

(A) should get out of the kitchen

(B) is an artist

(C) isn't following the recipe carefully

(D) is Chef Dearborn

The passage states that if you follow a recipe carefully, your cookies will always turn out right. The correct answer is Choice (C).

Passage three

The United States Postal Service delivers a one-pound package overnight for $20, although it doesn't guarantee on-time arrival. UPS delivers the same package for $25 and guarantees the delivery. FedEx delivers the package for $30 and guarantees the delivery and picks up your package for no additional charge.

18. Which service should you use if you must have a delivery guarantee but can't spend more than $25?

    (A) United States Postal Service

    (B) United Parcel Service

    (C) FedEx

    (D) None of the services meet the criteria.

    The passage's second sentence tells you everything you need to know. The correct answer is Choice (B).

Passage four

To motivate your people, give them tasks that challenge them. Get to know your people and their capabilities, so you can tell just how far to push each one. Give them as much responsibility as they can handle and then let them do the work without looking over their shoulders and nagging them. When they succeed, praise them. When they fall short, give them credit for what they've done and coach or counsel them on how to do better next time.

19. According to the above paragraph, if your subordinates fail to adequately perform their tasks, you should:

    (A) punish them

    (B) praise them

    (C) counsel them

    (D) both B and C

    The last sentence states you should give your subordinates credit for the parts of the task they performed correctly and counsel them how to do better the next time. The correct answer is Choice (D).

20. After assigning responsibility for the tasks at hand to your subordinates, you should:

    (A) supervise closely to ensure the tasks are performed correctly

    (B) let them do the work on their own

    (C) check their progress at the end of each day

    (D) schedule sufficient work-breaks to avoid job burnout

    Choices (C) and (D) sound like good ideas, but they aren't suggestions discussed by the topic paragraph. Remember to avoid the trap of answering based on your own personal feelings. Choice (B) is the correct answer.

Passage five

Approximately 15,000 years ago the first Native Americans may have appeared in Colorado. The earliest inhabitants were hunters and nomadic foragers on the plains, as well as the western plateau. Agricultural settlements began appearing along river valleys in the eastern part of Colorado from approximately 5,000 B.C. as people learned farming techniques from the Mississippi River Native Americans.

21. The first Native Americans in Colorado were:

(A) farmers

(B) traders

(C) hunters and scavengers

(D) originally from the Mississippi River region

The second sentence states that the original inhabitants were hunters and nomadic foragers, and because none of the other answer options include hunters, you can deduce that *nomadic foragers* means scavengers. The correct answer is Choice (C).

Passage six

Organizational leaders influence several hundred to several thousand people. They do this indirectly, generally through more levels of subordinates than do direct leaders. The additional levels of subordinates can make it more difficult for them to see results. Organizational leaders have staffs to help them lead their people and manage their organizations' resources. They establish policies and the organizational climate that support their subordinate leaders.

22. Organizational leaders provide:

(A) direct leadership

(B) general policies

(C) organizational budgets

(D) daily work schedules

According to the passage, organizational leaders establish policies and the organizational climate that support their subordinate leaders. The correct answer is Choice (B).

23. In order to help them become more efficient, organization leaders make significant use of:

(A) computer technology

(B) rules and regulations

(C) efficiency and management reports

(D) staffs

Organizational leaders have staffs to help them efficiently lead their subordinates and manage the organization. Therefore, Choice (D) is the correct answer.

Passage seven

His name is Frank Clarke, but his real name isn't really as real as the one the children gave him — The Toyman — because he's always making the kids things, such as kites and tops, sleds and boats, jokes and happiness and laughter. His face is as brown as saddle leather, with a touch of apple red in it from the sun. His face is creased, too, because he laughs and jokes so much. Sometimes when The Toyman appears to be solemn you want to laugh most, for he's only pretending to be solemn. And, best of all, if you hurt yourself or if your pet doggie hurts himself, The Toyman knows how to fix it to make it all well again.

24. Frank Clarke's face could best be described as:

(A) rugged

(B) pink and smooth

(C) fair

(D) feminine

According to the passage, Frank's face was brown as saddle leather, and he had creases from laughing often. Choice (A) is the correct answer.

25. Clarke received his nickname because he was always:

(A) fixing toys

(B) making toys for the children

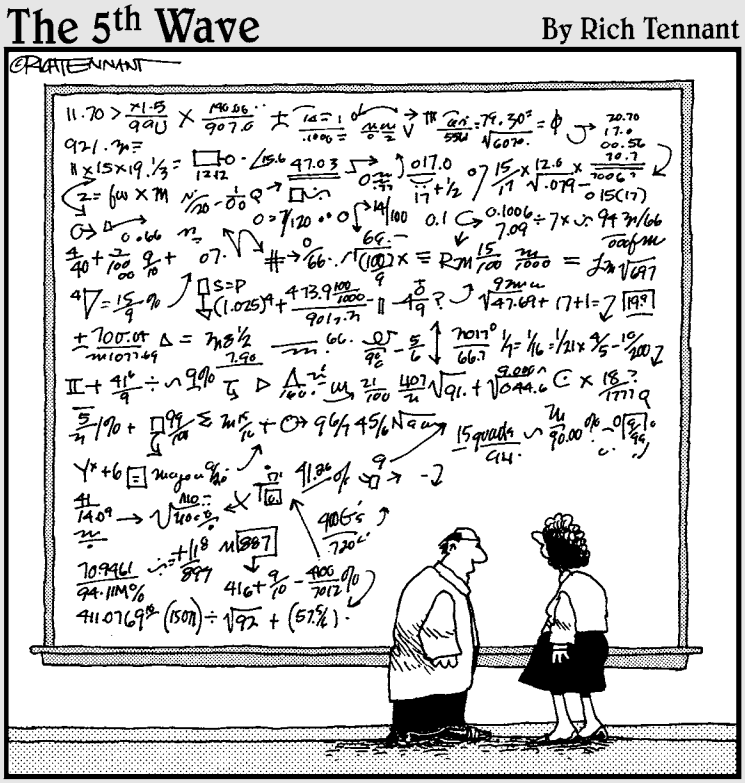
(C) telling stories about toys

(D) playing with toys

The first sentence in the passage explains why the children gave Frank the nickname of The Toyman. The correct answer is Choice (B).

Part III

All's Fair in Math and War: Arithmetic Skills



"What exactly are we saying here?"

In this part . . .

Many military careers require a solid understanding of math principles. Even though the military will spring for a calculator, you're expected to know how to add and subtract before you hit boot camp. And you can't use a calculator on the ASVAB.

Part III gives you a chance to brush up on your numbers knowledge. It includes all kinds of information that can help you do well on the two math-related subtests the ASVAB throws at you: Arithmetic Reasoning and Mathematics Knowledge. We also give you a ton of tips on everything from how to guess if you're running out of time to what to do if you forget how to solve a quadratic equation.

Chapter 7

Arithmetic Reasoning

In This Chapter

- Solving life's little (math) problems
- Reviewing essential basic math
- Multiplying your chances for a better score

How many miles-per-gallon does your brand-new SUV get? How long does it take to go over the river and through the woods to Grandmother's house? How much wood could a woodchuck chuck? These are examples of common everyday questions that can be answered by arithmetic reasoning. (Okay, maybe the woodchuck situation doesn't happen everyday.)

Arithmetic Reasoning is the ASVAB way of saying *word problems.* Word problems help you apply mathematical principles to the real world (at least the real world according to the people who think up word problems). And the Arithmetic Reasoning subtest measures your ability to do real-life, basic, mathematical calculations derived from simple word problems. If you slept through high-school math, don't worry. This chapter helps you decipher these mathematical equations.

The Arithmetic Reasoning subtest asks you to read a word problem, determine what the question asks, and select the correct answer. (Then you have to repeat the process 29 more times.)

The test administrator should supply you with scratch paper and a trusty number two pencil — one thing they *won't* give you (or even let you bring) is a calculator. You can use your paper and lead to clarify the data, write formulas, and mathematically solve the problem. You can even use them to draw pretty pictures to help you understand the problem. Don't get too artistic, though — you only have 36 minutes to answer 30 questions. That comes out to only 1 minute and 12 seconds per question.



Arithmetic Reasoning is an important part of the Armed Forces Qualification Test (AFQT) score, which is used to determine your general qualification for enlistment in all the service branches. (See Chapter 1 for more information.) Also, certain military jobs require that you score well on this subtest. Turn to the Appendix to find out which jobs require what scores on this subtest.

In order to do well on the Arithmetic Reasoning subtest, you have to remember that there are two parts: arithmetic and reasoning. You usually have to use both of these skills for each problem. The arithmetic part comes in when you have to perform mathematical operations such as addition, subtraction, multiplication, and division. The reasoning comes in when you figure out what numbers to use in your calculations. In other words, Arithmetic Reasoning tests how you apply your ability to perform calculations to everyday, real-life problems.

The Real World of Word Problems

Test takers often waste a lot of time reading and rereading word problems as if the answer might reveal itself to them by some miracle, which isn't going to happen. Correctly solving math word problems requires you to perform a series of organized steps:

1. Read the problem completely.
2. Figure out what the question is asking.
3. Dig out the relevant facts.
4. Set up one or more mathematical formulas to arrive at a solution and then solve the problem.
5. Review your answer.

These steps are covered in detail throughout this section.

Don't judge a word problem by its cover: Reading the entire problem

The first step in solving a word problem is reading the entire problem to discover what it's all about. Try forming a picture about the problem in your mind or — better yet — draw a sketch of the problem on your scratch paper.

Ask yourself if you've ever seen a problem like this before. If so, what's similar about it, and what did you do to solve it in the past?

As plain as the nose on a fly: Figuring out what the question is asking

The second and most important step in solving a word problem is to determine exactly what the question is asking. Sometimes the question is asked directly. At other times, it may be a little more difficult to identify the actual question. Suppose you're asked the following question:



What's the volume of a cardboard box measuring 12-inches long by 14-inches wide by 10-inches tall?

(A) 52 cubic inches

(B) 88 cubic inches

(C) 120 cubic inches

(D) 1,680 cubic inches

The question asked by this word problem is stated directly. The problem asks you to determine the volume of a cardboard box. Recall from your high school algebra and geometry classes that the volume of a rectangular container is length × width × height or $v = lwh$. So $12 \times 14 \times 10 = 1{,}680$. The correct answer is Choice (D).

Now take a look at the next example:



How many cubic inches of sand does a cardboard box measuring 12-inches long by 14-inches wide by 10-inches tall contain?

(A) 52 cubic inches

(B) 88 cubic inches

(C) 120 cubic inches

(D) 1,680 cubic inches

This is the same problem, but the question you need to answer isn't as obviously stated. Therefore, you have to use clues imbedded in the problem in order to figure out what the actual question is. Would figuring out the perimeter of the box help you with this question? Nope. Would figuring out the area of one side of the box help you? Nope (you're not painting the box, you're filling it). The question wants you to determine the *volume* of the container.



Clue words can be a big help when trying to figure out what question is being asked. Look for the following clue words:

- **Addition:** sum, total, in all, perimeter, increased by, combined, added
- **Division:** share, distribute, ratio, quotient, average, per, a, out of, percent
- **Equals:** is, was, are, were, amounts to
- **Multiplication:** product, total, area, cubic, times, multiplied by, of
- **Subtraction:** difference, how much more, exceed, less than, fewer than, decreased

Digging for the facts

After you figure out what question you're answering in the first place (see the preceding section), the next step is to figure out what data is necessary to solve the problem and what data is extraneous. Start by identifying all the information and variables in the problem and listing them on your scratch paper. Make sure you attach units of measurement contained in the problem (mile, feet, inches, gallons, quarts, and so on).

After you've made a list of the facts, try to eliminate those facts that aren't relevant to the question. Look at the following example:



To raise money for the school yearbook project, Tom sold 15 candy bars. Becky sold 12 candy bars, Debbie sold 17 candy bars, and Jane sold the most at 50. How many candy bars were sold by the girls?

The list of facts may look something like this:

Tom = 15 bars

Becky = 12 bars

Debbie = 17 bars

Jane = 50 bars

? = total sold by the girls

Because the question is the total number of candy bars sold by the girls, the number of bars sold by Tom isn't relevant to the problem and can be scratched off the list. Just add the remaining bars from your list.

Setting up the problem and working your way to the answer

You need to decide how the problem can be solved and then use your math skills to arrive at a solution. For instance, a question may ask the following:



Joan just turned 37. For 12 years she's dreamed of traveling to Key West to become a beach bum. To finance this dream, she needs to save a total of $15,000. How much does Joan need to save each year if she wants to become a beach bum by her 40th birthday?

Write down, in mathematical terms, what the question is asking you to determine. Because the question is asking how much money Joan needs to save per year to reach $15,000, you can say y (years Joan has to save) × m (money she needs to save each year) = $15,000. Or to put it more mathematically:

$$ym = \$15{,}000$$

You don't know the value of m (yet) — that's the unknown you're asked to find. But you can find out the value of y — the number of years Joan has to save. If she's 37 and wants to be a beach bum by the time she's 40, she has 3 years to save. So now the formula looks like this:

$$3m = 15{,}000$$

To isolate the unknown on one side of the equation, you simply divide each side by 3, so that $3m \div 3 = 15{,}000 \div 3$. (If you don't remember how to isolate unknowns, flip on over to Chapter 8.) Therefore, your answer is

$$m = 5{,}000$$

Joan needs to save $5,000 each year for 3 years to reach her goal of $15,000 by the time she's 40.



You may be tempted to include the 12 years Joan has been dreaming of this trip into your formula. This number was put into the problem as a *distracter*. It has no bearing on solving the problem. Tricky little questions, aren't they?

Reviewing your answer

Before marking your answer sheet or punching in that choice on the computer, you should review your answer to make sure it makes sense. Review by asking yourself the following questions:

- Does your solution seem probable?
- Does it answer the question asked?
- Are you sure?
- Is your answer expressed using the same units of measurement as used in the problem?

You may find that the solution you arrived at doesn't fit the facts presented in the problem. If this is the case, back up and go through the steps again until you arrive at an answer that seems probable.

Welcome Back to Basic (Math) Training

Numbers come in several varieties. *Whole* numbers are numbers such as 1, 2, 17, and 54. *Fractions, percents,* and *decimals* are numbers used to represent a part of a whole number. The following sections present some specific strategies you need to remember when you're crunching the numbers to figure out those menacing word problems.

Operations: What you do to numbers

When you toss numbers together (mathematically speaking), you perform an *operation.* When you add or multiply, you perform a *basic operation.* But because math functions according to yin-yang-like principles, each of these basic operations also has an opposite operation called an *inverse operation.* Thus, the inverse of addition is subtraction, and the inverse of multiplication is division. And, of course, the inverse of subtraction is — you got it — addition. The inverse of division (go on, you can do it) is multiplication. Great work!



Don't confuse *opposite* with *inverse.* When you're doing mathematical operations, such as adding and multiplying, the inverse operation is the opposite operation. But when you're talking numbers, opposite and inverse don't mean the same thing. The opposite of a positive number is a negative number, so the *opposite* of x is $-x$. But the inverse of a number is that number turned on its head! The inverse of x is $\frac{1}{x}$. The inverse of $\frac{1}{5}$ is $\frac{5}{1}$ (or just 5).

The result of each operation goes by a different name:

- When you *add* two numbers together, you arrive at a *sum.*
- When you *subtract,* all that remains is a *remainder.*
- When you *multiply,* you come up with a *product.*
- When you *divide,* you're left with a *quotient.*

When setting up formulas to solve word problems, you need to remember that operations must be performed in a certain order. For example, when you have parentheses in a math problem, the calculation in the parentheses must be done before any calculations outside of the parentheses. In the equation $5 + (16 \times 2) = ?$, you first multiply 16 by 2 to arrive at 32, and then you add the 5 to come up with a total of 37. You get a different (and wrong) answer if you simply calculate from left to right: $5 + 16 = 21$. $21 \times 2 = 42$. And you better believe that both results will be choices on the test!



To figure out which mathematical operation you should perform first, second, third, and so on, follow these rules, otherwise known as the *order of operations:*

1. **Parentheses take precedence.**

   You should do everything contained in parentheses first. In cases where parentheses are contained within parentheses, do the innermost parentheses first. If you're dealing with a fraction, treat the top as if it were in parentheses and the bottom as if it were in parentheses even if the parentheses weren't written in the original state.

   So if you have the problem

   $$\frac{1+2}{3} = ?$$

   Add the numbers above or to the left of the fraction bar and then divide. The answer is $\frac{3}{3} = ?$

The square root sign (√) is also a grouping symbol, so you solve for the square root before doing any other operation in the problem. (For more on fractions, see the next section. And to get your fill of square roots, march on over to Chapter 8.)

2. **Exponents come next.**

   Remember that the exponent goes with the number or variable that it's closest to. If it had been closest to a parenthesis sign, then you already would've performed the calculation inside the parenthesis. For example, $(5 \times 2)^2 = 10^2 = 100$.

   The square root sign (√) is also treated as an exponent symbol, so you solve for the square root during this step. (See Chapter 8.)

3. **Multiplication and division are next.**

   You always do these operations in left-to-right order (just like you read).

4. **Addition and subtraction are last.**

   Perform these operations from left to right as well.



Check out the following example for a little practice with order of operations:

$(15 \div 5) \times 3 + (18 - 7) = ?$

Follow these steps:

1. **Do the work in parenthesis.**

   The result is $3 \times 3 + 11 = ?$

2. **Division and multiplication come next (in this problem, only multiplication is needed and no exponent work is present).**

   You end with $9 + 11 = ?$

3. **Finally, do the addition and subtraction (in this problem, only addition is needed).**

   Your final answer is 20.

On both sides of the line: Fractions

We don't know why, but it seems almost all math textbooks explain fractions in terms of pies. (We think most mathematicians must have a sweet tooth.) But we like pizza, so we're going to use pizza instead.

If a *whole number* is a pizza, a *fraction* is a slice of pizza. A fraction also illustrates its relationship to the whole pizza. For example, consider the fraction ⅗. If you accuse your cousin of eating ⅗ of the pizza when he comes over for movie night, you're saying that the pizza is divided into five equal-sized slices — fifths — and your cousin ate three of those five slices. Can anyone say *pig?*



The number above the fraction bar — the three slices your cousin ate — is called the *numerator.* The number written below the fraction bar — the total number of slices the pizza is divided into — is called the *denominator.*

Adding and subtracting fractions

To add and subtract fractions, the fractions must have the same denominator, which is called a *common denominator.* If the fractions don't have a common denominator, you have to find one. There are two different methods to use. Sound fun? Read on.

Method one

Finding a common denominator can be easy, or it can be as hard as picking off all the anchovies. Suppose you want to add $\frac{3}{5}$ and $\frac{3}{10}$. This operation is an easy one, and you use this process whenever you can evenly divide one denominator by another. Follow the steps below:

1. **Divide the larger denominator by the smaller denominator.**

   If there's a remainder, then you can't use this method, and you have to use method two (see the following section). In this case, 10 can be divided evenly by 5. The quotient that results is 2.

2. **Take the fraction with the smaller denominator ($\frac{3}{5}$) and multiply the denominator by 2 — the quotient that resulted when you divided the larger denominator by the smaller.**

   The result is 10.

3. **Replace the denominator of the smaller fraction with the result from Step 2.**

4. **Multiply the numerator of the smaller fraction by 2.**

   In this case, the result is 6.

5. **Replace the numerator with the result of the previous step.**

   You can also express $\frac{3}{5}$ as $\frac{6}{10}$. (If you cut the pizza into 10 slices instead of 5, and your cousin ate 6 slices instead of 3, he would've eaten exactly the same amount of pizza.)

After you've found a common denominator, you add the two fractions by simply adding the numerators together: $\frac{6}{10} + \frac{3}{10} = \frac{9}{10}$. Think of it this way: If your cousin eats $\frac{6}{10}$ of the pizza (which is just another way of saying $\frac{3}{5}$), and you eat $\frac{3}{10}$ of the pizza, together you've eaten $\frac{9}{10}$ of the pizza.

Method two

Suppose your cousin eats $\frac{3}{5}$ of one pizza and your sister eats $\frac{1}{6}$ of another pizza (one that was cut into 6 slices instead of 5), and you want to know how much pizza has been eaten. In this case, you need to add $\frac{3}{5}$ and $\frac{1}{6}$.

Adding these fractions is a bit more difficult because you can't divide either denominator by the other. So you have to find a common denominator that both 5 and 6 divide into evenly:

1. **Multiply the denominator of the first fraction by the denominator of the second fraction.**

   In the example case, $5 \times 6 = 30$. The common denominator for both fractions is 30.

2. **Express the first fraction in terms of the new common denominator: $\frac{3}{5} = \frac{?}{30}$.**

3. **Multiply the numerator by the number you used to multiply to result in the new denominator.**

   To convert the denominator, 5, to 30, you multiply by 6, so multiply the numerator (3) by 6. The result is 18. Therefore, the fraction $\frac{3}{5}$ can be expressed as $\frac{18}{30}$.



   When you're trying to find the common denominator for a fraction, you must always multiply the numerator and the denominator by the same number. Otherwise, you change the value of the fraction.

   With the problem illustrated above, you multiply the numerator and the denominator by 6, discovering that $\frac{3}{5}$ is the same thing as $\frac{18}{30}$. But if you had multiplied only the denominator by 6, you would have a new number. $\frac{3}{5}$ and $\frac{3}{30}$ don't have the same value.

4. **Next, express the second fraction in terms of the new common denominator: $\frac{1}{6} = \frac{5}{30}$.**
5. **Multiply the numerator of the second fraction by the number you used to result in the denominator: $5 \times 1 = 5$.**

   The fraction $\frac{1}{6}$ can be expressed as $\frac{5}{30}$. After all that work, you can finally add the fractions: $\frac{18}{30} + \frac{5}{30} = \frac{23}{30}$. Now pause and take a bite of pizza.

Another more complicated way of adding fractions is having multiple fractions to add. If you have more than two fractions with different denominators, you have to find a common denominator that all the denominators divide into.

1. **Suppose you need to add $\frac{1}{2} + \frac{2}{3} + \frac{3}{5}$.**

   A simple way to find a common denominator is to take the largest denominator (in this case 5) and multiply it by whole numbers, starting with 1, 2, 3, 4, and so on until you find a denominator that the other denominators also divide into evenly.
2. **If you multiply 5 by 2, you get 10, but 3 doesn't divide evenly into 10.**

   So keep going: $5 \times 3 = 15$, $5 \times 4 = 20$, and so on until you find a number that 2, 3, and 5 can divide into evenly.
3. **In this case, 30 is the first number you can find that 2, 3, and 5 can divide into evenly, so 30 is your common denominator.**



Multiplying and simplifying fractions

Multiplying fractions is easy. You just multiply the numerators and then multiply the denominators. So look at the following equation:

$$\frac{1}{2} \times \frac{3}{4} \times \frac{3}{5} = ?$$

You multiply $1 \times 3 \times 3 = 9$ (the numerators) and then $2 \times 4 \times 5 = 40$ (the denominators) to result in $\frac{9}{40}$.

Occasionally, when you multiply fractions, you end up with an extremely large fraction that can be simplified or reduced. To express a fraction in its *lowest terms* means to put it in such a way that you can't divide the numerator and the denominator by the same number (other than 1).

A number that you can divide into both the numerator and the denominator is called a *common factor.* If you have the fraction $\frac{6}{10}$, both the numerator, 6, and the denominator, 10, can be divided by the same number, 2. In this example, the common factor is 2. If you perform the operations ($6 \div 2 = 3$ and $10 \div 2 = 5$), $\frac{6}{10}$ can be expressed in the simpler terms of $\frac{3}{5}$. You can't reduce (simplify) $\frac{3}{5}$ any further; the only other number that both the numerator and denominator can be divided by is 1, so the result would be the same, $\frac{3}{5}$.

Dividing fractions

Dividing fractions is simple if you remember this rule: Dividing a fraction by a number is the same as multiplying it by the inverse of that number. Of course there are always exceptions. You can't use this operation on zero. Zero has no inverse. No one knows why — it just is.



Don't forget that the inverse of a number is obtained by reversing the number. That means that if you want to divide a fraction by 5, you simply multiply the fraction by the inverse of 5, which is $\frac{1}{5}$.

This process is more easily illustrated if you remember that 5 is the same thing as $\frac{5}{1}$. In other words, 5 divided by 1 equals 5 ($5 \div 1 = 5$). And the inverse of $\frac{5}{1}$ is $\frac{1}{5}$. To come up with the inverse of a number, simply stand the number on its head.

So, to divide a fraction, use the inverse of the number that follows the division symbol (÷) and substitute a multiplication symbol (×) for the division symbol. Therefore, ⅓ ÷ 2 is expressed as ⅓ × ½, and you already know how to multiply fractions. (If not, check out the "Multiplying and simplifying fractions" section earlier in the chapter.) 1 × 1 = 1 and 3 × 2 = 6, so the product of ⅓ × ½ is ⅙. Therefore, ⅓ ÷ 2 = ⅙.

Converting improper fractions to mixed numbers . . . and back again

If you have a fraction with a numerator larger than its denominator, you have an *improper fraction.* For example, ⅞ is an improper fraction. To put an improper fraction into simpler (proper) terms, you can change ⅞ into a mixed number (a number that includes a whole number and a fraction). Simply divide the numerator by the denominator. 7 divided by 3 becomes a quotient of 2 with ⅓ left over. There's something left over because 3 doesn't divide evenly into 7. The number that's left over becomes a numerator over the original denominator. Therefore, ⅞ is the same as 2⅓.

If you want to multiply or divide a mixed number, you need to convert it into a fraction — an improper fraction. To make the change, you convert the whole number into a fraction and add it to the fraction you already have. So, if you have 7⅔, you convert 7 to a fraction, which gives you ²¹⁄₃, and add that fraction to the fraction that already exists — ⅔ — to arrive at ²³⁄₃.

How do you know that 7 is the same thing as ²¹⁄₃? Well, to convert the whole number into a fraction, multiply the whole number by the denominator of the existing fraction to arrive at a new numerator: 7 × 3 = 21. You then place this new numerator over the existing denominator to achieve ²¹⁄₃. But you're not done yet. You add that fraction to the remaining fraction to get the final answer: ²¹⁄₃ + ⅔ = ²³⁄₃. (Check out the "Adding and subtracting fractions" section earlier in this chapter for the complete scoop on adding fractions.) Or, if you want to get technical, you can look at the whole process this way, too:

$$7\tfrac{2}{3} = \frac{(7 \times 3) + 2}{3} = \tfrac{23}{3}$$

Expressing a fraction in other forms: Decimals and percents

A fraction can also be expressed as a decimal and as a percent. To change a fraction into a decimal, you divide the numerator by the denominator (for discussion on what numerators and denominators are, see "On both sides of the line: Fractions" earlier in the chapter.) Given that handy explanation, ⅗ converted into decimal form is 0.60. To make a decimal into a percent, move the decimal point two spaces to the right and add a percent sign — 0.60 becomes 60.0%. (See the following sections for more thorough discussions of decimals and percents.)



The first space to the right of the decimal is the *tenth* place, the second space is the *hundredth* place, and the third is the *thousandth* (and so on).

Adding and subtracting decimals

To add and subtract decimals, put the numbers in a column and line up the decimal points. Then add or subtract as if the decimals were whole numbers, keeping the decimal point in the same position in your answer. Here are two examples:

1.4583	1.4583
+0.55	–0.55
2.0083	0.9083



You can add zeroes to the end of a decimal if performing the calculations this way is easier for you. So 0.1 can be 0.100 without changing its value. In the above problems, 0.55 can be 0.5500 to help you line up the decimal points and perform the operation.

Multiplying decimals

Multiplying a decimal is like multiplying a regular, everyday whole number, except that you have to place the decimal point in the correct position once you reach an answer. To multiply decimals, start off by adding the number of decimal places (from the right of the decimal point) in the numbers being multiplied. If one of the numbers you're multiplying is 3.77, for example, you have two decimal places. If the other number you're multiplying is 2.8, you have one decimal place, so the total number of decimal places in your answer will be three. In this example, $377 \times 28 = 10556$. Move the decimal point back to the left 3 places. The resulting product is 10.556.



If you're multiplying a number that has only zeroes to the right of the decimal point, then those decimals don't count. For instance, 3 can also be expressed as 3.0, but you wouldn't count the "0" as a decimal place. All of the zeroes to the right of the decimal don't count unless a number other than zero is also to the right of the decimal. For instance, 3.000007 has six decimal spaces; 3.0070 has three decimal spaces; and 3.000 has none, at least not for the purpose of multiplying.

If your answer doesn't include enough numbers for the decimal spaces you need, then add as many zeroes as necessary to the left of the answer. Suppose your answer is 50, and you have to move the decimal point to the left three spaces. There aren't three spaces in 50. So you add a zero to the left, to make 050, and put the decimal point in its proper position: .050 is your answer.

Here's another example: 0.04×0.25. Add the decimal places in the two numbers. (There are four.) Multiply the decimals as if they were whole numbers: $4 \times 25 = 100$. Then put the decimal point in the correct place in the answer. For 100, count from right to left four places, and put the decimal point there: 0.0100. Here's the method behind the madness:

$$4/100 \times 25/100 = 100/1000 = 1/10 = 0.01 \text{ (or } 0.0100\text{)}$$



Dividing decimals

Decimals are divided according to slightly different rules depending on whether both numbers in the problem are decimals.

Dividing decimals by whole numbers

If you're dividing a decimal by a whole number, perform the operation as if the two numbers were both whole numbers. Move the decimal point over to the right until the decimal is a whole number, counting the number of decimal places. Remember how many places you moved the decimal — you need that info later.

Here's an example:

$1.25 \div 4 = ?$

Follow these steps:

1. **Change 1.25 to 125 by moving the decimal two decimal places to the right.**
2. **Perform the division operation on the whole number: 125 ÷ 4 = 31.25.**

   But you're not done yet.

3. **Now move the decimal point two places to the left (to make up for moving it two places to the right when you made 1.25 into a whole number), and your answer is 0.3125.**

Dividing decimals by decimals

To divide a decimal by another decimal in which there are equal numbers after the decimal point, make the divisor (the decimal going into the other number) a whole number. Move the decimal point all the way to the right, counting the number of places you move it. Then move the decimal in the dividend (the number being divided) the same number of decimal places.

So, if you want to divide 0.15 by 0.25, (0.15 ÷ 0.25), follow these steps:

1. **Move the decimal point two places to the right in the divisor: 0.25 then becomes 25.**
2. **Move the decimal in the dividend the same number of spaces: 0.15 becomes 15.**
3. **Divide 15 by 25.**

   The result is 0.60. You don't need to move any more decimals around — 0.60 is your final answer.

If the dividend is a longer decimal than the divisor, you follow the same steps, but you have to add an extra step at the end. So, if your problem is 0.125 ÷ 0.50, check out these steps:

1. **Move the decimal point in the divisor (0.50) two places to the right so that you have the whole number 50.**
2. **Then move the decimal point in the dividend two places, to come up with 12.5.**
3. **Now the problem looks like this: 12.5 ÷ 50.**
4. **Convert the first number (12.5) to a whole number by moving the decimal point one place to the right.**
5. **Now perform the division operation on the whole numbers: 125 ÷ 50 = 2.5.**
6. **Move the decimal point one place to the left (to make up for moving it one place to the right when you converted 12.5 to a whole number).**

   The answer is 0.25.

When the divisor is a longer decimal than the dividend, such as 0.5 ÷ 0.125, move the decimal place in the divisor all the way to the right, in this case making 0.125 into 125, counting spaces. Then move the decimal the same number of spaces in the dividend, adding zeroes as needed: 0.5 then becomes 500. 500 ÷ 125 = 4, which is the correct answer (0.50 ÷ 0.125 = 4).

Playing with percents

A *percent* is a fraction based on one hundredths. Five percent (5%) is the same as $\frac{5}{100}$ or 0.05. The ASVAB often asks you to calculate *10% off* or *an increase of 15%* on the Arithmetic Reasoning subtest. You need to be able to convert percents to fractions or decimals to answer these questions correctly.

Here are some helpful hints for figuring percents:

- To add, subtract, multiply, or divide using percents, change the percent to a fraction or a decimal.
- Remember, a percent is just hundredths, so 3% is $\frac{3}{100}$ or 0.03, 22% is $\frac{22}{100}$ or .22, and 110% is $\frac{110}{100}$ or 1.10.
- Just drop the percent sign and move the decimal point two places to the left, adding zeros as needed.

- The decimal point always starts to the right of a whole number, so 60 is the same thing as 60.0. Moving the decimal point two spaces to the left leaves you with 0.60.
- After you do the conversion, follow the rules outlined in the earlier sections for performing specific operations on fractions or decimals.

Some fractions convert to *repeating decimals* — a decimal in which one digit is repeated infinitely. ⅔ is the same as 0.66666 (with the sixes never stopping). Repeating decimals are often rounded to the nearest hundredth; therefore, ⅔ rounds to 0.67.

Numbers have relationships, too — they're called ratios

A ratio shows a relationship between two things. It expresses a comparison by proportion. For example, if Margaret invested in her tattoo parlor at a 2:1 ratio to her business partner Julie, then Margaret put in two dollars for every one dollar that Julie put in.

Here's another example:



Suppose you fill up your brand new, shiny SUV. You drive for 240 miles and then refill the tank with 15 gallons of gas. You can compute your gas mileage by comparing ratios. 240 miles is to 15 gallons as x (the unknown) is to 1 gallon or $\frac{240}{15} = \frac{x}{1}$. Multiply both sides of the equation by 1 and you get $x = \frac{240}{15}$, or $x = 16$. You're getting 16 miles to the gallon. Time for a tune up!

Remembering important rates

The term *rate* has various meanings. Essentially, a rate is a fixed quantity (a 5% interest rate, for example). It can mean the speed at which one works. (John reads at the rate of one page per minute.) It can also mean an amount of money paid based on another amount. (Life insurance may be purchased at a rate of $1 per $100 of coverage.)

Word problems often ask you to solve problems concerning travel or simple interest rates. Two formulas you should commit to memory include the following:

- Distance ($d = rt$), where d represents the distance traveled, r is the rate of travel, and t is the amount of time traveled.
- Simple interest ($I = prt$), where I represents the amount of interest, p is the principle invested, r is the interest rate, and t is the length of time the money is invested.

Navigating scale drawings

Scale, particularly when used on the ASVAB, relates to scale drawings. For example, a map drawn to scale may have a one-inch drawing of a road that represents one mile of physical road in the real world. The Arithmetic Reasoning portion of the ASVAB often asks you to calculate a problem based on scale, which can be represented as a ratio or a fraction.

On a map with a scale of one inch to one mile, the ratio of the scale is represented as 1:1. But questions are never this easy on the ASVAB. You're more likely to see something like, "If a map has a scale of one inch to every four miles. . . ." That scale is expressed as the ratio 1:4.



Try your hand with the following common scale problem:

If the scale on a road map is 1 inch = 250 miles, how many inches would represent 1250 miles?

The problem wants you to determine how many inches on the map represents 1250 miles, if 1 inch is equal to 250 miles.

You know that 1 inch = 250 miles. You also know that x inches is equal to 1250 miles. The problem can be expressed in ratios 1:250 = x:1250, or $\frac{1}{250} = \frac{x}{1250}$. Now all you have to do is solve for x.

$$\frac{1}{250} = \frac{x}{1250}$$

$$1250 \times \frac{1}{250} = \frac{x}{1250} \times 1250$$

$$\frac{1250}{250} = x$$

$$x = 5$$

So, if 1 inch is equal to 250 miles, then 5 inches would be equal to 1250 miles. If this problem causes you to scratch your head, check out Chapter 8 for more information on mathematics.



Almost every military job makes use of scales, which is why scale-related questions are so common on the ASVAB. Whether you're reading maps at Mountain Warfare School or organizing trash pickup around the base, you need to use and interpret scales frequently.

Completing a number series

The Arithmetic Reasoning subtest often includes questions that test your ability to logically complete a series of numbers. Generally, these problems are the only questions that aren't word problems, but they test your ability to do arithmetic and to reason because you must be able to determine how the numbers relate to each other. And to do this, you must also be able to quickly perform mathematical operations.

Suppose you have a series of numbers that look like this:

1, 4, 7, 10, ?

Each new number is reached by adding three to the previous number. 1 + 3 = 4; 4 + 3 = 7; and so on. So the next number in the sequence is 10 + 3 or 13. But, of course, the questions on the ASVAB aren't quite this simple. More likely, you'll see something like this:

2, 4, 16, 256, ?

In this case, each number is being multiplied by itself, so $2 \times 2 = 4$; $4 \times 4 = 16$; and so on. 256×256 is 65,536 — the correct answer. You may also see sequences like this:

1, 2, 3, 6, ?

In this sequence, the numbers are being added together. 1 + 2 = 3 and 1 + 2 + 3 = 6. So the next number is 1 + 2 + 3 + 6 or 12.

Finding the pattern

To answer sequence questions correctly, you need to figure out the pattern as quickly as possible. Some people, blessed with superior sequencing genes, can figure out patterns instinctively. The rest of the population has to rely on a more difficult, manual effort.



Finding a pattern in a series of numbers requires you to think about how numbers work. For instance, in the second example in the preceding section, seeing the number 256 should alert you that multiplication is the operation because 256 is so much larger than the other numbers. On the other hand, because the values in the third example don't increase by much, you can guess that the pattern requires addition instead of multiplication.

Dealing with more than one operation in a series

Don't forget that more than one operation can occur in a series. For example, a series may be "add one, subtract one, add two, subtract two." That would look something like this:

2, 3, 2, 4, ?

Because the numbers in the series both increase and decrease as the series continues, you should suspect that something tricky is going on.



In the beginning of this chapter, we mention that you should be supplied with some scratch paper. Make sure to use it! Jot down notes while you're trying to find the pattern in a series. Writing your work down helps you keep track of what operations you've tried.

Tips for Adding to Your Arithmetic Score

Guessing in boot camp is a definite no-no, but guessing in many areas of the ASVAB is perfectly fine. On the ASVAB, you aren't penalized for wrong answers, so it makes sense to guess if you don't know the answer. After all, you have a 1 in 4, or 25%, or 0.25, chance to guess the correct answer. A 25% chance is so much better than the 0% chance you have of getting a question right if you skip it. Plus, by following the tips in this section, you can do a better job of guessing correctly and increase your odds of winning the lottery, er, we mean scoring well on the ASVAB.



Don't spend much more than a minute on any one problem. If you do, you may not have time to finish this subtest. But, before you commit to an answer to a math question, double-check your calculations. One easy way to double-check your work is to plug the answer into the question.

Logical deductions: Eliminating unlikely answers

Check out the sand-in-the-box problem below. If you read this chapter all the way through, you may remember this problem from the section "As plain as the nose on a fly: Figuring out what the question is asking" earlier in this chapter.



How many cubic inches of sand does a cardboard box measuring 12-inches long by 14-inches wide by 10-inches tall contain?

(A) 52 cubic inches

(B) 88 cubic inches

(C) 120 cubic inches

(D) 1,680 cubic inches

You may have already shrewdly determined that the question is asking you to find the volume of the cardboard box. But you don't remember that Volume = length × width × height. In fact, you think that the only time anyone told you about volume was when they said that your stereo was too loud, which is no help to you now.

Still all is not lost. If you use logic, you may be able to eliminate some incorrect or unlikely answers from the choices, which improves your chances of guessing correctly. Check out the following thought process:

1. **You know that adding the length of each side of the box gives you the perimeter, which isn't the right answer.**

   So, if 12 + 12 + 14 + 14 = the perimeter, or 52 inches, then you know that Choice (A) isn't correct. So you continue thinking about the problem.

2. **You know that if you multiply the height of the box by its length, you get the area, not the volume.**

   So solving for area by multiplying length × width and coming up with 120 doesn't solve the problem. Therefore Choice (C) is also wrong.

3. **At this point, it may occur to you that if you multiply the height of the box by its length and by its width, you get its volume.**

   Or it may not occur to you. But you do know that the volume measurement is going to be greater than the area measurement. So you can choose an answer that is larger than the area of the cardboard box. Therefore, if Choice (C), 120, is too small, then Choice (B), 88, is also too small — and also wrong. So the correct answer is (D), 1680.



Everything doesn't usually work out quite so neatly on the ASVAB, but in general, you can eliminate a few choices through logical reasoning. Then you can choose among the remaining answers. Doing this means you have a greater chance of guessing the right answer.

Avoiding testing traps: Complete the whole problem!

Don't forget to solve the entire problem. Sometimes those crafty test makers set little traps for you to fall into. For instance, suppose you have this question:



John, a roofing contractor, needs to purchase asphalt shingles for a client's roof. How many 4-x-4-inch shingles are needed to cover a roof that measures 12 x 16 feet?

(A) 192

(B) 12

(C) 27,648

(D) 1,728

This question asks you to perform several operations. You must determine the area of the roof, figure out the area each shingle will cover, and then come up with the total number of shingles required to cover the area of the roof.



Many people fail to complete the entire series of calculations because they're sweating the pressure from the clock. They think, "Aha! I know how to answer this one!" They figure out that the area of the roof is 192 square feet (12 × 16) and choose Choice (A) as the correct answer. But Choice (A) isn't the correct answer because coming up with 192 square feet is only a small portion of the problem.

Others folks go further with their calculations and determine that the area of each shingle is 16 inches (4×4) and divide 192 (the area of the roof) by 16 to reach 12 shingles. They choose Choice (B), and they're wrong. They're wrong because *the roof is measured in feet and the shingles are measured in inches.* The measurements must be converted so the area of the shingles and the area of the roof are both expressed in the same measuring unit.

The easiest way to figure out this problem is to multiply both the length and the height of the roof by 12 (because 12 inches are in a foot) and then multiply the height and the length of the roof together to determine the total area of the roof in inches.

Thus, the area of the roof in inches is 27,648. Some people, pleased that they remembered to convert feet into inches, choose Choice (C). That's an incorrect answer because the question asks how many shingles are needed to cover the roof. To determine the number of shingles needed, divide 27,648 by 16 (the area in inches of each shingle) to come up with 1,728 shingles (or enough to cause John to go back to the shop for a heavy-duty pickup truck). *Correct answer:* Choice (D).



Use your common sense! If an answer doesn't seem reasonable — like a roof requiring only 12 shingles — you've probably made a mistake in your calculations. Go back and try again. Remember, this subtest tests your ability to make calculations based on *real-life* problems, and no real-life roof was ever covered with only 12 shingles.

If you find word problems difficult, you're not alone. Many people have a hard time with them. You not only have to foster a talent for analyzing the problem and picking out the essential information, but also you need a solid foundation in basic math skills. Here are some useful resources for you to check out:

- **Chapter 8 (of this book):** The next chapter contains additional high school-level math review to help you further develop your arithmetic reasoning skills.
- **Other books:** Other valuable teaching aids to help are available from the friendly Dummies' folks. Check out *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math for Dummies* by Scott Hatch — all published by Wiley Publishing, Inc

Chapter 8

Mathematics Knowledge

In This Chapter

- Getting more terminology under your belt
- Revisiting high school: Algebra and geometry review
- Performing calculations without the calculator
- Perfecting your way to a higher score

Albert Einstein once said, "Do not worry about your problems with mathematics. I assure you mine are far greater." The good professor obviously never faced an upcoming ASVAB exam! Okay, just kidding. You don't have to be a mathematical theoretician to score well on the Mathematics Knowledge subtest. This subtest asks questions about basic high school mathematics. No college or graduate degrees needed.

The Mathematics Knowledge subtest consists of 25 questions, and you have 24 minutes to complete the subtest. You don't necessarily have to rush through each calculation, but the pace you need to set (a little less than a minute per question) doesn't exactly give you time to daydream. You have to focus and concentrate to solve each problem quickly and accurately. And no calculators allowed!



The vast majority of questions on this subtest are expressed in mathematical terms, but you may see some word problems as well. Generally, such word problems are more direct than the problems you see on the Arithmetic Reasoning subtest (see Chapter 7). But most of the time, the Mathematics Knowledge subtest only contains one or two questions testing each specific mathematical concept. For example, one question may ask you to multiply fractions, the next may ask you to solve a mathematical inequality, and the question after that may ask you to find the value of an exponent. (If you're freaked out by the last sentence, calm down. These concepts are covered in this chapter.)

All this variety forces you to constantly shift your mental gears to quickly deal with different concepts. You can look at this situation from two perspectives. These mental gymnastics can be difficult and frustrating, especially if you know everything about solving for x but nothing about deriving a square root. But variety can also be the spice of life. If you don't know how to solve a specific type of problem, this oversight may only cause you to get one or two questions wrong.



To qualify for certain jobs in the military, you have to score well on the Mathematics Knowledge subtest. You also have to do well on this subtest (which is part of the AFQT discussed in Chapter 1) in order to enlist. Turn to the Appendix to find out more about the subtest scores needed for specific military jobs.

Just When You Thought You Were Done with Vocab: Math Terminology

Like any science, math has its own vocabulary. In order to understand what each problem on the Mathematical Knowledge subtest asks you to do, you must understand certain mathematical terms:

- **Base:** A number that's used as a factor at least two times. For instance, the term 4^3 (which can be written $4 \times 4 \times 4$, and in which 4 is a factor three times) has a base of 4.
- **Factorial:** A factorial is represented by an exclamation point (!), and is figured by finding the product of a whole number and all the whole numbers less than it. So 6 factorial (6!) is $6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$.

  A factorial helps you determine *permutations* — all the different possible ways an event might turn out. For example, if you want to know how many different ways six runners could finish a race (permutation), you would solve for 6!
- **Reciprocal:** The number by which another number can be multiplied to produce 1. For example, the reciprocal of 3 is ⅓. If you multiply 3 times ⅓ you get 1. The reciprocal of ⅙ is 6/1 (which is the same thing as 6). $⅙ \times 6 = 1$. Get the idea?
- **Root:** The square root of a number is the number, which, when multiplied by itself (*squared*), equals the original number. For example, the square root of 36 is 6. If you square 6, or multiply it by itself, you produce 36. (Check out "More about roots: Math roots, not the movie," later in this chapter.)
- **Rounding:** Limiting a number to a few (or no) decimal places. You perform rounding operations all the time — often without even thinking about it. If you have a $1.97 in change in your pocket, you may say, "I have about two dollars." The rounding process simplifies mathematical operations.

  Often, numbers are rounded to the nearest tenth. The ASVAB may ask you to do this. For any number 5 and over, round up; for any number under 5, round down. For example, 1.55 can be rounded up to 1.6, and 1.34 can be rounded down to 1.3.

  Many math problems require rounding. (Especially when you're doing all this without a calculator.) For example, pi (π) represents a number approximate to 3.14159265358979323846264338327 (and on and on and on). However, in mathematical operations, it's common to round π to 3.14.

What Part of X Don't You Understand? Algebra Review

Some people may freak out just hearing the word *algebra.* But in actuality, algebra is just a way to put problems into mathematical language using the simplest mathematical terms possible. In fact, it's almost impossible to solve most word problems without some use of algebra.

In algebra, you often hear about "solving for *x*" or "solving for the unknown," but what's the unknown? The *unknown* is the answer you want find. Check out this example:



Rod's mom has worked up a powerful thirst solving a ton of math problems and asked Rod to run to the corner store and get her one of those super-duper gigantic nuclear soft drinks. If a regular-sized soft drink costs $0.50 and the super-duper gigantic nuclear size costs three times the cost of the regular size, how much will Rod have to spend?

You can express this problem in terms of *x,* with *x* being the cost of the super-duper sized drink: *x* equals 3 (the price difference) × 50 cents. Written a bit more formally, the equation looks like this: $x = 3 \times .50$ *or* $3 \times .50 = x$.

What if you don't know how much the regular sized soft drink costs? You can express this missing piece of information in an equation as well: *x* (how much it will cost to buy a super-duper size) equals 3 (the cost increase) times *p* (the price of one regular sized drink). Once again, written a bit more formally, the equation looks like this: $x = 3 \times p$.



You can remove the multiplication symbol in algebraic expressions when using a combination of letters and numbers. Therefore, the equation $x = 3 \times p$ can also be written $x = 3p$. The multiplication symbol is implied.



The letters in an algebra problem are commonly called *variables,* meaning that the number they stand for *varies* or changes.

What? More vocabulary? Algebra-related terms

Special algebra terms are used to describe how numbers function and how they relate to each other. Knowing what these terms mean is important to your ASVAB success:

- **Composite number:** A whole number that can be divided evenly by itself and by 1, as well as by one or more other whole numbers, which means that it has more than two factors. Examples of composite numbers are 6, 8, and 9.
- **Exponents:** You can think of exponents as a shorthand method of indicating multiplication. For example, 15×15 can also be expressed as 15^2, which is also known as "15 squared" or "15 to the second power." The small number (2) written slightly above and to the right of a number is called the exponent. An exponent indicates the number of times you multiply the number it accompanies by itself — 15^2 (15×15) isn't the same as 15×2.

  To express $15 \times 15 \times 15$ using this shorthand method, simply write it as 15^3, which is also called "15 cubed" or "15 to the third power." Again, 15^3 isn't the same as 15×3.
- **Factors:** Numbers that can divide into a composite number. To *factor* a composite number, you simply determine the numbers that you can divide into it. For example, 8 can be divided by the numbers 2 and 4 (in addition to 1 and 8), so 2 and 4 are factors of 8.
- **Prime number:** A whole number that can be divided evenly by itself and by 1 but not by any other number, which means that it has exactly two *factors.* (Check out the definition of *factor* a bit earlier in this list.) Examples of prime numbers are 2, 5, and 11.

When all things are equal: The algebra equation

Algebra problems are equations, which means that the quantities on both sides of the equal sign are equal — they're the same. 2 = 2. 1 + 1 = 2. And 3 – 1 = 2. In all these cases, the quantities are the same on both sides of the equal sign. So, if $x = 2$, then *x is* 2 because the equal sign says so.

Solving one-step equations involving addition and subtraction

If $x + 1 = 2$, then x must be 1, because only 1 added to 1 is 2. So far, so simple, so good. But what if the equation is a little more complicated:

$$x + 47{,}432 = 50{,}000$$

To find out what x equals, which solves the problem, you need to isolate x on one side of the equal sign. To get that job done, you have to move any other numbers on the x side of the equal sign to the other side of the equal sign.

By looking at the x side of the equation, you can see that it's an addition problem. To move the number on the x side to the opposite side, you have to perform the inverse operation. The inverse operation of addition is subtraction. (For a full rundown on inverse operations, check out Chapter 7.) So, to move 47,432 from the x side to the non-x side of the equation, simply subtract it from both sides:

$$x + 47{,}432 - 47{,}432 = 50{,}000 - 47{,}432$$

Performing these operations removes the 47,432 from the x side of the equation (47,432 – 47,432 = 0, so that side of the equation is $x + 0$ or simply x) and gives you 2,568 on the non-x side of the equation (50,000 – 47,432 = 2,568). You're left with the final answer:

$$x = 2{,}568$$

To double-check that this answer is correct, plug your answer into the original problem:

$$x + 47{,}432 = 50{,}000$$
$$2{,}568 + 47{,}432 = 50{,}000$$

If you plug the answer in and it doesn't work, you've made an error in your calculations. Start again; remember that you're trying to isolate x on one side of the equation.



You can perform any calculation on either side of an equation as long as you do it to both sides of the equation. That keeps the equation *equal.*

Multiplying and dividing using integers

An *integer* is any positive or negative whole number or zero. The ASVAB often requires you to work with integers such as $-6x = 36$. (Don't forget, $6x$ is the same thing as $6 \times x$.)



In multiplication and division, if the two terms being operated on (on either side of the equal sign) are both positive numbers or both negative numbers, the answer is a positive number. If one number is negative and the other is positive, the answer is negative.

So to solve this problem, $-6x = 36$, you need to isolate x, so perform an inverse operation (remember, the inverse operation of multiplication is division):

$$-6x \div -6 = 36 \div -6$$
$$x = -6$$

The answer is a negative number because the two terms, 36 and –6, have different signs.



In an algebra equation, if the same letter is used more than once, it stands for the same number. $3x + 2x = 10$, the first x will *never* be a different number from the second x. In this case, $x = 2$ (both times).

You can only combine like terms when operating on algebraic expressions: $3x + 3x = 6x$, but $3x + 3y$ doesn't equal $6xy$, nor does $x^2 + x^3 = x^5$ (see the section "Explaining exponents," later in this chapter to find out more about algebra involving exponents).

Solving multistep equations

Not all algebra problems have one-step solutions. (That would be too easy, and you wouldn't sweat nearly as much.) Solving algebra problems on the ASVAB often requires you to perform several steps.

An example of a multistep equation is when x shows up on both sides of the equal sign. Then you have to get rid of x from one side of the equation by moving an x from one side to the other. You do this by performing the inverse operation.

Suppose you want to solve this equation:

$$3x + 3 = 9 + x$$

Follow these steps:

1. **To remove the x from one side of the equation, perform the inverse operation:**

   $3x + 3 - x = 9 + x - x$. This equation can also be stated as $3x + 3 - 1x = 9 + 0$.

2. **Perform the subtraction operation.**

   $2x + 3 = 9$

3. **To finish solving the problem, subtract 3 from each side of the equation.**

   $2x + 3 - 3 = 9 - 3$

   $2x = 6$

4. **Divide both sides of the equation by 2.**

   $2x \div 2 = 6 \div 2$

   $x = 3$



When you have a variable by itself, such as x, it's always equal to $1 \times$ that variable (or one of that variable), like $1x$, even if the 1 isn't written out. In fact, any number is equal to 1 times itself, so you could also say $2 = 2 \times 1$. Sometimes this comes in handy when you're solving those algebra problems.

Explaining exponents

Exponents are an easy way to show that a number is to be multiplied by itself a certain number of times. For example, 5^2 is the same as 5×5. y^3 is the same as $y \times y \times y$. The number or variable that's multiplied by itself is called the *base,* and the number or variable showing how many times it is to be multiplied by itself is called the *exponent* or *power.*

Here are important rules when working with exponents:

- Any base raised to the power of one equals itself. Example: $x^1 = x$.
- Any base raised to the zero power (except 0) equals 1. Example: $x^0 = 1$.
- To multiply terms with the same base, you add the exponents. Example: $x^2 \times x^3 = x^5$.
- To divide terms with the same base, you subtract the exponents. Example x^5 (divided by) $x^2 = x^3$.

- If a base has a negative exponent, it's equal to its reciprocal with a positive exponent. Example: $x^{-3} = \frac{1}{x^3}$.
- When a product has an exponent, each factor is raised to that power. Example: $(xy)^3 = x^3 \times y^3$.

A note about scientific notation

Scientific notation is a compact format for writing very large or very small numbers. While its most often used in scientific fields, you may find a question or two on the Mathematics Knowledge subtest of the ASVAB, asking you to covert a number to scientific notation or vice-versa.

Scientific notation separates a number into two parts: a decimal fraction, usually between 1 and 10, and a power of ten. Therefore 1.25×10^4 means 1.25×10 to the fourth power or 12,500; 5.79×10^{-8} means $5.79 \div$ by 10 to the eighth power or 0.0000000579.

More about roots: Math roots, not the movie

A *square root* is the factor (see the "What? More vocabulary? Algebra-related terms" section earlier in this chapter) of a number that, when multiplied by itself, produces the number. Take the number 36, for example. One of the factors of 36 is 6. If you multiply 6 by itself (6×6), you come up with 36, so 6 is the square root of 36. The number 36 has other factors such as 18. But, if you multiply 18 by itself (18×18), you get 324, not 36. So 18 isn't the square root of 36.



One number can only have one square root.

All numbers are grouped into one of two camps when it comes to roots:

- **Perfect squares:** Only a few numbers, called *perfect squares*, have exact square roots.
- **Irrational numbers:** All the rest have square roots that include decimals that go on forever and have no pattern that repeats (nonrepeating, nonterminating decimals), so they're called *irrational numbers*.



The sign for a square root is called the radical sign. It looks like this: √. Here's how you use it: √36 means "the square root of 36" — in other words, 6.

Perfect squares

Square roots can be difficult to find at times without a calculator, but because you can't use a calculator during the test, you're going to have to use your mind and some guessing methods. To find the square root of a number without a calculator, make an educated guess and then verify your results.

To use the educated-guess method, you have to know the square roots of a few perfect squares. One good way to do this is to study the squares of the square roots 1 through 12:

- 1 is the square root of 1 ($1 \times 1 = 1$)
- 2 is the square root of 4 ($2 \times 2 = 4$)
- 3 is the square root of 9 ($3 \times 3 = 9$)

- 4 is the square root of 16 ($4 \times 4 = 16$)
- 5 is the square root of 25 ($5 \times 5 = 25$)
- 6 is the square root of 36 ($6 \times 6 = 36$)
- 7 is the square root of 49 ($7 \times 7 = 49$)
- 8 is the square root of 64 ($8 \times 8 = 64$)
- 9 is the square root of 81 ($9 \times 9 = 81$)
- 10 is the square root of 100 ($10 \times 10 = 100$)
- 11 is the square root of 121 ($11 \times 11 = 121$)
- 12 is the square root of 144 ($12 \times 12 = 144$)

Irrational numbers

When the ASVAB asks you to figure square roots of numbers that don't have perfect squares, the task gets a bit more difficult. If you have to find the square root of a number that isn't a perfect square, the ASVAB usually asks you to find the square root to the nearest tenth.

Suppose you run across this problem:

$\sqrt{54}$

Think about what you know:

- You know from the preceding section that the square root of 49 is 7, and 54 is slightly greater than 49.
- You also know that the square root of 64 is 8, and 54 is slightly less than 64.
- So, if the number 54 is somewhere between 49 and 64, the square root of 54 is somewhere between 7 and 8.
- Because 54 is closer to 49 than to 64, the square root will be closer to 7 than to 8, so you can try 7.3 as the square root of 54:

  1. **Multiply 7.3 by itself.**

     $7.3 \times 7.3 = 53.29$, which is very close to 54.

  2. **Try multiplying 7.4 by itself to see if it's any closer to 54.**

     $7.4 \times 7.4 = 54.76$, which isn't as close to 54 as 53.29.

  3. **So 7.3 is the square root of 54 to the nearest tenth without going over.**

Exponential roots

The wonderful world of math is also home to concepts like *cube roots, fourth roots, fifth roots,* and so on. These roots are a factor of a number, which, when cubed (multiplied by itself three times), taken to the fourth power (multiplied by itself four times), and so on, produce the original number. A couple of examples seem to be in order:

- The cube root of 27 is 3. If you cube 3 (also known as raising it to the third power or multiplying $3 \times 3 \times 3$), the product is 27.
- The fourth root of 16 is that number which, when multiplied by itself four times, equals 16. Any guesses? Drumroll, please: 2 is the fourth root of 16 because $2 \times 2 \times 2 \times 2 = 16$.

Looking at Math from a Different Angle: Geometry Review

Geometry is the branch of mathematics that makes grown adults cry — end of discussion. What? You want a more specific explanation of geometry than that? Okay, geometry is the branch of mathematics concerned with measuring things and defining the properties of and relationships between and among shapes, lines, points, angles, and other such objects. Hey, don't blame us; you asked for it.

Before you read any further, you should note a few things to remember:

- Arcs, circles, triangles, and angles are measured in degrees and (not very often) in minutes (which are smaller than degrees).
- A circle has 360 degrees (360°).
- A *quadrilateral* (shapes with four sides like a square or rectangle) has 360°.
- Any arc or angle that isn't a complete circle or quadrilateral measures less than 360°.

Outlining angles

Angles are formed when two lines intersect at a point. Angles are measured in degrees. The greater the number of degrees, the wider the angle is:

- A *straight line* is 180°.
- A *right angle* is exactly 90°.
- An *acute angle* is more than 0° and less than 90°.
- An *obtuse angle* is more than 90° but less than 180°.
- *Complementary angles* are two angles that equal 90° when added together.
- *Supplementary angles* are two angles that equal 180° when added together.

Take a look at the different types of angles in Figure 8-1.

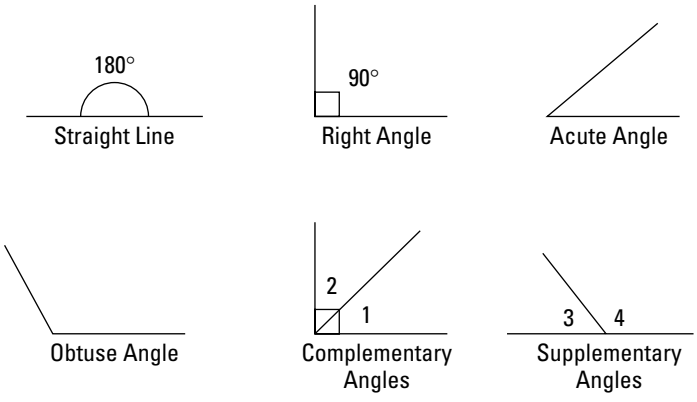


Figure 8-1: A diagram of the different types of angles.

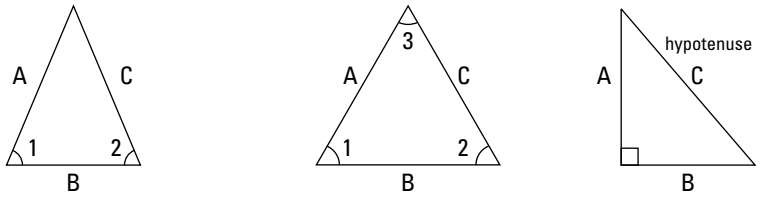
Pointing out triangle types

A *triangle* consists of three straight lines whose three angles always add up to 180°. The sides of a triangle are called *legs.* Triangles can be classified according to the relationship between their angles or the relationship between their sides or some combination of these relationships:

- **Isosceles triangle:** Has two equal sides, and the angles opposite the equal sides are also equal
- **Equilateral triangle:** Has three equal sides, and all the angles measure 60°
- **Right triangle:** Has one right angle (90°); therefore, the remaining two angles are complementary (add up to 90°)

  The side opposite the right angle is called the *hypotenuse,* which is the longest side of a right triangle.

Check out Figure 8-2 to see what these triangles look like.



Isosceles Triangle

If sides A and C are equal, then angles 1 and 2 are equal.

Equilateral Triangle

Sides A, B, C are equal. Angles 1, 2, 3 are equal.

Right Triangle

$A^2 + B^2 = C^2$

Figure 8-2: The different triangles of geometry.

When working with triangles, there are a few other terms and concepts you need to know:

- You can find the *perimeter* — the distance around a shape — of a triangle by adding together the length of the three sides.
- The *area* — the space within a shape — of a triangle is one-half the product of the base (the bottom or the length) and the height (the tallest point of the triangle) or $1/2bh$.
- The *Pythagorean theorem* states that if you know the length of two sides of a right triangle, the length of the third side can be determined, using the formula $a^2 + b^2 = c^2$, where a and b represent the length of the two known sides.

Back to square one: Quadrilaterals

Quadrilaterals — shapes with four sides — all contain angles totaling 360°. Many different types of quadrilaterals exist:

- **Parallelograms** have opposite sides that are parallel, and their opposite sides and angles are equal.
- **Rectangles** have all right angles.
- **Rhombuses** have four sides of equal length, but the angles don't have to be right angles.

- **Squares** have four sides of equal length, and all the angles are right angles.
- **Trapezoids** have at least two sides that are parallel.

See Figure 8-3 for the illustration of these quadrilaterals.

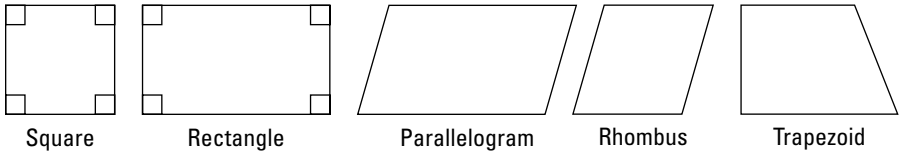


Figure 8-3: An illustration of quadrilaterals.

To determine the *perimeter* of a quadrilateral, simply add the length of all the sides. And to figure the *area* of a rectangle (including squares) multiply length × width.

Going around in circles

A *circle* is formed when the points of a closed line are all located equal distances from its center. A circle always has 360°. The closed line of a circle is called its perimeter or *circumference.* The *radius* of a circle is the measurement from the center of the circle to any point on the circumference of the circle. The *diameter* of the circle is measured as a line passing through the center of the circle, from a point on one side of the circle all the way to a point on the other side of the circle. The diameter of a circle is always twice as long as the radius of a circle, or $d = 2r$. (See Figure 8-4, which shows you the parts of a circle.)

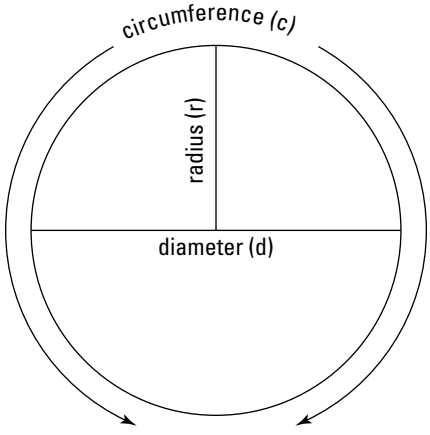


Figure 8-4: Checking out the parts of circles.

Navigating the circumference

To measure the *circumference* of a circle, use the number pi (π). Although π is a lengthy number, when used in geometry, it's generally rounded to 3.14 or $\frac{22}{7}$. Because π is rounded to 3.14 or $\frac{22}{7}$, when you solve a problem using π, the equal sign isn't used because the answer isn't exactly equal to the equation (due to the rounding). A symbol called the *approximation symbol* (≈) is used.

Use this formula:

Circumference = $\pi \times$ diameter

or

$C = \pi d$

Because the *radius* of a circle is half its diameter, you can also use the radius to determine the circumference of a circle. Here's the formula:

$C = 2\pi r$

Suppose that you know that the pie you just baked has a diameter of 9 inches. You can determine its circumference by using the circumference formula:

$C = \pi d$

$C \approx 3.14 \times 9$

$C \approx 28.26$ inches

Mapping out the area

Determining the area of a circle also requires the use of π.

Area = $\pi \times$ the square of the circle's radius

or

$A = \pi r2$

To determine the area of a 9-inch-diameter pie, multiply π by the square of 4.5. Why 4.5 and not 9? Remember, the radius is always half the diameter, and the diameter is 9 inches.

$A = \pi r^2$

$A \approx 3.14 \times 4.5^2$

$A \approx 3.14 \times 4.5 \times 4.5$

$A \approx 3.14 \times 20.25$

$A \approx 63.585$ inches

Filling 'er up: Calculating volume

Volume is the space a solid (three-dimensional) shape takes up. You can think of volume as how much a shape would hold if you poured water into it. Volume is measured in cubic units.

The formula for finding volume depends on the object:

- For rectangular objects, you multiply length $\times$ width (depth) $\times$ height. This is possible because the length, width, and height of a rectangle are consistent throughout the whole shape. The formula looks like this: $V = lwh$.

  For a box that measures 5-feet long, 6-feet deep, and 2-feet tall, you simply multiply $5 \times 6 \times 2$ to arrive at a volume of 60 cubic feet.





- For a cylinder that has two circles for its bases, the calculation is $V = (\pi r^2)h$ or, volume = pi × the radius squared × height.

  For a cylinder that has a radius of 2 inches and a height of 10 inches, here's the deal: Multiply the value of pi (3.14) times 4 (which is the radius squared) times 10, or $3.14 \times 4 \times 10 = 125.6$ cubic inches.

Calculating without a Calculator: All You Need to Know

Too bad those ASVAB honchos don't allow you to use a calculator on the test. That would make it a breeze. Remember, though, the Mathematics Knowledge subtest of the ASVAB is based on arithmetic you most likely studied in high school. In this section, you come up to speed on how to solve problems that the Mathematics Knowledge subtest commonly throws at its victims, um, test takers.

Factoring to find original numbers

Now and then, the ASVAB gives you a *product* (the answer to a multiplication problem), and you have to find the original numbers that were multiplied together to produce that product. This process is called *factoring*. You use factors when you combine like terms and add fractions.



Take, for example, this product:

$$4xy + 2x^2$$

To factor this product, follow these steps:

1. **Find the *highest common factor* — the highest number that evenly divides all the terms in the expression.**

   In this case, the highest number that divides into both terms is 2.

2. **Then figure out the common factors for the variables too.**

   In this case, the highest variable that divides into both xy and x^2 is x.

3. **Okay — take what you know to this point, and you can see that the highest common factor is $2x$.**

   So far, so good.

4. **Now divide $2x$ into both terms in the expression.**

   The resulting terms are $2y + x$.

5. **Finally, multiply the entire expression by 2x to set the equation equal to its original value.**

   Doing so produces the factors of $2x(2y + x)$.

Time to try something a little more complicated: factoring a *trinomial* (a problem with three terms). Look at the below example:



$$x^2 - 12x + 20$$

To factor this product, follow these steps:

1. **Find the factors of the first term of the trinomial.**

   The factors of x^2 are x and x ($x \times x = x^2$). Put those factors (x and x) on the left side of two sets of parentheses:

   $(x\,)(x\,)$

2. **Determine whether the two expressions will be positive or negative.**

   You can see that the last term in the trinomial (+ 20) has a plus sign. That means the resulting factors must be either plus or minus, because two pluses result in a positive number and two minuses result in a positive number. Because the second term ($-12x$) is a negative number, both of the factors must be negative. (Because two negative numbers multiplied equals a positive number.)

   $(x -)(x -)$

3. **Find the number that'll be used as the second term in the resulting factors.**

4. **Plug the two numbers into the right side of the parentheses.**

   This part can be tricky. The factors of the third term, when added or subtracted together must equal the second term of the trinomial. The factors of 20 (the third term) which combines with 12 are 2 and 10 because $2 \times 10 = 20$ (the third term) and $2 + 10 = 12$ (the second term).

   $(x - 2)(x + 10)$

   The factors of $x^2 - 12x + 20$ are $x - 2$ and $x + 10$.

Making alphabet soup: The quadratic equation

Algebra questions often ask you to solve for x or solve for an unknown. These questions can be expressed, for example, as $x = 2 + 3$. You simply isolate the unknown on one side of the equation and solve the other side to learn what x equals. In this case, x equals 5. The topic of solving for unknowns is covered in more depth in the section, "What Part of *X* Don't You Understand? Algebra Review," earlier in this chapter.

So what's a quadratic equation? Sounds a little scary, huh? The Mathematical Knowledge subtest may ask you to solve one of these equations, but have no fear. You've come to the right place. This section can help.



A *quadratic equation* is an equation that includes the square of an unknown. The exponent in these equations is never higher than 2 (because it would then no longer be the *square* of an unknown, but a cube or something else). Here are some examples of quadratic equations:

$$x^2 - 4x = -4$$
$$2x^2 = x + 6$$
$$x^2 = 36$$



Simple quadratic equations (those that consist of just one squared term and a number) can be solved by using the *square root rule:*

If $x^2 = \sqrt{k}$, then $x = \pm k$, as long as k isn't a negative number.

Remember to include the ± sign, which indicates the answer is a positive or negative number. Take the following simple quadratic equation:



$7y^2 = 28$

1. **First get rid of the pesky 7 by dividing both sides by 7.**

   The result is $y^2 = 4$.

2. **Using the square root rule, you then take the square root of both sides of the equation.**

   $\sqrt{y^2} = y$ and $\sqrt{4} = 2$

   $y = \pm 2$

The above steps work with simple quadratic equations, but when you're solving a complex quadratic equation, you put all the terms on one side of the equal sign, making the equation equal zero. In other words, get the quadratic equation into this form: $ax^2 + bx + c = 0$, where *a, b,* and *c* are numbers and *x* is unknown. Take a look at the following equation:



$x^2 - 2x = 15$

You can convert this equation to quadratic form by subtracting 15 from both sides of the equation.

$x^2 - 2x - 15 = 0$

The most efficient way to solve most quadratic equations is by factoring the equation and then setting each separate factor equal to zero. See the section "Factoring to find original numbers" earlier in this chapter.

Look at this equation again:



$x^2 - 2x - 15 = 0$

$(x - 5)(x + 3) = 0$

$x - 5 = 0$ and $x + 3 = 0$

$x = 5$ and $x = -3$

The solution for $x^2 - 2x - 15$ is 5, –3

All math isn't created equal: Solving inequalities

Some algebra problems state that two numbers aren't equal to each other (thus they're inequalities). In an inequality, the first number is either greater than (≥) or less than (≤) the second.

Just like with equations, the solution to an inequality is a value that makes the inequality true. For the most part, you solve inequalities the same as you would solve a normal equation. There are some facts of inequality life you need to keep in mind, however. Short and sweet, here they are:

- *Negative numbers* are less than zero and less than positive numbers.
- *Zero* is less than positive numbers but greater than negative numbers.
- *Positive numbers* are greater than negative numbers and greater than zero.

A regular algebraic equation includes the equal sign (=), because the very basis of the equation is that one side of the equation must equal the other. Quite the opposite is true with inequalities, and they have their own special symbols, used to express the differences:

- $\neq$ means *does not equal* in the way that 3 *does not equal* 4 or $3 \neq 4$.
- $>$ means *greater than* in the way that 4 *is greater than* 3 or $4 > 3$.
- $<$ means *less than* in the way the 3 *is less than* 4, or $3 < 4$.
- $\leq$ means *less than or equal to* in the way that x may be *less than or equal to* 4 or $x \leq 4$.
- $\geq$ means *greater than or equal to* in the way that x may be *greater than or equal to* 3 or $x \geq 3$.

To solve an inequality, you follow the same rules as you would for solving any other equation. For example, check out this inequality:

$$3 + x \geq 4$$

To solve it, simply isolate x by subtracting 3 from both sides of the equation:

$$3 + x - 3 \geq 4 - 3$$

or

$$x \geq 1$$



The only exception to this rule is when you multiply or divide both sides of the inequality by a negative number. In that case, the inequality sign is reversed. So, if you multiply both sides of the inequality $3 < 4$ by –4, your answer is $-12 > -16$.

Test-Taking Techniques for Your Mathematical Journey

As with most of the other subtests on the ASVAB, guessing on the Mathematical Knowledge subtest doesn't count against you. So scribble in an answer, any answer, on your answer sheet because, if you don't, your chances of getting that answer right are zero. But, if you take a shot at it, your chances increase to 25%, or 1 in 4. In the following sections, you find some tips that can help you improve those odds, even when you don't know how to solve the problem.

If you're not confident in your math skills you may wish to invest some extra study time. Check out *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch — all published by Wiley Publishing, Inc.

Knowing what the question is asking

This subtest presents most of the questions as straightforward math problems, not word problems, so knowing what the question is asking you to do is easier. However, reading each question carefully, paying particular attention to plus (+) and minus (–) signs (which can really change the answer to a question) is still important. Finally, make sure you do *all* the calculations needed to produce the correct answer. Check out this example:



Find the value of $\sqrt{(81^2)}$.

(A) 9

(B) 18

(C) 81

(D) 6,561

If you're in a hurry, you may put 9 down as an answer because you remember that the square root of 81 is 9. Or, in a rush, you could multiply 9 (the square root of 81) by 2 instead of squaring it, as the exponent indicates you should. Or, you might just multiply 81 by 81 to get 6,561 without remembering that you also need to then find the square root, which gives you the correct answer: Choice (C). So make sure you perform all the operations needed (and that you perform the *correct* operations) to find the right answer.

Figuring out what you're solving for

Even though getting artistic with your answer sheet can be fun, the techniques in this section help you try to first improve your chances of guessing the right answer. Right out of the gate, read the question carefully. Some questions can seem out of your league at first glance, but if you look at them again, a light may go on in your brain. Suppose you get this question:



s number of students are in a classroom. ⅖ of the students are enlisted personnel. ½ of the enlisted personnel are privates. How many privates are in the audience?

(A) 2½*s*

(B) 2*s*

(C) ⅕*s*

(D) ⅒*s*

At first glance, you may think, "Oh, no! Solve for an unknown, *s*. I don't remember how to do that!" But, if you look at the question again, you may see that you're not solving for *s* at all. You're simply multiplying a fraction. So you take ⅖ times ½ and arrive at ²⁄₁₀, but you should reduce that fraction to get ⅕. The correct answer is Choice (C). (See Chapter 6 for a refresher on multiplying fractions.)

Solving what you can and guessing the rest

Sometimes a problem requires multiple operations for you to arrive at the correct answer. If you don't know how to do all of the operations, don't give up. You can still narrow your guess down by doing what you can.



Because the Mathematical Knowledge subtest doesn't penalize you for guessing, mark the answer sheet even if you're clueless. You can even make a pretty design on your answer sheet and still have a one-in-four chance of getting each answer right.



Suppose this question confronts you:

What's the value of $(0.03)^3$?

(A) 0.0027

(B) 0.06

(C) 0.000027

(D) 0.0009

Say you don't remember how to multiply decimals. All isn't lost! If you remember how to use exponents, you'll remember that you have to multiply $0.03 \times 0.03 \times 0.03$. So, if you simplify the problem and just multiply $3 \times 3 \times 3$, without worrying about those pesky zeroes, your answer will have a 27 in it. With this pearl of wisdom in mind, you can see that Choice (B), which adds 0.03 to 0.03, is wrong. It also means that Choice (D), which multiplies 0.03 and 0.03, is wrong. Now you have two possible answers, and you've improved your chances of guessing the right one to 50 percent! By multiplying $3 \times 3 \times 3$ to get 27, don't forget to put the decimal points back in. You have six places to make up, so move the decimal from 27.0 six places to the left to get 0.000027. The correct answer is Choice (C).



Don't forget to use that scratch paper! Suppose you run across this question:

> A child is building a tower of blocks. Each block is a cube. Some blocks are white, and some blocks are red. Red blocks surround each white block. How many red blocks surround each white block?

This problem may be difficult to figure out until you sketch a six-sided block (a cube) on your scratch paper and realize that the block must be surrounded by six other blocks. Sometimes drawing that visual helps you solve the problem.

Using the process of elimination

Another method (besides guessing) you can use when you run into questions where you draw a total blank is to plug the possible answers into the equation and see which one works. Say the following problem is staring you right in the eyes:



Solve for *x*: $x - 5 = 32$

(A) $x = 5$

(B) $x = 32$

(C) $x = -32$

(D) $x = 37$

You're not sure what to do. If you're totally stumped and can't think of any possible way of approaching this problem, simply plugging in each of the four answers to see which one is correct is your best bet.

- **Answer A:** $5 - 5 = 32$, which you know is wrong
- **Answer B:** $32 - 5 = 32$, which is wrong
- **Answer C:** $-32 - 5 = 32$, which is wrong
- **Answer D:** $37 - 5 = 32$, which is correct



Don't forget that plugging in all the answers is time consuming, so save this procedure until you've answered all the problems you can answer. If you're taking the computer version, you can't skip a question, so remember to budget your time wisely. If you don't have much time, just make a guess and move on. You may be able to solve the next question easily.

Double-checking your work

Although you don't have a ton of time to complete the Mathematical Knowledge subtest, you do have about a minute per problem. Although a minute doesn't allow for a lot of head scratching, it's more time than you think. So double-check your answers before putting your pencil down (or before going on to the next problem on the computer).

You can go over your calculations again to make sure that you didn't make an error. You can also plug your answer into the original equation to make sure that it's the correct answer. Then move along, private!



Chapter 9

Brother, Can You Spare an Equation? Arithmetic Practice Questions

In This Chapter

- Putting your mathematical reasoning to the test
- Practicing your arithmetic skills

It's time to put those calculators, pocket computers, and abacuses away — the actual ASVAB doesn't allow you to use anything except paper, pencil, and a winning personality to solve the math problems. You should use the old-fashioned way on these practice questions, too. Tell you what. Instead of a number two pencil, you can use a number three or four instead. Heck, you can even use a pen. See? We're easy. No pressure here!

You may be tired of hearing this by now (if you've taken any of the other tests in this book), but the math subtests of the ASVAB are very important because they're used in calculating your AFQT score, which makes or breaks you as far as your eligibility to join the military. Additionally, every technical-oriented job in the military requires good to excellent math scores. Chapter 1 explains the AFQT in more detail.

On the ASVAB (and on the full-length practice tests later in this book), you'll see 30 Arithmetic Reasoning questions and 25 Mathematics Knowledge questions. In this chapter, you only have to sweat through 25 total questions.

Arithmetic Reasoning Practice Questions

Arithmetic Reasoning questions are mathematical problems expressed in a story format. Your goal is to determine what the question is asking by picking out the relevant factors needed to solve the problem, setting up mathematical equations as needed, and arriving at a correct solution. Sounds easy, right? Check out Chapter 7 for more help with Arithmetic Reasoning.

1. If apples are on sale at 15 for $3, what's the cost of each apple?

   (A) 50 cents

   (B) 25 cents

   (C) 20 cents

   (D) 30 cents

   Divide 3 by 15, so the correct answer is Choice (C).

2. A noncommissioned officer challenged her platoon of 11 enlisted women to beat her record of performing a 26-mile training run in 4 hours. If all of the enlisted women match her record, how many miles will they have run?

   (A) 71.5 miles

   (B) 6.5 miles

   (C) 286 miles

   (D) 312 miles

   Multiply 26×11. The other information in the question is irrelevant — it's there to throw you off. The correct answer is Choice (C).

3. Margaret gets her hair cut and colored at an expensive salon in town. She's expected to leave a 15% tip for services. If a haircut is $45 and a color treatment is $150, how much of a tip should Margaret leave?

   (A) $22.50

   (B) $29.25

   (C) $20.00

   (D) $195.00

   Add 45 and 150 and multiply the answer by .15 (15%). The correct answer is Choice (B).

4. A bag of sand holds 1 cubic foot of sand. How many bags of sand are needed to fill a square sandbox measuring 5-feet long and 1-foot high?

   (A) 25 bags

   (B) 5 bags

   (C) 10 bags

   (D) 15 bags

   To find the volume of the sandbox you take $l \times w \times h$. Don't forget that the measurements are for a *square* sandbox, so you can assume that if the box is 5-feet long, then it's also 5-feet wide. So $5 \times 5 \times 1$ is 25 cubic feet. Each bag holds one cubic foot of sand. Choice (A) is the correct answer.

5. The day Samantha arrived at boot camp the temperature reached a high of 90 degrees in the shade and a low of -20 at night in the barracks. What was the average temperature for the day?

   (A) 55 degrees

   (B) 45 degrees

   (C) 70 degrees

   (D) 62 degrees

   Divide the temperature range of 110 degrees by 2 to reach the average temperature. Choice (A) is the correct answer.

6. Farmer Beth has received an offer to sell her 320-acre farm for $3,000 per acre. She agrees to give the buyer $96,000 worth of land. What fraction of Farmer Beth's land is the buyer getting?

   (A) ¼

   (B) 1/10

   (C) ⅕

   (D) ⅔

   $96,000 divided by $3,000 (price per acre) equals 32 acres. 32 acres divided by 320 acres (total of the farm) equals 10% or 1/10 of the land. The correct answer is Choice (B).

7. A map is drawn so that 1 inch equals 3 miles. On the map, the distance from Kansas City to Denver is 192½ inches. How far is the round trip from Kansas City to Denver in miles?

   (A) 192½ miles

   (B) 577.5 miles

   (C) 385 miles

   (D) 1,155 miles

   Multiply 192.5×3 to get the distance in miles and then double the answer to account for both legs of the trip. Choice (D) is the correct answer.

8. Margaret and Julie can sell their tattoo parlor for $150,000. They plan to divide the proceeds according to the ratio of the money they each invested in the business. Margaret put in the most money at a 3:2 ratio to Julie. How much money should Julie get from the sale?

   (A) $50,000

   (B) $30,000

   (C) $60,000

   (D) $90,000

   According to the ratio, Margaret should get ⅗ of the money and Julie should get ⅖ of the money. The fractions are calculated by adding both sides of the ratio together (3 + 2 = 5) to determine the denominator. Each side of the ratio then becomes a numerator. Divide $150,000 by 5, then multiply the answer by 2 to determine Julie's share of the money. The correct answer is Choice (C).

9. What is the fifth number in the series 4, 8, 16, 32?

   (A) 48

   (B) 64

   (C) 96

   (D) 8

   The pattern is to double each number: 4 + 4 = 8; 8 + 8 = 16; 16 + 16 = 32; so 32 + 32 = 64. The correct answer is Choice (B).

10. In the military, ¼ of an enlisted person's time is spent sleeping and eating, 1/12 is spent standing at attention, ⅙ is spent staying fit, and ⅖ is spent working. The rest of the time is spent at the enlisted person's own discretion. How many hours per day does this discretionary time amount to?

    (A) 6.0 hours

    (B) 1.6 hours

    (C) 2.4 hours

    (D) 3.2 hours

    Calculate this answer by first assigning a common denominator of 60 to all the fractions and adjusting the numerators accordingly: 15/60, 5/60, 10/60, and 24/60. Add the fractions to find out how much time is allotted to all of these tasks. The total time is 54/60, which leaves 6/60 or 1/10 of the day to the enlisted person's discretion. 1/10 of 24 hours is 2.4 hours. Therefore, Choice (C) is the correct answer.

11. A designer sells a square yard of carpet for $15.00. The same carpet can be purchased at the carpet outlet store for $12.50. What is the percent difference in the higher priced carpet?

    (A) The designer's carpet costs about 17% more than the outlet-store carpet.

    (B) The designer's carpet costs about 20% more than the outlet-store carpet.

    (C) The designer's carpet costs about 25% more than the outlet-store carpet.

    (D) The designer's carpet costs about 12% more than the outlet-store carpet.

    Subtract the lower price from the higher price: $15.00 – $12.50 = $2.50. Divide the difference by the lower price to determine the percent difference: $2.50 ÷ $12.50 = 0.20 = 20%. The correct answer is Choice (B).

12. Terry got a haircut for $32.50, a hair color for $112.20, and a manicure for $17.25. How much total money did she spend at the salon?

    (A) $167.45

    (B) $144.70

    (C) $161.95

    (D) $156.95

    Simply add the amounts together: $32.50 + $112.20 + $17.25 = $161.95. Choice (C) is the correct answer.

13. Mailing the first ounce of a letter costs $0.39 and $0.24 to mail each additional ounce. How much does it cost to mail a 5-ounce letter?

    (A) $1.85

    (B) $1.16

    (C) $1.45

    (D) $1.35

    The first ounce costs $0.39. The next four ounces cost $0.24 each. Multiply $0.24 × 4 and then add $0.39 to the product to determine how much mailing a 5-ounce letter costs: $0.24 × 4 = $.96. $.96 + $0.39 = $1.35, the cost of mailing a 5-ounce letter. Choice (D) is the correct answer.

Arithmetic Skills Practice Questions

The remaining practice questions are straightforward math. You won't have to wonder how Terry got so much money to spend at the salon in the first place (like in the previous section). Remember, these questions are designed for high school level and below. You won't be solving equations to calculate the orbit of Mars around the Sun here.

14. Which of the following fractions is the largest?

(A) $\frac{2}{3}$

(B) $\frac{5}{8}$

(C) $\frac{11}{16}$

(D) $\frac{3}{4}$

To arrive at the answer, find a common denominator that all the denominators divide evenly into. In this case, the common denominator is 48 (multiply the smallest denominator by the largest denominator — 16×3). Next, convert all fractions to 48ths. In the case of Choice (A), multiply $\frac{2}{3} \times \frac{16}{16}$ to reach $\frac{32}{48}$. Perform the same type of calculation for all the other fractions, figuring out what number $\times$ the denominator gets 48, and then compare numerators. The largest numerator is the largest fraction. Choice (D) is the correct answer.

15. What's the product of $\sqrt{36}$ and $\sqrt{49}$?

(A) 1,764

(B) 42

(C) 13

(D) 6

The square root of 36 is 6 and the square root of 49 is 7. The *product* of those two numbers (6×7) is 42. The correct answer is Choice (B).

16. Solve for x: $2x - 3 = x + 7$.

(A) 10

(B) 6

(C) 21

(D) -10

Isolate the xs on one side of the equation by subtracting x from both sides: $2x - 3 - x = x + 7 - x$, or $x - 3 = 7$. Continue to perform operations to isolate x. Add 3 to both sides of the equation: $x - 3 + 3 = 7 + 3$, or $x = 10$. The correct answer is Choice (A).

17. A circle has a radius of 15 feet. What's most nearly its circumference?

(A) 30 feet

(B) 225 feet

(C) 94 feet

(D) 150 feet

The circumference of a circle is $\pi \times$ diameter; the diameter equals two times the radius. Therefore $30 \times 3.14 = 94$. The correct answer is Choice (C).

18. At 3:00 p.m., the angle between the hands of the clock is:

(A) 90 degrees

(B) 180 degrees

(C) 120 degrees

(D) 360 degrees

At 3:00 p.m., one hand is on the 12, and the other is on the 3. This creates a right angle — a 90-degree angle. The correct answer is Choice (A).

19. $2^3 \times 2^4 =$

(A) 16

(B) 108

(C) 128

(D) 148

$2^3 \times 2^4 = 2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$. Choice (C) is the correct answer.

20. Express 403,000,000,000,000 as scientific notation.

(A) 4.03×10^{14}

(B) 4.03×10^{-14}

(C) 403×10

(D) 0.43×10

Because the decimal point is moved 14 places to the left, the exponent is a positive number. Choice (A) is the correct answer.

21. Simplify $8x^2 - 3x + 4xy - 9x^2 - 5x - 20xy$

(A) $5x^2 + 9xy$

(B) $8x - 9x^2$

(C) $-x^2 - 8x - 16y$

(D) $8x + 9x^2$

$8x^2 - 3x = 4xy - 9x2 - 5x - 20xy = (8x^2 - 9x^2) + (-3x - 5) + (4xy - 20xy) = -x^2 - 8x - 16xy$. The correct answer is Choice (C).

22. What's the prime factorization of 90?

(A) $2 \times 3 \times 5$

(B) $2 \times 3^2 \times 5$

(C) $2^2 \times 3^2 \times 5$

(D) $2 \times 3 \times 5^2$

$90 = 9 \times 10 = 3 \times 3 \times 2 \times 5 = 2 \times 3^2 \times 5$. The correct answer is Choice (B).

23. $\frac{1}{4} \times \frac{2}{3} =$

(A) $\frac{3}{4}$

(B) $\frac{1}{4}$

(C) $\frac{1}{6}$

(D) $\frac{1}{3}$

$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12} = \frac{1}{6}$. The correct answer is Choice (C).

24. A baker has s pounds of sugar to use in baking. After she uses 50 pounds to make donuts, how much sugar does she have left?

(A) $s + 50$

(B) $50 - s$

(C) $s - 50$

(D) $s \div 50$

s is the amount of sugar the baker had before she made the donuts. Taking away 50 pounds, the amount of sugar used, gives you $s - 50$. Choice (C) is the correct answer.

25. Six pizzas are pepperoni, seven are hamburger, four are cheese, and three are "with everything." What's the probability that a randomly selected pizza is pepperoni?

(A) $\frac{1}{2}$

(B) $\frac{2}{5}$

(C) $\frac{3}{10}$

(D) $\frac{2}{3}$

There are 20 total pizzas. The probability of one of them being a pepperoni pizza is $\frac{6}{20}$ or $\frac{3}{10}$. The correct answer is Choice (C).

Part IV
The Whole Ball of Facts: Technical Skills



"I think I've fixed the intercom. Just remember to speak into the ceiling fan when the doorbell rings."

In this part . . .

To get into the military, you have to know how to read and how to add. But to qualify for certain military jobs, you also have to understand how the world works. Several ASVAB subtests test your knowledge of science and mechanics. Don't worry — we've got you covered.

Part IV helps you review principles of science, auto and shop information, mechanical comprehension, principles of electronics, and spatial relationships. If you're not interested in jobs that require this type of background (for a list of jobs requiring this info, see the Appendix), you don't need to score high on these tests. But, if you've set your heart on working on Humvees or F-18 Super Hornets, you should study this part to get you started.

Chapter 10

General Science

In This Chapter

- Reviewing scientific classification
- Grasping measurements
- Figuring out the scientific method
- Studying scientific disciplines
- Using scientific strategies to improve your score

General Science is an area of study that requires a lot of straight-up memorization. If you don't know that Earth is the third planet from the sun, then all the other science knowledge you may have won't help you one bit when the question asks, "Which planet is the third planet from the sun?"

As you study for this subtest, you may feel overwhelmed with facts and figures. You're presented with questions about facts you probably learned in high school in various science classes, such as health, life sciences, biology, and chemistry classes. If you do feel a bit overwhelmed, instead of trying to remember nine million individual facts, spend some time reviewing the general principles behind the facts. Looking at the big picture is an effective learning technique.

You have 11 minutes to answer 25 questions on the General Science subtest. That comes out to about 26 seconds per question, so there's no time to dilly dally. For the most part, you either know the answer or you don't. If you don't know the answer, you can always guess (check out Chapter 3 for tips on guessing on the ASVAB).

If you've read and worked through other chapters in this book, you're probably tired of us emphasizing that a particular subtest is important because the results are used in computing the Armed Forces Qualification Test (AFQT) score. Well, you can relax this time around. The General Science subtest has no bearing on this score. On the other hand, your score on this subtest is used to calculate some of the military composite scores that are used for job qualification purposes (see the Appendix for more information).

So take some time to review the facts in this chapter as a mini science lesson. If the job you want requires a good score on this subtest, you need to dedicate yourself to the information in this chapter to boost your General Science score. You may also want to seek additional study time in these excellent references to boost your science knowledge: *Chemistry For Dummies* by John T. Moore, *Biology For Dummies* by Donna Rae Siegfried, *Astronomy For Dummies*, 2nd Edition, by Stephen P. Maran, *Weather For Dummies* by John D. Cox, and *Physics For Dummies* by Steve Holzner, Ph.D. (all published by Wiley Publishing, Inc.).

Everything in Its Place: Categorizing Mother Nature

A long time ago, scientists looked at the world, noticed the hundreds of thousands of plants and animals around them, and decided that all these organisms needed to be labeled and grouped. Thus, the system of scientific classification was developed.

In order to effectively study plants and animals, all scientists need to use the same names. Using the same names keeps scientists from getting confused about what species is being referred to.



The current day classification system was created by Swedish botanist Carl Linnaeaus in 1757. Scientists often refer to this system as *taxonomy.* The Linnaean taxonomic system is quite useful as a classification system. Not only does it provide official names for every plant and animal, it also helps scientists understand how objects are related to one another.

Showing off your genus about the species

This scientific classification system notes the relationships and similarities among organisms. Each organism is given a scientific name that consists of two words (usually derived from Latin) — the *genus* and the *species* of the organism. The *genus* is the first word, and the *species* is the second word in this name. Thus, *Homo sapiens* refers to humans. *Canis familiaris* is the family dog, and *Canis lupus* is the family wolf. Because wolves and dogs share many similarities, they share the same genus (no, no, not the same *genes,* the same *genus*).



When writing a scientific name, the genus name is capitalized, and the species name is all lowercase. Both names are italicized.



No one is privy to the actual questions asked on the ASVAB (test materials are considered "controlled items" and are locked up in safes when not in actual use). In this category, questions can range anywhere from "how many Kingdoms are there," to "What's the genus for Canis familias?"

Counting down the classification system

The classification system consists of a total of seven levels:

- **Kingdom:** A *kingdom* is the broadest level. It contains the most kinds of organisms. The relationship between organisms in a kingdom is extremely loose.
- **Phylum:** Phylum is the major taxonomic group of animals and plants. Within the kingdoms, organisms are divided by general characteristics. For example, in the Animal Kingdom, animals with backbones are placed in a separate phylum from animals without backbones.
- **Class:** Organisms in a phylum are divided into classes that further group similarities. In the Animal Kingdom, for example, birds, mammals, and fish all group in their own classes. Among plants, all flowering plants comprise the angiosperm class, and all conifers, such as pines and spruces, comprise the conifer class.
- **Order:** Scientific groupings don't follow hard and fast rules. After you get to the "order" of a living thing, there's disagreement about where it belongs. You may find that different scientific organizations group creatures in different orders or families.

- **Family:** Families further divide organisms of the same class by similar characteristics. Not all scientific organizations may agree to the exact family an organization should be classified in.
- **Genus:** Two or more species that share unique body structures or other characteristics are considered to be closely related and are placed together in a genus. Sometimes a genus may include only a single species if there's nothing else in the world that has similarities with it.
- **Species:** A *species* is the most specific level. It contains the fewest organisms. The relationship between organisms in a species is very close.

In order to get a better idea of how the scientific classification system works, here's how the average lion is classified:

Kingdom Animalia: This kingdom includes all animals.

Phylum Chordata: All vertebrate animals belong to the Phylum Chordata.

Class Mammalia: All mammals belong to this class.

Order Carnivora: All mammals that eat meat belong to the Order Carnivora.

Family Felidae: The Family Felidae includes all cats.

Genus Panthera: This genus includes all the roaring cats, such as lions, tigers, jaguars, and leopards.

Species Leo: Lion.

Although not every scientist agrees (scientists never agree on any subject), in general, most lab-coated individuals settle on five as the number of kingdoms. Check out the organisms that comprise the five kingdoms:

- **Animals:** One of the two largest kingdoms. Includes many-celled organisms that, unlike plants, don't have cellulose cell walls, chlorophyll, or the capacity to convert light into energy *(photosynthesis)*; members of this kingdom can move and respond to stimuli. The Animal Kingdom includes more than 1,000,000 species.
- **Plants:** One of the two largest kingdoms. Includes organisms that can't move, don't have obvious nervous or sensory systems, and possess cellulose cell walls. Over 250,000 species belong to the Plant Kingdom.
- **Monerans and viruses:** Includes bacteria and algae — one-celled organisms that don't have a nucleus. Viruses don't have a true cell structure either — that's why they're stuck in this kingdom. More than 10,000 species have been discovered and classified in the Monera Kingdom.
- **Protists:** One-celled organisms that do have a nucleus like the protozoa (you may remember from biology class). This kingdom consists of more than 250,000 species.
- **Fungi:** Complex, many-celled organisms that don't photosynthesize (use light to create energy) like plants. Mushrooms are the most famous fungi (they have a star on the Fungi Walk of Fame). Over 100,000 species belong to the Fungi Kingdom.

There are 33 phyla that make up the animal kingdom, and 17 main phyla comprise the plant kingdom. Monerans consist of three phyla; Protists have seven phyla, and Fungi are made up from four phyla. Numerous classes, orders, families, genera, and species fall under each phylum.



Humans belong to the kingdom Animalia, the phylum Chordata, the class Mammalia, the order Primata, the family Hominidae, the genus Homo, and the species sapiens. You know, just in case you were wondering.

More vocabulary — nope, it never ends!

Just when you thought vocabulary study was over (because this section isn't the Word Knowledge subtest of the ASVAB), leave it to us to bring it up again. Many scientific words come from Latin or Greek. If you know the meaning of the Latin or Greek word, you can often figure out the meaning of the scientific word. Often, a Latin or Greek root word is used to create a longer, more specific word. For more information on common word roots, see Chapter 4.

For example, the Latin root *homo* means both *human being* and *same.* So *Homo sapiens* refer to *members of the human species,* but *homogeneous* means *of the same kind.* So if you ran across the word *homologous* on the General Science subtest, you'd know that it either has something to do with humans or with things that are the same.



Take a look at the following example question:

Which of the following instruments might an oceanographer be expected to use?

(A) Aspirator

(B) Hydrophone

(C) Calorimeter

(D) Centrifuge

Even if you don't have a clue about what any of these instruments do, if you know that *hydro* relates to water, you've significantly increased your chances of getting the right answer.

Understanding the Forms of Measurement

Because science is based on developing objective facts — evidence and results that are measurable and experiments that can be reproduced — measurements are an important part of science. And because this subtest is all about general science, you can expect to run into a few questions about measuring scientifically on the ASVAB.

Doing the metric thing

The *metric system* is based on a decimal system of multiples (and fractions) of ten. Scientists almost always use the metric system for precise measurement. No, they don't use it just to make the ASVAB harder for you. Scientists use the metric system so a standard exists among scientists around the world. In fact, the majority of countries around the globe use the metric system — the U.S. is in its own world when it comes to the nonmetric system.

Here are some main ideas you need to remember for the General Science subtest of the ASVAB:

- The *meter* is the unit of length.
- The *liter* is the unit of volume.
- The *gram* is the unit of weight.

Check out Tables 10-1 and 10-2 for more information.

Table 10-1	Metric Abbreviations
Measurement	***Abbreviation***
Centigram	cg
Centiliter	cl
Centimeter	cm
Gram	g
Kilogram	kg
Kiloliter	kl
Kilometer	km
Liter	l
Meter	m
Milligram	mg
Milliliter	ml
Millimeter	Mm

Table 10-2	Metric Units of Measure — Prefixes
Prefix	***What It Means***
Deci-	One-tenth (0.1)
Centi-	One-hundredth (0.01)
Milli-	One-thousandth (0.001)
Deca-	10
Hecto-	100
Kilo-	1000

Figuring temperature conversions

When you think of temperatures, you may consider different scales to figure temperatures in degrees. Scientists actually use three different scales to report temperature:

- **The *Celsius* scale (°C):** This scale measures temperature, which is the metric standard worldwide. On the Celsius scale, the *freezing point* (for water) is zero degrees and the *boiling point* (for water) is 100 degrees.
- **The *Fahrenheit* scale (°F):** This scale is more common in the United States. On the Fahrenheit scale, water freezes at 32 degrees and boils at 212 degrees.
- **The *Kelvin* scale:** Scientists often use a third scale called the Kelvin scale. Scientists have theorized that the absolute coldest it can get is minus 273.15 degrees Celsius. Scientists believe at this temperature molecular motion would stop. That's pretty darn cold! This temperature is assigned to be zero on the Kelvin scale and is often called *absolute zero.* On this scale, the freezing point of water is 273.15 K, and the boiling point is 373.15 K.



The word *degrees* isn't used when stating temperature by Kelvin. Scientists who work with thermodynamics, such as physicists and astronomers measure temperature using Kelvin. In fact, surface temperature of planets is always stated in Kelvin.

There are times on the test you may be asked to convert temperatures from one scale to another. So here are some equations to commit to memory:

- To convert from Celsius to Fahrenheit use this formula:

  $F = \frac{9}{5} \times (C + 32)$

  (C = temperature in degrees Celsius, and F = temperature in degrees Fahrenheit)
- To convert from Fahrenheit to Celsius use the following formula:

  $C = \frac{5}{9} \times (F - 32)$

  (C = temperature in degrees Celsius, and F = temperature in degrees Fahrenheit)
- To get temperatures in the Kelvin scale, you add 273.15 degrees to the Celsius temperature. And then you can convert the Celsius temperature to Fahrenheit.



Here's a conversion system that may be easier to remember (*Note:* This process only works with Celsius and Fahrenheit):

1. **Add 40 to the temperature you want to convert.**
2. **Multiply this sum by $\frac{5}{9}$ if converting from Fahrenheit to Celsius, or $\frac{9}{5}$ if converting from Celsius to Fahrenheit.**
3. **Subtract the 40 you added at the beginning to yield the result.**



An easy way to remember whether to use $\frac{9}{5}$ or $\frac{5}{9}$ in the conversion is to associate the F in Fahrenheit with "fraction" ($\frac{5}{9}$ is a fraction). But while $\frac{9}{5}$ is also a fraction, it can also be converted to a mixed number ($1\frac{4}{5}$). This isn't the case with $\frac{5}{9}$.

There's a Scientific Method to the Madness

Scientists are pretty skeptical and don't necessarily believe anything said by anyone else unless it's been shown to be true (time after time after time) by using a process called the *Scientific Method.* Scientists know that personal and cultural biases may influence perceptions and interpretations of data, so they've derived a standard set of procedures and criteria to minimize those influences when developing a theory. Because the Scientific Method is prevalent in all fields of science, you can expect to see a few questions about the process on the General Science subtest.

The steps to solving a problem by using the Scientific Method are as follows:

1. **Observe some aspect of the universe.**
2. **Make an educated guess about why this is happening.**

   Scientists call an educated guess a *hypothesis.*
3. **Make predictions based on the hypothesis.**
4. **Experiment and observe to test the predictions.**

   If the results don't match the predictions, modify the hypothesis.
5. **Keep repeating Steps 3 and 4 until there are no discrepancies in experimentation and observation in relation to the hypothesis.**

When developing and testing a hypothesis, scientists are guided by a principle known as Ockham's Razor. This rule (sometimes spelled *Occam's razor*), states, "When given two equally valid explanations for a phenomenon, one should embrace the less complicated formulation." In other words, all things being equal, the simplest solution tends to be the best one. At this point the hypothesis becomes a *theory.* When a theory is proven consistently over time, scientists may then consider it as a *law, fact,* or *principle.*

Another Day, Another Science: Scientific Disciplines You Should Know

Science comes in many sizes and colors. Some scientists concentrate their studies on plants, some scientists study ocean life, and some scientists even study bugs. Yuck! Science is divided into areas of studies called disciplines, and most of these disciplines have sub-disciplines. When you take the ASVAB, this subtest may ask you some definitions of these disciplines. We couldn't possibly list all the scientific disciplines, but Table 10-3 is a handy chart for you to start looking over and that you may run into on the ASVAB.

Table 10-3 Scientific Disciplines Covered on the ASVAB

Discipline	*What It Means*
Agriculture	An *agriculturalist* studies farming. That involves more than just driving tractors around. The discipline includes studying different methods of cultivating soil, producing crops, and managing livestock.
Archeology	An *archeologist* likes old things. In fact, the older the better. This scientist studies past human life and culture. The job requires recovery and examination of material evidence, such as graves, tools, pottery, and buildings.
Astronomy	*Astronomers* (not to be confused with astrologists) study outer space. They get their jollies examining the existence, locations, orbits, energy, and composition of planets and other celestial matter.
Biology	*Biologists* are the spice of life. They love everything to do with living organisms and life sciences.
Botany	A *botanist* studies plant life. This examination includes everything from beautiful flowers to the moss that grows on the north side of the tree.
Chemistry	*Chemists* like to mix things together to see what happens. These scientists study the structure, properties, composition, and reactions of matter.
Ecology	*Ecologists* do more than just warn people that they're destroying the ozone layer. They study all aspects of the environment and how organisms (such as people) interact with it.
Entomology	*Entomologists* like bugs. More specifically, they like insects (bugs with six legs). This position isn't to be confused with an arachnologist who studies spiders (bugs with eight legs).
Genealogy	If you want to find out where your great, great, great, great, great Grandfather was born, and what he did for a living, ask a genealogist. These specialists study ancestry and family history.
Genetic	*Geneticists* tell you whether your children will have blue eyes and blonde hair and how big their noses will be. Geneticists study heredity, especially the aspect that deals with inherited characteristics.

(continued)

Table 10-3 *(continued)*

Discipline	*What It Means*
Geology	Is it a real diamond or just a piece of rock? A *geologist* can tell you. These scientists study the dynamics and physical history of the earth, the rocks of which it's composed, and the physical, chemical, and biological changes that the earth has undergone or is undergoing.
Ichthyology	*Ichthyologists* like fish but not just to catch and eat. This discipline is the branch of zoology (the study of animals) dealing with fish.
Meteorology	You know that person who gets on the TV each day and tells you whether your planned outing to the beach is going to be ruined by rain? *Meteorologists* study the weather and attempt to predict it.
Paleontology	*Paleontologists* study prehistoric life, including dinosaurs. How cool is that? The science involves the examination of prehistoric fossils, including those of plants, animals, and other organisms.

If the ASVAB only asked questions like "What does a chemist do?", the test would be a piece of organic matter (cake). Unfortunately, it's not that easy. The ASVAB expects you to know a little more than just the definitions of various scientific disciplines. The following sections detail a few of the main branches of science you'll see on the ASVAB.

Uncovering biology, from big to small

There are more disciplines of biology than you can shake a stick at. And, yes, some biologists study sticks. Other biologists specialize in fish; some love looking at trees; some spend all their time studying insects; some biologists get excited thinking about snakes . . . you get the picture.

It would be impossible to cover all the areas of biology in this book, and we're not even going to try. Luckily, the General Science subtest of the ASVAB measures your knowledge of scientific disciplines at the average high school level. You remember studying about the human body and cell structures in high school, right? If not, the following sections can serve as your short refresher course.

Perusing the human body systems

Your body consists of major systems that work together to keep you alive. (And staying alive is a good thing, so be sure to thank your circulatory system and all the rest!) These systems include those listed in Table 10-4.

Table 10-4 The Five Major Human Body Systems

System	*Components*	*What the System Does*
Central nervous system	Brain, spinal cord, and nerves	Receives, processes, and responds to all physical stimuli For example, if you burn your hand on the stove, this system prompts you to remove your hand from the stove.
Circulatory system	Heart, blood, and blood vessels	Delivers oxygenated blood from the heart to the rest of the body and returns the blood to the heart to be re-oxygenated

System	Components	What the System Does
Digestive system	Mouth, esophagus, stomach, small and large intestines, rectum, and anus	Breaks down food into smaller substances that the body can absorb and process into energy, and eliminates the resulting waste
Musculoskeletal system	Consists of bones, joints, voluntary muscles, and involuntary muscles	Bones support the body's muscles and organs; joints allow bones to move; voluntary muscles work in pairs to move joints; involuntary muscles you can't control and are found in organs such as the heart.
Respiratory system	Nose, nasal cavity, trachea, lungs, and blood	Inhales air, uses the oxygen in the air to release energy, and exhales the carbon dioxide that results from this process

Thinking small: A look at cell structures

Most living things (except for those pesky viruses and a few other odds and ends) are made up of cells that share certain characteristics. Cells come in different sizes and shapes depending on what they do. In the human body, a muscle cell looks very different from a brain cell. (Has all this talk of cells caused your brain cells to hurt yet?) Cells combine to create other structures like tissues, bones, and skin.

Here are a few terms to remember:

- A *cell* has two main parts — the nucleus and the cytoplasm.
  - The *nucleus* controls cellular activity. It's like the brains behind the cell.
  - The *cytoplasm* is a gel-like substance, composed mostly of water, inside the cell membrane and outside the nucleus. Cytoplasm contains many chemicals that carry out the life processes in the cell.
- A thin *cell membrane* protects the nucleus and cytoplasm.

See Figure 10-1 for a description of other cell structures.

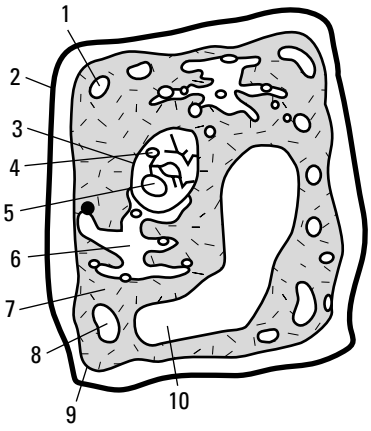
Pointing out cell differences

Plant cells differ from animal cells in a number of ways:

- Plant cells have a firm cell wall that supports and protects the cell. Animal cells don't have such a structure.
- Plant cells have larger *vacuoles* (storage areas) than those found in animal cells.
- Many plant cells contain *chloroplasts,* which contain *chlorophyll,* a chemical that helps plants create food with the help of sunlight. Animals don't have chloroplasts.
- Animal cells contain *centrioles* (cylindrical structures). Plant cells don't.
- Animal cells have *lysosomes* (sacs of enzymes), which aren't found in typical plant cells.

Plant Cell

1. Chloroplast: Contains chlorophyll, which produces food
2. Cell wall: Protects the cell
3. Nucleus: The "brain" of the cell
4. Chromatin: Thin fibers containing genes
5. Nucleoplasm: Protoplasm (living material) in the nucleus
6. Ribosome: Combines amino acids into proteins
7. Cytoplasm: The cell's factory
8. Mitochondria: Produce the energy for cellular activity
9. Cell membrane: Contains the cellular material within it
10. Vacuole: Storage areas



Animal Cell

1. Nucleus
2. Chromatin
3. Nucleoplasm
4. Ribosome
5. Cytoplasm
6. Mitochondria
7. Cell membrane
8. Vacuole

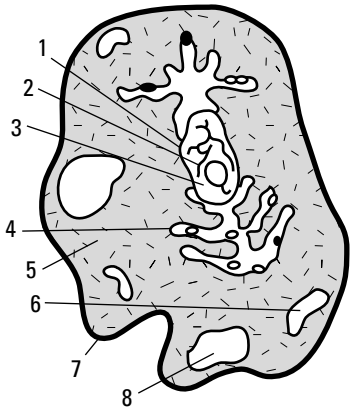


Figure 10-1: Basic structures of plant and animal cells.

Profiting from cell processes

Cells perform various processes in order to function at an optimum level. Here are a few of these processes:

- **Metabolism:** Chemical reactions causing the creation and destruction of complex molecules
- **Osmosis:** Movement of water through the cell membrane
- **Phagocytosis:** Acquisition of particles of material from outside of the cell; accomplished by surrounding the particles and passing them through the cell membrane
- **Photosynthesis:** Conversion of carbon dioxide and water into glucose and oxygen (in plants); in other words, sunlight is used to create energy
- **Respiration:** Elimination of waste materials at the cellular level

Swimming in the gene pool: Genetics

Someday you're going to find yourself acting like your mother or father. Whether you like it or not, it's inevitable because parents pass their traits on to their offspring. Understanding genetics (how these traits are passed from parents to offspring and what happens when the process goes wrong) helps scientists pinpoint the causes of diseases and disorders and can help them develop treatments and cures.



In human genetics, a healthy fetus contains 23 pairs of *chromosomes* (the bodies that actually contain the genes). The mother and the father each supply one chromosome per pair. Genes contained on the chromosomes determine many characteristics of the resulting child.

When cells multiply to produce tissues and organs (and eventually a complete living thing), they reproduce their genetic material. Sometimes this process doesn't work perfectly, and a genetic "mistake" is made. This mishap frequently results in a fetus that doesn't live or in a fetus with a genetic disease or disorder. For example, Down's Syndrome is the result of a fetus having 47 instead of 46 chromosomes.



Most cells reproduce by *mitosis,* a process in which two identical cells are formed from one parent cell. However, sex cells (eggs and sperm), reproduce differently. Through *meiosis,* each sex cell divides and contains only half the number of chromosomes as a nonsex cell. This process takes place so that the sex cells of one person (with 23 chromosomes) can hook up with the sex cells of another person (with 23 chromosomes) to produce 46 chromosomes or 23 pairs. Otherwise, way too many chromosomes would be floating around.

Determining your gender with two little letters

The genes on one pair of chromosomes, called the *sex chromosomes,* determine whether the resultant child will be male or female. In females, the two sex chromosomes are alike, and they're labeled *XX.* In males, the chromosomes are different and are labeled *XY.*



The child always receives an *X* chromosome from the mother. The father can contribute either an *X* or a *Y* chromosome. So papa actually determines the sex of the child.

Knowing which genes get passed down the family line

Many characteristics that you possess (from the way your nose turns up at the end to the color of your eyes) are determined by a pair of genes. These genes may be alike, or they may not. Some genes are *dominant* and some genes are *recessive.* If you have two unalike genes, the characteristic that they produce comes from the dominant gene. The gene that doesn't dominate is called the recessive gene. But because each parent contributes a gene to the offspring, each parent may contribute a recessive gene to the child, which then gives the child the recessive characteristic, even if both parents showed the dominant characteristic. Whew!

Relating to your world through ecology

Ecology is the study of the environment — more specifically, the relationship between organisms and the world around them. All plants and animals are part of an *ecosystem* (a community including living things and the environment around them). An ecosystem includes producers and consumers (a lot like the economy). An ecosystem also has *decomposers,* like bacteria, which the economy doesn't have.

Conditions in the world either encourage or prevent the establishment of individual ecosystems. For plants *(producers)* to grow, adequate sunlight, good soil, moderate temperatures, and water must be part of the environment. Without these factors in place, plants can't grow. If plants aren't around, plant-eating *consumers* can't be sustained, which means *predators* (who eat other animals) can't be sustained either.

For consumers (a category that includes predators as well as plant-eating consumers), mates are as essential as a food supply. Diseases and enemies can prevent an animal from establishing itself in an ecosystem. An ecosystem can be disrupted or destroyed by wasting natural resources and by polluting the air, water, and/or soil.



Animals can't produce their own food, and they're classified in three categories:

- **Carnivores** eat only meat. A few examples include lions, tigers, polar bears, snakes, crocodiles, hawks, and eagles.
- **Herbivores** eat only plants. Cows, moose, giraffes, and elk are herbivores.
- **Omnivores** eat both plants and other animals. People are omnivores, and so are pigs, mice, raccoons, chickens, crows, and foxes.

Chemistry: How not to blow up the lab

Those mad scientists in the movies always seem to be chemists, but that doesn't seem quite right because chemistry shouldn't drive you crazy. Here's a straightforward review of the chemistry you need to know for the General Science subtest.

Everything that has mass and takes up space, including your old Chevy that's up on blocks and the mosquito buzzing around the room, is *matter.* And all matter is made up of basic substances — building blocks — called *elements.*



Mass isn't the same thing as weight. Weight has to do with the force gravity exerts on mass. If you were in a gravity-free zone, you wouldn't weigh anything, but you'd still be there, so you'd still exist and have mass.

Understanding the elements, my dear Watson

Elements can be broken into small parts. The *atom* is the smallest part of an element that still retains the characteristics of that element. Every atom has particles — pieces of matter so small they have no magnitude. *Electrons* are negatively charged particles that float around the atom's *nucleus,* or core, which is made up of *neutrons* (particles with no charge) and *protons* (positively charged particles). If an atom has one proton in its nucleus, it has the atomic number 1. Each element has its own atomic number.



Hydrogen is the only element with just one proton in its nucleus, so it has the atomic number 1. Magnesium, which has 12 protons in its nucleus, is given the atomic number 12.

Atoms can combine with each other to form molecules. Elements can combine with each other to form *compounds,* which consist of two or more different elements. A compound can have very different properties from the elements that make it up. For example, table salt, which is mostly harmless, consists of two lethal elements — sodium and chlorine — but, when combined, make a compound that people ingest every day.

Sitting down at the periodic table

The *periodic table* (also known as the *table of elements*) classifies all elements (scientists love to classify things). Elements are listed according to their atomic numbers and are arranged into families of similar elements. The table of elements (see Figure 10-2) lists the atomic number, the abbreviation for the element, and its atomic weight, which is the mass of one atom of the element.

Looking at Figure 10-2, you can see that copper (Cu, atomic number 29), for example, has an atomic weight of 63.55, which means that copper is much, much heavier than helium (He, atomic number 2), which has an atomic weight of 4.

You don't have to memorize these charts to do well on the ASVAB, but you should know the atomic numbers for common elements such as hydrogen, helium, mercury, carbon, copper, gold, iron, lead, nitrogen, oxygen, plutonium, sodium, and uranium.

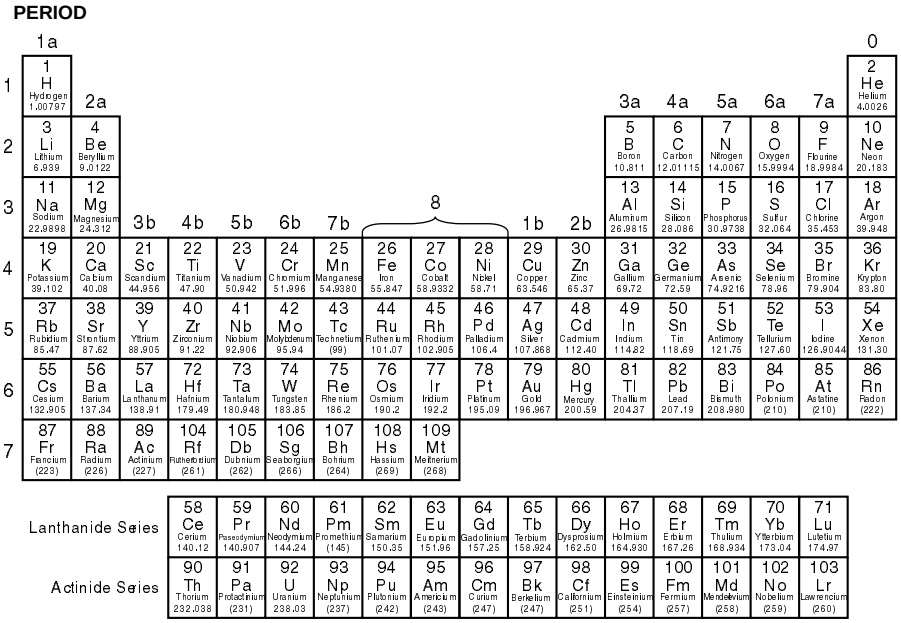


Figure 10-2: The periodic table (also known as the table of elements).

Changing states

Particles of matter are always in motion. How much *kinetic energy* (motion energy) a particle has determines whether the matter is a solid, liquid, or gas in its normal state. Gas particles move around very quickly; liquid particles move more slowly, and solid particles move much more slowly than either of the other two.

When heat or cold is applied to matter, the kinetic energy of the matter changes; therefore, the nature of the substance can change. Heat applied to water changes the water from a liquid to a gas (steam), and cold applied to water changes it from a liquid to a solid (ice).



Particles of matter no longer move at absolute zero (–273°C or –459°F).

Causing a chemical reaction

Matter may change from one state to another (like from liquid to solid) through the application of cold or heat. When these physical changes occur, the molecule itself remains the same. For example, water is still made of hydrogen and oxygen, no matter what state it's in. However, chemical reactions create molecules of new matter. Here's an example: When iron rusts, a chemical change occurs. The rust isn't the same molecule as the iron.

In a chemical reaction, two subjects are present:

- **Reactants:** The elements, molecules, or compounds involved in the reaction
- **Products**: The elements, molecules, or compounds that result from the chemical reaction

Where few have gone before: Astronomy

Earth's *solar system* consists of the sun and a number of smaller bodies (such as asteroids), planets, and moons that the sun's mass holds in orbit. The sun's mass creates gravity, and this gravity controls the movements of the smaller bodies.

The sun

The sun is the largest and most important object in the solar system. It contains 99.8 percent of the solar system's mass (quantity of matter). The sun provides most of the heat, light, and other energy that makes life possible.

The sun's outer layers are hot and stormy. The hot gases and electrically charged particles in those layers continually stream into space and often burst out in solar eruptions. This flow of gases and particles forms the solar wind, which bathes everything in the solar system.

The sun is much larger than Earth. From the sun's center to its surface, it's about 109 times the radius of Earth. Some of the streams of gas rising from the solar surface are even larger than Earth.

The planets

Astronomers define a planet as "a non-luminous celestial body larger than an asteroid or comet, illuminated by light from a star, around which it revolves." The solar system consists of nine known planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

The Earth revolves around the sun in an oval-shaped pattern called an *ellipse.* Every 365¼ days, the Earth completes its orbit around the sun and starts again. The Earth *rotates* (spins) on its axis and completes a rotation every 24 hours, but because of the tilt of the Earth, hours of daylight and darkness aren't equal, except for two days a year.

The inner four planets consist chiefly of iron and rock. They are known as the terrestrial (earthlike) planets because they're somewhat similar in size and composition. The outer planets, except for Pluto, are giant worlds with thick, gaseous outer layers. Almost all their mass consists of hydrogen and helium, giving them compositions more like that of the sun than that of Earth. Beneath their outer layers, the giant planets have no solid surfaces. The pressure of their thick atmospheres turns their insides liquid, though they may have rocky cores.



Rings of dust, rock, and ice chunks encircle all the giant planets. Saturn's rings are the most familiar, but thin rings also surround Jupiter, Uranus, and Neptune.



Until August 2006, Pluto was referred to as the ninth planet since its discovery in the 1930s. But Pluto has so many unusual features that recently it was reclassified as a dwarf planet. For example, it travels around the sun in an elongated oval path much different from the nearly circular orbits of the other planets. And unlike the other outer planets, Pluto is small and solid and contains only 1/500 the mass of Earth.

Is Pluto really a planet?

In August 2006, the International Astronomical Union (IAU) established a new definition for the word *planet.* Under the new standards, Pluto is no longer considered a planet but instead is classified as a *dwarf planet.* According to the planet definition, currently the solar system consists of eight planets and three dwarf planets. The definition doesn't apply outside the solar system and doesn't include provision for extra-solar planets. The definition was a controversial one and has been both criticized and supported by different astronomers.

Remember, though, the ASVAB was last revised long before the IAU decision, so if you see a question on the ASVAB, asking how many planets there are in the solar system, the correct answer would be nine.

Moons

Moons (sometimes called *satellites*) orbit all the planets except Mercury and Venus. The moon you refer to as *the moon* revolves around the earth. It makes a complete revolution every 27⅓ days. When the moon moves into the earth's shadow, a *lunar eclipse* results — the earth is positioned between the sun and the moon. When the earth moves into the moon's shadow, a *solar eclipse* results — the moon is positioned between the earth and the sun.

The inner planets have few moons. The giant planets probably have more small moons not yet discovered. See Table 10-5 for a lineup of the planets and their moons. ***Note:*** Although Pluto is no longer officially considered a planet, the current version of the ASVAB was written before this decision was made. That's why Pluto is included in Table 10-5.

Table 10-5 The Number of Moons Per Planet in Earth's Solar System

Planet	*Number of Moons*	*Additional Info*
Mercury	0	
Venus	0	
Earth	1	
Mars	2 tiny satellites	
Jupiter	25, with many smaller satellites	Each moon is at least 6 miles (10 kilometers) in diameter.
Saturn	25, with many smaller satellites	Each moon is at least 6 miles (10 kilometers) in diameter.
Uranus	21	
Neptune	11	
Pluto	3	The largest moon (Charon) is more than half the size of Pluto.



Jupiter's four largest moons are known as the Galilean satellites because the Italian astronomer Galileo discovered them in 1610 with one of the first telescopes. The largest Galilean satellite — and the largest satellite in the solar system — is Ganymede, which is even bigger than Mercury and Pluto. The largest of Saturn's moons, Titan, has an atmosphere thicker than Earth's and a diameter larger than that of Mercury or Pluto.

Meteors, comets, and asteroids

A *meteor* is a fiery rock from space that hits Earth's atmosphere, resulting in a brief streak of light. It's often called a *shooting star*. When a meteor enters the Earth's atmosphere, it usually burns up, and that's a good thing. If a meteor actually lands on the ground, it's called a *meteorite*.

Comets are snowballs composed mainly of ice and rock. When a comet approaches the sun, some of the ice in its nucleus (center) turns into gas. The gas shoots out of the sunlit side of the comet. The solar wind then carries the gas outward, forming it into a long tail. Astronomers divide comets into two main types:

- **Long-period comets,** which take 200 years or more to orbit the sun.
- **Short-period comets,** which complete their orbits in fewer than 200 years.



The most famous of all comets, Halley's Comet — also referred to as Comet Halley after Edmond Halley — is a comet that can be seen every 75 to 76 years, making it a short-period comet. Halley is the only short-period comet that's visible to the naked eye and will return within a human lifetime. Its many appearances over the centuries have had a notable effect on human history. Halley's Comet last appeared in the inner Solar System in 1986 and will next appear in mid 2061.

Asteroids are minor planets. Some have elliptical orbits that pass inside the orbit of Earth or even that of Mercury. Others travel on a circular path among the outer planets. Most asteroids circle the sun in a region called the *asteroid belt,* between the orbits of Mars and Jupiter. The belt contains more than 200 asteroids larger than 60 miles (100 kilometers) in diameter. Scientists estimate that more than 750,000 asteroids exist in the belt with diameters larger than ⅗ mile (1 kilometer). There are millions of smaller asteroids, and astronomers have even found several large asteroids with smaller asteroids orbiting them.

Adding a dash of geology and meteorology

The study of the physical makeup of the earth is often called *earth science. Geology* describes the earth's physical appearance and *meteorology* explains the earth's atmosphere.

Peeling back the layers

The earth is like an onion that consists of several layers. The *crust* is the earth's surface, and it varies in depth from a few miles to 30 miles. The *mantle,* the solid rock below the crust, makes up most of the mass of the earth. The core is the earth's fiery center, with a temperature estimated to reach 3,000 to 4,000 degrees Celsius (to see what that is in Fahrenheit, check out the conversion equations in "Figuring temperature conversions" earlier in this chapter). The mantle prevents this heat from escaping and causing all the plants to wilt.

Sometimes cracks in the earth's crust, called *faults,* appear. When the land shifts along these faults, earthquakes result. When rocks in the mantle are heated to liquid, they become *magma.* Upon reaching the earth's surface, magma becomes lava, which forms volcanoes.

Checking outta this world

The earth's atmosphere also contains many layers of air surrounding the earth's surface. Starting with the layer closest to the earth and extending outward, here are those layers:

- **Troposphere:** Extends 5 to 10 miles above the earth. Sometimes called the jet stream, this layer is where almost all weather changes occur.
- **Stratosphere:** Extends about 30 miles. The reported main cause of ozone depletion is the presence of chlorofluorocarbons in the Earth's stratosphere. These molecules undergo a series of chain reactions, which ultimately lead to the destruction of the ozone layer.
- **Mesosphere:** Extends about 50 miles. Millions of meteors burn up daily in the mesosphere as a result of collisions with the gas particles contained there.
- **Ionosphere:** Extends about 70 miles. This layer reflects radio waves, making it important to communications.

  Scientists disagree among themselves as to whether the ionosphere is a separate atmospheric layer.
- **Thermosphere:** Extends about 350 miles. The International Space Station has a stable orbit within the upper part of the thermosphere, between 320 and 380 kilometers.
- **Exosphere:** Extends about 40,000 miles. It's only from the exosphere that atmospheric gases, atoms, and molecules can escape into outer space. Many scientists call the exosphere an extension of the thermosphere.



Warming up to cold fronts

When the sun shines, land and water absorb its warmth. Land warms faster than water, so air over land is warmer than air over water. At night, the air is cooler over land than water, affecting air *density* (density has to do with how closely packed the air molecules are). The angle of the sun (the sun shines directly over the equator, but not the poles) also affects air density.

Cold air is denser than warm air. Because it's denser, cold air has high pressure, compared to warm air's low pressure. (A *barometer* measures this atmospheric pressure.) Air moves from areas of high pressure to areas of low pressure, creating wind.

Air masses have certain characteristics depending on where they form. If an air mass forms over land, it's dry, and if it forms over water, it's wet. Air masses formed in the northern and southern regions are cold, and those formed at the equator are warm. When two different air masses meet, they don't mix. They form a boundary called a *front.* When cold air meets warm air, a *cold front* develops. The warm air in the cold front may be pushed up to form clouds, causing heavy rain. When a warm air mass meets a cold air mass, a warm front develops. The warm air passes over the cold air, forming a different kind of cloud, which causes light rain.

Classifying clouds

Clouds are made of small droplets of water or bits of ice that are spread out from each other. Rain (or snow) falls when the drops get too big and heavy to stay in the cloud. Clouds have three main types, and the ASVAB may ask you a question or two about their characteristics, which are detailed in Table 10-6.

Table 10-6 Types of Clouds

Cloud Type	*Description*	*What It Forecasts*
Cirrus	Thin, feathery, high clouds	Generally indicate rain or snow.
Cumulus	Flat bottoms and round tops	Common during fair weather, but when they darken, they cause heavy rains.
Stratus	Broad, flat, and low hanging	When they're dark, rain usually occurs.

Additionally, a prefix or suffix is frequently given to the cloud name to indicate what level of the atmosphere it's in or whether it's producing precipitation:

- *Cirro* is the prefix given to high clouds (base above 20,000 feet).
- *Alto* is the prefix given to mid-level clouds (base between 6,000 and 20,000 feet).
- *Nimbo* added to the beginning or *nimbus* added to the end of a cloud name means the cloud is producing precipitation.

Therefore, a cirrocumulus cloud is a cloud with a flat bottom and round top at high altitude. Altostratus clouds are broad, flat clouds at mid altitude.

Employing Strategies for this Part of the Test

Even if you study hard for the General Science subtest, chances are you may come across at least a couple of questions that you can't answer. That's the nature of this subtest — it pretty much asks you to know all there is to know about the world. Face it: Even Einstein wouldn't get *every* answer right. However, you can use several strategies to improve your chances of selecting the correct answer, and these strategies are outlined in the following sections.

If you don't know the answer to a question right off the bat, don't panic. You can often eliminate a few bad choices simply based on common sense. Even if you can't determine the only answer, keep in mind that this subtest doesn't penalize you for guessing, so guessing makes sense — you have a 25 percent chance of guessing right even if you can't eliminate any obviously wrong answers. If you can eliminate just one wrong answer, you improve your chances to 33 percent.



Although the General Science subtest is a timed test, most people don't have to rush to finish it, but then again, you don't have that much leisure time to stop and think about all the questions at length, either. So, if you don't know the answer to a question right away, do your best to quickly eliminate wrong answers, mark your best guess, and move along. For more help on making these eliminating decisions check out Chapter 3.



Try the process of elimination in the following question:

The knee joint is known as a

(A) pivot joint

(B) fixed joint

(C) ball-and-socket joint

(D) hinge joint

Looking at the choices, you can eliminate Choice (B), fixed joint, because your knee isn't fixed or not moveable (or, if it is, it shouldn't be). Your skull is an example of a fixed joint, but that's irrelevant to this question. Is your knee a pivot joint? If you think of something that pivots, you think of it moving in a circular or at least a semi-circular, manner. Your knee doesn't do that either; therefore, you can safely eliminate Choice (A). A ball-and-socket joint is one that permits limited movement in any direction. (Your shoulder joint is a ball-and-socket joint.) Your knee doesn't do that. So you can strike off Choice (C) and choose Choice (D), hinge joint, as the most likely answer. Your knee moves like a door on a hinge.



Now suppose you have a question like this:

The most common gas found in Earth's atmosphere is

(A) oxygen

(B) nitrogen

(C) calcium

(D) helium

Eliminate Choice (C) because calcium isn't a gas. You can also cross out Choice (D) because if helium were the most common gas, everyone would be talking in squeaky voices (you know, like sucking helium from a balloon). Eliminating these two answers leaves you with just two choices, and if you simply guessed, you'd have a 50 percent chance of being right. Unfortunately, most people would guess that oxygen is the most common gas in Earth's atmosphere, but they'd be wrong. Nitrogen — Choice (B) — tops the list, making up 78 percent of the atmosphere.

Chapter 11

Auto & Shop Information

In This Chapter

- Looking under the hood of vehicles
- Knowing the tools of the trade
- Checking out the many uses of fasteners
- Driving up your test score

Ever wonder why automobile mechanics and carpenters charge you about a billion dollars an hour when you need to hire their services? Because if the jobs were easy, everyone would do them.

Fortunately, in order to do well on the Auto & Shop Information subtest of the ASVAB, you won't have to get your hands greasy or chance hitting your thumb with a hammer. The questions on this subtest are pretty basic. Automotive questions usually ask about basic automotive systems and malfunctions. The shop questions generally ask you to identify a tool or fastener, or the purpose of such.

The Auto & Shop Information subtest consists of 25 questions. Happily, the ASVAB gurus give you 26.4 seconds to answer each question (11 minutes total). About one-half of the questions measure your basic knowledge of automotive principles and one-half queries you about shop tools and basic shop principles. On this subtest you either know the answer, or you don't, but sometimes basic *common sense* can come into play. For example, if a car stalls when the needle of the gas gauge is resting on "E," the most probable cause of the malfunction is obvious. Well, obvious to most people, that is. Rod's daughters may argue with this statement.



The military only uses the Auto & Shop Information subtest to determine your qualifications for certain jobs. It's not used in the calculation of your AFQT score. Turn to the Appendix at the back of this book to find the jobs that require a good score on this subtest. If you don't need to do well on this subtest to qualify for the kind of job you want, you may be better off studying for a different part of the ASVAB.

Checking Under the Hood

Contrary to what you may think, an automobile is much more than the mechanical monster you park in your driveway each night that both you and the bank own. It's actually a complex machine that has undergone over a century of evolution. Henry Ford would probably have a stroke if he could see what his simple horseless carriage evolved into today.

The modern car is divided into several primary and secondary systems. These systems are covered in the next few sections.

Engine

How does an engine work? You turn the key, and if it doesn't start, you call your mechanic or your dad, right? Well, not quite. The *internal combustion engine* burns a mixture of gas and air. Burning gas and air (the fuel mixture) makes the fuel mixture expand quickly (explode). The pressure from this explosion is transferred to the wheels to make the car move.

The movement is brought about by a cycle, which your car's engine repeats a zillion and one times. Figure 11-1 illustrates how this process works:

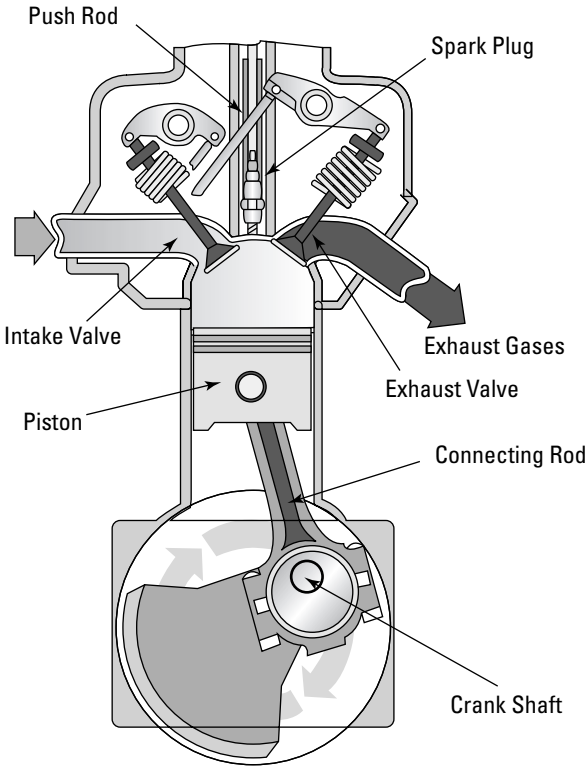


Figure 11-1: The cycle process of an engine.

1. **During the *intake stroke,* an explosive mixture of fuel and air enters a *cylinder* through the *intake valve*.**

   The intake valve knows when to open because it is attached to a *pushrod,* which is connected to the *crankshaft* of the engine. The crankshaft is discussed in further detail below.



   Engines in cars have more than one cylinder. Generally cars have an even number of cylinders — four, six, or eight. These cylinders are arranged in a row or rows, which are called *inline* (one row) or *V* (two rows) depending on how the cylinders are arranged.

2. **A *piston,* located within the cylinder, compresses the fuel and air mixture during the *compression stroke*.**

   This increase in pressure makes the mixture extremely explosive.

3. **At the point of maximum compression, a spark plug emits (you guessed it) a spark, igniting the fuel and air mixture.**

   The pressure from the burning gas and air moves the piston. This is referred to as the *power stroke.*

Octane ratings

Octane ratings measure gasoline's ability to resist *engine knock,* a rattling or pinging sound that results from premature ignition of the compressed fuel-air mixture in one or more cylinders. Most gas stations offer three octane grades: regular (usually 87 octane), midgrade (usually 89 octane) and premium (usually 92 or 93). By federal law, the ratings must be posted on bright yellow stickers on each gasoline pump.

The octane rating correlates to how much the gasoline can be compressed before it ignites spontaneously. When gasoline ignites this way, instead of by the spark of a spark plug, the engine begins knocking. That's not a good thing because early ignition can cause engine damage over time.

But, don't be fooled — that doesn't mean using higher octane gas is better. In most cases, using a higher octane gasoline than your owner's manual recommends offers absolutely no benefit. It won't make your car perform better, go faster, get better mileage, or run cleaner. The only time you might need to switch to a higher octane level is if your car engine knocks when you use the recommended fuel. This occurrence happens to a small percentage of cars. Buying higher octane gasoline is a waste of money, too. Premium gas costs 15 to 20 cents per gallon more than regular. That can add up to $100 or more a year in extra costs.

How can you tell if you're using the right octane level? Listen to your car's engine. If it doesn't knock when you use the recommended octane, you're using the right grade of gasoline.

4. **The *piston*, which is connected (by a *connecting rod*) to a crankshaft, turns the crankshaft.**

   The *crankshaft* is connected to the flywheel at the rear of the engine. Only one crankshaft is present, even with multiple cylinders. But the crankshaft has more than one crank (in fact, it has exactly as many cranks as the engine has cylinders).

5. **The *flywheel,* once properly motivated, continues revolving (using momentum) between pushes from the crankshaft.**

   The flywheel keeps the engine going.

6. **The crankshaft forces the piston back to the top of its stroke, while at the same time moves a pushrod, opening the exhaust valve so that the exploded gases can escape the cylinder.**



Most people refer to their engines as a four-cycle engine. This isn't really true. It is a four-stroke, one cycle engine, including the intake stroke, compression stroke, power stroke, and exhaust stroke that are one engine cycle. When the fourth stroke is completed, the cycle begins again. Automobile engines do this very fast. When the *tachometer* (an instrument measuring revolutions per minute [rpm]) on your dashboard shows 4,800 rpm, for example, that means the engine is performing 4,800 of these cycles every minute.

In order for the cycle to happen at all, fuel must be properly mixed with air and transported within the cylinder at the proper time. Various components perform this function:

- *Carburetors* are used on most older cars (pre-1990) to mechanically mix the fuel and air. As air moves faster through the carburetor, it creates a vacuum which draws more and more fuel into the mixture.
- *Fuel injectors* have replaced carburetors on newer cars to perform the air/fuel mixture function. Actually, fuel injectors have been around since the late 1950s, but weren't widely introduced until the late 80s and early 90s. The fuel injector acts as the fuel-dispensing nozzle. It injects liquid fuel directly into the engine's air stream. In almost all cases this requires an external pump.

A doodad called the *EFI computer* (Electronic Fuel Injection computer) determines the amount of fuel entering the engine. Just as your brain takes in information from your five senses and processes it, so does the EFI computer. It receives information from the sensors in the fuel, air and exhaust system and from that information, it determines how much fuel the engine needs to operate at optimum levels.

- A *throttle* is mechanically connected to the carburetor (on older cars) and electronically connected to the EFI computer (on newer cars). Advancing (opening) the throttle causes more fuel to be transferred to the carburetor or the fuel injectors.
- The *accelerator* (the gas pedal) is connected to the throttle by mechanical linkages. The harder you push on the gas pedal, the farther the throttle is advanced (opened). Thus, more fuel is transported to the carburetor or fuel injectors.

Cooling system

Because of the high temperature at which the fuel burns, the engine has a cooling system (otherwise the engine would melt). Here's how the process works:

1. ***Water jackets* surround the parts that reach the highest temperatures.**
2. **The *water pump* circulates water through the jackets.**
3. **While the water circulates, it heats up and then passes through the *radiator,* where outside air cools the water.**
4. **The water in the system is usually mixed with *coolant* (antifreeze).**

   This mixture raises the boiling point of the water (which keeps the water from boiling away), as well as its freezing point (which keeps the system from freezing up during cold weather.

In addition, the engine parts must be lubricated to prevent them from breaking down, which occurs if the metal parts are allowed to rub against each other. An oil pump circulates oil through the engine; oil flows through the crankshaft and connecting rods, lubricating as it goes.

Electrical and ignition systems

Your car requires more than just gasoline to operate. It also needs a supply of electricity. In the old days, automotive electrical systems operated on six volts. Shortly after World War II, as electrical accessories became more prevalent in automobiles, 12 volts became the standard.

An electric motor powered by the *battery* starts the engine when you turn the key. This motor is called a *starter* (for obvious reasons). A gizmo called an *alternator* sends an electric current back to the battery to keep the battery charged and also powers the other electronic gadgets on your car when the engine is running.

The ignition system supplies a high-voltage current to the spark plugs to ignite the fuel mixture in the cylinders. (See the section entitled, "Engine," earlier in this chapter.) The system takes the 12-volt current from the battery, steps it up to about 20,000 volts, and then sends the current to the spark plugs.

In older cars, this increase of voltage is accomplished by means of a device called a *coil,* which uses electromagnetic induction to step up the voltage. The current then passes through an electrical/mechanical switching device called a *distributor.* A rotating shaft and a switch within the distributor, called *breaker points*, routes the current through wires to the

spark plugs. A *condenser* absorbs excess current and protects the breaker points from damage by the high-voltage surge. The distributor and other devices control the timing of the spark-plug discharges.

In the 1970s, the electronic ignition systems were introduced. In modern ignition systems, the distributor, coil, points, and condenser have been replaced by solid-state electronics controlled by a computer. A computer controls the ignition system and adjusts it to provide maximum efficiency in a variety of driving conditions.

Drive system

Having a working engine is all fine and dandy, but the power of the engine still has to be transferred to the wheels to make them move. This is the job of the *drive system.* Cars have drive systems that run on axles. The *axle* is the shaft on which the wheels revolve. The *universal joint* allows the axle to move up and down without breaking the drive shaft. Gears on the axle allow the vehicle to make turns. Axle shafts turn the wheels. The wheels on vehicles turn in three different ways:

- **Rear-wheel drive:** The rear wheels push the car. The drive shaft extends from the transmission to the rear axle.
- **Front-wheel drive:** The front wheels pull the car. The drive shaft extends from the transmission to the front axle.
- **All-wheel drive (four-wheel-drive):** All wheels push and pull the car at the same time. The drive shaft extends from the transmission to both axles.

Cars also have transmissions. The *transmission* changes the speed of the engine in relation to the speed of the rear wheels (in rear-wheel-drive), the front wheels (in front-wheel-drive), or all the wheels (in four-wheel or all-wheel-drive). Vehicles have two types of transmissions: automatic and manual (stick shift).

The transmission consists of gears in several combinations so that the amount of torque used can vary according to needs. When the terrain is difficult (as in snow), the wheels need more *torque* (the force that produces rotation) in order to move. The transmission increases torque as needed. In an automatic transmission, this variation is done automatically by the *torque converter.* In a manual transmission, the driver shifts the gears by hand. The *clutch* is used to facilitate this process; it also allows the engine to run when the car isn't moving.

Brake system

When a vehicle is in motion, brakes are applied to stop that car from moving. (A long way from the time when Fred and Barney stopped their car by dragging their heels.) Today's brake system process is a detailed one:

1. **Each wheel has a brake that applies friction to the wheel to stop its rotation.**
2. **A *drum brake* consists of a master cylinder that has *brake lines* (filled with *brake fluid*) running from it.**
3. **The *brake pedal* applies pressure to the *master cylinder,* which sends pressure (and brake fluid) through the lines.**
4. **The lines are connected to a *hydraulic cylinder* on each wheel.**

   This cylinder contains pistons that move outward and force two *brake shoes* against a *metal drum* that rotates the wheel. Usually, two independent systems are used; one governs the front wheels and the other controls the rear wheels.

The magic of ABS

In the modern world of cars today, most vehicles are equipped with an *Anti-Lock Brake System* (ABS). The ABS is a four-wheel system that prevents the wheels from locking up. The system does this by automatically adjusting the brake pressure during an emergency stop. This enables the driver to maintain steering control and to stop in the shortest possible distance under most conditions.

The theory behind ABS is simple. A skidding wheel has less traction than a non-skidding wheel. If your car isn't equipped with ABS, and you have to stop quickly, your wheels may lock up (stop turning), causing you to skid. As a result, you don't stop as quickly, and you won't be able to steer while your wheels are skidding.

5. **A *disc-brake system* consists of *master cylinder* that forces a *caliper*, with brake shoes on each side, to squeeze against a rotating disc in each wheel, thus stopping your car.**

Emissions-control systems (in layman's terms, filters)

Think of the engine as a giant cigarette and the emissions-control system as a filter. The exhaust from automobiles emits pollutants, including carbon monoxide. These pollutants are a result of the combustion process (or they're partially combusted fuel or unburned fuel). To prevent these pollutants from poisoning the atmosphere, manufacturers place emissions-control systems on cars. These systems include

- **Positive-crankcase ventilation:** An old method (still in use) that forces unburned or partially burned fuel back into the cylinder so the fuel can be burned
- **Air-injection systems:** Systems that force air into the engine's exhaust system to burn unburned or partially burned fuel before the fuel comes out the exhaust pipe
- **Catalytic converter:** Oxidizes hydrocarbons and carbon monoxide into water vapor and carbon dioxide (the same thing people exhale). This system doesn't control other types of pollutants such as nitrogen oxides.
- **Exhaust-gas-recirculation system:** Helps control nitrogen-oxide emissions by forcing some of the gases back into the cylinders

Picking Up the Tools of the Trade

You've probably heard the phrase, "the right tool for the right job." This comment is what Dad used to yell at you when you'd use a Phillips screwdriver to punch holes in oil cans (thereby getting oil on your shirt). The ASVAB folks also believe in using the right tool for the right job, and many of the questions on the Auto & Shop subtest ask you to identify the best tool for certain tasks.

Tools are easiest to understand when you classify them by their function, so the following sections are divided by function. See Figure 11-2 for an illustration of the various types of tools covered.

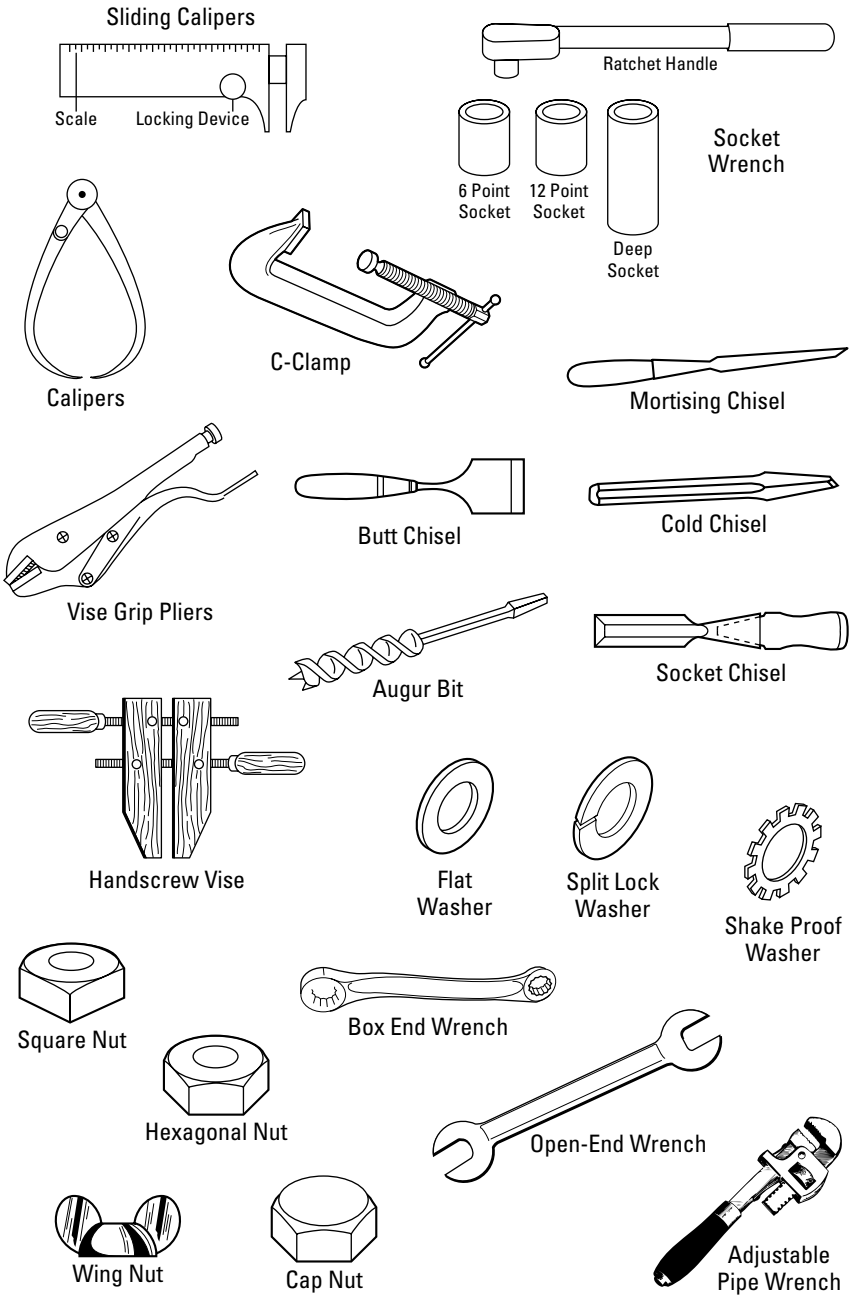


Figure 11-2: Pictures of the various tools you need to know for the ASVAB.

Striking tools

Striking tools apply driving force to an object. (Watch your fingers!) These tools include hammers, sledges, and mallets. Here's a brief explanation of the three:

- **Hammer:** Generally made of metal or plastic and consists of a handle, a head, a face (the part of the hammer that touches the nail or other fastener), a claw (to pull nails), and a wedge that attaches the head to the handle. The face of a hammer may be made of steel, brass, or lead.

- **Mallet:** Generally made of metal or plastic but may be made of wood, rubber, or rawhide. Used to strike another tool or to strike a surface without damaging it. A mallet doesn't have a claw like its friend, the hammer.
- **Sledge:** Generally made of metal; people use it to drive bolts and chisels and to break rock. A sledge doesn't have a claw either.

Fastening tools

Fastening tools apply fasteners, such as screws, to objects. (For more info on fasteners, check out "Sticking Materials Together with Fasteners," later in this chapter.) Numerous tools make up the fastening category:

- A *stapler* is a fastening tool; heavy-duty staplers can staple roofing felt to a roof, for instance.
- *Wrenches* turn screws and bolts. The bolt or screw fits between the jaws of the wrench, and the wrench turns the bolt. Some wrenches have adjustable jaws.
  - *Open-end wrenches* have open jaws.
  - *Box wrenches* are closed. Some wrenches have open-end jaws on one end and a box wrench on the other.
  - *Socket wrenches* have box-type sockets of varying sizes that can be attached to a handle, which in turn can be attached to an extension.

    Socket, box, and open-ended wrenches come in set, standard sizes — either in inches or in millimeters. They're not interchangeable. (Selecting the wrong socket wrench is how mechanics learn to use cuss words.)
  - *Torque wrenches* apply additional leverage to a fastener.
  - *Pipe wrenches* have serrated jaws and grip round objects.
- A *screwdriver,* in the shop world, turns screws. (In the civilian world, it's a yummy drink!) Some special screwdrivers have different blades to fit different types of special screws.
  - A *standard screwdriver* has a flat blade at one end of the shank (the other end of the shank goes into a handle).
  - *Phillips screwdrivers* have a blade that is shaped like a cross; this blade fits into a cross-shaped Phillips screw.
  - An *Allen wrench* fits hexagonal screw heads. Nobody knows why this tool is called an Allen wrench, instead of an Allen screwdriver; after all it's used on hexagonal screws. That's just one of the mysteries of the shop-world.

    This tool gets its name from the Allen Manufacturing Company of Hartford, Connecticut. The Allen wrench was designed in 1943.
  - *Offset screwdrivers* have the shank set at an angle to the blade to allow the tool to be used in cramped spaces. Offset screwdrivers can have a standard blade, Phillips blade, or any number of other blades.
- *Pliers* can be used to fasten and unfasten fasteners, hold objects, and cut material. When you squeeze the handles, the jaws of the pliers come together.
  - *Long-nosed pliers,* also called *needle-nose pliers,* have tapered jaws that can hold small objects or fit into small spaces.
  - *Curve-nose pliers* have curved jaws.
  - *Slip-joint pliers* can be adjusted so the handles lock in a certain position.

- *Wrench pliers* or *vise-grip pliers* have serrated jaws that clamp onto and hold objects of all shapes.
- *Cutting pliers* are used to cut wire.

Cutting tools

Cutting tools use sharp blades to cut through metal, wood, or other materials. Cutting tools have teeth. The number of teeth per inch, called *points per inch,* gives an indication of the type of work the saw can do. A saw with fewer teeth is used for rough work, like cutting wood to size. A saw with more teeth cuts more finely and is used for more delicate work, like sawing joints and lightweight pieces of wood. Check out Table 11-1 for a breakdown of the different cutting tools that may be covered on the ASVAB.

Table 11-1 Cutting Tools Covered on the ASVAB

Cutting Tool	*Function*
Bolt cutters to cut bolts	Heavy-duty shears that produce enough force when the handles are closed to slice through metal bolts or rods
Circle snips	Used to cut curves
Crosscut saw	A type of handsaw that cuts against the grain of the wood. The shape of the teeth and the angle in which they're set are the main differences in this type of saw.
Coping saw	A type of handsaw that's used to cut curved lines or shapes.
Hacksaw	A type of handsaw that's used to cut metal. A hacksaw has an adjustable frame that holds thin blades of varying length in place; a handle is set in one end.
Pipe cutters and tube cutters	Used to score and cut metal pipes and tubes
Ripsaw	A type of handsaw that cuts with the grain of the wood. The shape of the teeth and the angle in which they're set are the main differences in this type of saws.
Snips and shears of various types	Snips and shears have two cutting blades that scissor together when the handles close. The blades can be curved or straight.

Drilling, punching, and gouging tools

No, this section isn't about hand-to-hand combat training from basic training. Masters in the art of shop often make holes in the material they're working with in order to build that perfect birdhouse (or whatever else they're working on). These holes can be done with a variety of tools, which are covered in the following sections.

Drills and bits

Twist drills use *drill bits,* which are round pieces of steel shaped in a spiral, to create holes. Drill bits are attached to a drill (usually a power drill, but sometimes a hand drill operated by manually turning a crank). The point of the drill bit is sharpened, and the shank is smooth and fits into the drill.



A *countersink* is a drill bit that enlarges the surface of a hole so that a screw head can be accommodated. A countersink is used to allow the top of the fastener to be set exactly even with the material to which it's attached. Without a countersink, the fastener slightly protrudes from the material to which it's been attached.

Auger bits bore larger holes. They're shaped differently from drill bits. They're also much larger. Auger bits are most commonly used with a brace for drilling holes in wood. Their length varies from 7 to 10 inches.

Punches

Punches have a sharp end that's placed against the material to be punctured; the other end is struck with a hammer. A *center punch* is used to mark where a drilled hole is to be placed; this keeps the drill bit in position and prevents the drill from jumping to another part of the material.



Using a Phillips screwdriver as a punch is bad form in the shop world because hitting the handle of a screwdriver with a hammer can damage it (and then you'll get talked about in serious shop circles).

Chisels

Chisels are used to chip or cut metal or wood. Chisels are made of steel and have a sharp cutting edge. *Metal-cutting chisels* have different shapes depending on how they'll be used; *cold chisels* are flat; *round chisels* make circular cuts. Chisels that cut metal are usually struck with a mallet to make the cut. Some *wood chisels,* called *socket chisels,* are also struck with a mallet. Other wood chisels require only the pressure of your hands.

Wood chisels also come in different shapes, depending on what they're used for. A *butt chisel* has a short blade and is used for in-close work. A *mortising chisel* has a narrow blade made for chiseling out the narrow mortises in joints. A *framing chisel* has a heavy, strong blade meant for rough work.



Because you use chisels with other tools and the pressure of your hands, there's a little bit of a risk involved with this tool. One slip and these instruments can easily cut large chunks out of your skin, so be careful.

Finishing tools

Filing and finishing shop tools are used to sharpen the blades of other tools and to smooth the edges of cut metal objects. Files come in a range of fineness, and the blades can be cut in different patterns. Files also come in different shapes to finish different kinds of objects. Here are the different kinds of files:

- *Single-cut files* are used for finishing work and sharpening blades.
- *Double-cut files* are used for rough work.
- *Flat files* and *half-round files* are for general purposes.
- *Square* and *round files* fit square and round openings.

Planes are also a type of finishing tool used to prepare wood for final finishing and to fit doors and trim. Planes consist of a handle to push with, a knob to guide with, a frame, a sole, and a mouth (where the blade is). *Bench planes* are used to smooth surfaces. Longer planes give a more uniform surface.

Clamping tools

A *clamping tool* is a device used to hold or fasten objects securely so they won't move while you're working on them. There are several types of clamping tools available for many different purposes:

- *Pliers* (discussed in the "Fastening tools" section earlier in the chapter) can be used to hold objects while you're working on them.
- *Vises* hold material while it's being sawed, drilled, or glued. There are different types of vises:
  - *A bench vise* has large, rough jaws that keep the material from slipping.
  - *Pipe vises* hold round trim or pipes.
  - A *handscrew vise* has two hard, wood jaws connected by two long screws. The screws are tightened to bring the jaws of the handscrew vise together.

Clamps are used when a vise won't work. *C-clamps* consist of a stationary frame and a screw that moves back and forth to open and shut the clamp.

Measuring tools

As any shop enthusiast will tell you, the golden rule of shop is to "measure twice and cut once." It's frustrating to cut a piece of material only to find it's just a little bit too short to fit in the place you intended. Using measuring tools helps you avoid this embarrassing situation.

Tape rules, rigid steel rules, steel (or fiberglass) tape rules, and *folding rules* are all used to measure material. *Calipers* are also used for very exact and small measurements. Calipers can be used with a rule to measure diameter; the legs of a caliper curve in to measure outside curves and curve out to measure inside curves. *Slide calipers* have the rule built in.

Depth gauges measure the depth of holes. *Thickness gauges* measure the thickness of small openings. *Thread gauges* measure the number of threads per inch in threaded fasteners. *Wire gauges* measure the thickness of wire.

Leveling and squaring tools

A *square* is used to check the trueness (accuracy) of an angle. Because most squares have a rule, they can also be used for measuring (see "Measuring tools" earlier in this chapter). Squares have two arms, called the blade and the tongue, that meet at a right angle. A square can be set against any angle that is supposed to be a 90-degree angle. If a gap exists between the square and the material, the material isn't true — that is, it's not at the specified angle. A *sliding T-bevel* has an adjustable blade so that different angles can be checked.

A *plumb bob* is a heavy weight that's suspended from a line. It indicates vertical trueness. *Levels* show whether a surface is true. A level has one or more small tubes filled with a liquid (like alcohol) and an air bubble. If the level is placed on a surface, and the bubble remains exactly in the center of the tube, the surface is level. (This method can't be used to see if your recruiter is on the level. We tried it. Recruiters simply won't hold still long enough.)

Sticking Materials Together with Fasteners

Although wood and metal (and other materials) can be held together with glue, straps, and other brilliant fastening methods, people usually fasten these types of materials with nails, screws, bolts, and rivets. These fasteners offer more strength and stability than the white glue that you used to fasten painted macaroni noodles onto construction paper in the first grade.

Nails

Nails are used to hold pieces of wood together. The nail head is flat, and the shank is usually round. Nail length is designated by the *penny system,* which is abbreviated with a *d.* A ten-penny nail is a 10d nail. Length and thickness generally correspond. Nails that are larger than 20-penny are called *spikes* and are measured in inches.

Other type of nails include

- **Brad and finish nails:** They have heads that are made to fit flush with or slightly below the surface of the wood.
- **Common nails:** These nails are the most commonly used nails. (How about that for a truly difficult vocab word?)
- **Double-headed nails:** These have two heads, one lower than the other. The nail is driven to the lower head but can be pulled out of the material because of the remaining higher head. These nails are used for temporary construction that will be taken apart.

Screws and bolts

Unlike nails, you can easily take screws and bolts out of the wood without causing additional damage to the wood (unless of course the threads are stripped). These fasteners also hold more tightly than nails. Screws have flat heads, round heads, or oval heads; and in addition to this classification, they also have standard heads (for slotted screwdrivers) or Phillips heads. Screw sizes are based on length and the diameter of the unthreaded part of the screw.

Here's the lowdown on these types of fasteners:

- *Wood screws* can also be used to fasten wood. (Hmmm, ingenious!)
- *Lag screws* have square- or hexagon-shaped heads.
- *Bolts* don't thread into wood. They have flat ends (as opposed to the pointed ends of screws). They're held in place by a *nut* and *washer* (check out the following "Nuts and washers" section). The body of the bolt may have few threads or many.
- *Machine screws* are used to fasten metal parts. Machine screws are sometimes used with nuts. They come in various lengths and widths and have a wide variety of heads.

Nuts and washers

Nuts can be square or hexagonal. *Cap nuts* are rounded and smooth; *stop nuts* prevent the screw or bolt from coming loose. *Wing nuts* have flanges on each side so they can be tightened by hand.

Washers, on the other hand, prevent damage to the surface of material by preventing the bolt head from digging into the material. They also help keep the bolt or screw in place. *Flat washers,* a simple ring of flat metal, are the most common type of washer. *Shakeproof washers* have teeth to prevent them from skipping, while *split-lock washers* have two ends that dig into the nut and the material to keep the screw from slipping out.

Rivets

Rivets are commonly used to fasten metal parts together, especially when a weld is insufficient. *Standard rivets* are driven using a *bucking bar.* They come in a wide variety of lengths, diameters, and head shapes. The rivet material should match the material being fastened. *Pop rivets* can be driven when only one side of a join is accessible.

Building a Better Score

If you haven't picked up auto and shop knowledge by this point in your life and want to do well on this subtest, one thing you can do is get an automotive manual and take your car apart (hoping that you can get it back together again). Then get a woodworking book and build some furniture for your mom. (Even if you mess it up, Mom always likes gifts from the heart.) Or you can check out your local community college, which may be a more practical solution. Many community colleges offer basic Auto & Shop classes. You may also want to take a gander at the following books, all published by Wiley Publishing, Inc.:

- *Auto Repair For Dummies* by Deanna Sclar
- *Woodworking For Dummies* by Jeff Strong
- *Home Improvement All-in-One For Dummies* by Roy Barnhart, James Carey, Morris Carey, Gene Hamilton, Katie Hamilton, Donald R. Prestly, and Jeff Strong



On this subtest, you usually either know the answer or you say, "Huh?" However, some questions you run into can be answered by using the common sense approach. For example, say you run into a question on the ASVAB that reads something like the following:

When attaching two pieces of wood together, the most secure bond would be formed by using:

(A) wood screws

(B) nails

(C) wood glue

(D) both A and C

If you think about it, screws have threads, which are likely to "grab" wood more securely than a nail would. Glue would likely strengthen that bond even more. It's obvious that the *common sense answer* would be Choice (D).

Try a variation of the same question:

The best fastening method to use when attaching pieces of wood together, when time is of the essence would be:

(A) wood screws

(B) nails

(C) wood glue

(D) both A and C

In this case, the best answer would be Choice (B), as pounding a nail in with a hammer is generally faster than screwing a screw in with a screwdriver. (Even in these days of electric screwdrivers).



When all else fails, guessing is okay. If you guess, you have a 25 percent chance of guessing the right answer. If you leave the answer blank, you have a zero percent chance. If you're taking the computerized version of the ASVAB, you don't have a choice, of course, because you must provide an answer before you're presented with the next question.

For help with general guessing hints, check out Chapter 3.

Chapter 12

Mechanical Comprehension

In This Chapter

- Making machines simple (or simpler)
- Figuring out the principles of work
- Knowing how gravity works
- Using the force and the elements of physics
- Manipulating machines to help you work
- Jacking up your test score

If your M-16A2 .223 caliber rifle jams on the firing range, knowing how to take it apart and put it back together will benefit you. Of course, your drill sergeant in basic training will be more than happy to teach you this, but how easily you grasp such tasks depends greatly on your aptitude for understanding simple mechanical operations. That's the purpose of the Mechanical Comprehension subtest of the ASVAB.

The questions on this subtest measure your understanding of simple machines and mechanisms. Many of the questions on this subtest display a diagram of a simple machine, such as a series of gears, followed by a question, such as which direction the gears turn or how fast they revolve. This subtest is almost all about mechanical physics, so you may want to review some basic physics textbooks from your local library.



Only some military jobs require a good score on this subtest. Turn to the Appendix at the back of this book for information about the subtest scores you need to qualify for specific military jobs. If you have no interest in taking apart a fighter aircraft or rebuilding a tank, you're better off reviewing for the Word Knowledge or Arithmetic Reasoning subtests, which make up part of the core exam (the AFQT; see Chapter 1) that you must do well on to even qualify for enlistment.



To ace this subtest, you also have to bone up on your mathematical skills. The Mechanical Comprehension subtest often asks you to make calculations based on formulas to explain mechanical principles. Don't panic; the formulas are easy to understand, but you do have to use math to come up with a final answer. See Chapters 7 and 8 for more information on math. In this chapter, you get the mathematical formulas for commonly asked questions on the ASVAB, so pay especially close attention to these little beauties. (If the information probably isn't on the ASVAB, we don't burden you with it here.)

This subtest has 25 questions. You have 19 minutes to answer the questions, which is enough time for a mechanically oriented individual to tackle this subtest and put a broken clock back together. Well, maybe not the whole clock.

Understanding Machines and Mechanisms

Ever since the invention of the wheel, humans have used machines to help do work more efficiently. Machines are also used to help with work that couldn't be done otherwise. Think of the mechanisms and machines you use everyday — from the simple (like the hinge that allows a door to move easily when you push it open) to the more complex (like the hydraulic lift that allows you to lift a car up to check its underside). You could move most doors out of the way without hinges, but you couldn't lift a car over your head without some help.

Machines help apply and use force more effectively. In physics, *force* (power or strength) allows change to the *velocity* (speed) of an object. By applying force, you can open the door or close it; speed it up (slam it), or slow it down (catch it before it slams); or make it change direction (push it shut when the wind blows it open).

Here are some of the forces that act on objects:

- **Friction:** Resistance to the motion of two objects or surfaces that touch
- **Gravity:** The physical property that draws objects toward the center of the earth
- **Magnetism:** The property of attracting iron or steel
- **Recoil:** The property of kicking back when released
- **Static electricity:** The production of stationary electrical charges, often the result of friction

In order to perform work, sometimes you have to overcome these forces by applying more force. For example, when you're moving a piano across a smooth, vinyl floor, little friction is produced so the amount of force required to push the piano is equal only to the piano's weight. But when you're moving a piano across a carpeted floor, more friction is produced, so you have to push harder to move the same piano the same distance.



You can use a mathematical formula to determine force:

$$\text{Force} = \text{Mass} \times \text{Acceleration}$$

Martial artists use this concept all the time. Although a larger fighter may have more size (mass), a smaller fighter usually has more speed (acceleration), possibly resulting in both fighters applying the same amount of force. This concept is why 110-pound martial artists can break boards and bricks just as well as 200-pound martial artists.

All Work and No Play: Measuring Work

When a machine multiplies the force you use, it gives you a *mechanical advantage.* This concept can be stated as

$$\text{Mechanical Advantage} = \frac{\text{Resistance}}{\text{Effort}}$$

Some simple machines may give you a mechanical advantage of only one or two. (This means that they enable you to do one or two times the amount of work by expending the same effort.) But those simple machines are still worth using! Often, even if a machine doesn't multiply your effort (or doesn't multiply your effort by much), it can at least spread your effort out and make it more effective.

The inclined plane and simple pulley work as simple machines (check out the "Ramping up the inclined plane" and the "Easing your effort: Pulleys and gears" sections later in this chapter for more info).

What is work?

Mechanically speaking, *work* happens when a force (usually measured in pounds), moving over a measurable distance (usually measured in feet), overcomes a resistance. So the unit of measure for work is often called a *foot-pound.*

Work is different from *effort* — work is the result of effort. You can think of effort as being force and work being what you produce with that force.



One foot-pound of work occurs when a one-pound weight is lifted to a height of one foot. Or you can represent this concept in equation form:

Work = Force × Distance

The resistance that the work overcomes isn't the same thing as the weight of the object that the work moves. (If you've ever tried to put your freaked-out cat in a cat carrier to go to the vet, you know what we mean.)

In other words, if you try to move a 1,200-pound piano, you'll probably notice a measurable difference between the amount of work it takes to shove it along the floor and the amount of work it takes to carry it up the stairs. But don't take our word for it — you can demonstrate this concept at home. First, find a 1,200-pound piano and push it across the floor. Next, put it on your back and carry it up the stairs. See the difference? (Really, don't put the piano on your back. We're just trying to make a point here.)

When you move the piano across the floor, you're really working (pushing) against the frictional resistance (the force that's produced when two surfaces rub together) of the piano rather than its full weight. Under these circumstances, the frictional resistance of the piano offers less resistance than its full weight. There are also times when an object's full weight is less than its frictional resistance. Consider trying to push a textbook across a deep-pile carpet. Picking the book up and carrying it is easier. (For more about friction, see the section, "Friction: Resisting the urge to work.")



So why do you get tired from holding all those textbooks when you have to stand around and wait to talk to your teacher? You're not doing anything with the books, right? Well, actually, you are. You're resisting the pull of gravity, which is a force. Next time, set the books down on the floor (but don't shove them across a deep-pile carpet).

Friction: Resisting the urge to work

When one surface (a floor) resists the movement of another surface (the bottom of a piano), the result is *frictional resistance.* This friction isn't like resisting to cut the grass. That type of resistance may cause friction between you and your dad, but we're talking about a different kind of resistance here.

Rolling friction (like the friction that occurs when you roll a wheel along the pavement) is always less than sliding friction (which occurs when you shove a piano along the floor). If you put wheels on a piano, it's much easier to push!



You can decrease friction by using a lubricant. Oil, grease, and similar materials reduce friction between two surfaces. So, theoretically, if you oil the bottom of a piano, it's easier to move! ***Note:*** Oiling the bottom of your piano isn't recommended (for reasons involving the appearance of your floor and piano).

Gaining power by working quicker

Power is the rate of work. If Mary Lou is able to lift more 50-pound sacks of potatoes onto the truck bed in ten minutes than Joe is, Mary Lou is more powerful than Joe. Mathematically speaking:

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

In this formula, work is measured in foot-pounds, time is measured in minutes, and power is measured in foot-pounds per minute. However, the unit of measure for power is commonly put in terms of horsepower (hp).

Horsepower is derived from the fact that an average horse can do 33,000 foot-pounds of work in one minute. Therefore, 1 horsepower = 33,000 foot-pounds per minute. One horsepower is also the same as 550 foot-pounds per second.

Working well under pressure

Pressure is a measurement of force. Pressure is usually measured in pounds per square inch (psi). The formula for deriving pressure is

$$\text{Pressure} = \frac{\text{Force (in pounds)}}{\text{Area (in inches)}}$$

If 50 pounds of force are exerted on 10 square inches of surface, the amount of pressure is 5 pounds per square inch (5 = 50 ÷ 10).

Consider this: If you're sleeping in bed, the amount of pressure being exerted per square inch is much less than when you're standing on your feet. The surface area of the bottoms of your feet (supporting all that weight) is much less than the surface area of all your body parts that touch the mattress.

Ever wonder how a person can lie on a bed of nails? The answer involves elementary physics. His or her body rests evenly on hundreds of nails; therefore, no individual nail exerts a great amount of pressure against the skin. Have you ever seen someone stand on a bed of nails? It's unlikely because more pressure is on the foot, and the nails would puncture the feet.



A barometer is a gauge that measures atmospheric pressure. Normally atmospheric pressure is 14.7 psi. A change in air pressure means the weather is about to change. For more information on science and barometric pressure, see Chapter 10.

The Force of Attraction: Gravity

Gravity is a force of nature that you experience every day. It's produced by all matter in the universe and attracts all pieces of matter, regardless of type. The Earth produces gravity and so do the sun, other planets, your car, your house, and your body. Even this book you're reading produces gravity. Check out the next couple of sections for a detailed discussion of gravity and how it works.

What goes up must come down

Sir Isaac Newton invented gravity in 1687 when he failed to pay attention while sitting under a tree and got bonked on the noggin by an apple. Before that, gravity didn't exist, and everyone just floated around. Okay, we're kidding. Isaac Newton didn't invent gravity. But the famous mathematician was the first to study gravity seriously, and he came up with the theory (now a scientific law) of how gravity works.



Newton's law of universal gravitation states that every object in the universe attracts every other object in the universe. The amount (force) of the attraction depends on the mass of the object. If you're sitting in front of your television, you may be surprised to know that the television set is attracting you. However, because the mass of the TV is so small compared to the mass of the Earth, you don't notice the physical "pull" toward the television set.

The old saying, "What goes up must come down," is appropriate when discussing gravity. If you fire a bullet straight up into the air, it will travel (overcoming the force of gravity) until it reaches its furthest or highest point, and then it will fall. So, what causes it to fall?

On Earth, gravity pulls objects downward toward the center of the Earth. The force of gravity acting on an object is equal to the weight of the object. Of course, this fact is only true on Earth. Other planets have lesser or greater masses than the Earth, so the weight of objects on those planets will be different.

Newton's law also says that the greater the distance is between two objects, the less the objects will attract each other. In other words, the farther away an object is from the Earth (or any large body), the less it will weigh. If you stand at the top of a high mountain, you will weigh less than you will at sea level. Don't get too excited about this weight-loss technique. Gravitational pull isn't the next big diet craze. The difference is incredibly small. Sorry!

For an object to really lose weight, it must be far away from the Earth (or any other large body). When an object is far enough away from these bodies that it experiences practically no gravitational pull from them, it is said to experience weightlessness — just like the astronauts you see on TV.

False gravity of a spinning object: Centrifugal force

An object traveling in a circle appears to experience a gravitational force. This isn't really gravity, but instead it's a concept known as *centrifugal force.* The amount of force depends on the mass of the object, the speed of rotation, and the distance from the center:

- The more massive the object, the greater the force.
- The greater the speed of the object, the greater the force.
- The greater the distance from the center, the greater the force.



Centrifugal Force doesn't really exist, so many scientists refer to it as a *false force.* It's not a force at all, but rather a product of Newton's (remember him?) laws of motion (see the previous section, "What goes up must come down"). This characterization seems wrong because when your car goes off the road and crashes or when your bicycle skids out from under you when cornering a slippery curve, you feel like this force had something to do with it. Because it feels real, it's often useful to treat it as if it's a real force.

If you're riding on a merry-go-round on the playground (wee!), you have to exert a constant force to keep from flying off. This force isn't due to something actually pushing you in that direction, but by your body's inertia trying to keep you moving in a straight line. Because

one of Newton's laws states that accelerating objects tend to want to travel in one direction, as the merry-go-round turns, your accelerating body wants to keep traveling in one direction, so you feel you're being "pushed" outward.

Giving Force a Direction

Forces are vector quantities. That means that they have both a magnitude and a direction associated with them. Forces applied in the same direction as other forces magnify the total force, while forces that move in opposite directions reduce the total force. In general, an object can be acted on by several different forces at any one time. This section gives you the basics of force that you need to know for the ASVAB.

The basics of action and reaction

Sir Isaac Newton sure was one of the sharpest crayons in the box. His third law of motion states that for every action (force) in nature there's an equal and opposite reaction. In other words, if object A exerts a force on object B, then object B also exerts an equal and opposite force on object A. Notice that the forces are exerted on different objects.

Take a look at Figure 12-1. As you sit in your chair reading this book, your body exerts a downward force on the chair and the chair exerts an upward force on your body. There are two forces resulting from this interaction: a force on the chair and a force on your body. These two forces are called *action and reaction forces.*

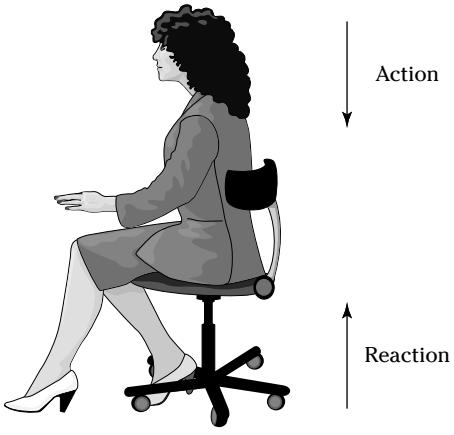


Figure 12-1: An example of action and reaction forces.

This force can also be used to describe how a motorboat moves through the water. As the propellers turn, they push (accelerate) the water behind the boat (action). The water reacts by pushing the boat forward (reaction).

Applying force to two ends: Tension

Tension force is the force transmitted through a rope, string, or wire when force is applied to both ends. The force is the amount of tension directed along the rope, string, or wire and pulls equally on the objects at both ends. Tension force is usually measured in either *force-pounds* or *newtons* (N). 4.45 newtons equal 1 force-pound. See Figure 12-2.

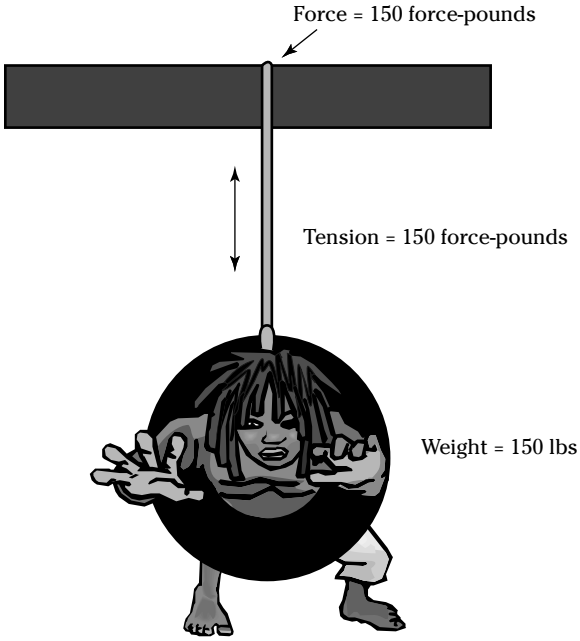


Figure 12-2: An example of tension force.

Balancing forces

A very basic concept when dealing with forces is the idea of *equilibrium* or *balance.* When two or more forces interact so that their combination cancels the other(s) out, a state of equilibrium occurs. In this state, the velocity of an object doesn't change. The forces are considered to be balanced if the rightward forces are balanced by the leftward forces and the upward forces are balanced by the downward forces.

If an object is at rest and is in a state of equilibrium, then it's at *static equilibrium. Static* means being stationary or at rest. For example, a glass of water sitting on a table is at static equilibrium. The table exerts an upward force on the glass to counteract the force of gravity.

Elastic recoil: The trampoline of physics

Liquids and gasses don't have a specific shape, but solid matter does. Solids are perfectly happy with the way they look and resist changes in shape. If you exert a force on a solid shape, it responds by exerting a force in the opposite direction. This force is called *elastic recoil.*

Take a look at Figure 12-3. The cat is standing on a board suspended on two blocks. While the board bends, the cat can feel the force of the board trying to regain its original shape. If the cat steps off the board, the board will spring back to its normal state.

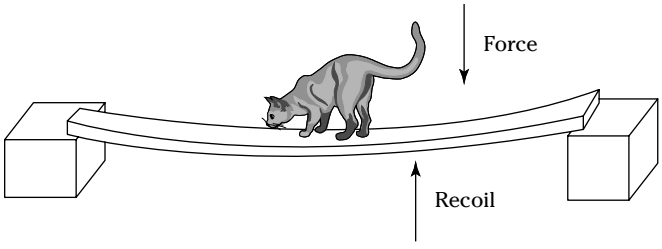


Figure 12-3: The concept of elastic recoil.

Relying on Machines to Help You Work

Ever since Zog crawled out of his cave and invented the wheel to help him carry fur coats to his girlfriend, mankind has made use of machines that help him to make work easier.

Machines give you the ability to magnify and change the direction of forces. Machines make work easier by providing some trade-off between the force applied and the distance over which it's applied. Keep reading to find out more!

Using leverage to your advantage

You may not think of the seesaw at the neighborhood park as a machine, but it is. It's a lever. Levers are among the simplest machines used to help increase force.

All *levers* work by using a *fulcrum* (point of support) to reduce resistance and multiply the effect of effort. Resistance is exerted at one end of the lever (the *resistance arm*) and effort is exerted at the other (the *effort arm*). The effort arm moves the resistance arm. See Figure 12-4.

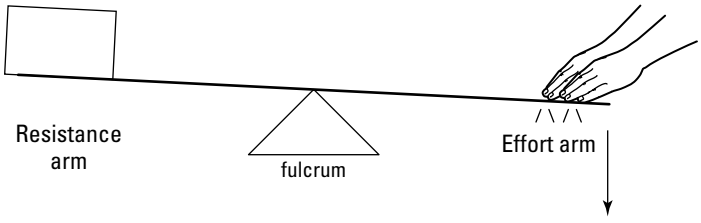


Figure 12-4: A simple lever.

To determine how much a lever reduces the amount of effort needed to do work, use the following formula:

$$\frac{\text{Length of Effort Arm}}{\text{Length of Resistance Arm}} = \frac{\text{Resistance Force}}{\text{Effort Force}}$$

As you can see, the amount of effort needed to move the lever varies depending on how long the effort arm is and how long the resistance arm is. Keep in mind that a short resistance arm, while easier to move, can't move an object as far through space as a longer resistance arm can.



The mechanical advantage of using a lever can be stated as

$$\text{Mechanical Advantage} = \frac{\text{Effort Arm}}{\text{Resistance Arm}}$$

If the effort arm is six inches and the resistance arm is three inches, the mechanical advantage is two. If the effort arm is six feet and the resistance arm is three feet, the mechanical advantage is still two.

Ramping up the inclined plane

The *inclined plane,* also called a ramp, is another very simple machine that makes moving an object from one point to another easier. The ramp spreads your work out over a longer distance, so less force is needed to do the work.

For instance, suppose you have to lift a 50-pound barrel to a truck bed that's 3 feet off the ground. You would have to use 50 pounds of force for 3 feet to move the barrel. But if you put a 6-foot ramp in place and rolled the barrel up the ramp, you would only use half as much force to get the barrel in the truck because the mechanical advantage of such a ramp is 2.

The advantage of using a ramp can be expressed as

$$\frac{\text{Length of Ramp}}{\text{Height of Ramp}} = \frac{\text{Weight of Object Being Moved}}{\text{Force Required to Move Object}}$$



Wedges are a form of inclined plane and can multiply your effort in much the same way as a ramp can. Screws are also inclined planes, only in spiral form. Screw jacks, which you can use to lift your house up to build a new foundation, are a combination of a lever and an inclined plane.

Easing your effort: Pulleys and gears

Pulleys and gears are simple machines that can be used to change the magnitude and direction of force. When you ride in an elevator, step onto an escalator, drive your car, or wind up your watch, you're using pulleys and gears.

Block and tackle systems

When used in a *block and tackle* arrangement, *pulleys* make lifting heavy objects easier. In block and tackle systems, pulleys can also be used to change the direction of your pull. If you tie a 200-pound crate to one end of a rope, run the rope through a pulley, and grab the other end of the rope, you can pull down on the rope to lift the crate up. Without a pulley, you could pull *down* on the crate all day, and it wouldn't go up (see Figure 12-5). In this case, using a simple pulley, the force of your pull must equal the weight of the object being lifted. The regular pulley doesn't multiply your force, but it makes the process of lifting easier.

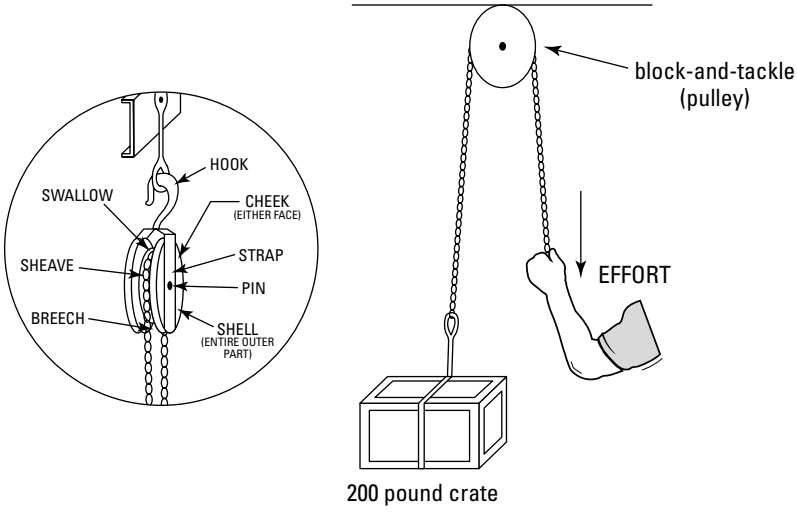


Figure 12-5: Pulley used in a block and tackle system.



Using a block and tackle allows you to distribute your force more effectively. Instead of hoisting that entire 200-pound crate in one try, you can pull on a rope to lift it a few inches, pull on the rope some more to lift it a few more inches, and so on. This makes the work easier to perform.

A block and tackle system can also be used to reduce effort by magnifying force. To help understand how this works, look at Figure 12-6:

- Example 1 shows a 100-pound box secured to the ceiling by a single line. The weight supported by the line is equal to the weight of the box.
- In Example 2, the box is secured to the ceiling by using two lines. Each line is supporting one-half the weight of the box.
- In Example 3, a single line is threaded through a pulley. While the line (as a whole) is supporting the entire weight of the box, each section of the line is only supporting one-half of the box's weight, just as in Example 2.
- In Example 4, a man is using this principle to lift the 100-pound box by applying only 50 pounds of force. In short, this block and tackle system provides the man with a mechanical advantage of 2. In receiving a mechanical advantage of force, the man must pull the rope farther than if he weren't using a pulley. In this example, the man would have to pull two feet of rope to raise the box one foot.

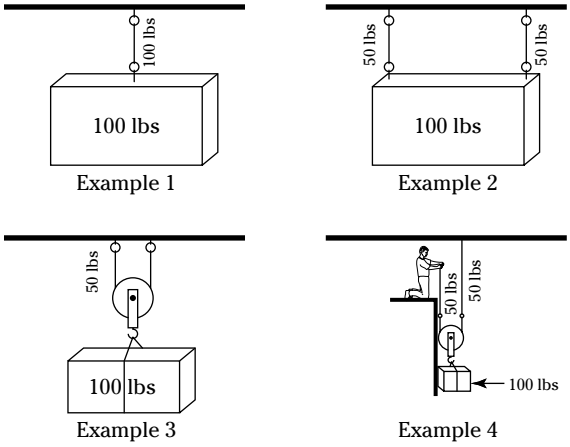


Figure 12-6: Reducing effort by using block and tackle.

Additional pulleys can be added to a block and tackle arrangement to further increase the mechanical advantage. Figure 12-7 shows a couple of examples:

- In the first example, three sections of rope equal a mechanical advantage of three. Lifting a weight with this pulley arrangement requires only ⅓ of the effort required to lift the weight directly. However, in order to lift the crate one foot, you have to pull three feet of rope.
- Example 2 illustrates a block and tackle system with six sections of rope. Using this arrangement provides you with a mechanical advantage of six, but you have to pull the rope six feet for every foot you wished to raise the box.

Understanding how gears work

Machines often use gears to transmit motion from one place to another. An additional advantage of using gears is that they can be used to change direction, increase or decrease speed, or increase or decrease force.

Gears arranged in a series turn in the opposite direction of each other. If you have an even number of gears connected in a series, the first and last gear turn in opposite directions. If you have an odd number of gears aligned in a series, the first and last gear spin in the same direction. Look at Figure 12-8. Gear 1 is rotating counterclockwise, which causes Gear 2 to turn clockwise, resulting in Gear 3 spinning counterclockwise, with Gear 4 turning clockwise.

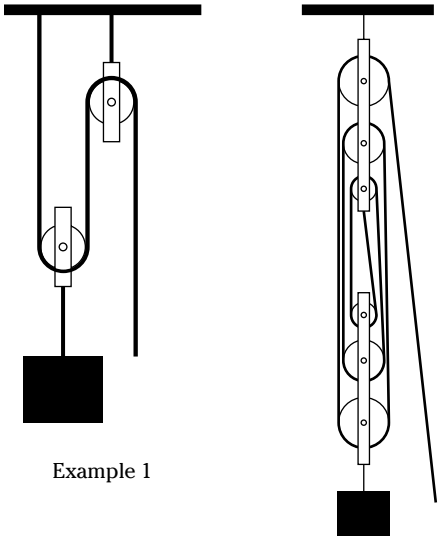


Figure 12-7: Two examples of a block and tackle arrangement.

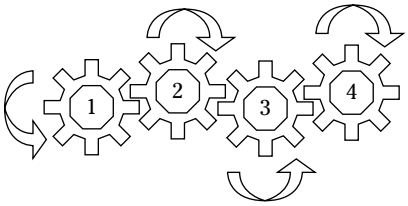


Figure 12-8: The motion of gears with an even number of gears aligned in a series.



The speed at which a gear rotates (in relation to the *driving gear* connected to it) is dependent on the number of teeth. In Figure 12-9, Gear 1 has six teeth while Gear 2 interacts with eight teeth. This relation of teeth can be expressed as a ratio of 6:8, which can be further reduced to 3:4. That means that Gear 1 has to rotate four times in order for Gear 2 to make three revolutions. Or, expressed another way, for each rotation made by Gear 1, Gear 2 will make ¾ of a revolution.

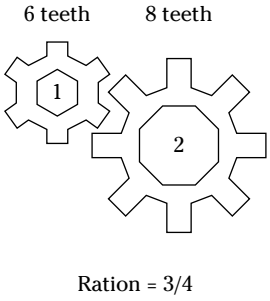


Figure 12-9: Ratio of teeth between two gears affects rotational speed.

When gear shafts aren't parallel to one another, special gears called *bevel gears* can be used to connect gears that have shafts at different angles. This concept can be easily confused. The principles of gear rotation remain the same. Figure 12-10 shows an example of a bevel gear designed to connect shafts having a 90-degree angle to the other.

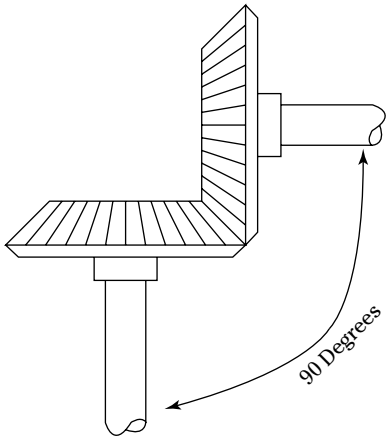


Figure 12-10: A bevel gear.

Pulley and belt arrangements

Pulleys have another use, in addition to magnifying force as part of a block and tackle system. When arranged with a system of belts, pulleys can drive other pulleys. Like gears, pulleys are used to transmit motion from one location to another. However, the physical properties of pulleys are different than those of gears. For example, unless the driving belt is reversed (twisted), pulleys connected in series rotate in the same direction. Figure 12-11 illustrates this concept by two sets of pulleys: In the first set of pulleys, all the pulleys turn in the same direction (counterclockwise) as the driving pulley. Note, however, the second set of pulleys. The driving pulley and the lower pulley are rotating counterclockwise, but the right-hand pulley is rotating in a clockwise direction.

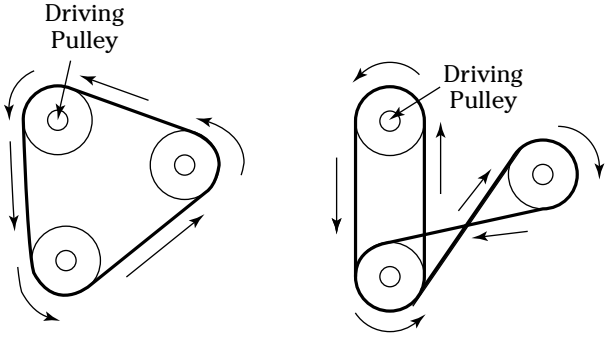


Figure 12-11: Pulleys rotate in the same direction unless the belt is reversed.

While the speed of gear rotation is determined by the number of teeth, how fast a pulley rotates depends on the diameter of the pulley in relation to the diameter of the pulley which is driving it. Have a look at Figure 12-12.

Pulley A has a diameter of 1 inch, Pulley B has a diameter of 2 inches, and Pulley C measures 3 inches in diameter. The ratio between the three pulleys is 1:2:4. For every complete revolution made by Pulley A, Pulley B makes ½ of a revolution. Each time Pulley B makes a full revolution, Pulley C makes ½ of a revolution. Thus, for every full revolution of Pulley A, Pulley C makes ¼ of a revolution.

Multiplying your effort: Wheels and axles

The *wheel-and-axle* machine multiplies the effort you use. When you steer a car by using a steering wheel (which is a wheel-and-axle device), a little effort exerted on the steering wheel turns the wheels of the car in the direction you desire. Turning your car wheels would be a lot more complicated if you didn't have the steering wheel.

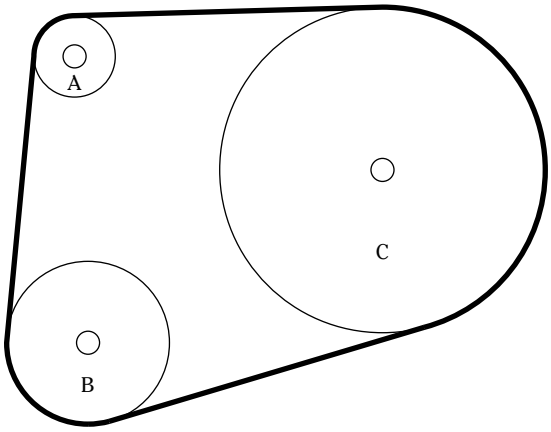


Figure 12-12: Pulley rotation speed is based on the pulley's diameter.

Pulley A Diameter = 1 inch
Pulley B Diameter = 2 inch
Pulley C Diameter = 4 inch

In true wheel-and-axle machines, the wheel and the axle are fixed together and turn at the same time. This arrangement multiplies the amount of force you can exert by a considerable amount. The relationship between the radius of the wheel and the radius of the area to which force is being applied determines the mechanical advantage you receive by using this piece of equipment. (Remember, the radius of a circle equals half the diameter; a straight line extending from the center of the circle to the edge is the radius of a circle.) A hand drill may apply 200 pounds of force for your 10 pounds of effort. (A hand drill uses a gear to convert the direction of the force.) See Figure 12-13.

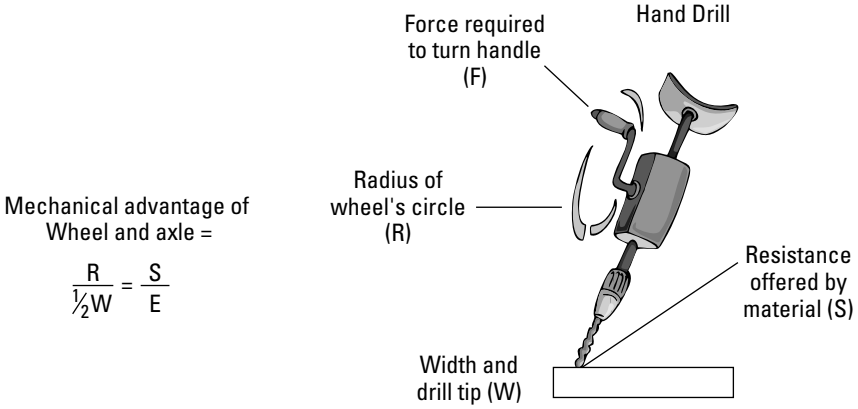


Figure 12-13: A hand drill.

Getting a grip on things with vices

While many mechanisms are designed to transmit motion, some machines have the purpose of keeping things motionless. *Vices* are very useful because they can close around items and hold them with great force (much greater force than you could do by holding the item in your hands). Figure 12-14 shows an illustration of a standard shop vice.

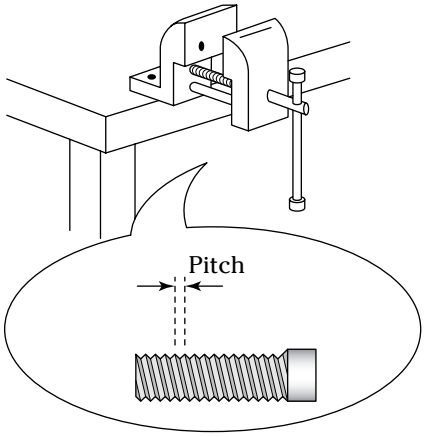


Figure 12-14: A standard shop vice.

Rotating the handle on the vice causes a screw to turn, which either tightens or loosens the vice. A *screw* is a cylinder wrapped in a continuous spiral. The distance between the ridges of the spiral are called the *pitch* of the thread. The greater the pitch of the thread, the farther the jaws of the vice move for each revolution of the handle. However, there's a trade-off. Larger pitches require more force to rotate the handle than screws with smaller pitches.

Magnifying your force with liquid: Hydraulic jacks

Hydraulic jacks use liquid to magnify force. Usually some type of oil is used, because oil is nearly incompressible, meaning that it transmits whatever force is applied to it with no (or little) loss in efficiency. The mechanical advantage is the ratio between the diameters of the two cylinders.

In Figure 12-15, the small cylinder has a diameter of 1 inch and the large cylinder has a diameter of 4 inches. This difference in diameter results in a mechanical advantage of 4. If the rocks weigh a total of 100 pounds, only 25 pounds of force has to be applied to the piston in the small cylinder in order to lift the load. However, while force required is reduced by a factor of 4, the smaller piston has to move four feet for every foot the piston in the larger cylinder moves.

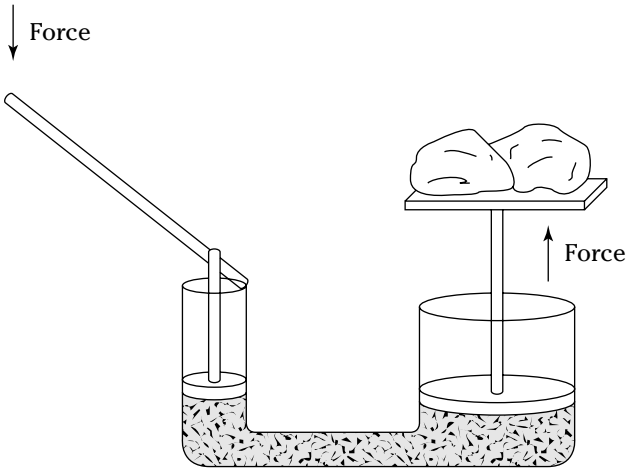


Figure 12-15: A hydraulic jack.

Working Your Way to a Better Test Score

When you take the Mechanical Comprehension subtest, you may not know the correct answer to a question, or you may not know the mechanical principle involved. You may know the mechanical principle but not remember the formula you need to come up with the right answer. Never fear, you can still stumble through this test without totally flaming out.

Questions on this subtest often include illustrations. The ASVAB test makers expect you to look at the illustrated device and guess how it operates. When you run across these types of questions, make sure that you understand the illustration. Often, parts of the device are labeled. Make certain you read and understand these labels before you try to answer a question about the illustration. Then try to use a common-sense approach. You may see the following question:



Which of the following controls an automatic sump pump?

(A) mechanical switch

(B) manual switch

(C) pneumatic valve

(D) float

You may not know the answer to this question, but you can rule out one answer, manual switch (Choice B), because the question asks you about an automatic sump pump, and anything manual isn't automatic. Eliminating one choice narrows your chances from one in four to one in three. Not a bad start, huh?



A sump pump is used to drain water from an area, and if you knew that, you have an even better shot at getting this question right. Think about what type of device detects the presence of water, and you may guess correctly that Choice (D), float, is the right answer.

You can answer a lot of the questions correctly if you just think about what you've observed in the world around you. Remember, the Mechanical Comprehension subtest also tests your knowledge of physical principles of the world around you — questions you may expect to find on the General Science subtest. For example, a question may ask something like this:



If all the following objects are the same temperature, which one will feel coldest?

(A) a wooden spoon

(B) a plastic spoon

(C) a metal spoon

(D) a fiberglass spoon

You don't need to know mechanical or scientific principles to know that a metal spoon will feel colder than the other spoons. So it makes sense to select Choice (C) as your answer, even if you can't explain the science behind this correct answer.



The nerve endings in your skin detect the difference between your inside body temperature and your outside skin temperature. Metal is an excellent conductor of heat, so heat flows from your hand into the metal. The heat is then conducted rapidly away into the bulk of the metal, leaving your skin surface relatively cool. That's why metal feels cooler than other, less efficient conductors of heat, such as wood, plastic, or fiberglass.



Mechanical comprehension is mostly elementary physics. Improving your knowledge of basic mechanical physics principles improves your chances for a better score on this subtest. *Physics For Dummies* by Steve Holzner, Ph.D., (Wiley) is an excellent place to start if you decide you need extra study in this area.

The mathematics of mechanics

Mechanical principles are based on mathematical principles. Therefore, a screw making a complete revolution turns 360 degrees because math states that a complete revolution always equals 360 degrees. If you have to know the surface area of a floor in order to determine the pounds per square inch a ton of tile would put on the floor, that's a mathematical principle too (area = length × width).



Suppose you run across this question:

A 3-inch-diameter flanged pipe with six holes is being fitted to a base with six holes. What's the maximum number of degrees the pipe must be rotated in order to line up the holes?

(A) 120 degrees

(B) 180 degrees

(C) 60 degrees

(D) 360 degrees

This isn't really a Mechanical Comprehension question at all — it's a math question. The only part that requires mechanical knowledge is knowing that the holes are spaced equidistant from one another on a flanged pipe. The answer is 360 degrees ÷ 6 = 60 degrees (Choice C).

Guessing with a mechanical mind

Like most of the other subtests on the ASVAB, you can and should guess on the Mechanical Comprehension subtest when you don't know the answer. You have at least some small chance of guessing the correct answer when you take a stab at it. If you don't guess at all, then you have no chance of getting the correct answer.



Check out these tips to help you narrow the field:

- The amount of force needed to move an object (not including friction resistance) is never greater than the weight of the object. Any answer that includes a force that's greater than the weight of the object being moved is probably wrong.
- The correct answer is a *mechanical* answer. For example, if the question asks, "What's the purpose of lubricating oil in an engine?" the correct answer won't be, "To make the parts look shiny." The answer would be "to reduce friction between moving parts."
- Any change in a mechanical operation almost always has pluses and minuses associated with it. So, when a question proposes a change, the correct answer is probably the one that specifies the good, the bad, and the ugly. For instance, suppose the question is, "Enlarging the wheel on a hand drill will . . . ?" The correct answer is the one that says something like, "Increase the amount of mechanical advantage but also increase the amount of effort needed to operate the drill."

For more general tips on guessing on the ASVAB, flip back to Chapter 3.

Chapter 13

Electronics Information

In This Chapter

- Discovering the mystery of electricity
- Comprehending electrical flow
- Amplifying your test score

When Rod was around 12 years old, he impressed his parents by taking an old television set apart and putting it back together. He impressed them right up to the point where he plugged it in and blew up the garage. But the world of electronics is a bit more complex than simply plugging something in and seeing if it works. Rod (and the garage) learned this lesson the hard way.

So six years later, when Rod took the ASVAB, he scored very well on the Electronic Information subtest. (Go figure!) This subtest is designed to measure your knowledge of the principles of electricity and how these principles are applied in the real world. You may see questions about transistors, magnets, engines and motors, and radio and television. Curiously, there are no questions on this subtest concerning the impromptu demolition of garages.

You don't have to be an electronics wiz to score well on this subtest. If you're not familiar with this information, and you want to pursue a military career that requires you to do well on this subtest, this chapter is calling your name. You also need to have some familiarity with basic mathematical and algebraic principles (see Chapters 7 and 8 for more information).



Not every military career requires a good score on this subtest. (Turn to the Appendix to find out what military jobs require a score on this — and other — subtests.) If the military feels that the Electronics Information subtest is important to your desired career, study intensively for this test. You can even take a course or two at the local community college if you don't have a strong enough background in this area. If, however, you don't intend to pursue a career that requires a score on this subtest, spend your time studying for other areas of the ASVAB.

You have 9 minutes to answer 20 questions on this subtest. Although 9 minutes is sufficient time to answer the questions, it doesn't provide much time for anything else — if you don't know an answer, guess and go.

Uncovering the Secrets of Electricity

One day in 1752, Benjamin Franklin was minding his own business, flying a kite in a storm. A key was tied to the kite string and when lightning struck the metal key, Ben was struck by the notion that lightning must be electrified air. Although electricity was just a hobby for Ben Franklin, he made many important contributions. As a result of his famous kite flight he created many of the terms used today when folks talk about electricity: battery, conductor, condenser, charge, discharge, uncharged, negative, minus, plus, electric shock, and electrician.

Electricity is a general term for the variety of phenomena resulting from the presence and flow of electric charge. You can't see electricity running through a wire (but you can certainly feel it). You only know electricity is there when you flip on the light switch and the light turns on. Even though electricity appears to be pretty mysterious at first glance, scientists understand a great deal about its properties and how it works.

Electricity is like water — it flows. Electricity is subject to pressure, which causes the electrical current to flow; it's also subject to resistance, which interferes with the electrical flow. Electricity is also measured in three different ways:

- **Volts:** The amount of work done when electrons move between two points
- **Amperes (amps):** The number of electrons that move past a specific point in one second
- **Ohm:** Measures resistance, including anything that could limit the flow of electrons

Electricity comes with some other terms that are important for you to know for the ASVAB:

- *Electric current* occurs when electrons move from one place to another.
- The use of *conductors,* such as copper and water, allow the electrons to move freely.
- *Insulators,* such as rubber and wood, discourage the electric current.
- A *watt* measures the amount of electricity consumed.
- A *watt-hour* is an amount of energy used in a length of time.
- Most electricity is measured in *kilowatt-hours,* which is the amount of energy used in one hour by one kilowatt of electricity.

See "Measuring power" later in this chapter for the complete scoop on watts.

Examining the current of the electrical river

Electrical current is the flow — or, more precisely, the *rate* of flow — of electrical force in a conductor. Current is measured in coulombs. A *coulomb* is the amount of electricity provided by a current of one ampere flowing for one second. It's called a coulomb because a guy named Charles de Coulomb discovered this little bugger in the late nineteenth century, and the rules say that if you discover something, someone will stick your name on it for life (not sure who made up those rules, though). Calling a coulomb a coulomb is easier than calling a coulomb by its other name — a *meter-kilogram-second unit* of electricity.

If one coulomb flows past a specified point in one second, that's one ampere (amp). For the sake of convenience, measured electrical currents are often taken in amps. Some really tiny currents are measured in milliamperes; one milliampere is one-thousandth of an ampere. (An *ampere* represents the strength of a current.)

Current meters, called *ammeters,* measure the flow of current through a circuit. A *circuit* (you knew this was coming) is just the path of a current. See "Floating along the circular river: Circuits," later in this chapter.

Withstanding the pressure

Electrical pressure affects the number of amperes moseying along a wire (or whatever you're using to conduct the electricity from one place to another). More pressure means that more

amperes flow along a wire (or conductor). The unit of measure for this pressure is called a *volt.* The voltage between two points in a circuit is sometimes called the *drop.*

If you have a small wire and you want to run electrical current through it, you have to use more pressure — that is, a higher voltage — than if you have a large wire that you want to run current through. Think of the water pipes in your house. The narrower the pipe, the more pressure required for the water to flow through it. The wider the pipe, the less pressure required. Just take a look at your bathroom: The water in your toilet is under less pressure than the water in your shower.



A *cell* (a storage compartment for electricity) has a voltage of about 1.5 volts. Therefore, you can figure out the number of cells a battery has by dividing the voltage by 1.5. Pretty handy stuff, huh? You can also measure the amount of voltage being applied to a current in a circuit with a *voltmeter.*

Regulating the electrical river

Current doesn't just flow from one end of a wire (or whatever conductor you're using) to the other. Impediments pop up along the way. The amount of resistance that interferes with the flow is measured in *ohms* (pronounced just like those yoga chants). If the flow of electricity needs to be regulated, resistance is deliberately set up in a circuit. (If the flow of electricity wasn't regulated, the engines powering can openers and microwave ovens would quickly overheat and melt.) In a sense, sending electric current down a narrow wire (which exerts more resistance than a wider wire) is a way to deliberately implement resistance.



The symbol for ohm looks like an upside-down horseshoe: Ω.

Resistance can be measured by dividing the voltmeter reading by the ammeter reading or by using an *ohmmeter.*

If you have a current flowing through a wire, three influences are present:

- The pressure of the current (voltage)
- The resistance to the current (ohms)
- The strength of the current (amperes)

These three influences are always present in direct relationship to each other. If you know the value of any two of the influences, you can find the value of the third. (Yes, this requires more math. Sorry.)

Ohm's law, which was first stated by Simon Ohm, reads, "The current in a circuit is directly proportional to the applied voltage and inversely proportional to the circuit resistance," but it's easier to understand in mathematical terms:

- Current (amperes) = Voltage (volts)/Resistance (ohms)
- Voltage = Current × Resistance
- Resistance = Current ÷ Voltage



When stating the relationship mathematically, abbreviations are used: I (current) = E (voltage) × R (resistance).

Measuring power

Power is measured in *watts.* One watt is a very small amount of power. It would require nearly 750 watts to equal one horsepower. A kilowatt represents 1,000 watts. A kilowatt-hour (kWh) — the amount of electricity a power plant generates or a customer uses over a period of time — is equal to the energy of 1,000 watts working for one hour. Kilowatt-hours are determined by multiplying the number of kWhs required by the number of hours of use. For example, if you use a 40-watt light bulb 5 hours a day, you have used 200 watts of power, or 0.2 kilowatt-hours of electrical energy.



The term *watt* was named to honor James Watt, the inventor of the steam engine.

Floating along the circular river: Circuits

Although this section suggests that electricity flows like water, it actually flows more like NASCAR. Electricity must be sent along the path of a closed circle (a *circuit*), just like all those NASCAR speedsters roaring around the track. They never actually get anywhere; they just keep driving in circles. Electricity is a lot like that.

However, electricity does flow like a river in one respect. In general, electricity, follows the path of least resistance. The conventional way in thinking about the electrical flow of current is to imagine electrical particles moving from the positive (+) terminal of a battery to the negative (–) terminal. In fact, this concept is called *conventional current.*

To prevent confusion you should always use conventional current when trying to understand how circuits work. Imagine positively charged particles flowing from + to – (even though this is technically wrong — see the nearby sidebar, "Electricity in the early days"). One *terminal* (also called a *pole;* in other words, one end) in a circuit is always the negative (–) terminal and one is always the positive (+) terminal (see Figure 13-1).

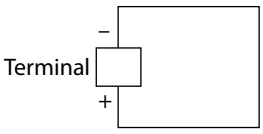


Figure 13-1: A simple electric circuit.



If any of the wires leading from one terminal to the other is broken, the circuit is shot — no more electricity. Here's another circuit problem that may come up: A *short circuit* occurs when any wire accidentally crosses over another wire, causing the electricity to bypass the rest of the circuit and not follow the intended path.

Obeying the electrical traffic rules

To control the current needed for different electrical applications, more or less resistance is applied to a circuit. Sometimes the circuit must be opened in order to add or remove resistance. In other words, the flow of the electricity must be interrupted in order to physically change the resistance. (A circuit breaker, which is a device that automatically interrupts the electrical current, is an example of opening a circuit to control the current. But when the circuit breaker "trips," the electrical device can no longer operate.) Some devices use a *rheostat,* which can vary the resistance without opening the circuit — the device can continue to work even as the resistance is altered. If an application doesn't use all the electricity, the rheostat absorbs it.

Electricity in the early days

In the early days, when scientists were just beginning to experiment with electricity, they attempted to discover the direction of electrical flow. They knew there were two kinds of electrical charge, positive (+) and negative (–). However, with the equipment they had at the time, they found it impossible to determine which way current moves through a circuit. Finally they just threw up their hands and made a guess! Everything known at the time could be explained by imagining positive electrical charges flowing through the circuit toward the negative terminal.

Turns out they were wrong. When the electron was discovered in 1897, it was found to have a negative charge. Electricity in a circuit is actually the travel of electrons (negative) toward the positive terminal. However, by the time the electron was discovered the idea of electricity flowing from + to – (conventional current) was firmly established. Luckily it's not a problem to think of electricity in this way because positive charge flowing forward is equivalent to negative charge flowing backward.

A dimmer switch on a light is an example of a rheostat. You increase the amount of resistance to dim the light and decrease the resistance to brighten the light.



Keep in mind, though, that a current doesn't always flow in one direction. A *direct current* (DC) does — it only and always flows in one direction. An *alternating current* (AC), however, constantly changes direction (in a regular pattern). The number of times a current changes direction per second is known as its *frequency.* The *hertz* (Hz) is the unit of measurement for frequency.



The AC (alternating current, not the air conditioner) in your house probably completes 60 alternating cycles per second. One hertz equals one complete cycle per second. In other words, the current makes two complete alternations of direction. Therefore, the AC in your house has a frequency of 60 Hz. (Another way to say *frequency* or *hertz* is *cycles per second.*)

High voltage is easier to obtain with alternating current. And sending high voltage down a power line is cheaper than sending low voltage, so most electricity comes in the form of AC.

Electronic devices operate at high frequencies. Because electronic devices operate at very high frequencies, kilohertz (kHz) — one thousand hertz — are often used to measure their frequencies. A megahertz (MHz) is one million hertz.



AM radio stations often broadcast in the 500- to 1,600-kHz range. Television stations may broadcast at 50 MHz. Radar operates at frequencies as high as 100,000 MHz.

Producing electrical cause and effect

Electric currents can produce different effects. These effects are packaged and sold commercially. The following is a description of effects produced by current and some of their commercial applications:

- **Chemical effect:** Current produces this effect when it passes through a chemical compound and breaks that compound up. Also called electrolytic decomposition, this phenomenon is used in electroplating (a process used to cover objects with a very thin coating of metal).
- **Heat effect:** Conducting electricity causes wires to become heated. Heat develops because the current must overcome the resistance of the wire. This heat energy can be quite obvious or hardly noticeable to touch depending on the size of the wire and the amount of current.

Magnetic, electric: No, not your personality

Certain magnetic effects always accompany an electric current, and these effects follow definite laws. In a wire, the *magnetic lines of force* (these lines are imaginary and used to explain magnetic effects) are perpendicular to the conductor and parallel to each other.

But, when you wrap a wire around a core and pass current through it, the wire forms a coil. As the lines of force around the core take on a different shape, the field around each turn of wire links with the fields from the other turns of wire around it. The combined influence of all the turns of wire produce a two-pole magnetic field very much like the magnetic field of a simple bar magnet — one end of the coil is a north pole; the other end is a south pole.

The strength of the field depends on several factors. Here are the main ones:

- **Number of turns:** If you increase the number of turns, you increase the field strength.
- **Closeness of the turns:** The closer the turns, the stronger the field strength.
- **Amount of current flowing:** If you increase current, you increase field strength.
- **Material in the core:** Most coils are either air or soft iron. Air coils are usually wrapped around a piece of cardboard; soft-iron coils are wrapped around a piece of iron. Soft iron offers a better path for magnetic lines of force because its high permeability offers less reluctance to magnetic flux, resulting in more lines of force. The more lines of force, the stronger the magnetic field.

Passing a suspended loop of conductive material (wire) through a magnetic field performs *electromagnetic induction,* which is the basic principle behind the electric generator. Standing still, the conductor has no current flow. But, when the conductor starts to rotate clockwise through the lines of force of the magnets, the lines of force induce free electrons to move through the wire.

- **Magnetic effect:** Magnetic force is produced when two simple magnets are brought together. Each magnet has two poles: a north pole and a south pole. When two like poles touch, the magnets repel each other. When two unlike poles touch, the magnets attract and stick together. A magnetic field surrounds magnets when magnetic force is working, which means that magnetic force extends beyond the magnets. When a wire is introduced into the magnetic field, the wire becomes a conductor for the magnetic current. Electricity flowing through a wire will repel a magnet. If the wire is wrapped around an iron core and a current is sent through the wire, the iron becomes magnetized. This effect is used to create energy through electromagnetic induction, the basic principle behind the electric generator.
- **Physiological effect:** Current produces this effect when it passes through your bicep (or any of your muscles for that matter) and causes the muscle to contract. This effect is used in medicine.

Understanding Two Important Properties of Alternating Currents

Resistance interferes with the flow of current in a circuit. But the flow of current is also impeded by two properties of alternating currents:

- **Capacitive reactance (capacitance):** The storage of energy that occurs in a nonconductor. This property resists any change in voltage in a circuit.
- **Inductive reactance (inductance):** The property that causes an electromotive force (another way of saying voltage) to be induced in a circuit.



More than you ever wanted to know about capacitors and inductors

Capacitors store or hold a charge of electrons. In an AC circuit, the capacitor is constantly charging and discharging (AC voltage goes positive and negative in each cycle). The rate of the charging and discharging acts as opposition to changing AC voltage — as a resistive effect called capacitive reactance.

Inductors are coils of wire that make use of the properties of a magnetic field. The property specifically desired in this instance is that of the current flowing through the wire. With full current, the magnetic field is at maximum. However, if you take away the current, the field doesn't disappear immediately. It decays gradually, and the decay continues to push electrons in the path they were going.

But, in an AC circuit, the current constantly reverses. The rate of changing current flow, and the resulting collapse and regeneration of the magnetic field in the coil, act as opposition to changing AC current — a resistive effect called inductive reactance.

These two types of reactance combine to impede the flow of current. *Impedance* can be expressed as the ratio of electromotive force to the current:

Impedance = Electromotive Force ÷ Current

Electronics often require specific capacitive or inductive reactance to work. *Capacitors* and *inductors* are devices used in circuits to provide the type of reactance needed. Capacitors are rated in microfarads (μF) and inductors are rated in millihenries (mH).

Rectifying the situation

Certain electronic circuits can change alternating current to direct current. The process of making the change is called *rectification,* and the circuits that perform the rectification are called *rectifiers.* Rectifiers contain semiconductor diodes (vacuum tubes with poor conductivity at low temperatures). These diodes conduct electricity in only one direction. The process of rectification also often requires the use of inductors and capacitors (see the preceding section for more info). Rectification helps appliances run at cooler temperatures and allows them to run at variable speeds.

Turning up the old transistor radio

A *transistor* is a semiconductor (an object that conducts electricity poorly at low temperatures), and it has many properties:

- Transistors control the flow of electricity in a circuit.
- A transistor is usually made of germanium or silicon.
- A transistor can amplify a signal, which is why they're used in transistor radios.
- A transistor doesn't require a vacuum to operate.
- Transistors are small, require little power, and last a long time.

- A transistor contains at least three terminals:
  - The emitter, which gives off or emits current carriers
  - The base, which controls the flow of current carriers
  - The collector, which collects the current carriers

Taking a symbolic trip around an electronic circuit

Electronic circuits can be combined to create *complex systems,* such as those required to operate a stereo system. *Block diagrams* are used to show the various combined circuits that form a complex system.

Many of the questions on the Electronics Information subtest require you to identify an electronic component symbol and know what that component does in an electronic circuit. Figure 13-2 shows the most common component symbols. The figure's items are grouped based on similarity of functions. For example, cells, batteries, DC power supplies, and AC power supplies all have similar functions (they supply power to the circuit).

So, what do all these electronic doodads do when connected in a circuit? Each item is covered in the list below:

- **Wires:** Wires are used to pass current from one part of the circuit to another. Wires that are connected to each other are indicated by a dark circle and called joined wires. Sometimes in complex circuit diagrams, it's necessary to draw wires crossing even though they aren't connected. In this case, the dark circle is omitted, or a "hump" symbol is drawn to make it clear the wires aren't connected — called unjoined wires.
- **Cell:** A cell supplies electrical current. Some call this a battery, but technically a battery is more than one cell. The large terminal (on the left side of the cell picture in Figure 13-2) is positive.
- **Battery:** A battery is two or more cells. The large terminal (on the left side of the cell picture in Figure 13-2) is positive.
- **DC power supply:** A DC power supply provides direct current electrical energy. Direct current always flows in one direction.
- **AC power supply:** AC power supplies provide alternating current electrical energy. Alternating current constantly changes direction.
- **Fuse:** A fuse is a safety device that "blows" (melts) if the current flowing through it exceeds a specified value.
- **Transformer:** A transformer consists of two coils of wire linked by an iron core. Transformers are used to step up (increase) and step down (decrease) AC voltages. No electrical connection exists between the coils. Energy is transferred between the coils by the magnetic field in the core.
- **Ground:** A ground is a connection to the earth.
- **Lighting lamp:** This transducer converts electrical energy to light, such as a light bulb or an automobile headlight.
- **Indicator lamp:** This transducer converts electrical energy to light for such uses as a warning light on a car's dashboard.
- **Motor:** A motor is a transducer that converts electrical energy to kinetic energy (motion).

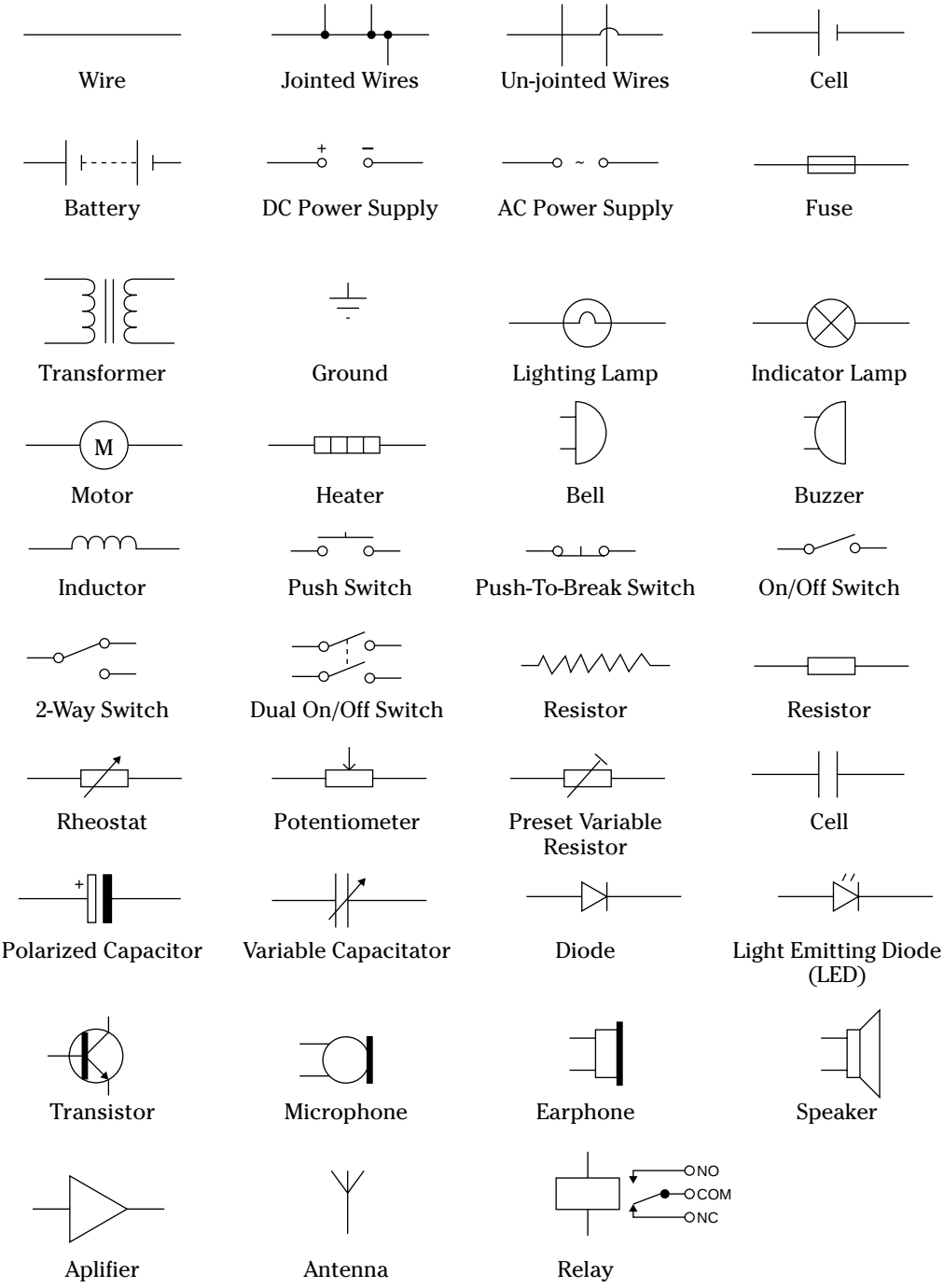


Figure 13-2: Symbols you may be required to know on the Electronics Information subtest of the ASVAB.

- **Heater:** This transducer converts electrical energy to heat.
- **Bells and buzzers:** These transducers convert electrical energy to sound.
- **Inductor:** An inductor is a coil of wire that creates a magnetic field when current passes through it. It can be used as a transducer converting electrical energy to mechanical energy by pulling on something.

- **Switches:** Switches have many different types:
  - **Push switch:** Allows current to flow only when the button is pressed (such as a doorbell)
  - **Push-to-break switch:** Normally closed (on), it's open (off) only when the button is pressed
  - **On-off switch:** Allows current to flow only when it's in the closed (on) position
  - **2-way switch:** Directs the flow of current to one of two routes, according to its position
  - **Dual on-off switch:** Often used to switch main electricity because it can isolate both the live and neutral connections
- **Resistors:** Resistors restrict the flow of electric current. There are two accepted symbols in use in circuit diagrams for standard (preset) resistors. Types of resistors include
  - **A rheostat:** A type of variable resistor with two contacts, usually used to control current. Examples would be adjusting lamp brightness or adjusting motor speed.
  - **A potentiometer:** A type of variable resistor with three contacts that's used to control voltage.
- **A preset variable resistor:** Operates with a small screwdriver or similar tool. It's designed to be set when the circuit is made and then left without further adjustment.
- **Capacitors:** Capacitors store electric charge. They are used with resistors in timing circuits because it takes time for a capacitor to fill with charge. They are also used in filter circuits because capacitors easily pass AC (changing) signals but they block DC (constant) signals. Two types of capacitors include the following:
  - *Polarized capacitors* must be connected the correct way round.
  - *Variable capacitors* are used in radio tuners.
- **Diodes:** Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a valve and early diodes were actually called valves. Light Emitting Diodes (LEDs) emit light when an electric current passes through them.
- **Transistor:** Transistors amplify current. For example they can be used to amplify the small output current from a logic chip, so it can operate a lamp, relay, or other high current device.
- **Microphone:** A microphone is a transducer that converts sound to electrical energy.
- **Earphone and speaker:** These transducers convert electrical energy to sound.
- **Amplifier:** An amplifier isn't actually an electronic component but instead a complex circuit. The block diagram symbol shows where an amplifier circuit would be connected. Amplifier circuits are used to magnify power, current, or voltage.
- **Antenna:** A device designed to receive or transmit radio signals.
- **Relay:** An electrically operated switch. For example, a 9V battery circuit connected to the coil can switch a 110V AC main circuit.

Circuit diagrams show how electronic components are connected together. Circuit diagrams show the connections as clearly as possible with all wires drawn neatly as straight lines. The actual layout of the components is usually quite different from the circuit diagram, however. Circuit diagrams are useful when testing a circuit and for understanding how it works. Figure 13-3 shows a diagram of an adjustable timer circuit.

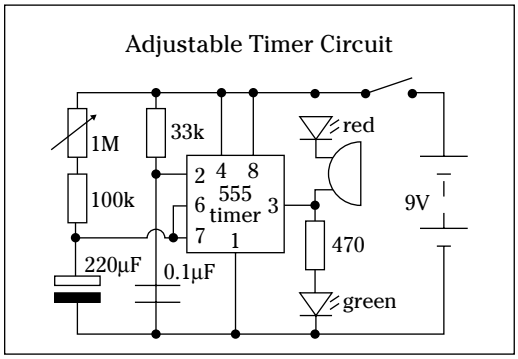


Figure 13-3: An adjustable timer circuit.

Getting Some Help: Electrical Test-Taking Tips

When it comes to the electronics test, don't feel like you have to know as much as Ben Franklin to get a passing score. Just use your common sense. If a question asked, "What's the safest way to run an extension cord to a reading light?", the answer, "Across the middle of the floor," is probably going to be wrong.

You can also figure out quite a few answers if you remember these units of measure:

- Current = amperes
- Pressure = volts
- Resistance = ohms
- Power = watts

Memorizing simple principles

If you commit the following principles to memory, you'll have an easier time succeeding on the Electronics Information subtest:

- Ohm's law: Current = voltage/resistance
- Power = voltage × amperes
- Electricity flows from a negative pole to a positive pole.
- A closed circuit must exist for electricity to flow. Think NASCAR.
- Alternating current (AC) changes direction constantly. The number of times a current completes two alternations of direction per second is known as its frequency; the unit of measurement for frequency is the hertz (Hz).
- Electronic devices operate at very high frequencies.
- Electronics often require a specific capacitive or inductive reactance to work. Capacitors and inductors are devices used in circuits to provide the type of reactance needed.
- Devices that change alternating current to direct current are called rectifiers.
- A transistor can amplify a signal.



If you need a good score on this subtest to get your military dream job or you want to rebuild that old television set without sacrificing your garage, you may want to consider *Electronics For Dummies* by Gordon McComb and Earl Boysen (Wiley) for additional help.

Playing the guessing game

The Electronics Information subtest is the type of test where you either know the answer or you don't. But, if you don't know the answer, you should still guess. Remember, you have to answer 20 questions in 9 minutes, so you don't have a lot of time to ponder the answer choices. Guess and move on.



To increase your chances of guessing correctly, you can often eliminate an incorrect answer. Sometimes one answer is obviously wrong, or one answer is more obviously right than another. The electronics answer is usually the right answer. Therefore, an answer that has to do with how much something costs or how pretty it looks will probably be wrong.

Not all questions are specifically electronics questions. You may be asked, "A *mil* measures what quantity?" Think about how you've seen that prefix used before, such as in the word millimeter. A millimeter, you may remember, is one thousandth of a meter. So you may be safe in assuming that a *mil* is one thousandth of an inch.

For additional guessing help, flip back to Chapter 3.

Chapter 14

Assembling Objects

In This Chapter

- Checking out the new ASVAB subtest
- Connecting the dots and putting the pieces together
- Getting your test score into shape

While much of the ASVAB measures academic knowledge at the high-school level, here's a subtest that probably doesn't resemble any of your high school classes (unless your high school offered a course in Jigsaw Puzzle 101).

The Assembling Objects subtest is designed to measure your ability to look at pieces of an object and determine how those pieces should fit together (technically called visualizing spatial relationships). Spatial skills, which help people figure out maps and interpret technical drawings, are important to everyday living as well as to performing well in school and on the job. Our society today places greater demands on spatial skills, such as interpretation of graphs, maps, architectural drawings, and X-rays.



The Assembling Objects subtest is relatively new to the ASVAB. It was added when the ASVAB was last revised, when the Numerical Operations and Coding Speed subtests were deleted. First it was added only to the computerized version of the ASVAB, and then it was added to the paper production (recruiting) version about a year later. If you're taking the high-school version of the ASVAB or the in-service version (Armed Forces Classification Test), you won't see this subtest.



At the time of this writing, only the navy uses the score from the Assembling Objects subtest for job qualification purposes. Additionally, only a handful of ratings (what the navy calls *jobs*) require a score in this area. The other branches don't use the results of this subtest at all, but they may in the future. For details about what navy enlisted jobs require a score in this area, see the Appendix.

Getting the Picture about Assembling Objects

It's interesting that the navy is the only service to use scores from the Assembling Objects subtest, because it was an army study that brought this subtest to life. Way back in 1994, the army concluded a study called *Project A.* (Kind of makes you wonder if the people in charge of naming military projects were on vacation that week, doesn't it?) *Project A* was all about trying to improve the selection and classification of enlisted personnel. The Assembling Objects subtest was a major product of this effort. The U.S. Army Research Institute for the Behavioral and Social Sciences found Assembling Objects questions to be an excellent measure of both overall spatial ability and complex problem-solving skills.

The army developed two types of Assembling Objects questions and tested them under field conditions for a few years. A mere ten years later, the Department of Defense incorporated the subtests into the ASVAB. (You just got to love the speed at which the military makes

changes.) By that time, the army had decided that they really didn't need to use this new subtest at all. But the navy said, "Hey, that looks pretty cool . . . let's give it a try!"

The Assembling Objects subtest consists of 16 graphical problems that must be solved in 15 minutes. That gives you a little less than a minute for each question (not counting any time you take out to scratch your head). That's plenty of time to finish, if you're good at jigsaw puzzles.

Two Types of Questions for the Price of One

The Assembling Objects subtest has two types of questions, both of which consist of five separate drawings. In the first drawing, you see a picture with various disassembled parts, followed by four drawings that show what the parts look like if they were assembled or connected. Your task is to choose the drawing that shows what the parts might actually look like after they're assembled or connected properly.



Both types of problems require you to perform *mental rotation* — a process through which you predict what an array of objects would look like if they were rotated on their axes by some number of degrees.

Putting slot A into tab B: Connectors

The first type of problem presents you with simple geometric figures such as stars, cloud shapes, letter shapes, circles, and triangles. In the first drawing you can see shapes and lines labeled with dots and the letters *A* or *B.* These letters and dots indicate points of attachment.

The next four drawings show possible solutions of what the shapes would look like if connected at designated points by the line. The shapes may be reoriented or rotated on their axes from what you observe in the first drawing. The correct solution shows the line connected correctly to reflect the points shown in the first drawing.



If a connection point in the first drawing shows a line that goes through some part of the shape, the correct solution will also reflect this same line and point relationship. Sound complicated? It's not really, once you get the hang of it.

Look at Figure 14-1 and see if you can solve it. In the first drawing you see a star and a sort of lopsided *T.* There's a small dot on the short appendage of the *T,* labeled *A,* and a dot on one of the points of the star, labeled *B.*

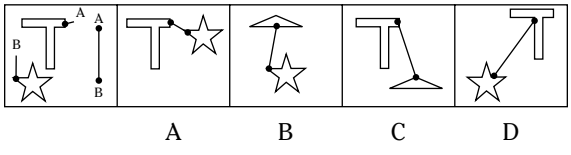


Figure 14-1: Identifying points and shapes.

In Figure 14-1, Choice (A) is the correct solution. Choices (B) and (C) include shapes that aren't included in the first drawing, so they're obviously incorrect. While Choice (D) has the correct shapes, they aren't connected at the same points depicted in the first drawing.

Okay that sounds simple, doesn't it? Don't worry; it gets more complicated (sorry to burst your bubble). Figure 14-2 shows the same problem, but with a different twist. (Sorry, we just couldn't avoid the pun.)

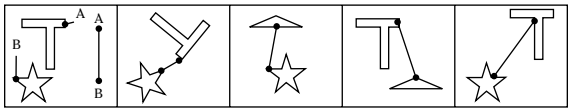
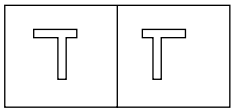


Figure 14-2: Rotated shapes.

Choice (A) is the correct solution for the problem in Figure 14-2. In this case, the two shapes have been repositioned and rotated on their axes.



Mirroring isn't the same as *rotation,* as Figure 14-3 illustrates. The shape in Box B isn't the same as the shape in Box A. It's a mirrored image. No matter how you rotate the shape in Box A, it will never look like the shape in Box B. Think of it this way — while you can turn a jigsaw puzzle shape upside down so the picture-side is facing the table, it may fit, but it's not the proper method of putting the puzzle together. (It wouldn't look very pretty, either). The Assembling Objects subtest is the same way. The possible solutions may include shapes that are mirrors of a shape shown in the first drawing, but they'll never be the correct solution.



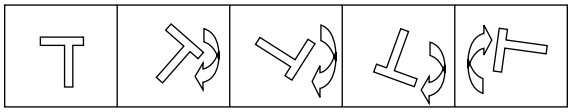


Figure 14-3: Figuring out mirrored shapes.

If you read earlier in this section, you may remember the rule that if a shape in the first drawing showed a line that went through any part of the shape, the correct solution must also reflect the same line-shape relationship.

Check out Figure 14-4. In the first drawing, Point B is in the center of the star. But note the line intersects the star at one of its indents and not one of its points. That means the correct solution shows the same intersection.

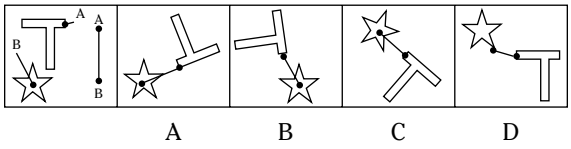


Figure 14-4: Line-shape relationships.

In this example, Choice (B) is the correct solution. At first glance, Choice (C) looks like it could be correct. Can you spot the reason why it's not the correct solution? Right! The lop-sided "T" shape in the image is a mirror of the shape shown in the first drawing.

You're starting to see the shape of things! (Really, we're sorry, but these little zingers just keep popping out.) Try a couple more, just to get into shape. Look at Figure 14-5.

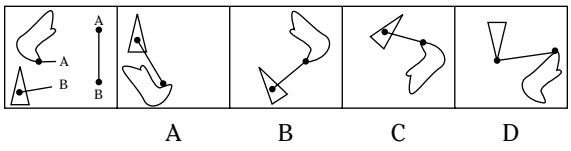


Figure 14-5: Another example of spatial relationships.

In Figure 14-5 did you select Choice (C) as the correct answer? If so, good job! Choice (A) is incorrect because the line intersects the triangle at the wrong point. Choice (B) is incorrect because the weird shape is actually a mirror image of the shape shown in the first drawing. Choice (D) is incorrect because the points don't correlate to the points depicted in the first drawing.

Now try Figure 14-6. The first drawing includes a shape that kind of looks like a *Y,* and a shape that looks like the letter *C.*

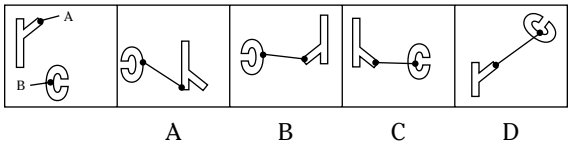


Figure 14-6: More shapes to test your spatial skills.

The correct answer for the problem shown in Figure 14-6 is Choice (B). Choice (A) is incorrect because the *Y* shape is a mirror image of the shape shown in the first drawing, and the connection points don't correspond to the first drawing's points. Choice (C) is incorrect because the *Y* shape is a mirror image of the shape shown in the first drawing. Choice (D) is incorrect because the *Y* shape is a different shape (the stem is much shorter) than the shape shown in the first drawing.

Solving the Jigsaw Puzzle: Shapes

Many people may find the second type of Assembling Objects problem easier than the connection problems. (This is especially true if you had the kind of parents who would buy you jigsaw puzzles for your birthday, when what you really wanted was a brand new shiny bike.) The second type of problem is very much like a jigsaw puzzle, except it doesn't result in a picture of the Statue of Liberty or a map of the United States. Also, there's a heck of a lot fewer pieces than that 1,000-piece puzzle your parents kept insisting on buying you. The difficulty lies in the fact that you can't use your hands to twist the pieces around on the table in order to see how they fit. You have to rotate and move the pieces mentally.

In Figure 14-7, the solution is pretty straightforward.

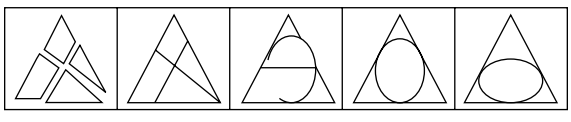
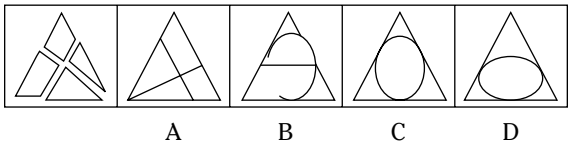


Figure 14-7: A simple jigsaw example.

By mentally sliding the shapes in the first drawing together, it's easy to see that they fit together to form the picture shown in Choice (A). Unfortunately, the Assembling Objects questions on the ASVAB won't be so simple.

Look at Figure 14-8.

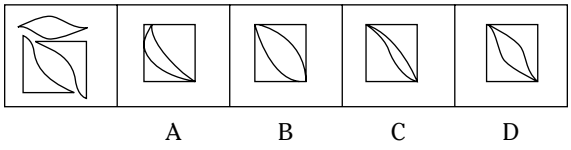
Figure 14-8: Putting the pieces together with rotation.



Choice (A) is the correct answer. The figure shown in Choice (A) is the same as the Figure depicted in Choice (A) of Figure 14-7, except it's been rotated on its axis.

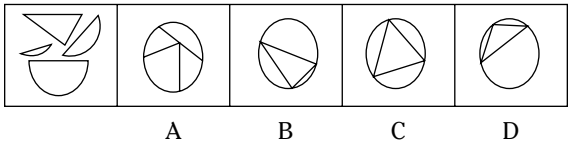
The previous two figures were warm-up exercises — the questions on the ASVAB are harder. Check out Figure 14-9 for a better representation of the types of questions on the ASVAB.

Figure 14-9: A harder example of spatial problems.



If you selected Choice (D) as the correct solution, give yourself a pat on the back. Try a couple more examples to see if you've gotten the hang of it. Check out Figure 14-10.

Figure 14-10: Practicing mentally rotating and relocating pieces of puzzles.



In Figure 14-10, you should've chosen Choice (B) as the correct answer. Mentally rotate and relocate the pieces in the first picture until you can see how they fit together to form the shape in Choice (B). Now try Figure 14-11.

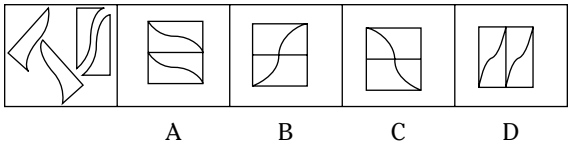


Figure 14-11: Putting the pieces of the puzzle together with your mental spatial skills.

In Figure 14-11, Choice (A) is the correct answer. If you didn't get this one quite right, head to Chapter 15 for additional help and Chapters 16, 18, and 20 for practice examinations.

Tips for the Assembling Objects Subtest



Researchers at the University of Chicago have determined that your basic foundation for spatial skills is established at a very early age, perhaps as young as age 4 or 5. Unfortunately, ladies, boys tend to have better spatial skills than girls. Scientists disagree as to why. It could be a genetic factor, or a result of environment, or both. Young boys tend to play in a way that encourages use of spatial skills, such as playing with blocks or building models.

Don't worry. That doesn't mean all is lost if you're female. The same research has concluded that spatial skills can be improved by engaging in activities that are spatially orientated. Some of those activities include

- **Practicing reading maps:** Map reading can help you develop the ability to gauge scales of size and direction between related objects (roads, rivers, towns, cities, and so on).
- **Putting together jigsaw puzzles:** This way is an obvious form of practice for improving your spatial perceptions.
- **Playing graphical computer games:** Computer games may help you to improve your spatial skills. A study conducted in the United Kingdom showed that children who played computer games consistently scored higher on spatial aptitude tests than children who didn't play the games.
- **Sketching:** Look at an object or a picture and attempt to sketch it as viewed from a different direction. This exercise can help you to improve your ability to mentally visualize spatial angles.



On the Assembling Objects subtest, you can sometimes improve your odds of getting the answer right if you select just one shape from the first drawing, and then quickly look at each of the choices to see if that shape is represented there but in a different orientation. This process can help you eliminate answer choices quickly that are obviously wrong.

On connection-type problems, note the position of the dot on one of the shapes in the first drawing and then quickly scan the possible answer, eliminating any choice that depicts the dot in a different location, or if the line passes through the shape at a different point than shown in the first drawing.



Remember to be aware of mirror images — shapes that are reversed (instead of rotated) from the image shown in the first drawing. The tricky test makers often make use of such mirror representations to see if they can trick your eyes.



Chapter 15

Facing the Facts: Technical Skills Practice Questions

In This Chapter

- Taking a stab at General Science questions
- Getting a handle on Auto & Shop information
- Practicing your Mechanical Comprehension knowledge
- Tuning into the Electronics Information section of the ASVAB
- Building a better score on the ASVAB with an Assembling Objects practice test

It's time to see a few examples of what the ASVAB technical skills questions look like. None of these subtests are used in calculating your AFQT score (the score used to determine your general qualifications to join the military) but may be used in computing the line score you need to get the military job you want. See the Appendix to determine whether you need to do well on any of these subtest areas for the job that you want.

On the actual ASVAB (and on the full-length practice tests in the following chapters), you get 25 General Science questions, 25 Auto & Shop questions, 25 Mechanical Comprehension questions, 20 Electronics Information questions, and 16 Assembling Objects graphical problems. We don't want you to tire out too quickly, so in this chapter you get only eight sample questions in each area.

General Science Practice Questions

General science is a hard topic to study for because the field is so broad. To score well on this subtest you pretty much have to wade through the textbooks and memorize the facts. You can also check out Chapter 10 for additional help. See how well you do on the following eight practice questions.

1. If the temperature in Fahrenheit is 212 degrees, the temperature in Celsius is:

   (A) 0 degrees

   (B) 32 degrees

   (C) 100 degrees

   (D) 106 degrees

Measured in Celsius, the boiling point is 100 degrees. To convert from Fahrenheit to Celsius, use the formula, $C = \frac{5}{9} \times (F - 32)$. The correct answer is Choice (C).

2. Cellular activity is controlled by the:

   (A) nucleus

   (B) cytoplasm

   (C) cell membrane

   (D) vacuole

   The *cytoplasm* is the cell's factory, the *cell membrane* protects the nucleus and the cytoplasm, and *vacuoles* are storage areas. The correct answer is Choice (A).

3. The human circulatory system:

   (A) uses air to release energy

   (B) processes food and eliminates waste

   (C) moves oxygenated blood throughout the body

   (D) controls movement of joints

   The respiratory system uses air to release energy, the digestive system processes food and eliminates waste, and the musculoskeletal system controls the movement of joints. So the correct answer is Choice (C).

4. If the north pole and the south pole of a magnet come near each other, the magnets:

   (A) spin

   (B) attract

   (C) repel

   (D) melt

   Opposite poles of magnets attract; like poles repel. Choice (B) is the correct answer.

5. If an atom has one proton in its nucleus and, therefore, one electron in its nucleus, it has an atomic number of:

   (A) 2

   (B) 10

   (C) 5

   (D) 1

   The *atomic number* corresponds with the number of electrons an atom has in its nucleus. Choice (D) is the correct answer.

6. The element with the lowest atomic number is:

   (A) hydrogen

   (B) helium

   (C) lithium

   (D) uranium

   Hydrogen has an atomic number of 1. The atomic numbers for the other elements listed are helium (2), lithium (3), and uranium (92). The correct answer is Choice (A).

7. Absolute zero is equivalent to:

   (A) 0 degrees Kelvin

   (B) 0 Kelvin

   (C) -273.15 degrees Kelvin

   (D) -273.15 Kelvin

   Absolute zero is -273.15 degrees Celsius, which is equivalent to 0 Kelvin. Temperatures stated in Kelvin are measured by using units of Kelvin, not degrees. The correct answer is Choice (B).

8. Comets are composed mainly of:

   (A) rock and metal alloys

   (B) hydrogen and rock

   (C) metal alloys and hydrogen

   (D) ice and rock

   Comets are snowballs composed mainly of ice and rock. The comet's tail is formed when the ice turns into gas from the heat of the sun. The correct answer is Choice (D).

Auto & Shop Information Practice Questions

If you like to tinker with cars and your idea of a fun weekend is to rebuild the garage, you should do well on this subtest without too much additional study. If your idea of fixing your car involves calling that guy down the street, a little extra study may be in order. Check out Chapter 11 for help with this area.

9. A two-penny nail is:

   (A) thicker than a 10d nail

   (B) shorter than a 10d nail

   (C) the same thing as a 10d nail

   (D) harder than a 10d nail

   Penny, abbreviated *d,* indicates length and thickness; a 2d nail is shorter and thinner than a 10d nail. Choice (B) is the correct answer.

10. A carburetor has the same function as a(n):

    (A) distributor

    (B) fuel-injection system

    (C) alternator

    (D) exhaust system

    The alternator, exhaust system, and distributor all have very different purposes from the carburetor, which combines the fuel and air mixture and sends it to the engine, just as the fuel-injection system does. Therefore, Choice (B) is the correct answer.

11. An automotive crankshaft turns the:

(A) connecting rod

(B) rear axle

(C) flywheel

(D) cylinder

The drive shaft turns the *rear axle.* The *cylinder* contains the piston that moves the *connecting rod* that's connected to the crankshaft, which turns the *flywheel.* The correct answer is Choice (C).

12. A hacksaw is used to cut

(A) with the grain of wood

(B) against the grain of wood

(C) round stock

(D) metal

The *hacksaw* has a blade specifically designed to cut metal, not wood. Choice (D) is the correct answer.

13. To drive a cold chisel, you can use:

(A) a hammer

(B) a sledge

(C) a mallet

(D) your foot

A hammer has a smaller, harder striking surface than a mallet, which won't damage the chisel (or the object being chiseled, should the mallet slip off the chisel). A sledge has a cutting edge and is inappropriate for this use. Choice (C) is the correct answer.

14. If your engine knocks or pings, the most likely cause is:

(A) faulty valves

(B) faulty cylinder

(C) low on fuel

(D) using fuel with too low of an octane rating

Using fuel with an octane rating lower than the manufacturer recommends can result in engine knock. Choice (D) is the correct answer.

15. Antifreeze is used to:

(A) prevent the engine from overheating

(B) prevent water in the cooling system from freezing

(C) prevent damage to the engine block

(D) all of the above

Antifreeze raises the boiling point of water and lowers the freezing point. This process keeps the water in the cooling system from boiling away. It also keeps the water from freezing. Both conditions can cause damage to the engine. The correct answer is Choice (D).

16. The best tool for cutting curves or shapes in wood is:

(A) ripsaw

(B) crosscut saw

(C) coping saw

(D) pliant saw

Coping saws have thin blades with many teeth and are specifically designed to cut curves and shapes in wood. The correct answer is Choice (C).

Mechanical Comprehension Practice Questions

Mechanical comprehension is all about figuring out how machines and mechanical mechanisms operate. A solid background in mechanical physics is a big advantage in scoring well in this area. You can also flip back to Chapter 12 if you need additional help with mechanical info. Basic mathematic skills are also a plus in this area. Test yourself with the next few questions.

17. The moisture that forms on the inside of a window on a cold day is called:

(A) condensation

(B) distillation

(C) evaporation

(D) tarnation

Distillation is the process of extracting or refining a substance; *evaporation* is the process of removing moisture. Tarnation is an interjection used to express anger. The correct answer is Choice (A).

18. If a 200-pound barrel must be lifted 4 feet to the bed of a box truck, an incline plane will reduce the amount of effort required to move the barrel in half if the incline plane is:

(A) 2 feet long

(B) 6 feet long

(C) 8 feet long

(D) 9 feet long

The formula used for determining how an incline plane reduces effort is Length of Ramp divided by Height of Ramp = Weight of the Object divided by Force, or $x \div 4 = 200 \div 100$. (The amount of force needed to lift the object is equivalent to the object's weight. But the question wants to reduce that amount of force to half, so half of the object's weight is 100.) $x \div 4 \times 4 = 2 \times 4$ or $x = 8$. The correct answer is Choice (C).

19. Two people are carrying a 100-pound crate on a 2-x-8-x-12-inch board. To distribute the load evenly between the two people, the crate should be placed:

(A) two feet from the end of the board

(B) in the middle of the board

(C) three feet from the end of the board

(D) the load can't be evenly distributed

If the weight is placed closer to one or the other person, that person would carry more of the load, so the weight should be placed in the middle. Choice (B) is the correct answer.

20. Wheel A has a diameter of 9 feet. Wheel B has a diameter of 12 feet. If both wheels revolve at the same rate, Wheel B will cover a linear distance of 24 feet:

    (A) at the same speed as Wheel A

    (B) more slowly than Wheel A

    (C) in half the time of Wheel A

    (D) faster than Wheel A

    Because Wheel A has less surface area, it covers a shorter linear distance than Wheel B when turning at the same rate. Thus, Wheel B covers the distance of 24 feet faster than Wheel A. Choice (D) is the correct answer.

21. A stationary single pulley (not including friction) gives a mechanical advantage of:

    (A) 2

    (B) 4

    (C) 3

    (D) 1

    A stationary single pulley allows you to change the direction of force but doesn't result in an increased mechanical advantage. The correct answer is Choice (D).

22. There are four gears connected in a series. If Gear #1 is turning clockwise, Gear #4 will turn:

    (A) clockwise

    (B) counterclockwise

    (C) faster than Gear #1

    (D) slower than Gear #1

    Gears connected in series turn in opposite directions of each other. The correct answer is Choice (B).

23. The sideways force one feels when a car turns sharply is called:

    A) thrust force

    (B) angle force

    (C) centrifugal force

    (D) positive force

    Centrifugal force isn't actually a force at all but rather a property of Newton's laws of motion. The correct answer is Choice (C).

24. When two or more forces act to balance each other out, the condition is called:

    (A) equilibrium

    (B) static recoil

    (C) gravitational balance

    (D) concurrent forces

    When two or more forces interact so that their combination cancels the other(s) out, there's a state of equilibrium. In this state the velocity of an object doesn't change. Choice (A) is the correct answer.

Electronics Information Practice Questions

The questions in this section measure your knowledge of basic electronic principles. Chapter 13 contains a more in-depth discussion of the electronics if you need some help. For now, give these questions a try!

25. What does the abbreviation DC stand for?

(A) duplicate charge

(B) direct charge

(C) direct current

(D) diode current

DC stands for *direct current.* We made up the other choices. The correct answer is Choice C.

26. Which of the following is the ohm symbol?

(A) Σ

(B) ♦m

(C) Φ

(D) Ω

Remember, the upside-down horseshoe is the symbol for ohm. The correct answer is Choice (D).

27. Which of the following has the least resistance?

(A) iron

(B) rubber

(C) silver

(D) wood

Silver is the best conductor of electricity of those listed above. Therefore, it offers the least resistance to an electric current. The correct answer is Choice (C).

28. The core of an electromagnet is made of what kind of material?

(A) rubber

(B) brass

(C) silver

(D) iron

Iron is used because it magnetizes and demagnetizes more readily than the other materials listed. Choice (D) is the correct answer.

29. A device used to amplify a signal is called a:

(A) diode

(B) transformer

(C) rectifier

(D) transistor

A *diode* is a semiconductor that conducts electricity in one direction only; a *transformer* is a device that changes voltage (either "transforming" low voltage to high voltage or high voltage to low voltage); a *rectifier* is a circuit that changes alternating current to direct current. Choice (D) is the correct answer.

30. The amount of electricity used is measured in units called:

(A) volts

(B) amperage

(C) watts

(D) ohms

A *watt* measures the amount of electricity consumed. The correct answer is Choice (C).

31. Components designed to store electrical charges are called:

(A) capacitors

(B) transformers

(C) resistors

(D) transistors

Capacitors store electric charge. They're used with resistors in timing circuits because it takes time for a capacitor to fill with charge. The correct answer is Choice (A).

32. In an electronic circuit diagram, the symbol used to show wires connecting is a/an:

(A) "X" symbol

(B) dot

(C) dark square

(D) "T" symbol

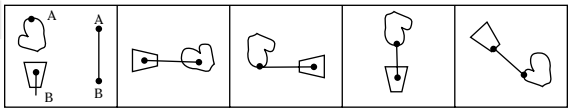
Wires connected to each other are indicated by a dark circle. The correct answer is Choice (B).

Assembling Objects Practice Questions

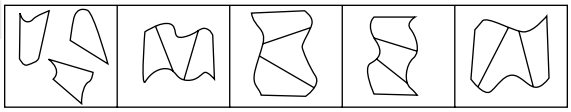
Assembling Objects questions measure your spatial skills. There are two types of questions: connection questions and putting pieces together questions.

The first type of problem presents you with simple geometric figures such as stars, cloud shapes, letter shapes, circles, and triangles. Your task is to choose the answer that shows the shapes properly connected together at the designated points. The second type of question is similar to putting a jigsaw puzzle together. Choose the answer that best shows what the shapes in the first drawing would look like, if assembled together.

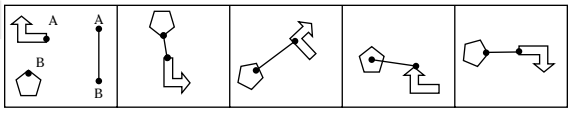
See Chapter 14 for a complete explanation and illustrated examples.

33. 

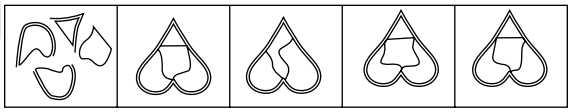
Note that the second figure in the first drawing has a line that intersects an area of the shape. The correct answer is Choice (B).

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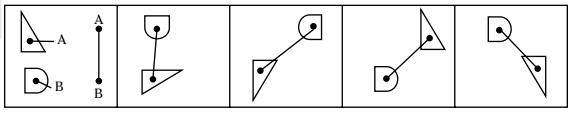
Mentally rotate and reposition the shapes in the first drawing until you can see how they fit together to form the shape shown in Choice (C) — the correct answer.

35. 

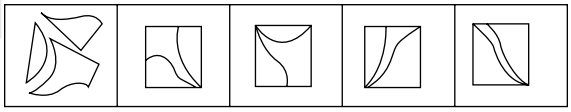
If you selected Choice (A), you were fooled. The arrow shape shown in Choice (A) is a mirror of the shape depicted in the first drawing. The correct answer is Choice (D).

36. 

Mentally rotate and reposition the shapes in the first drawing until you can see how they fit together to form the shape shown in Choice (A) — the correct answer.

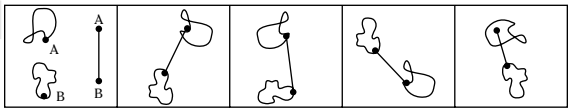
37. 

Note that both shapes in the first drawing have lines that intersect the shapes at designated points. If you selected Choice (B), your eyes were fooled by mirror images. The correct answer is Choice (D).

38. 

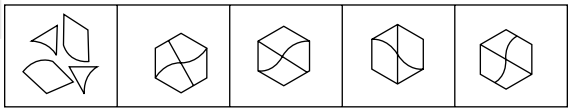
Mentally rotate and reposition the shapes in the first drawing until you can see how they fit together to form the shape shown in Choice (B) — the correct answer.

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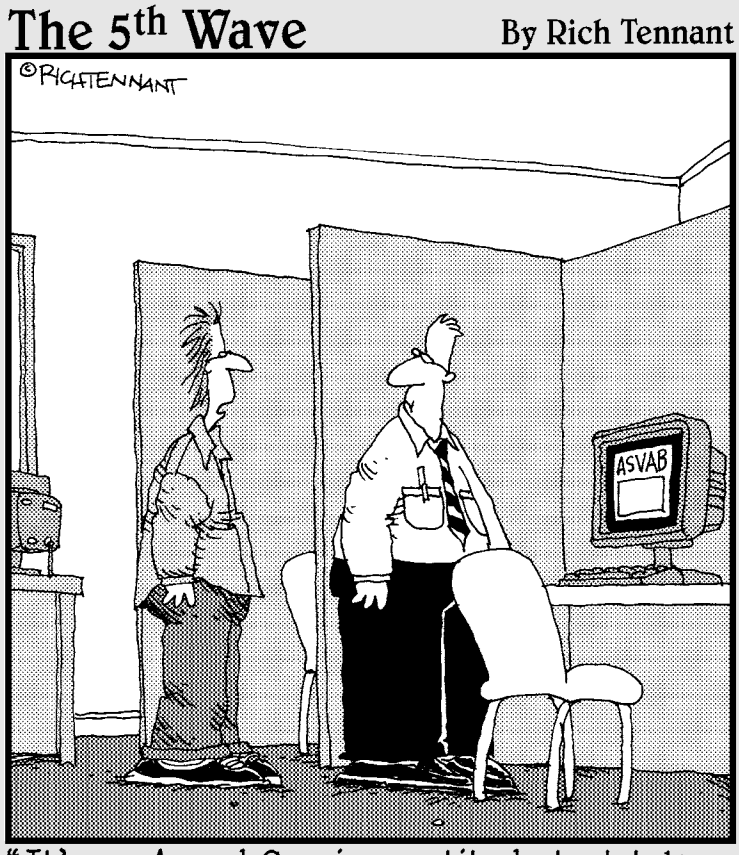
Don't be fooled by the mirror shapes in Choice (B) because the correct answer is Choice (A).

40.



Mentally rotate and reposition the shapes in the first drawing until you can see how they fit together to form the shape shown in Choice (C), which is the correct answer.

Part V
Practice ASVAB Exams



"It's an Armed Services aptitude test taken on a computer, and you're telling me my hours of experience playing World of Warcraft count for nothing?!"

In this part . . .

Doing well on the ASVAB requires an effective study plan. You want to concentrate your study time on subject areas you may be having problems with. The practice examinations in this part are great tools to enhance and plan your study program.

Take the first test in this section to determine your strengths and weaknesses. Concentrate most of your study efforts on subject areas that are hard for you. When you think you've got it down, take the second test to measure your improvement. Take the third test right before you're ready to take the actual ASVAB to brush up on your test-taking skills.

In this part, you also find a bonus Armed Forces Qualification Test (AFQT) practice exam. This practice test includes only the four ASVAB subtests that are used to make up your AFQT score — the score that determines whether you can even join the military branch of your choice.

Taking the sample tests helps you understand where you need to study, but it also gets you into the test-taking mindset. By taking the tests, you get used to the format of each subtest. Trust us — these sample tests give you confidence on test day.

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Chapter 16

Practice Exam 1

This sample test features nine subtests, just like the actual ASVAB. As you may have guessed, the sample tests in this book are paper-based tests. (Yes, we're the masters of the obvious.) When you take the actual ASVAB, it may be a paper-based or a computer-based exam. The computer version follows the same format as the paper version. (Check out the computer-based test in greater detail in Chapter 3.) The only real differences are that on the computer-based test, you can't skip a question and go back to it, and you can't change an answer after you enter it into the computer.

To get the most out of this sample test, take it like you'd take the real ASVAB under the same conditions:

1. **Allow yourself about three hours to take the entire exam, and take the whole thing at one time.**
2. **Find a quiet place where you won't be interrupted.**
3. **Bring a timer that you can set for various lengths of time, some scratch paper, and a pencil.**
4. **At the start of each subtest, set your timer for the specified period of time.**

   Don't go on to the next section until the timer has gone off, and don't go back to a previous section. If you finish early, check your work for that section only.
5. **Use the answer sheet that's provided.**
6. **Don't take a break during any subtest.**

   You can take a short one- or two-minute break between subtests if you need it.

After you complete the entire sample test, check your answers against the answer key in Chapter 17. Remember that the test is scored by comparing your raw score to the scores of other people, which produces a scaled score. So just because you missed a total of 20 questions doesn't mean that your score is 80 (that would be too simple). Turn to Chapter 1 to find out how the ASVAB is scored.

Your primary goal with this sample test is to determine your strengths and weaknesses. If you only miss one question on the Word Knowledge subtest but you miss 15 on Arithmetic Reasoning, you know where to spend your study time. If you're not going to pursue a career that requires a score on a particular subtest or the type of knowledge a subtest covers, don't worry about your score. (See the Appendix for more information on the subtests various careers require good scores on.) Go ahead and take the sample test like it's the actual ASVAB, but don't worry about your score.

Part 1

General Science

Time: 11 minutes; 25 Questions

Directions

This section tests your knowledge of general science principles usually covered in high-school classes. Pick the best answer for each question and then mark the space on your answer sheet that corresponds to the question number and the letter indicating your choice.

1. A series of cell divisions that results in the formation of an embryo is called:
   (A) mitosis
   (B) meiosis
   (C) osmosis
   (D) cleavage

2. An animal that eats only plants is called a(n):
   (A) omnivore
   (B) herbivore
   (C) carnivore
   (D) voracious

3. The process by which energy is provided at the cellular level is called:
   (A) respiration
   (B) recreation
   (C) oxidation
   (D) metabolism

4. All of the following are domains except:
   (A) Regelia
   (B) Eukarya
   (C) Bacteria
   (D) Archaea

5. Light waves travel at a rate of about:
   (A) 186,000 miles per hour
   (B) 186,000 miles per minute
   (C) 18,600 miles per hour
   (D) 186,000 miles per second

6. The largest moon in the solar system is:
   (A) Ganymede
   (B) Titan
   (C) Io
   (D) Charon

7. The spinal cord is part of the:
   (A) circulatory system
   (B) nervous system
   (C) respiratory system
   (D) digestive system

8. Joints that hold bones firmly together are called:
   (A) hinge joints
   (B) ball and socket joints
   (C) fixed joints
   (D) pivot joints

9. The top or broadest level of the classification system for living organisms is called:
   (A) class
   (B) phylum
   (C) kingdom
   (D) genus

10. If there are two full moons in a single month, the second full moon is called:
    (A) new moon
    (B) full moon
    (C) blue moon
    (D) secondary moon

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11. The brainstem connects the brain to the:
    (A) heart
    (B) lungs
    (C) neck
    (D) spinal cord

12. Red blood cells:
    (A) produce antibodies
    (B) fight infections
    (C) carry oxygen and carbon dioxide
    (D) are few in number

13. Protein can be found in all of the following foods EXCEPT:
    (A) eggs
    (B) meat
    (C) peas
    (D) apples

14. Which inorganic substance is present in the greatest quantity inside animal cells?
    (A) protein
    (B) oxygen
    (C) sodium chloride
    (D) water

15. Cell protoplasm is made up mostly of:
    (A) water
    (B) oxygen
    (C) sugar
    (D) protein

16. A meter consists of:
    (A) 10 centimeters
    (B) 100 millimeters
    (C) 100 centimeters
    (D) 10 millimeters

17. It's impossible for the sun to turn into a black hole because:
    (A) it's too large
    (B) it's too small
    (C) it's a yellow star
    (D) it has planets

18. Electrons are particles that are:
    (A) positively charged
    (B) neutral
    (C) able to move freely
    (D) negatively charged

19. The chamber of the heart that pumps blood to the lungs is called the:
    (A) right ventricle
    (B) left ventricle
    (C) right atrium
    (D) left atrium

20. The atomic number of an atom is determined by:
    (A) the size of its nucleus
    (B) the number of protons
    (C) the number of electrons
    (D) its location in the periodic table

21. The smallest part of an element that still acts like an element is:
    (A) the nucleus
    (B) a compound
    (C) the element itself
    (D) the atom

22. How many planets in the solar system have rings?
    (A) one
    (B) two
    (C) three
    (D) four

23. The temperature at which a solid becomes a liquid is its:
    (A) melting point
    (B) boiling point
    (C) freezing point
    (D) concentration point

Go on to next page

24. The surface of the earth is called the:
    (A) mantle
    (B) core
    (C) shawl
    (D) crust

25. Not counting the sun, the closest star to the Earth is:
    (A) Rigel
    (B) Proxima Centauri
    (C) Antares
    (D) Betel



Part 2

Arithmetic Reasoning

Time: 36 minutes; 30 questions

Directions

This test contains questions about arithmetic. Each question is followed by four possible answers. Decide which answer is correct and then mark the space on your answer sheet that has the same number and letter as your choice. Use scratch paper for any figuring you wish to do.

1. If a car is towed 12 miles to the repair shop, and the tow charge is $3.50 per mile, how much did the tow cost?
   (A) $12.00
   (B) $3.50
   (C) $42.00
   (D) $100.00

2. The sum of two numbers is 70. One number is 8 more than the other. What's the smaller number?
   (A) 31
   (B) 33
   (C) 35
   (D) 36

3. A sales manager buys antacid in bottles by the gross. If he goes through 3 bottles of antacid every day, how long will the gross last?
   (A) 144 days
   (B) 3 days
   (C) 20 days
   (D) 48 days

4. Jenny's test grades are 93, 89, 96, and 98. If she wishes to raise her average to 95, what does she need to score on her next test?
   (A) 100
   (B) 99
   (C) 97
   (D) 95

5. A waitress earns an average tip of 12% of the cost of the food she serves. If she serves $375 worth of food in one evening, how much money in tips will she earn on average?
   (A) $37
   (B) $45
   (C) $42
   (D) $420

6. How many square feet of carpeting are needed to carpet a 12-foot x 12-foot room?
   (A) 24
   (B) 120
   (C) 48
   (D) 144

7. Carpet stain protector costs $0.65 per square yard to apply. How much will it cost to apply the protectant to a 16-foot x 18-foot carpet?
   (A) $187.20
   (B) $62.40
   (C) $20.80
   (D) $96.00

8. A printing plant that produces baseball cards has a monthly overhead of $6,000. It costs 18 cents to print each card, and the cards sell for 30 cents each. How many cards must the printing plant sell each month in order to make a profit?
   (A) 30,000
   (B) 40,000
   (C) 50,000
   (D) 60,000

Go on to next page

9. Joe received an hourly wage of $8.15. His boss gave him a 7% raise. How much does Joe make per hour now?

   (A) $0.57

   (B) $8.90

   (C) $8.72

   (D) $13.85

10. Alice leaves her house, driving east at 45 miles per hour (mph). Thirty minutes later, her husband Dave notices she forgot her cell phone and sets off after her. How fast must Dave travel in order to catch up with Alice 3 hours after he leaves?

    (A) 49 mph

    (B) 50.5 mph

    (C) 52.5 mph

    (D) 54 mph

11. A baker made 20 pies. A Boy Scout troop buys one-fourth of his pies, a preschool teacher buys one-third of his pies, and a caterer buys one-sixth of his pies. How many pies does the baker have left?

    (A) ¾

    (B) 15

    (C) 12

    (D) 5

12. Miriam bought five cases of motor oil on sale. A case of motor oil normally costs $24.00, but she was able to purchase the oil for $22.50 a case. How much money did Miriam save on her entire purchase?

    (A) $7.50

    (B) $1.50

    (C) $8.00

    (D) $22.50

13. A security guard walks the equivalent of six city blocks when he makes a circuit around the building. If he walks at a pace of eight city blocks every 30 minutes, how long will it take him to complete a circuit around the building, assuming he doesn't run into any thieves?

    (A) 20.00 minutes

    (B) 3.75 minutes

    (C) 22.50 minutes

    (D) 24.00 minutes

14. The population of Grand Island, Nebraska, grew by 600,000 people between 1995 and 2005, one-fifth more than the town council predicted. The town council originally predicted the city's population would grow by:

    (A) 400,000

    (B) 500,000

    (C) 300,000

    (D) 200,000

15. Joan is taking an admissions examination. If she has to get at least 40 of the 60 questions right to pass, what percent of the questions does she need to answer correctly?

    (A) 30%

    (B) 40%

    (C) 66⅓%

    (D) 66⅔%

16. A teacher deposited $3,000 in a retirement fund. If she didn't add any more money to the fund, which earns an annual interest rate of 6%, how much money would she have in 1 year?

    (A) $180

    (B) $3,006

    (C) $3,180

    (D) $6,000

Go on to next page

17. The high-school track measures one quarter of a mile around. How many laps would you have to run in order to run three and a half miles?

(A) 12

(B) 14

(C) 16

(D) 18

18. Karl is driving in Austria, where the speed limit is posted in kilometers per hour. The car's speedometer shows that he's traveling at a rate of 75 kilometers per hour. Karl knows that a kilometer is about ⅝ of a mile. Approximately how many miles per hour is Karl traveling?

(A) 47

(B) 120

(C) 50

(D) 53

19. A carpenter earns $12.30 an hour for a 40-hour week. His overtime pay is 1½ times his base pay. If he puts in a 46-hour week, how much is his weekly pay?

(A) $602.70

(B) $492.00

(C) $565.80

(D) $110.70

20. An office building has 30 employees and allows 42 square feet of work space per employee. If five more employees are hired, how much less work space will each employee have?

(A) 6 square feet

(B) 7 square feet

(C) 7.5 square feet

(D) 8 square feet

21. Stan bought a monster truck for $2,000 down and payments of $450 a month for five years. What's the total cost of the monster truck?

(A) $4,250

(B) $29,000

(C) $27,000

(D) $34,400

22. Darla spent $120.37 on groceries in January, $108.45 in February, and $114.86 in March. What was the average monthly cost of Darla's groceries?

(A) $343.68

(B) $110.45

(C) $114.86

(D) $114.56

23. Keith is driving from Reno to Kansas City to meet his girlfriend. The distance between the two cities is 1,650 miles. If Keith can average 50 miles per hour, how many hours will it take him to complete his trip?

(A) 8 hours

(B) 30 hours

(C) 33 hours

(D) 82 hours

24. Michael needs 55 gallons of paint to paint an apartment building. He would like to purchase the paint for the least amount of money possible. Which of the following should he buy?

(A) two 25-gallon buckets at $550 each

(B) eleven 5-gallon buckets at $108 each

(C) six 10-gallon buckets at $215 each

(D) fifty-five 1-gallon buckets at $23 each

25. As a member of FEMA, you're required to set up a contingency plan to supply meals to residents of a town devastated by a tornado. A breakfast ration weighs 12 ounces and the lunch and dinner rations weigh 18 ounces each. Assuming a food truck can carry 3 tons and that each resident will receive 3 meals per day, how many residents can you feed from one truck during a 10-day period?

(A) 150 residents

(B) 200 residents

(C) 250 residents

(D) 300 residents

Go on to next page

26. A train headed south for Wichita left the station at the same time a train headed north for Des Moines left the same station. The train headed for Wichita traveled at 55 miles per hour. The train headed for Des Moines traveled at 70 miles per hour. How many miles apart were the trains at the end of 3 hours?

(A) 210 miles

(B) 165 miles

(C) 125 miles

(D) 375 miles

27. A carpenter needs to cut four sections, each 3-feet 8-inches long, from a piece of molding. If the board is only sold by the foot, what's the shortest length of board she can buy?

(A) 15 feet

(B) 14 feet

(C) 16 feet

(D) 12 feet

28. Kiya had a coupon for 10% off one frozen turkey breast. The turkey breasts cost $8.50 each, and Kiya bought two. How much did she pay?

(A) $16.15

(B) $17.00

(C) $15.30

(D) $7.65

29. A recruiter travels 1,100 miles during a 40-hour workweek. If she spends ⅖ of her time traveling, how many hours does she spend traveling?

(A) 22

(B) 5½

(C) 16

(D) 8

30. Your car uses gasoline at the rate of 21 miles per gallon. If gasoline costs $2.82 per gallon, and you drive for 7 hours at a speed of 48 miles per hour, how much will you pay for gasoline for the trip?

(A) $38.18

(B) $45.12

(C) $47.73

(D) 59.27



Part 3

Word Knowledge

Time: 11 minutes; 35 questions

Directions

This test is about the meanings of words. Each question has an underlined word. You may be asked to decide which one of the four words in the choices *most nearly means* the same thing as the underlined word or which one of the four words means the opposite. If the underlined word is used in a sentence, decide which of the four choices most nearly means the same thing as the underlined word, as used in the context of the sentence. Mark the corresponding space on your answer sheet.

1. The gold was kept in a secure vault.
   (A) locked
   (B) safe
   (C) unknown
   (D) thick

2. Assimilate most nearly means:
   (A) absorb
   (B) react
   (C) pretend
   (D) lie

3. Theorize most nearly means:
   (A) know
   (B) speculate
   (C) study
   (D) travel

4. Symmetrical most nearly means:
   (A) uplifted
   (B) congruent
   (C) handsome
   (D) positive

5. The exchange student was proficient in French, German, and English.
   (A) poor
   (B) knowledgeable
   (C) adept
   (D) exacting

6. The students were scheduled to observe a plenary session of Congress.
   (A) scheduled
   (B) example
   (C) special
   (D) full

7. He tried to goad his audience.
   (A) insult
   (B) incite
   (C) please
   (D) bore

8. He ran headlong into the fight.
   (A) headfirst
   (B) reluctantly
   (C) happily
   (D) recklessly

9. Flagrant most nearly means:
   (A) quiet
   (B) amazing
   (C) delayed
   (D) glaring

10. The word *most opposite* in meaning to stimulate is:
    (A) support
    (B) arrest
    (C) travel
    (D) dislike

Go on to next page

11. Legacy most nearly means:
    (A) history
    (B) bequest
    (C) story
    (D) will

12. The actions of the CEO were unconscionable.
    (A) clever
    (B) illegal
    (C) excessive
    (D) automatic

13. The sergeant gave his reasoned opinion.
    (A) irate
    (B) logical
    (C) impressive
    (D) uninformed

14. Laudable most nearly means:
    (A) loud
    (B) fluid
    (C) commendable
    (D) transparent

15. The brass was burnished.
    (A) yellow
    (B) old
    (C) expensive
    (D) polished

16. The commodity was sold.
    (A) product
    (B) stock
    (C) idea
    (D) table

17. Her motives were oblique.
    (A) pure
    (B) emotional
    (C) obscure
    (D) amusing

18. Superfluous most nearly means:
    (A) superior
    (B) unnecessary
    (C) helpful
    (D) expensive

19. The word *most opposite* in meaning to hypocrisy is:
    (A) honesty
    (B) happy
    (C) angry
    (D) threatening

20. The report indicated a significant hemorrhage of corporate earnings.
    (A) gain
    (B) payout
    (C) trade
    (D) loss

21. The army soldiers were ordered to immediate garrison duty.
    (A) field
    (B) combat
    (C) latrine
    (D) fort

22. Fiscal most nearly means:
    (A) year
    (B) financial
    (C) calendar
    (D) three months

23. Domicile most nearly means:
    (A) office
    (B) domestic
    (C) home
    (D) vacation

24. Abate most nearly means:
    (A) recover
    (B) aid
    (C) foreclose
    (D) end

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25. To commission most nearly means:
(A) to give
(B) to rescind
(C) to earn
(D) to authorize

26. He gave a succinct account of the events.
(A) passionate
(B) lengthy
(C) uncensored
(D) concise

27. The vote resulted in the demise of the proposed new law.
(A) passage
(B) death
(C) postponement
(D) abatement

28. The politician exuded charisma.
(A) odors
(B) falseness
(C) charm
(D) generosity

29. Burrow most nearly means:
(A) deepen
(B) hide
(C) nestle
(D) jump

30. That custom still prevails.
(A) angers
(B) persists
(C) surprises
(D) excites

31. Contravene most nearly means:
(A) invade
(B) obstruct
(C) argue
(D) reverse

32. Chasm most nearly means:
(A) hole
(B) sky
(C) mountain
(D) valley

33. Fundamental most nearly means:
(A) radical
(B) religious
(C) basic
(D) excessive

34. Susceptible most nearly means:
(A) travel
(B) resistant
(C) limited
(D) gullible

35. To emit most nearly means:
(A) to give off
(B) to smell
(C) to contain
(D) to admit



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Part 4

Paragraph Comprehension

Time: 13 minutes; 15 questions

Directions

This test contains items that measure your ability to understand what you read. This section includes one or more paragraphs of reading material followed by incomplete statements or questions. Read the paragraph and select the choice that best completes the statement or answers the question. Mark your choice on your answer sheet, using the correct letter with each question number.

1. An important stage of personal time management is to take control of appointments. Determined by external obligation, appointments constitute interaction with other people and an agreed-on interface between your activities and those of others. Start with a simple appointment diary. List all appointments including regular and recurring ones. Now, be ruthless and eliminate the unnecessary. There may be committees where you can't productively contribute or where a subordinate may be able to participate. Eliminate the waste of your time.

   Effectively managing your appointments allows you to:

   (A) spend more time with your subordinates

   (B) delegate responsibility to subordinates

   (C) make more efficient use of your time

   (D) attend only the most important meetings

2. The U.S. Congress consists of 100 senators and 435 representatives. Two senators are elected from each state. The number of representatives from each state is based on population, although each state has at least one representative. Senators serve six-year terms and representatives serve two-year terms.

   According to this passage:

   (A) There are an equal number of senators and representatives.

   (B) The number of representatives from each state is decided by a lottery.

   (C) It's possible for a state to have no representatives.

   (D) Senators and representatives have different term lengths.

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3. Indo-European languages consist of those languages spoken by most of Europe and in those parts of the world that Europeans have colonized since the 16th century (such as the United States). Indo-European languages are also spoken in India, Iran, parts of western Afghanistan, and in some areas of Asia.

   The author of this passage would agree that:

   (A) Indo-European languages are spoken in areas all over the world.

   (B) Indo-European languages include all the languages spoken in the world.

   (C) Only Europeans speak Indo-European languages.

   (D) Indo-European language speakers can easily understand one another.

4. In privatization, the government relies on the private sector to provide a service. However, the government divests itself of the entire process, including all assets. With privatized functions, the government may specify quality, quantity, and timeliness requirements, but it has no control over the operations of the activity. Also, the government may not be the only customer. Whoever the government chooses to provide the services would likely provide the same services to others.

   This paragraph best supports the statement that:

   (A) The government must closely supervise privatized functions.

   (B) Privatized functions consist of a mixture of government employees, military personnel, and private contractors.

   (C) Privatized functions are those institutions that provide services only to a government agency.

   (D) Privatized functions provide essential services to the government.

5. The success or failure of a conference lies largely with its leader. A leader's zest and enthusiasm must be real, apparent, and contagious. The leader is responsible for getting the ball rolling and making the attendees feel as if the meeting is theirs and its success depends on their participation. A good, thorough introduction helps establish the right climate.

   A good title to this paragraph would be:

   (A) Lead by Example

   (B) The Importance of Proper Introductions

   (C) Leading a Successful Conference

   (D) Conference Participation Basics

6. Cloud seeding is accomplished by dropping particles of dry ice (solid carbon dioxide) from a plane onto super-cooled clouds. This process encourages condensation of water droplets in the clouds, which usually, but not always, results in rain or snow.

   From this passage, it's reasonable to assume that:

   (A) Cloud seeding could be used to end a drought.

   (B) Cloud seeding is prohibitively expensive.

   (C) Cloud seeding is rarely used.

   (D) Cloud seeding can be accomplished by using regular ice.

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7. To write or not to write — that is the question. If assigned a writing task, there's no option. However, if someone is looking for a specific answer, find out if they need a short answer or a detailed one. Can the requirement be met with a telephone call, e-mail, or short note, or is something more necessary? A former CEO of a major corporation once commented that he had looked at 13,000 pieces of paper in a 5-day period. Think how much easier and more economical it would be if people would use the telephone, send an e-mail, or write a short note.

   The main point of this passage is:

   (A) Written records are important as they provide detailed documentation.

   (B) More business people should invest time and energy improving their writing skills.

   (C) Writing may not be the best way to communicate information.

   (D) It's pointless for business people to spend time improving their writing skills.

8. The transistor, a small, solid-state device that can amplify sound, was invented in 1947. At first, it was too expensive and too difficult to produce to be used in cheap, mass-market products. By 1954, though, these cost and production problems had been overcome, and the first transistor radio was put on the market.

   According to this passage:

   (A) There was no market for transistors before 1954.

   (B) When transistors could be produced cheaply and easily, the transistor radio was put on the market.

   (C) Transistors were invented in 1947 by order of the Department of Defense.

   (D) Transistors are still expensive to produce.

9. I returned from the City about three o'clock on that May afternoon pretty well disgusted with life. I had been three months in the Old Country and was fed up with it. If people had told me a year ago that I would've been feeling like that I should've laughed at them; but there was the fact. The weather made me liverish, the talk of the ordinary Englishman made me sick, I couldn't get enough exercise, and the amusements of London seemed as flat as soda water that had been standing in the sun.

   The author is speaking of his travels in:

   (A) Spain

   (B) Great Britain

   (C) Germany

   (D) Scotland

10. Surveys show that the average child under the age of 18 watches four hours of television per day. Although some of the programming may be educational, most isn't. Spending this much time watching television interferes with a child's ability to pursue other interests, such as reading, participating in sports, and playing with friends.

    The author of this passage would agree that:

    (A) Television viewing should be restricted.

    (B) Parents who let their children watch this much television are neglectful.

    (C) Reading, participating in sports, playing with friends, and watching television should all be given equal time.

    (D) Adults over 18 can watch as much television as they want.

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Questions 11 and 12 are based on the following passage.

High-school and college graduates attempting to find jobs should participate in mock job interviews. These mock interviews help students prepare for the types of questions they'll be asked, make them more comfortable with common interview formats, and help them critique their performance before facing a real interviewer. Because they're such a valuable aid, schools should organize mock job interviews for all of their graduating students.

11. The above passage states that mock job interviews:
    (A) frighten students
    (B) should be offered to the best students
    (C) help prepare students for real job interviews
    (D) should be organized by students

12. From the above passage, it is reasonable to assume that:
    (A) Mock interviews can increase a student's confidence when he or she goes into a real job interview.
    (B) Mock interviews are expensive to organize.
    (C) Few students are interested in mock interviews.
    (D) Students don't need job interview preparation.

Questions 13 through 15 are based on the following passage.

Due process, the guarantee of fairness in the administration of justice, is part of the 5th Amendment to the U.S. Constitution. The 14th Amendment further requires states to abide by due process. After this amendment was enacted, the U.S. Supreme Court struck down many state laws that infringed on the civil rights guaranteed to citizens in the Bill of Rights.

13. According to the above passage, due process:
    (A) is an outdated concept
    (B) guarantees fairness in the justice system
    (C) never became part of the U.S. Constitution
    (D) is the process by which winning lottery tickets are selected

14. According to the above passage, it's reasonable to assume that the 5th Amendment:
    (A) is about taxes
    (B) guarantees due process in all criminal and civil cases
    (C) guarantees due process in federal law
    (D) should never have become part of the Bill of Rights

15. The author of the above passage would agree that:
    (A) Without the passage of the 14th Amendment, many laws restricting civil rights would still exist in various states.
    (B) The Supreme Court overstepped its jurisdiction when it struck down laws infringing on citizens' civil rights.
    (C) The Supreme Court had every right to strike down state laws before the passage of the 14th Amendment.
    (D) The 14th Amendment was opposed by all states.



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Part 5

Mathematics Knowledge

Time: 24 minutes; 25 questions

Directions

This section tests your ability to solve general mathematical problems. Select the correct answer from the choices given, and then mark the corresponding space on your answer sheet. Use scratch paper to do any figuring.

1. If $x = 8$, what's the value of y in the equation $y = (x^2 \div 4) - 2$?
   (A) 14
   (B) 16
   (C) 18
   (D) 20

2. The cube of 5 is:
   (A) 125
   (B) 25
   (C) 15
   (D) 50

3. $2.5 \times 3^3 =$
   (A) 22.5
   (B) 75.0
   (C) 67.5
   (D) 675.0

4. The fourth root of 16 is:
   (A) 4
   (B) 1
   (C) 3
   (D) 2

5. What's the equation of a line that passes through points (0, -1) and (2, 3)?
   (A) $y = 2x - 1$
   (B) $y = 2x + 1$
   (C) $x = 2y - 1$
   (D) $x = 2y + 1$

6. (12 yards + 14 feet) ÷ 5 =
   (A) 12 feet
   (B) 5⅕ feet
   (C) 10 feet
   (D) 2½ yards

7. $x^3 \times x^4 =$
   (A) x^{12}
   (B) $2x^7$
   (C) $2x^{12}$
   (D) x^7

8. $(x + 4)(x + 2) =$
   (A) $x^2 + 6x + 6$
   (B) $x^2 + 8x + 8$
   (C) $x^2 + 8x + 6$
   (D) $x^2 + 6x + 8$

9. $1.5 \times 10^3 =$
   (A) 45
   (B) 150
   (C) 1,500
   (D) 15

10. Which of the following is a prime number?
    (A) 27
    (B) 11
    (C) 8
    (D) 4

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11. What's the mode of the following series of numbers? 4 4 8 8 8 10 10 12 12
    (A) 9
    (B) 8
    (C) 11
    (D) 10

12. If $a = 4$, then $a^3 \div a =$
    (A) 4
    (B) 12
    (C) 64
    (D) 16

13. Solve for the factorial of 5 (5!):
    (A) 25
    (B) 125
    (C) 120
    (D) 15

14. $(900 \times 2) \div 6 =$
    (A) 30
    (B) 300
    (C) 150
    (D) 3,000

15. If $x = 2$, then $x^x \times x =$
    (A) 8
    (B) $2x^x$
    (C) 4
    (D) 6

16. If $(5 + 1)(6 \div 3)(8 - 5) = (3 + 3)x$, then $x =$
    (A) 12
    (B) 3
    (C) 4
    (D) 6

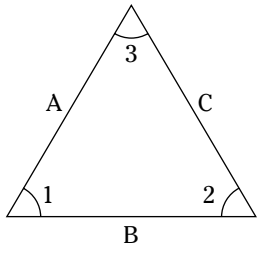
17. $\sqrt{49} \times \sqrt{64} =$
    (A) 56
    (B) 15
    (C) 42
    (D) 3,136

18. Which of the following fractions is the largest?
    (A) $\frac{2}{5}$
    (B) $\frac{3}{8}$
    (C) $\frac{7}{10}$
    (D) $\frac{13}{16}$

19. If $2 + x \geq 4$, what is the value of $x \geq$?
    (A) 6
    (B) 2
    (C) 4
    (D) ½

20. If a circle has a radius of 12 feet, what's its circumference most nearly?
    (A) 24 feet
    (B) 72 feet
    (C) 75 feet
    (D) 36 feet

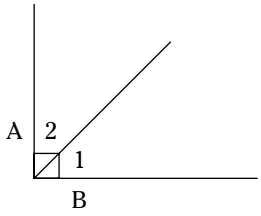
21. An aquarium measures 16-inches long x 8-inches deep x 18-inches high. What's its volume?
    (A) 2,304 cubic inches
    (B) 128 cubic inches
    (C) 42 cubic inches
    (D) 288 cubic inches



22. Triangle ABC (shown above) is a(n):
    (A) right triangle
    (B) obtuse triangle
    (C) equilateral triangle
    (D) isosceles triangle

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23. The sum of the measures of the angles of a trapezoid is:
    (A) 360 degrees
    (B) 540 degrees
    (C) 180 degrees
    (D) 720 degrees



24. In the Angle AB (shown above), Angles 1 and 2 are:
    (A) supplementary
    (B) complimentary
    (C) both obtuse
    (D) both right angles

25. Convert 24% to a fraction.
    (A) $\frac{6}{25}$
    (B) $\frac{1}{25}$
    (C) $\frac{6}{24}$
    (D) $\frac{1}{24}$



Part 6

Electronics Information

Time: 9 minutes; 20 questions

Directions

This test contains questions to challenge your knowledge of electrical, radio, and electronics information. Select the correct response from the choices given and then mark the corresponding space on your answer sheet.

1. Ohm's law states:
   (A) Voltage = Current × Resistance
   (B) Amperes = Current × Resistance
   (C) Voltage = Resistance ÷ Amperes
   (D) Ohms = Voltage ÷ Current

2. An electromagnetic-induction device usually has which of the following materials in its core?
   (A) brass
   (B) silver
   (C) aluminum
   (D) iron

3. How many diodes should you expect to find in a bridge rectifier?
   (A) 0
   (B) 4
   (C) 8
   (D) 10

4. Another name for cycles per second is:
   (A) watts
   (B) voltage
   (C) hertz
   (D) amperes

5. Newer cell phones contain a removable memory card, which is often called a:
   (A) SIM card
   (B) DIM chip
   (C) PIN card
   (D) Pin chip

6. When current flows through a wire, the following influences are present:
   (A) amperes and ohms only
   (B) voltage, watts, and ohms only
   (C) voltage and amperes only
   (D) voltage, ohms, and amperes

7. Millihenries are related to:
   (A) capacitors
   (B) inductors
   (C) relays
   (D) transformers

8. Radar can operate at frequencies as high as:
   (A) 100,000 Hz
   (B) 100,000 kHz
   (C) 100,000 MHz
   (D) 500,000 MHz

9. Radio waves travel:
   (A) at the speed of light
   (B) at the speed of sound
   (C) faster than the speed of light
   (D) faster than the speed of sound but slower than the speed of light

10. Changing alternating current to direct current is called:
    (A) capacitance
    (B) impedance
    (C) rectification
    (D) induction

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11. Insulated fittings can be used to splice wires, thus eliminating the need for:
    (A) cleaning the wires
    (B) removing the plastic coating from the wires
    (C) twisting the wires together
    (D) soldering the wires together



12. The symbol shown above stands for:
    (A) battery
    (B) transformer
    (C) capacitor
    (D) resistor

13. How many wires do serial cables used on computers have?
    (A) 3
    (B) 9
    (C) 15
    (D) 25

14. To produce greater storage of electrons and more capacitance, capacitors should:
    (A) be connected in parallel
    (B) be connected in series
    (C) have more voltage applied to them
    (D) be eliminated

15. A light bulb is 60 watts. Operated at 120 volts, how much current does it draw?
    (A) 0.5 ampere
    (B) 5.0 amperes
    (C) 50.0 amperes
    (D) 7,200 amperes

16. A number-12 wire, compared to a number-6 wire:
    (A) is longer
    (B) is shorter
    (C) is smaller in diameter
    (D) is larger in diameter

17. A fuse with a higher-than-required rating used in an electrical circuit:
    (A) improves safety
    (B) increases maintenance
    (C) may not work properly
    (D) is less expensive

18. Neutral wire is always:
    (A) whitish or natural
    (B) black
    (C) green
    (D) blue

19. To measure electrical power, you would use a(n):
    (A) ammeter
    (B) ohmmeter
    (C) voltmeter
    (D) wattmeter

20. If you operate an incandescent light bulb at less than its rated voltage:
    (A) The bulb will burn brighter and last longer.
    (B) The bulb will burn dimmer and last longer.
    (C) The bulb will burn brighter but won't last as long.
    (D) The bulb will burn dimmer but won't last as long.



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Part 7

Auto & Shop Information

Time: 11 minutes; 25 questions

Directions

This test is about automobiles, shop practices, and the use of tools. Pick the best answer for each question and then mark the corresponding space on your answer sheet.

1. Overheating the engine can cause all of the following problems EXCEPT:
   (A) burned engine bearings
   (B) enlarged pistons
   (C) melted engine parts
   (D) improved fuel efficiency

2. If an alternator overcharges the battery, a likely explanation is:
   (A) The governor has malfunctioned.
   (B) The voltage regulator isn't working properly.
   (C) The ignition coil has overheated.
   (D) The battery-acid solution is low.

3. A primary advantage of the electronic ignition system over conventional ignition systems is:
   (A) The electronic ignition system is less expensive to repair.
   (B) The electronic ignition system provides a higher voltage.
   (C) The electronic ignition system allows for use of a lower octane fuel.
   (D) All of the above

4. The primary purpose of piston rings is to:
   (A) seal the combustion chamber and allow the pistons to move freely
   (B) connect the piston to the crankshaft
   (C) allow fuel to enter the piston cylinder
   (D) provide lubrication to the piston cylinder

5. Connecting rods connect the piston to the:
   (A) flywheel
   (B) fuel pump
   (C) crankshaft
   (D) battery

6. In an overhead valve system (OHV), what mechanism opens and closes the valves?
   (A) rocker arms
   (B) camshaft
   (C) valve rotator
   (D) electrical energy from the alternator

7. If a car's ignition system, lights, and radio don't work, the part that's probably malfunctioned is the:
   (A) cylinder block
   (B) water pump
   (C) carburetor
   (D) battery

8. A gauge shows the complete loss of oil pressure while driving. The best action is to:
   (A) Stop by the gas station when convenient to top off the oil.
   (B) Pull over immediately and investigate the problem.
   (C) Drive directly to a repair garage.
   (D) Assume everything is fine and continue driving as usual.

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9. A two-cycle engine will normally be found on:
   (A) small cars
   (B) large diesel trucks
   (C) trucks, vans, and some cars
   (D) snowmobiles, chainsaws, and some motorcycles

10. The difference between a single-acting and an opposed piston engine is:
   (A) Single-acting piston engines wear longer.
   (B) Opposed piston engines have cylinders set in a V-shape.
   (C) Single-acting piston engines have one piston per cylinder and opposed piston engines have two.
   (D) Single-acting piston engines are used with carburetors and opposed piston engines are used with fuel injectors.

11. A car equipped with limited-slip differential:
   (A) can be readily put into all-wheel (four-wheel) drive
   (B) won't lock up when the brakes are applied steadily
   (C) transfers the most driving force to the wheel with the greatest amount of traction
   (D) is rated for off-road driving

12. Pouring cold water on an overheated engine:
   (A) reduces damage caused by overheating
   (B) makes no difference
   (C) should only be done by a qualified mechanic
   (D) could cause the engine block to crack

13. Soft brake-pedal movement can be caused by:
   (A) air in the hydraulic brake system
   (B) malfunctioning brake shoes
   (C) loss of brake fluid
   (D) worn rotors

14. The safest way to make a hole in sheet metal is to:
   (A) burn it with a soldering iron
   (B) cut it using snips
   (C) punch it using a metal punch
   (D) get someone else to do it

15. Rebar is used to:
   (A) measure the depth of concrete
   (B) reinforce concrete
   (C) stir concrete
   (D) smooth concrete

16. Nail sets are used to:
   (A) protect your fingers from the hammer
   (B) set nails below the surface of wood
   (C) complete projects requiring sets of nails
   (D) mark the position where the nail should go

17. A ripsaw cuts:
   (A) against the grain of the wood
   (B) with the grain of the wood
   (C) most materials, including metal
   (D) only plastic

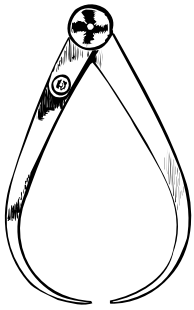
18. Sledges can be used to drive:
   (A) nails
   (B) screws
   (C) staples
   (D) bolts and chisels

19. To check for horizontal trueness, the best tool to use is a:
   (A) steel tape rule
   (B) plumb bob
   (C) level
   (D) sliding T-bevel

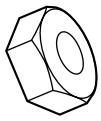
20. A bucking bar is used to:
   (A) pull nails
   (B) pry wood apart
   (C) drive rivets
   (D) drive screws

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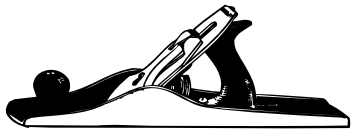
21. Washers that have teeth all around the circumference to prevent them from slipping are called:
    (A) shakeproof washers
    (B) jaw washers
    (C) flat washers
    (D) split-lock washers



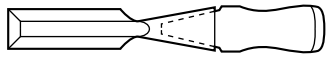
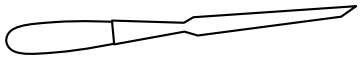
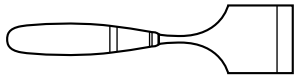
22. The tool above measures:
    (A) an inside curve
    (B) an outside curve
    (C) the depth of a hole
    (D) the thickness of wire



23. The object above is a type of:
    (A) nut
    (B) washer
    (C) screw
    (D) bolt



24. The tool above is used to:
    (A) finish concrete
    (B) spread joint compound
    (C) smooth wallpaper
    (D) dress wood

25. The chisel used to cut metal is:
    (A) 
    (B) 
    (C) 
    (D) 



Part 8

Mechanical Comprehension

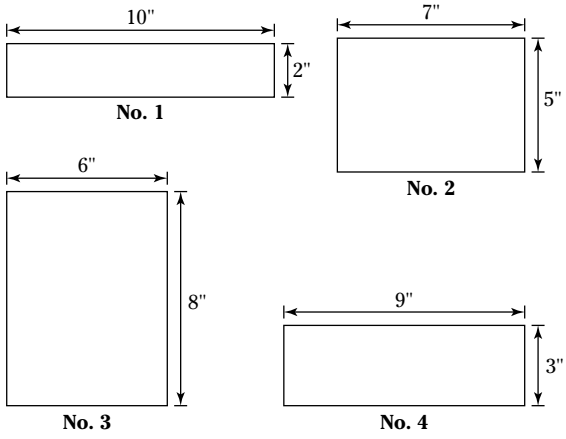
Time: 19 minutes; 25 questions

Directions

This test is about mechanical principles. Many of the questions use drawings to illustrate specific principles. Choose the correct answer and mark the corresponding space on the answer sheet.

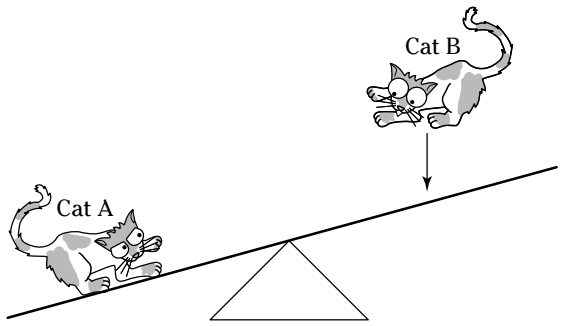
1. An induction clutch works by:
   (A) magnetism
   (B) pneumatics
   (C) hydraulics
   (D) friction

2. If a first class lever with a resistance arm measuring 2 feet and an effort arm measuring 8 feet are being used, what's the mechanical advantage?
   (A) 2
   (B) 4
   (C) 6
   (D) 1



3. The bottoms of four boxes are shown above. The boxes all have the same volume. If postal regulations state that the sides of a box must meet a minimum height, which box is most likely to be too short to go through the mail?
   (A) No. 4
   (B) No. 2
   (C) No. 1
   (D) No. 3

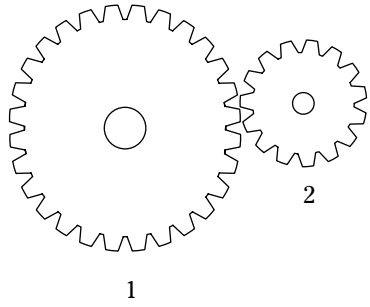
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4. Looking at the figure above, when Cat B lands on the seesaw, Cat A will:
   (A) remain stationary
   (B) hit the ground hard
   (C) rise in the air quickly
   (D) enter the stratosphere

5. Air weighs about 15 psi. What's the amount of pressure (force) exerted on the top of your head, given a surface area of 24 inches?
   (A) 360 pounds
   (B) 625 pounds
   (C) 58 pound
   (D) 180 pounds

6. The force produced when a boxer's hand hits a heavy bag and "bounces" off it is called:
   (A) static electricity
   (B) magnetism
   (C) recoil
   (D) gravity



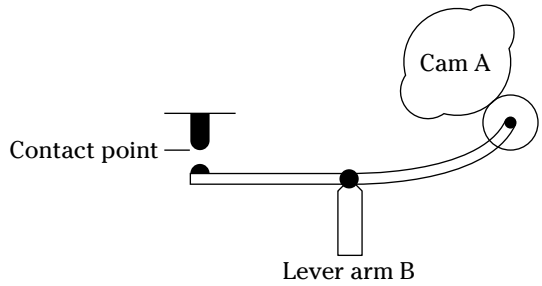
7. In the figure above, if Gear 1 has 25 teeth and Gear 2 has 15 teeth, how many revolutions does Gear 2 make for every 10 revolutions Gear 1 makes?
   (A) about 16⅔
   (B) 12
   (C) about ⅓ more
   (D) about 20

8. A cubic foot of water weighs about 62.5 pounds. If an aquarium is 18 feet long, 10 feet deep, and 12 feet wide, what's the approximate pounds-per-square-inch pressure (psi) on the bottom of the tank?
   (A) 2 psi
   (B) 4 psi
   (C) 5 psi
   (D) 7 psi

9. Springs used in machines are usually made of:
   (A) plastic
   (B) bronze
   (C) nylon fiber
   (D) steel

10. A clutch is a type of:
    (A) universal joint
    (B) coupling
    (C) gear differential
    (D) cam follower

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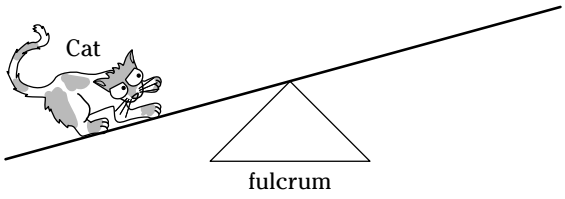


11. When Cam A completes one revolution, the lever will touch the contact point:

(A) once
(B) never
(C) four times
(D) twice

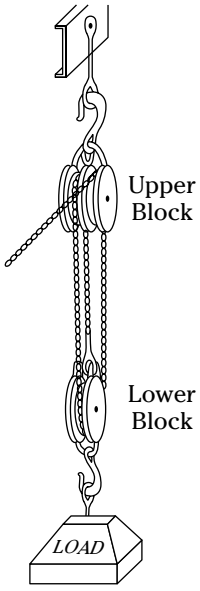
12. A single block-and-fall is called a:

(A) fixed pulley
(B) gun tackle
(C) runner
(D) sheave



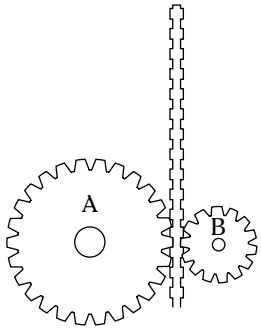
13. In the figure above, if the fulcrum supporting the lever is moved closer to the cat, the cat will be:

(A) easier to lift and will move higher
(B) harder to lift but will move higher
(C) easier to lift but will not move as high
(D) harder to lift and will not move as high



14. The mechanical advantage of the block-and-tackle arrangement shown above is:

(A) 2
(B) 4
(C) 6
(D) 1



15. In the figure above, if the cogs move up the track at the same rate of speed, Cog A will:

(A) reach the top at the same time as Cog B
(B) reach the top after Cog B
(C) reach the top before Cog B
(D) have greater difficulty staying on track

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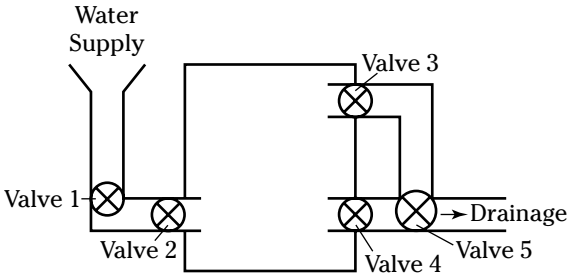
16. If a house key, a wooden spoon, a plastic hanger, and a wool jacket are all the same temperature, which one feels the coldest?

(A) key

(B) spoon

(C) hanger

(D) jacket



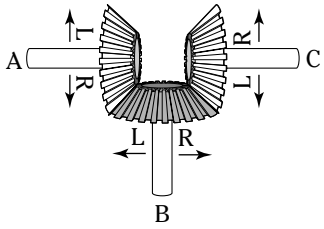
17. In the figure above, assume the valves are all closed. To fill the tank, but to prevent it from filling entirely, which valves should be open?

(A) 1 and 2 only

(B) 1, 2, and 3 only

(C) 1, 2, and 4 only

(D) 1, 2, 3, and 5 only



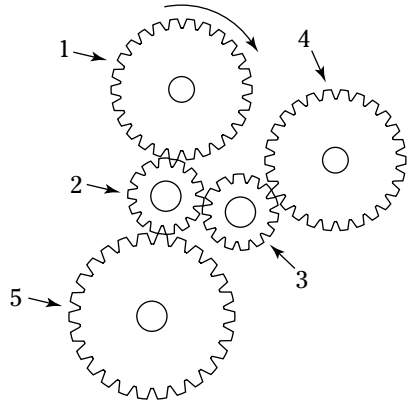
18. If Gear A is turned to the left:

(A) Gear B turns to the right and Gear C turns to the left.

(B) Gear B turns to the left and Gear C turns to the left.

(C) Gear B turns to the right and Gear C turns to the right.

(D) Gear B turns to the left and Gear C turns to the right.



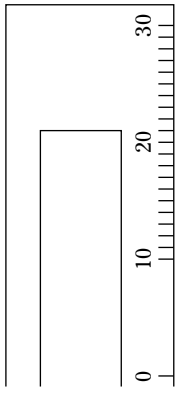
19. If Gear 1 moves in a clockwise direction, which other gears also turn clockwise?

(A) 3 and 5

(B) 3, 4, and 5

(C) 2 and 5

(D) 3 and 4



20. The pressure gauge in the figure above shows a reading of:

(A) 15.0

(B) 19.5

(C) 21.0

(D) 23.0

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21. A way to determine the amount of power being used is to:

(A) Multiply the amount of work done by the time it takes.

(B) Multiply the distance covered by the time it takes to move a load.

(C) Divide the amount of work done by 550 pounds per second.

(D) Divide the amount of work done by the amount of time it takes.

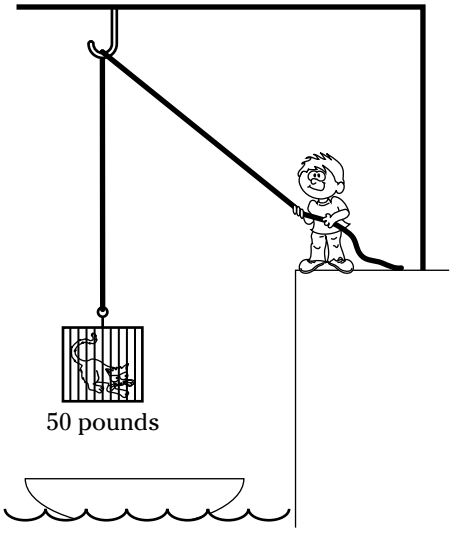
22. A wood tool, a silver tool, and a steel tool are placed in boiling water for cleaning. Which tool gets the hottest?

(A) steel

(B) wood

(C) silver

(D) All three are equally hot.



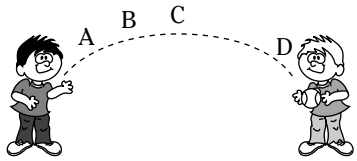
23. A runner is being used in the figure shown. The cat lover lifting the 50-pound crate (with cat) is using how much effort (disregard friction, wind resistance, and the weight of the pulley and the rope)?

(A) 50-pound effort

(B) 100-pound effort

(C) 25-pound effort

(D) 10-pound effort



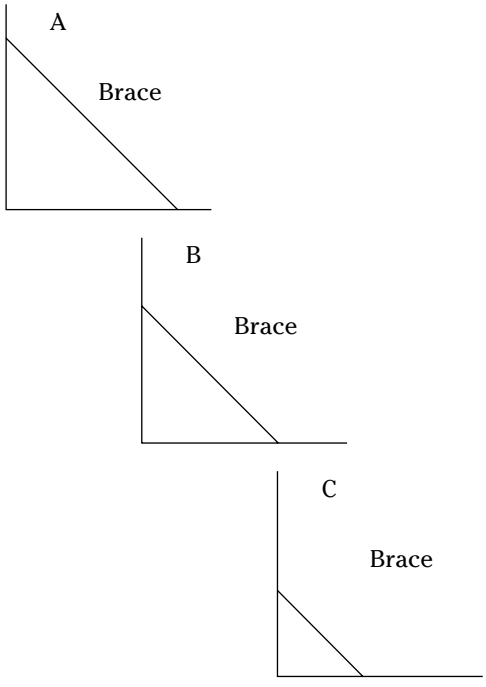
24. In the figure above, at what point was the ball traveling most slowly?

(A) A

(B) B

(C) C

(D) D



25. In the figure above, which angle is braced most solidly?

(A) A

(B) B

(C) C

(D) All are braced equally solidly.



Part 9

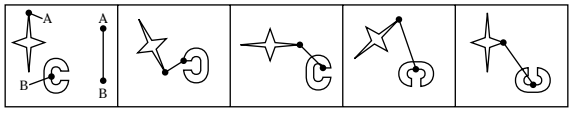
Assembling Objects

Time: 15 minutes; 16 questions

Directions

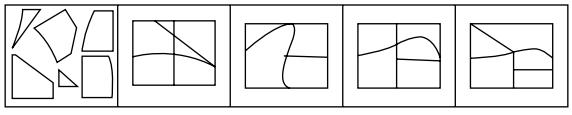
The Assembling Objects subtest consists of questions that measure your ability to mentally picture items in three dimensions. Each question is comprised of five separate drawings. The problem is presented in the first drawing and the remaining four drawings are possible solutions. Determine which of the choices best solves the problem shown in the first picture and then mark the corresponding choice on your answer sheet.

1.



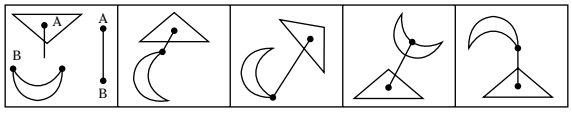
A B C D

2.



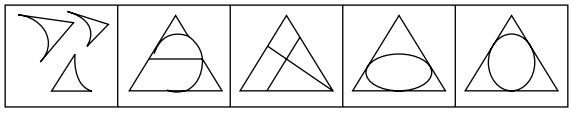
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3.



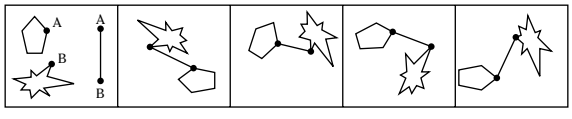
A B C D

4.



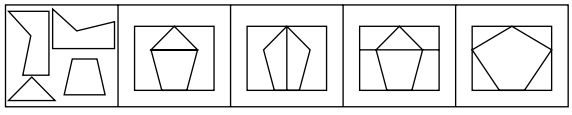
A B C D

5.



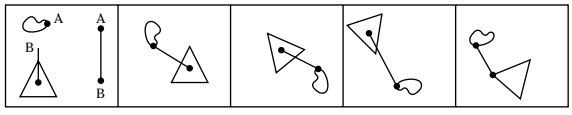
A B C D

6.



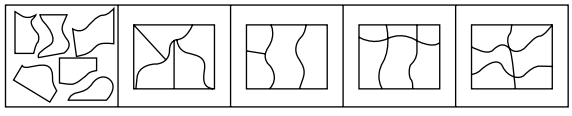
A B C D

7.



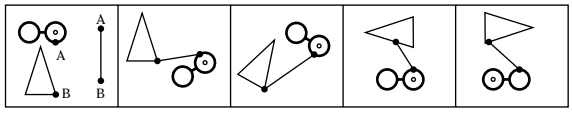
A B C D

8.



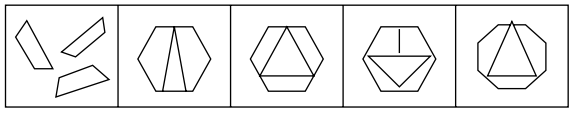
A B C D

9.



A B C D

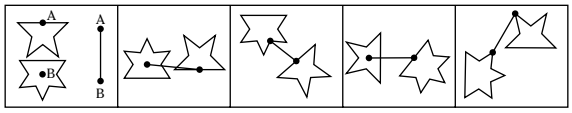
10.



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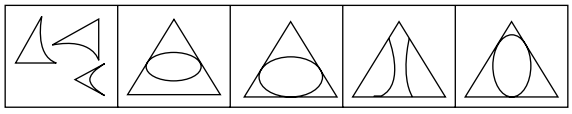
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11.



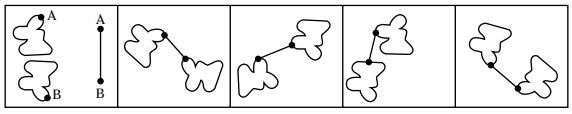
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12.



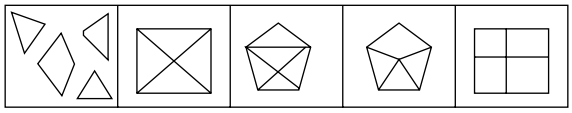
A B C D

13.



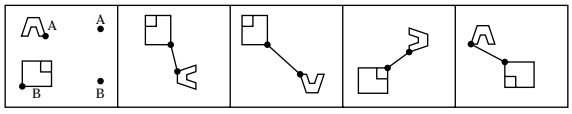
A B C D

14.



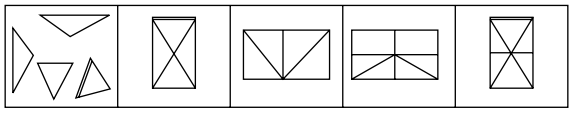
A B C D

15.



A B C D

16.



A B C D



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DO NOT RETURN TO A PREVIOUS TEST.

Chapter 17

Practice Exam 1: Answers and Explanations

With the first practice test out of the way, you're probably anxious to see how well you did. Use the answer keys in this chapter to score yourself on each of the nine subtests. Remember, your scores on this practice exam don't equate to scores on the actual ASVAB. That's because on the production ASVAB, you get more points for answering harder questions correctly than you do for easier questions. The practice exam, however, is a valuable tool for determining what subject areas you need to brush up on.

Part 1: General Science Answers

The General Science subtest tests your knowledge of science facts. If you missed a few questions, reread the questions and try to figure out where you went wrong. If you missed more than a few questions, review Chapter 10.



General Science is a broad field, but some of the following books published by Wiley Publishing, Inc. may help you: *Chemistry For Dummies* by John T. Moore, *Biology For Dummies* by Donna Rae Siegfried, *Astronomy For Dummies*, 2nd Edition, by Stephen P. Maran, *Weather For Dummies* by John D. Cox, and *Physics For Dummies* by Steve Holzner, Ph.D. Additional practice questions can be found in Chapter 15.

1. **(D)**	6. **(A)**	11. **(D)**	16. **(C)**	21. **(D)**
2. **(B)**	7. **(B)**	12. **(C)**	17. **(B)**	22. **(D)**
3. **(D)**	8. **(C)**	13. **(D)**	18. **(D)**	23. **(A)**
4. **(A)**	9. **(C)**	14. **(D)**	19. **(A)**	24. **(D)**
5. **(D)**	10. **(C)**	15. **(A)**	20. **(B)**	25. **(B)**

Part 2: Arithmetic Reasoning Answers

The Arithmetic Reasoning subtest is one of the four ASVAB subtests that make up your Armed Force Qualifying Test (AFQT) score. This score is important because it determines whether you qualify to join the service branch of your choice (check the Appendix to see if the jobs you're interested in require a score in this subtest). If you missed more than five or six questions, it's time to dig out that old high school math textbook and wrap your brain around some math problems. Chapters 7 and 8 may also help you out.



Some other great books that may help you score better on this subtest include *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch — all published by Wiley Publishing, Inc. Also see Chapter 9 for additional practice questions.

1. **(C).** Multiply 12 miles by $3.50 per mile to get $42.00.
2. **(A).** Let x = the smaller number and $x + 8$ equal the larger number. Because the sum of the two numbers equals 70, you can express this mathematically as $x + (x + 8) = 70$. Now all you have to do is solve for x. Combine the like terms: $2x + 8 = 70$. Then subtract 8 from both sides of the equation: $2x + 8 - 8 = 70 - 8$, or $2x = 62$. Divide both sides of the equation by two, and you find that x is equal to 31.
3. **(D).** 144 bottles are in a gross. 144 ÷ 3 (bottles per day) = 48 days.
4. **(B).** To determine Jenny's average, add the test scores and divide the sum by the number of tests taken. You want to know what she would need to make on the next test in order to achieve an average of 95. The formula can be set up as $(93 + 89 + 96 + 98 + x) \div 5 = 95$. Combining the like terms results in $(376 + x) \div 5 = 95$. Multiplying both sides by 5 results in $376 + x = 475$. So, $x = 99$.
5. **(B).** Multiply the total amount spent on drinks, $375, by 12% to determine the amount of tips. $\$375 \times 0.12 = \$45$.
6. **(D).** Square footage is determined by multiplying length by width, or $12 \times 12 = 144$.
7. **(C).** To determine the number of square yards to be protected, multiply 16 feet by 18 feet to determine the number of square feet, 288. Then divide 288 by 9 to convert square feet to square yards (1 square yard = 3 feet × 3 feet = 9 square feet). Multiply the quotient, 32 square yards, by the cost of protection per square yard, $0.65, to get the correct answer, $20.80. Remember to perform all the steps in a calculation.
8. **(C).** Let x = the number of cards printed and sold each month. Therefore, cost is equal to $6000 + 18x$, and revenue is equal to $0.30x$. You're looking for the point where revenue is greater than the cost (revenue > cost). The inequity is $0.30x > 6000 + 18x$. Subtracting $18x$ from both sides of the inequity results in $0.12x > 6000$. Divide both sides by 0.12. The result is that $x > 50{,}000$. The printing plant would have to print and sell 50,000 cards per month to make a profit.
9. **(C).** To calculate the new wage, start off by multiplying $\$8.15 \times 0.07 = \$0.57$. Then add that number (the amount of Joe's raise) to his original hourly wage. Joe's new hourly wage is $8.15 + $0.57 = $8.72.
10. **(C).** By the time Dave leaves, Alice has already been traveling for half an hour. Three hours later, she would've been traveling for 3½ hours at 45 mph, or 157.5 miles. In order to travel 157.5 miles in 3 hours, Dave would have to travel at 55.5 mph (divide 157.5 by 3).
11. **(D).** Convert the different denominators to a common denominator that all the denominators can divide into evenly. 4, 3, and 6 all divide evenly into 12. To convert ¼ to ⁄₁₂, divide 12 (the new common denominator) by 4 (the old common denominator) to get 3. Then multiply ¼ by ⅗ (another way of saying 1). The product is ⁄₁₂. (¼ = ⁄₁₂).

    Do the same calculation for the other fractions: ⅓ = ⁄₁₂ and ⅙ = ⁄₁₂. Then add the new numerators together: 3 + 4 + 2 = 9. This gives you your new added numerator. Place the added numerator over the new denominator, and you can see that ⁄₁₂ of the pies have been sold. ⁄₁₂ can be reduced to ¾. ¾ or 75% of the pies have been sold. $20 \times 0.75 = 15$. 15 of 20 pies have been sold. 20 – 15 = 5 pies remaining.
12. **(A).** Subtract the sale price from the regular price: $24.00 – $22.50 = $1.50. Multiply the remainder by the number of cases to get your answer: $\$1.50 \times 5 = \$7.50$.

13. **(C).** Divide 30 by 8 to determine that the security guard takes 3.75 minutes to walk one city block. Multiply 3.75 by 6, the number of blocks it takes to complete the circuit, to arrive at 22.50, or 22½ minutes.

14. **(B).** Let x = the original estimate. An additional one-fifth would be $\frac{6}{5}x$, or 120% of x. The equation can be expressed as $1.2x = 600000$. To solve for x, divide both sides of the equation by 1.2. $x = 500{,}000$.

15. **(D).** Divide the number of questions she must get right (40) by the total number of questions (60) to reach 66⅔ %.

16. **(C).** To determine the amount of interest earned, multiply the principal ($3,000) by the interest rate (6%) and the number of years interest accrues (1 year): $\$3{,}000 \times 0.06 \times 1 = \$180$. Add the interest earned to the principal to show how much total money the teacher would have: $\$180 + \$3{,}000 = \$3{,}180$.

17. **(B).** Divide the total number of laps by the length of one lap. 3½ ÷ ¼. First, convert the mixed number to a fraction, then divide by ¼. ½ ÷ ¼ = $\frac{28}{2}$, which can be reduced to 14.

18. **(A).** A kilometer is ⅝ of a mile, so multiply $75 \times \frac{5}{8}$, or $\frac{75}{1} \times \frac{5}{8} = \frac{375}{8}$. Divide 8 into 375 to reduce the fraction and determine that Karl was traveling at 47 miles per hour.

19. **(A).** $\$12.30 \times 40$ hours = $492, his base pay per week. $\$12.30 \times 1.5 = \$18.45$, his overtime rate per hour. $18.45 (overtime rate per hour) × 6 (hours of overtime) = $110.70 (overtime pay). $492.00 (base pay) + $110.70 (overtime pay) = $602.70 (total pay for the week).

20. **(A).** The office has 1,260 square feet of space (multiply 42 square feet by 30 employees). With 35 employees, each employee will have 36 square feet of work space (1,260 ÷ 35), which is 6 square feet less than originally.

21. **(B).** Five years contain 60 months, so multiply $450 (monthly payment) × 60 = $27,000 (total payments). Then add $27,000 (total payments) + $2,000 (down payment) = $29,000 (total cost).

22. **(D).** Add the three monthly amounts to determine the total amount Darla spent on groceries: $120.37 + $108.45 + $114.86 = $343.68. Divide the total by 3 to determine the average monthly cost: $114.56.

23. **(C).** 1,650 miles (total distance) ÷ 50 miles per hour (average speed) = 33 hours.

24. **(B).** Determine the cost of each option. Choice (A) doesn't provide enough paint (2×25 gallons = 50 gallons). Choice (B): $11 \times \$108 = \$1{,}188$. Choice (C): $6 \times \$215 = \$1{,}290$. Choice (D): $55 \times \$23 = \$1{,}265$. The lowest price is $1,188.

25. **(B).** One ton = 2,000 pounds, so one truck can carry 6,000 pounds. There are 16 ounces in a pound, so one truck can carry 96,000 ounces. The total daily ration for each resident is 12 ounces + 18 ounces + 18 ounces, or 48 ounces. The number of daily rations supplied can be expressed as 96,000 ÷ 48 = 2,000. Dividing 2,000 by 10 days results in 200 residents who can be fed by one truck during this 10-day period.

26. **(D).** The train headed for Wichita traveled 55 miles per hour × 3 hours = 165 total miles. The train headed for Des Moines traveled 70 miles per hour × 3 hours = 210 total miles. Adding the distances together gives you the number of miles apart the two trains were after three hours: 210 + 165 = 375. Another option: You can add the two rates of speed (55 + 70) and multiply the sum by 3 hours (125×3 hours = 375).

27. **(A).** Convert the mixed number to inches. 3 feet 8 inches equals 44 inches (12 inches per foot × 3 feet = 36 inches + 8 inches = 44 inches). 44 inches (length each section needs to be) × 4 (number of sections needed) = 176 inches (total molding needed). To determine the amount of molding needed in feet, convert 176 inches into feet by dividing 176 inches by 12 inches. You get 14⅔ feet, so the shortest board length is 15 feet.

28. **(A).** One turkey breast costs $8.50 minus 10% of $8.50, or $8.50 – $0.85 = $7.65. The other turkey breast is full price. $7.65 + $8.50 = $16.15.

29. **(C).** Don't let the number of miles traveled confuse you — you don't use them to solve the problem. $\frac{2}{5}$ of a 40-hour workweek is $\frac{2}{5} \times \frac{40}{1} = \frac{80}{5}$. Reduce the fraction: 80 ÷ 5 = 16 hours per week spent traveling.

30. **(B).** Your first step is to determine the number of miles traveled. Multiply the rate of travel by the time. 48 × 7 = 336 miles. The amount of gas used is the total miles driven, divided by the number of miles per gallon. 336 ÷ 21 = 16 gallons of gasoline used. At the price of $2.82 per gallon, you spent $45.12 for gas ($2.82 × 16 = $45.12).

Part 3: Word Knowledge Answers

The Word Knowledge subtest is nothing more than a vocabulary test. However, it's very important because it's another one of the four subtests used to make up your AFQT score. If you find you need to improve your vocabulary, see Chapter 4.



A couple of other great study references are *Vocabulary For Dummies* by Laurie E. Rozakis (Wiley) and *SAT Vocabulary For Dummies* by Suzee Vlk (Wiley). Additionally, see Chapter 6 for more practice questions.

1. **(B)**	8. **(D)**	15. **(D)**	22. **(B)**	29. **(C)**
2. **(A)**	9. **(D)**	16. **(A)**	23. **(C)**	30. **(B)**
3. **(B)**	10. **(B)**	17. **(C)**	24. **(D)**	31. **(B)**
4. **(B)**	11. **(B)**	18. **(B)**	25. **(D)**	32. **(A)**
5. **(C)**	12. **(C)**	19. **(A)**	26. **(D)**	33. **(C)**
6. **(D)**	13. **(B)**	20. **(D)**	27. **(B)**	34. **(D)**
7. **(B)**	14. **(C)**	21. **(D)**	28. **(C)**	35. **(A)**

Part 4: Paragraph Comprehension Answers

The Paragraph Comprehension subtest can be a bit tricky. But you need to get a good score on this subtest to enlist and get the career you want (check the Appendix to see if the jobs you're interested in require a score in this subtest). So pay special attention if you've missed more than a couple of these answers — you need some study time (see Chapter 5). Remember that rereading the paragraph several times to make sure that you have the right answer is perfectly fine. The best method of improving your reading comprehension skills is simply to read more. Additional practice questions can be found in Chapter 6.

1. **(C).** Effective appointment management eliminates the waste of your time, as explained in the last sentence of the passage.

2. **(D).** The passage gives the numbers of senators and representatives, so Choice (A) is incorrect. The passage states that each state's population determines the number of representatives a state has, so Choice (B) is incorrect. As stated in the passage, each state has at least one representative, so Choice (C) is incorrect.

3. **(A).** Many languages are excluded from the Indo-European language group, so Choice (B) is incorrect. Indians, Iranians, Asians, and Afghans aren't Europeans, so Choice (C) is incorrect. The passage gives no evidence to support Choice (D), which isn't true.
4. **(D).** Privatized functions operate independently of the government, making Choices (A) and (B) incorrect. The passage states that privatized functions may sell goods and services to other customers as well as the government, so Choice (C) is also incorrect. Choice (D) is the correct answer, as privatized functions do perform essential services to government agencies.
5. **(C).** Choice (A) is always a good philosophy but isn't pertinent to the main point of the passage. Choices (B) and (D) are subpoints, which support the main point of the passage, which is how to lead a successful conference.
6. **(A).** One can assume that causing rain or snow would end a drought. Nothing in the passage has to do with expense, so Choice (B) is incorrect. The passage says nothing about how frequently the process is used, so Choice (C) is incorrect. The passage specifies that dry ice (solid carbon dioxide) is used; solid water (regular ice) is a different chemical, so Choice (D) is wrong.
7. **(C).** Choices (A) and (B) may be true in certain situations, but they're not the point of this particular paragraph. The passage doesn't say anything about working to improve writing skills being a waste of time, so Choice (D) is incorrect. The main point of the paragraph is that writing may not be the most efficient way of communicating, depending on the situation.
8. **(B).** Products with transistors weren't widely sold before 1954 because of the expense and difficulty of production, not because markets didn't exist; so Choice (A) is incorrect. Choices (C) and (D) aren't supported in the passage. The passage states that the problem of transistors being expensive and difficult to produce was solved by 1954.
9. **(B).** The words *London* and *Englishmen* make it clear that the author is speaking of his travels in England (Great Britain).
10. **(A).** The author makes no reference to parents in the passage, so Choice (B) is incorrect. The author doesn't imply anything about all these interests requiring equal time, so Choice (C) is incorrect. The passage is about children under 18; no conclusion can be drawn about what the author thinks people over 18 should do, so Choice (D) is incorrect.
11. **(C).** The passage doesn't say anything about mock job interviews being frightening, so Choice (A) is wrong. The passage says that mock job interviews should be available to all students, so Choice (B) is wrong. The passage says that schools, not students, should organize mock interviews, so Choice (D) is incorrect.
12. **(A).** Choices (B), (C), and (D) are the opposite of what the paragraph states and implies.
13. **(B).** Nothing in the paragraph supports Choice (A), which is incorrect. When an amendment is passed, it becomes part of the Constitution, so Choice (C) is incorrect. The passage doesn't support Choice (D).
14. **(C).** Because the 14th Amendment guarantees due process in states' laws, the 5th Amendment must guarantee due process only in federal law. Nothing in the passage implies that the 5th Amendment is about taxes, so Choice (A) is wrong. Because the passage states that the 14th Amendment had to be enacted to require states to abide by due process, Choice (B) is incorrect. Choice (D) is neither stated nor implied in the passage.
15. **(A).** Because the Supreme Court struck down many state laws after the 14th Amendment was enacted, it's probably true that these laws would still exist if there had been no 14th Amendment. The passage doesn't support Choices (B), (C), or (D).

Part 5: Mathematics Knowledge Answers

This subtest is also used to calculate your AFQT score, so it's important. If you miss more than four or five, you should consider brushing up on your basic math skills. Chapter 8 can help with this.



The following Dummies books may also be of some help: *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch (all books published by Wiley Publishing, Inc.). Chapter 9 also has some additional practice questions.

1. **(A).** Substitute 8 for x in the equation. $y = (x^2 \div 4) - 2$. $y = (8^2 \div 4) - 2$. $y = (64 \div 4) - 2$. $y = 16 - 2$. $y = 14$.
2. **(A).** The cube of $5 = 5 \times 5 \times 5 = 125$.
3. **(C).** $2.5 \times 3^3 = 2.5\ (3 \times 3 \times 3) = 2.5 \times 27 = 67.50$.
4. **(D).** $2^4 = 16$; the fourth root of 16 is 2.
5. **(A).** The slope of the line is equal to the change in y values divided by the change in x values. The change in y values is 4 (3 – –1). The change in x values is 2 (2 – 0). ½ = 2. To find the intercept, substitute 0 for x in the equation $y = 2x + b$. $-1 = 2(0) + b$. Therefore, $b = -1$, so the equation is $y = 2x - 1$.
6. **(C).** Convert 12 yards and 14 feet to feet: (12 yards × 3 feet per yard) + 14 feet = 36 feet + 14 feet = 50 feet. Divide by 5 as instructed: 50 feet ÷ 5 = 10 feet.
7. **(D).** If two powers have the same base, they can be multiplied by keeping the base and adding the powers together.
8. **(D).** Multiply the first variable in the first set of parentheses with the first variable in the second set of parentheses ($x \times x = x^2$). Next, multiply the first variable in the first set of parentheses with the second number in the second set of parentheses ($x \times 2 = 2x$). So far, the results are $x^2 + 2x$. Now, multiply the second number in the first set of parentheses to the first variable in the second set of parentheses ($4 \times x = 4x$). Next, multiply the second variable in the first set of parentheses to the second number in the second set of parentheses ($4 \times 2 = 8$). The solution is $x^2 + 2x + 4x + 8$. Combining the like terms results in $x^2 + 6x + 8$.
9. **(C).** $1.5 \times 10^3 = 1.5 \times (10 \times 10 \times 10) = 1.5 \times 1{,}000 = 1{,}500$.
10. **(B).** A prime number is a number that can be divided evenly by itself or by one, but not by any other number. Choices (A), (C), and (D) can all be divided evenly by other numbers.
11. **(B).** The *mode* of a series of numbers is the number that appears in the series the most frequently. In this case, it's 8.
12. **(D).** Substitute 4 for all a's in the problem. $4^3 \div 4 = (4 \times 4 \times 4) \div 4 = 64 \div 4 = 16$.
13. **(C).** The factorial (!) of a number is the number multiplied by the next smallest whole number, then by the next smallest whole number, and so on (down to 1). $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.
14. **(B).** $(900 \times 2) \div 6 = 1{,}800 \div 6 = 300$.
15. **(A).** Substitute 2 for all x's in the problem. $2^2 \times 2 = 4 \times 2 = 8$.
16. **(D).** Solve the first half of the equation. (6) (2) (3) = 36. Therefore, $36 = (3 + 3)x$, which turns into $36 = 6x$. Isolate x.

    $36 \div 6 = 6x \div 6$

    $6 = x$

    To check your answer, substitute 6 for x.

17. **(A).** The square root of 49 is 7; the square root of 64 is 8. $7 \times 8 = 56$.
18. **(D).** Find a common denominator for the fractions. In this case, 80 works for all the fractions. Convert all the fractions: $\frac{2}{5} = \frac{32}{80}$; $\frac{3}{8} = \frac{30}{80}$; $\frac{7}{10} = \frac{56}{80}$; and $\frac{13}{16} = \frac{65}{80}$. Comparing the fractions, you can see that $\frac{13}{16}$ ($\frac{65}{80}$) is the largest fraction.
19. **(B).** Solve as you would solve for any unknown. $2 + x \geq 4 = 2 + x - 2 \geq 4 - 2$. Or, $x \geq 2$. To check your answer, substitute 2 for x. $2 + 2 \geq 4$. True, so the answer is correct.
20. **(C).** Circumference equals pi × diameter, and diameter is equal to two times the radius. Or $C = \div d$, and $d = 2r$. $C = \div 24$. If you round ÷ to 3.14, the answer is about 75.36 or about 75 feet.
21. **(A).** Volume equals length × width × height (V = *lwh*). $16 \times 8 \times 18 = 2{,}304$ cubic inches.
22. **(C).** In an equilateral triangle, all sides are equal, and all angles are equal.
23. **(A).** All quadrilaterals have angles that total 360 degrees.
24. **(B).** If the sum of two angles equals 90 degrees, they're called complementary angles.
25. **(A).** 24% = $\frac{24}{100}$. This fraction can be further reduced to $\frac{6}{25}$.

Part 6: Electronics Information Answers

The Electronics Information subtest is important only if you plan on a career that requires a solid score in this area (check the Appendix to see if the jobs you're interested in require a score in this subtest). Otherwise, spend your time studying for the math- and word-related ASVAB subtests. If you do need to score big on this test, and you missed more than five answers, start brushing up. Start by reviewing the corresponding chapter in this book (Chapter 13).



If you need even more study, consider *Electronics For Dummies* by Gordon McComb (Wiley) or consider enrolling in a quick course at a community college. You can also find additional practice questions in Chapter 15.

1. **(A).** Ohm's law states that Voltage (V) = Current (I) × Resistance (R). All other answer are incorrect expressions of this law.
2. **(D).** Iron is easily magnetized and demagnetized, so it works well for this device.
3. **(C).** A bridge rectifier is also known as a full wave rectifier, usually containing 8 diodes.
4. **(C).** The number of times alternating current changes direction in one second is known as its frequency, which is measured in hertz.
5. **(A).** SIM stands for Subscriber Identity Module. The card contains information such as your phone number, your billing information, and your address book. It makes it easier to switch from one cell phone to another.
6. **(D).** Voltage, ohms, and amperes are always present when current flows through a wire.
7. **(B).** Inductors are rated in millihenries.
8. **(C).** Radar can operate as high as 100,000 MHz (megahertz).
9. **(A).** Radio waves travel at the speed of light. The speed of sound is much slower.
10. **(C).** Changing AC to DC is a process called rectification.
11. **(D).** Insulated fittings replace soldering.
12. **(A).** This symbol stands for *battery.*
13. **(B).** This is true, even if the cable has a 25-pin connector. Serial cables are often used to connect computers to perpetual devices.

14. **(A).** Connecting capacitors in parallel produces more capacitance.
15. **(A).** Power = Current × Voltage or, written another way, Current = Power/Voltage. $^{60}/_{120}$ = 0.5 ampere.
16. **(C).** The larger the number, the smaller (in diameter) the wire.
17. **(C).** Because fuses are designed to prevent current overload at a specific level, a fuse with a high rating may not work properly for a circuit rated at a lower level.
18. **(A).** Neutral wire is always whitish or natural colored.
19. **(D).** Electrical power is measured in watts, so you use a wattmeter.
20. **(B).** The bulb will burn dimmer because its full potential isn't used; it will last longer for the same reason.

Part 7: Auto & Shop Information Answers

The Auto & Shop Information subtest is fairly straightforward. You either know the information or you don't. Not knowing the info may not matter to you as long as the career you want doesn't require a subtest score in this area (check the Appendix to see if the jobs you're interested in require a score in this subtest). But, if you do need to do well on this subtest, and you've missed more than five answers, you need to review the material in Chapter 11.



Reviewing *Auto Repair For Dummies* by Deanna Sclar (Wiley) may also help you score better on this subtest. *Home Improvement All-in-One For Dummies* by Roy Barnhart, James Carey, Morris Carey, Gene Hamilton, Katie Hamilton, Donald R. Prestly, and Jeff Strong (Wiley) can help you get a better handle on basic tools and their uses. You may even want to take a class at a nearby community college or at least hang out at the garage and help some mechanics for a couple of weeks. See Chapter 15 for some more practice questions.

1. **(D)**	6. **(A)**	11. **(C)**	16. **(B)**	21. **(A)**
2. **(B)**	7. **(D)**	12. **(D)**	17. **(B)**	22. **(B)**
3. **(B)**	8. **(B)**	13. **(A)**	18. **(D)**	23. **(A)**
4. **(A)**	9. **(D)**	14. **(C)**	19. **(C)**	24. **(D)**
5. **(C)**	10. **(C)**	15. **(B)**	20. **(C)**	25. **(A)**

Part 8: Mechanical Comprehension Answers

The Mechanical Comprehension subtest is important only if you want to pursue a military career that requires a good score on this subtest (check the Appendix to see if the jobs you're interested in require a score in this subtest). Otherwise, spend your time studying more important areas of the ASVAB. If you're considering a military job that requires a high mechanical aptitude and you missed more than four or five questions on this subtest, give Chapter 12 another once over.



Physics For Dummies by Steve Holzner, Ph.D. (Wiley) may help you to get a better grasp on the various forces applicable to mechanics. Chapter 15 has some additional practice questions.

1. **(A).** An induction clutch is a magnetic clutch.
2. **(B).** Mechanical advantage can be calculated as Length of Effort Arm ÷ Length of Resistance Arm. MA = 8 ÷ 2 = 4.
3. **(D).** The box with the largest area on the bottom will have the shortest sides. If length × width × height = volume, and all the boxes have equal volume, then the sides must be shortest on the box with the largest area on the bottom. Calculate the area of each box bottom: No. 1 = 20 square inches; No. 2 = 35 square inches; No. 3 = 48 square inches; and No. 4 = 27 square inches. No. 3, which has the largest area, will have the shortest sides.
4. **(C).** Cat B landing on the seesaw will propel Cat A into the air.
5. **(A).** Power equals force divided by area in square inches (P = F⁄A). This formula can also be stated as F = A × P. Substitute the known quantities. F = 15 × 24 = 360 pounds.
6. **(C).** Recoil occurs when an object producing a force is kicked back.
7. **(A).** To determine the answer, multiply the number of teeth Gear 1 has (D) and the number of revolutions it makes (R). Divide that number by the number of teeth Gear 2 has (d) to determine the number of revolutions Gear 2 makes (r). Because the gears are proportional, this formula will show you the ratio of teeth to revolutions.

   $r = DR/d$

   $r = (25 \times 10)/15$

   $r = {}^{250}\!/_{15}$, or $16{}^{10}\!/_{15}$, or $16{}^{2}\!/_{3}$
8. **(B).** You can determine the pressure of all that water by multiplying the volume of the aquarium by the weight of the water. Volume = *lwh.* The bottom of the tank is 18 feet long by 12 feet wide by 10 feet high for a total volume of 2,160 cubic feet (18 × 12 × 10). A cubic foot of water weighs approximately 62.5 pounds. 2,160 × 62.5 gives an approximate pressure on the bottom of the tank of about 135,000 pounds over the entire surface area. The surface area of the bottom of the tank is length × width. 216 inches (18 feet × 12) × 144 inches (12 feet × 12) = 31,104. Dividing the pressure of 135,000 by the number of square inches of surface area gives an approximate PSI of 4.
9. **(D).** Machine springs are usually made of steel although sometimes they're made of brass or other metal alloys.
10. **(B).** Clutches connect and disconnect parts, so they're a type of coupling.
11. **(D).** When the high point of the cam connects with the lever arm, the lever arm will touch the contact point. Two high points on the cam mean the lever arm will touch the contact point twice with each revolution of the cam.
12. **(C).** A single block-and-fall is called a runner.
13. **(C).** If the fulcrum is moved closer to the cat, the length of the effort arm of the lever will be increased, making the cat easier to raise, but the height to which the cat can be raised will be reduced.
14. **(A).** Because this block-and-tackle arrangement merely changes the direction of the pull, it has a mechanical advantage of only 2.
15. **(C).** The larger cog (Cog A) covers a greater linear distance in a given period of time.
16. **(B).** The key will feel coldest because metal is a better conductor than the other materials.
17. **(D).** Opening Valves 1 and 2 allows water to enter the tank. Opening Valves 3 and 5 prevents water from filling the tank entirely. Opening Valve 4 allows water to leave the tank.
18. **(A).** Gears with their teeth together in mesh turn in opposite directions. Gear A turns Gear B in the opposite direction (right), and Gear B turns Gear C in the opposite direction (left).

19. **(A).** Gears with their teeth together in mesh turn in opposite directions. Gear 1 turns clockwise. Gear 2, in mesh with Gear 1, turns counterclockwise. Gear 3, in mesh with Gear 2, turns clockwise. Gear 4, in mesh with Gear 3, turns counterclockwise. Gear 5, in mesh with Gear 2, turns clockwise.
20. **(C).** The gauge shows a reading of 21.
21. **(D).** The formula for determining power is Power = Work ÷ Time.
22. **(C).** Silver is the best conductor, so it becomes hottest.
23. **(A).** Stationary pulleys give no mechanical advantage, so effort equals the weight of the crate or 50 pounds.
24. **(C).** At the height of the arc, the ball has no upward momentum, so it goes the slowest at that point.
25. **(A).** The brace on Angle A covers more area of the angle, so it's more solidly braced.

Part 9: Assembling Objects Answers

There's not much one can do to study for the Assembling Objects subtest, with the exception of possibly buying some jigsaw puzzles and practicing fitting the pieces together. The good news is that at present this subtest is used only by the navy, and even then, just for a few navy enlisted jobs. If you plan on enlisting in the navy, check the Appendix to see if the jobs you're interested in require a score in this subtest. Otherwise, don't worry about it. For more information about the Assembling Objects subtest, see Chapter 14. For additional practice questions see Chapter 15.

1. **(C)**	5. **(A)**	9. **(B)**	13. **(D)**
2. **(A)**	6. **(A)**	10. **(B)**	14. **(C)**
3. **(D)**	7. **(C)**	11. **(A)**	15. **(B)**
4. **(D)**	8. **(D)**	12. **(D)**	16. **(A)**

Part 1

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Part 2

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Part 3

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Chapter 18

Practice Exam 2

Hopefully you used the results from the first practice exam to determine your weak areas and spent some time hitting the ol' books and recharging your thinking cap. We designed the second practice test so you can see how much you've improved. This exam is exactly like the first one from Chapter 16, except (of course) the questions are different.

You don't have to be an algebra ace to determine whether you're making progress through your review efforts. Simply compare the number of wrong answers you got on Practice Exam 1 from Chapter 16 against the number of wrong answers you have on this test. If you put the work in, you'll probably find that you made fewer errors on Practice Exam 2. (A little luck never hurt anything either.)

If you're still weak on some of the subtests, go back and hit the books (including this one) again. To get the most out of this practice exam, take it like you'd take the real ASVAB under the same conditions:

1. **Allow yourself about three hours to take the entire exam, and take the whole thing at one time.**
2. **Find a quiet place where you won't be interrupted.**
3. **Bring a timer that you can set for various lengths of time, some scratch paper, and a pencil.**
4. **At the start of each subtest, set your timer for the specified period of time.**

   Don't go on to the next section until the timer has gone off, and don't go back to a previous section. If you finish early, check your work for that section only.
5. **Use the answer sheet that's provided.**
6. **Don't take a break during any subtest.**

   You can take a short one- or two-minute break between subtests if you need it.

After you complete the entire sample test, check your answers against the answer key in Chapter 19. Remember that the test is scored by comparing your raw score to the scores of other people, which produces a scaled score. So just because you missed a total of 20 questions doesn't mean that your score is 80 (that would be too simple). Turn to Chapter 2 to find out how the ASVAB is scored.

Part 1

General Science

Time: 11 minutes; 25 Questions

Directions

This exam tests your knowledge of general science principles usually covered in high-school classes. Pick the best answer for each question and then mark the space on your answer sheet that corresponds to the question number and the letter indicating your choice.

1. The ovaries produce:
   (A) androgen
   (B) estrogen
   (C) adrenaline
   (D) growth hormone

2. An earthquake that measures 4 on the Richter Scale would be how many times stronger than an earthquake that measured 2?
   (A) 2 times stronger
   (B) 4 times stronger
   (C) 10 times stronger
   (D) 100 times stronger

3. Muscles attach to bone with:
   (A) connective tissue
   (B) ligaments
   (C) tendons
   (D) rubber bands

4. Atoms are most tightly packed in:
   (A) solids
   (B) gas
   (C) liquids
   (D) all of the above

5. Blood leaving the lungs is:
   (A) hydrogenated
   (B) coagulated
   (C) watery
   (D) oxygenated

6. The longest river in the world is:
   (A) Amazon
   (B) Nile
   (C) Colorado
   (D) Congo

7. Mitosis is a process of:
   (A) creating energy
   (B) sexual reproduction
   (C) destroying mass
   (D) asexual reproduction

8. When added to a cloud's name, which of the following means rain?
   (A) Nimbus
   (B) Cirrus
   (C) Strato
   (D) Alto

9. The movement of particles from an area of high concentration to an area of lower concentration is called:
   (A) metabolic action
   (B) diffusion
   (C) photosynthesis
   (D) catalysis

10. The instrument used to measure wind speed is:
    (A) barometer
    (B) anemometer
    (C) altimeter
    (D) fanometer

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11. Electric charges can be:
    (A) positive or negative
    (B) positive or neutral
    (C) negative or neutral
    (D) neutral only

12. Which planet in the solar system has the most moons?
    (A) Neptune
    (B) Venus
    (C) Saturn
    (D) Uranus

13. Hydrogen has the atomic number 1. This means that hydrogen has:
    (A) one electron
    (B) one nucleus
    (C) one proton
    (D) one neutron

14. Which U.S. space program is responsible for putting 12 men on the moon?
    (A) Gemini
    (B) Titan
    (C) Voyager
    (D) Apollo

15. Organisms that eat other organisms are called:
    (A) prey
    (B) plants
    (C) predators
    (D) insects

16. Unlike most other fish, sharks have no:
    (A) gills
    (B) bones
    (C) liver
    (D) heart

17. What human organ is responsible for cleaning the blood?
    (A) liver
    (B) kidneys
    (C) intestines
    (D) stomach

18. Kinetic energy is the energy that:
    (A) is produced by sound waves
    (B) an object potentially has
    (C) is possessed by a moving object
    (D) results from the attraction of two magnets

19. In what year did the first woman travel in space?
    (A) 1963
    (B) 1969
    (C) 1974
    (D) 1985

20. A step-up transformer:
    (A) increases the voltage in a power line
    (B) decreases the voltage in a power line
    (C) doesn't affect the voltage in a power line
    (D) measures the voltage in a power line

21. What animal has the heaviest brain?
    (A) human
    (B) elephant
    (C) rhinoceros
    (D) sperm whale

22. Passing sunlight through a prism:
    (A) separates the colors into a spectrum
    (B) reflects the light rays
    (C) creates incident rays
    (D) determines the focal point of a ray

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23. Molecules are created when:
    (A) matter is created
    (B) matter is destroyed
    (C) atoms combine together
    (D) atoms are separated

24. The first genetically engineered organism was:
    (A) sheep
    (B) tobacco
    (C) rats
    (D) wheat

25. The vernal equinox is:
    (A) the first day of winter
    (B) near the equator
    (C) the first day of spring
    (D) a lunar eclipse



Part 2

Arithmetic Reasoning

Time: 36 minutes; 30 questions

Directions

The questions in the arithmetic test are each followed by four possible answers. Decide which answer is correct and then mark the space on your answer sheet that has the same number and letter as your choice. Use scratch paper for any figuring you need to do.

1. If a hexahedral die is rolled two times, what's the probability of NOT rolling a five both times?
   (A) 1/36
   (B) 1/6
   (C) 4/36
   (D) 25/36

2. Jack loaned Bob $1,500 at an annual interest rate of 7%. After one year, how much will Bob owe Jack?
   (A) $105
   (B) $1,500
   (C) $1,605
   (D) $1,507

3. A 2-ton truck is taxed at a rate of $0.12 per pound. How much is the total tax bill?
   (A) $480
   (B) $240
   (C) $120
   (D) $600

4. If $ab = 10$, and $a^2 + b^2 = 30$, solve for y in the equation, $y = (a + b)^2$.
   (A) 40
   (B) 45
   (C) 50
   (D) 55

5. A half-pint of cream is what part of a gallon?
   (A) ⅛
   (B) ¼
   (C) 1/16
   (D) ⅙

6. The cost of a protein bar increased from $2.50 to $2.80. The percent increase to the $2.80 rate was how much?
   (A) 16%
   (B) 10%
   (C) 15%
   (D) 12%

7. An aircraft flies over Boondock Air Force Base at 10:20 a.m. At 10:32 a.m., the plane passes over Sea Side Naval Air Station, 120 miles away. How fast is the aircraft traveling?
   (A) 400 mph
   (B) 500 mph
   (C) 600 mph
   (D) 700 mph

8. Last year, Margot grew 50 bushels of corn in her backyard. This year, the yield has increased 8%. How many bushels of corn did Margot grow this year?
   (A) 56
   (B) 52
   (C) 60
   (D) 54

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9. Junior has saved money in his piggybank over the winter. He wants to buy a $30 computer game. If he has 14 one-dollar bills, 16 half dollars, 12 quarters, 8 dimes, 25 nickels, and 10 pennies, how much more does he need to borrow from Dad to buy the game?

   (A) $27.15

   (B) $2.85

   (C) $2.95

   (D) $1.85

10. Debbie receives a weekly salary of $80, plus a 5% commission on any sales. During the week, she has $800 in total sales. What's the ratio of her commission to her salary?

    (A) 2/1

    (B) 1/2

    (C) 3/1

    (D) 1/3

11. How many quart cans can be filled from a 25-gallon bucket of paint?

    (A) 50

    (B) 75

    (C) 100

    (D) 80

12. If a crew of four people can paint the barn in three days, how long will it take a crew of two people?

    (A) 4 days

    (B) 1½ days

    (C) 8 days

    (D) 6 days

13. Brian works for five hours and is paid $24. Christina works for three hours and is paid $10.95. How much more per hour does Brian make than Christina?

    (A) $1.15

    (B) $1.25

    (C) $1.35

    (D) $1.37

14. Margaret is getting married and must be ready by 11:15 a.m. If it's now 8:30 a.m., how much time does she have to get ready?

    (A) 1½ hours

    (B) 2½ hours

    (C) 2¾ hours

    (D) 2⅓ hours

15. An accounting-firm employee is asked to shred 900 documents. If he can shred documents at a rate of 7 per minute, the number of documents remaining after 1½ hours of shredding is:

    (A) 630

    (B) 90

    (C) 270

    (D) 810

16. A home stereo depreciates by 20% each year. What's the value of a stereo, purchased new for $1,200, after two years?

    (A) $768

    (B) $693

    (C) $827

    (D) $654

17. Janet's old pickup truck can only reach a speed of 45 miles per hour. If she drives at top speed, how long will it take her to reach a city 135 miles away?

    (A) 3 hours

    (B) 2 hours

    (C) 4 hours

    (D) 2½ hours

18. A blouse normally costs $18.50. How much money is saved if the blouse is purchased at a 20% discount?

    (A) $1.85

    (B) $14.80

    (C) $4.50

    (D) $3.70

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19. A clerk's weekly salary of $320 is increased to $360. The percent increase is:

(A) 10½%

(B) 11%

(C) 12½%

(D) 12%

20. Two go-carts are racing on a circular track with a perimeter of 360 feet. Camera One is following Go-Cart One, and Camera Two is following Go-Cart Two. If the angle between the two cameras is 40 degrees, how far apart are the two go-carts?

(A) 30 feet

(B) 40 feet

(C) 30 ÷ feet

(D) 40 ÷ feet

21. Dinner at a nice restaurant cost $35.98. If Joan gave the cashier $40.00, how much change should she get back?

(A) $5.02

(B) $4.02

(C) $3.92

(D) $1.02

22. A balloonist circumnavigated the globe in 13 days, 12 hours, 16 minutes, and 13 seconds. A plane circumnavigates the globe in 4 days, 10 hours, 15 minutes, and 7 seconds. How much longer did it take for the balloon to go around the world?

(A) 12 days, 7 hours, 11 minutes, and 35 seconds

(B) 9 days, 2 hours, 1 minute, and 6 seconds

(C) 8 days, 14 hours, 16 minutes, and 6 seconds

(D) 9 days, 7 hours, 3 minutes, and 20 seconds

23. Darlene bought 12 boxes of cookies for $48.00. What was the cost of each box of cookies?

(A) $4.00

(B) $0.48

(C) $0.40

(D) $4.80

24. A tune-up increases a car's fuel efficiency by 5%. If a car averaged 20 miles per gallon before the tune-up, how many miles per gallon will it average after the tune-up?

(A) 25

(B) 22

(C) 20½

(D) 21

25. A lumberjack wishes to drive a spike through the center of a tree with a circumference of 43.96 feet. What's the minimum length of the spike needed to go completely through the tree, passing through the center?

(A) 14 feet

(B) 15 feet

(C) 16 feet

(D) 17 feet

26. A bin of hard candy holds 10½ pounds. How many ¾-pound boxes of candy can be filled from the bin?

(A) 30 boxes

(B) 15¼ boxes

(C) 7⅞ boxes

(D) 14 boxes

27. A patio measures 12 feet by 14 feet. How many 8-inch-square paving stones are needed to pave the patio?

(A) 21

(B) 252

(C) 32

(D) 168

28. A computer programmer is making $25,000 per year. 28% of her salary is withheld for federal and state deductions. How much is the computer programmer's net pay?

(A) $20,000

(B) $7,000

(C) $18,750

(D) $18,000

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29. Pam cuts a pie in half in a straight line. She then cuts a line from the center to the edge, creating a 55-degree angle. What's the supplement of that angle?

(A) 55 degrees

(B) 125 degrees

(C) 70 degrees

(D) 130 degrees

30. A stack of lumber is 6-feet high. If each piece of lumber is 4-inches thick, how many pieces of lumber are in the stack?

(A) 72

(B) 12

(C) 18

(D) 10



Part 3

Word Knowledge

Time: 11 minutes; 35 questions

Directions

This test's questions cover the meanings of words. Each question has an underlined word. You may be asked to decide which one of the four words in the choices *most nearly means* the same thing as the underlined word or which one of the four words means the opposite. If the underlined word is used in a sentence, decide which of the four choices most nearly means the same thing as the underlined word as used in the context of the sentence. Mark the corresponding space on your answer sheet.

1. Ardent most nearly means:
   (A) trustworthy
   (B) passion
   (C) diligent
   (D) busy

2. It was a sturdy table.
   (A) well-built
   (B) ugly
   (C) thick
   (D) small

3. Listless most nearly means:
   (A) gullible
   (B) inattentive
   (C) lazy
   (D) practical

4. Brevity is the soul of wit.
   (A) beauty
   (B) intelligence
   (C) terseness
   (D) humor

5. Pare most nearly means:
   (A) cut
   (B) fruit
   (C) two
   (D) umbrella

6. He facilitated her promotion.
   (A) hindered
   (B) helped
   (C) disliked
   (D) ignored

7. The word *most opposite* in meaning to perpetuate is:
   (A) kill
   (B) preserve
   (C) small
   (D) structure

8. The spectator enjoyed the game.
   (A) competitor
   (B) observer
   (C) referee
   (D) organizer

9. Sally was such a precocious child.
   (A) tall
   (B) talkative
   (C) shy
   (D) smart

10. The teacher cited some examples.
    (A) memorized
    (B) finished
    (C) specified
    (D) examined

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11. The word *most opposite* in meaning to sentinel is:
    (A) guard
    (B) prisoner
    (C) pilot
    (D) teacher

12. Illustrious most nearly means:
    (A) illustrated
    (B) famous
    (C) foolish
    (D) intelligent

13. Fallacious most nearly means:
    (A) invalid
    (B) delightful
    (C) noisy
    (D) overlooked

14. Tim had a penchant for engaging in subterfuge.
    (A) religion
    (B) evasion
    (C) gambling
    (D) danger

15. The goods were transported yesterday.
    (A) donated
    (B) conveyed
    (C) destroyed
    (D) trucked

16. Rigid most nearly means:
    (A) strong
    (B) weak
    (C) pliable
    (D) inflexible

17. The vassals engaged in hard work daily.
    (A) employees
    (B) slaves
    (C) soldiers
    (D) construction workers

18. Deplore most nearly means:
    (A) accept
    (B) insult
    (C) disapprove
    (D) salute

19. Sparse most nearly means:
    (A) space
    (B) meager
    (C) brief
    (D) thirsty

20. Weal most nearly means:
    (A) happiness
    (B) injury
    (C) scream
    (D) tire

21. The dog yearned for a bone.
    (A) barked
    (B) dug
    (C) begged
    (D) longed

22. The customs agent confiscated the goods.
    (A) bought
    (B) noticed
    (C) seized
    (D) stole

23. Eloquent most nearly means:
    (A) long
    (B) beautiful
    (C) articulate
    (D) dangerous

24. Illusion most nearly means:
    (A) mirage
    (B) distant
    (C) sight
    (D) perspective

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25. The sight was fantastic.
(A) simple
(B) illusory
(C) typical
(D) strange

26. Enmity most nearly means:
(A) enemy
(B) hatred
(C) anger
(D) childish

27. Abridge most nearly means:
(A) native
(B) shorten
(C) travel
(D) delirious

28. They terminated his contract.
(A) bought
(B) extended
(C) sold
(D) ended

29. The textbook presented a finite number of solutions to the problem.
(A) unlimited
(B) limited
(C) variety
(D) unusual

30. Null most nearly means:
(A) zero
(B) dull
(C) unskilled
(D) rapid

31. She was a tennis fanatic.
(A) observer
(B) zealot
(C) player
(D) coach

32. Impertinence most nearly means:
(A) fun
(B) boring
(C) rude
(D) impatient

33. Ridicule most nearly means:
(A) mock
(B) support
(C) ride
(D) silly

34. Pardon most nearly means:
(A) courtesy
(B) excuse
(C) believe
(D) respect

35. Isochronous most nearly means:
(A) fast
(B) slow
(C) equal
(D) different



Part 4

Paragraph Comprehension

Time: 13 minutes; 15 questions

Directions

This test measures your ability to understand what you read. This section includes one or more paragraphs of reading material followed by incomplete statements or questions. Read the paragraph and select the choice that best completes the statement or answers the question.

1. Scientists believe that a black hole is created when a supernova from a large star collapses on itself. This collapse causes a gravitational field that grows more and more intense until nothing can escape from its pull, not even light. It's thought that the universe may end as a black hole.

   According to this passage:

   (A) A black hole emits light.

   (B) A supernova is a black hole.

   (C) The gravitational field of a black hole allows nothing to escape.

   (D) The universe was created by a black hole.

2. Military customs and courtesies are proven traditions that explain what should and shouldn't be done in many situations. They are acts of respect and courtesy when dealing with other people and have evolved as a result of the need for order, as well as the mutual respect and sense of fraternity that exists among military personnel. Military customs and courtesies go beyond basic politeness; they play an extremely important role in building morale, esprit de corps, discipline, and mission effectiveness. Customs and courtesies ensure proper respect for the chain of command and build the foundation for self-discipline.

   According to this passage:

   (A) Military customs and courtesies are enforced by regulation.

   (B) Military customs and courtesies are nothing more than basic politeness.

   (C) Military customs and courtesies are the building blocks to self-discipline.

   (D) Military customs and courtesies aren't applicable to the Coast Guard.

3. The Panama Canal is a ship canal that cuts through the Isthmus of Panama, connecting the Atlantic and Pacific oceans. Although several foreign companies tried to build the canal throughout the 19th century, none were successful. After the U.S. helped Panama revolt against Columbia, the U.S. was given rights to the land the canal occupied. The U.S. government finished the canal in 1914.

   According to this passage:

   (A) Panama and Columbia fought a war over the Panama Canal.

   (B) The U.S. was given rights to the canal land.

   (C) Foreign companies built the canal before the U.S. stepped in.

   (D) Panama built the canal in 1914.

4. Extreme care must be exercised to ensure proper handling and cleaning of soiled U.S. flags. A torn flag may be professionally mended, but a badly torn or tattered flag should be destroyed. When the flag is in such a condition that it's no longer a fitting emblem for display, destroy it in a dignified manner, preferably by burning.

   According to this passage, torn flags should be:

   (A) mended

   (B) burned

   (C) destroyed

   (D) all of the above

Go on to next page

5. Medieval guilds were similar to modern-day labor unions. These groups of merchants or craftspeople set rules regarding economic activity in order to protect themselves. Some guilds held considerable economic power, but even small guilds protected members. Guilds also served a social purpose.

   According to this passage, guilds:

   (A) had only one purpose

   (B) had little in common with modern labor unions

   (C) exploited workers

   (D) held considerable economic power

6. After a series of well-publicized failures by various inventors, Orville and Wilbur Wright succeeded in flying and controlling a heavier-than-air craft on December 17, 1903. The War Department, stung by its investment in a failed effort by Samuel Langley and compounded by the Wright's own secretiveness, initially rejected the brothers' overtures toward the government to buy the aircraft. Prevailing sentiments held that the immediate future still belonged to the balloon. In August 1908, the two brothers delivered the first Army aircraft to the U.S. Government. That the U.S. government managed to purchase an airplane was a minor miracle. For more than four years after the Wright brothers' successful flight at Kitty Hawk, North Carolina, the government refused to accept the fact that man had flown in a heavier-than-air machine.

   Which of the following statements is <u>not</u> supported by the above passage?

   (A) The U.S. Government felt that balloons were more practical than airplanes.

   (B) The Wright Brother's own secretiveness contributed to their problems in getting the government interested in their aircraft.

   (C) The historic flight took place on the East Coast.

   (D) It took more than six years for the Wright Brothers to interest the U.S. Government in their airplane.

7. An ex-post-facto law is a law applied retroactively. Usually it makes an act illegal that was legal at the time it was performed. The U.S. Constitution prohibits ex-post-facto criminal laws, although the British Commonwealth allows them.

   According to this passage, it can be assumed that:

   (A) Ex-post-facto laws are a problem in the United States.

   (B) Laws applied retroactively are fair.

   (C) A person could be prosecuted for an act that was not a crime when he or she did it.

   (D) Retroactive laws are illegal in the British Commonwealth.

8. Troy weight is based on a pound of 12 ounces and an ounce of 480 grains. Common, or avoirdupois, weight is based on a pound having 16 ounces and an ounce having 437.5 grains. A common pound has 7,000 grains while a troy pound has 5,760.

   According to this passage:

   (A) A troy pound is smaller than a common pound.

   (B) A troy pound and a common pound are the same weight.

   (C) Common weight and avoirdupois weight are different measures.

   (D) A troy ounce is smaller than a common ounce.

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9. Good leaders get involved in their subordinates' careers. People merely obey arbitrary commands and orders, but they respond quickly and usually give extra effort for leaders who genuinely care for them. An often neglected leadership principle in today's environment of technology and specialization is knowing the workers and showing sincere interest in their problems, career development, and welfare. Leadership is reflected in the degree of efficiency, productivity, morale, and motivation demonstrated by subordinates. Leadership involvement is the key ingredient to maximizing worker performance.

   A key leadership principle that's often ignored is:

   (A) leading by example

   (B) showing sincere interest in the problems of the workers

   (C) ensuring workers have access to the most modern technology

   (D) maximizing worker performance

10. Leukemia is a blood disease in which white blood cells in the blood or bone marrow reproduce rapidly, interfering with the body's ability to produce red blood cells. Red blood cells are needed to perform vital bodily functions.

    According to this passage:

    (A) White blood cells perform no vital function in the body.

    (B) No treatment for leukemia exists.

    (C) Leukemia makes it hard for the body to produce red blood cells.

    (D) White blood cells are found only in the blood.

Questions 11 and 12 are based on the following passage.

Any discussion of distinctive military capabilities would be incomplete without looking at their relationship to the Joint Service vision of the future. JV 2020 guides all the Services into the next century with its vision of future war fighting. JV 2020 sets forth four overarching operational concepts: dominant maneuver, precision engagement, focused logistics, and full-dimensional protection. Each of these operational concepts reinforces the others. The aggregate of these four concepts, along with their interaction with information superiority and innovation, allows joint forces to dominate the full range of military operations from humanitarian assistance through peace operations to the highest intensity conflict.

11. According to the passage above, which of the following <u>is not</u> an operational concept?

    (A) dominant maneuver

    (B) focused logistics

    (C) high intensity conflict

    (D) precision engagement

12. The document discussed in the above passage is primarily about:

    (A) military operations of the past

    (B) present military operations

    (C) military operations in the future

    (D) training for future military operations

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Questions 13 through 15 are based on the following passage.

Genetics is a branch of science dealing with heredity. The field is concerned with how genes operate and the way genes are transmitted to offspring. Subdivisions in the field include cytogenetics, which is the study of the cellular basis of inheritance; microbial genetics, the study of inheritance in microbes; molecular genetics, the study of the biochemical foundation of inheritance; and human genetics, the study of how people inherit traits that are medically and socially important. Genetic counselors are primarily concerned with human genetics. They advise couples and families on the chances of their offspring having specific genetic defects.

13. In the passage above, cytogenetics is defined as:
    (A) the study of the psychological impact of genetics
    (B) the study of the cellular foundation of genetics
    (C) the study of molecular genetics
    (D) the study of human genetics

14. According to the passage above, genetics:
    (A) concerns how genes operate and how they're passed along
    (B) is a field of study populated by quacks, fakes, and frauds
    (C) is a field of study only concerned with human genetics
    (D) is a new field of study

15. According to the passage above, it's reasonable to assume that genetic counseling:
    (A) is restricted to the very rich
    (B) is used to diagnose diseases
    (C) can be used by parents to learn if their offspring are likely to inherit a disease one of the parents has
    (D) can be used by parents to prevent their offspring from inheriting a specific genetic defect



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Part 5

Mathematics Knowledge

Time: 24 minutes; 25 questions

Directions

This test is a test of your ability to solve general mathematical problems. Select the correct answer from the choices given and then mark the corresponding space on your answer sheet. Use scratch paper to do any figuring.

1. $x^2 \times x^4 =$
   (A) x^6
   (B) x^8
   (C) $2x^6$
   (D) $2x^8$

2. If a rectangle has a perimeter of 36 feet, and it's 4-feet wide, what's its area?
   (A) 56 square feet
   (B) 128 square feet
   (C) 112 square feet
   (D) 16 square feet

3. The cube root of 64 is:
   (A) 3
   (B) 9
   (C) 2
   (D) 4

4. Convert 314,000 to scientific notation.
   (A) 3.14×10^5
   (B) $3.14 \times 10\text{-}^5$
   (C) 314×10
   (D) 31.4×100

5. The reciprocal of ⅙ is:
   (A) 1
   (B) 3
   (C) 6
   (D) ⅓

6. If $0.05 \div x = 1$, then $x =$
   (A) 0.05
   (B) 0.5
   (C) 50.0
   (D) 5.0

7. Factor $x^2 - 6x + 9$.
   (A) $(x + 6)(x + 6)$
   (B) $(x - 6)(x + 6)$
   (C) $(x - 3)^2$
   (D) $(x + 3)^2$

8. $(3 \times 2)(7 - 2)(6 + 2) = (6 \times 4)x$. What's the value of *x?*
   (A) -5
   (B) 5
   (C) 10
   (D) 1

9. Solve for *x:* $2x - 6 = x + 5$
   (A) 3
   (B) 11
   (C) 7
   (D) 5

10. If $I = prt$, and $p = \$1{,}000$, $r = 7\%$, and $t = 1$, what does I equal?
    (A) $35
    (B) $1,000
    (C) $700
    (D) $70

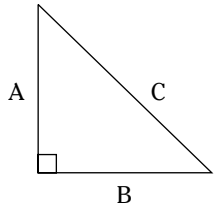
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11. Solve for x in the equation $(x - 7)^2 - 4 = (x + 1)^2$.
    (A) 2½
    (B) 2¾
    (C) 4½
    (D) 4¾

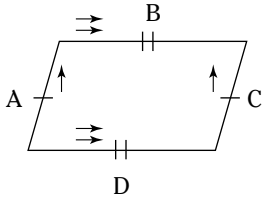
12. A circle has a radius of 5 inches. What's its approximate area?
    (A) 78.5 inches
    (B) 70.0 inches
    (C) 314.0 inches
    (D) 25.0 inches

13. Solve the following inequity:
    $\frac{2}{3}(6x - 9) + 4 > 5x + 1$
    (A) $x > 6$
    (B) $x < 6$
    (C) $x > -3$
    (D) $x < -3$

14. A tube has a radius of 3 inches and a height of 5 inches. What's its approximate volume?
    (A) 34 cubic inches
    (B) 141 cubic inches
    (C) 565 cubic inches
    (D) 45 cubic inches



15. Triangle ABC (shown above) is a(n):
    (A) right triangle
    (B) equilateral triangle
    (C) scalene triangle
    (D) isosceles triangle



16. The figure above is what type of quadrilateral?
    (A) square
    (B) rhombus
    (C) trapezoid
    (D) parallelogram



17. Angle AB (shown above) is a(n):
    (A) complementary angle
    (B) supplementary angle
    (C) acute angle
    (D) obtuse angle

18. Solve for x: $-x^2 - x + 30 = 0$
    (A) 4, -8
    (B) -6, 5
    (C) -4, 5
    (D) 6, -3

19. A square box has a volume of 64 cubic inches. What's its perimeter?
    (A) 8 inches
    (B) 16 inches
    (C) 64 inches
    (D) 32 inches

20. A cube has a volume of 64 cubic inches. What's its surface area?
    (A) 16 square inches
    (B) 64 square inches
    (C) 96 square inches
    (D) 32 square inches

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21. $(x^3)^3 = ?$
(A) $3x^3$
(B) x^6
(C) x^9
(D) $2x^6$

22. 4! =
(A) 16
(B) 40
(C) 0
(D) 24

23. If $a^3 + b^3 = a^3 + x^3$, then $b =$
(A) $b^3 - a^3$
(B) x
(C) $a^3 - b^3$
(D) a

24. What's the sum of the integers from 1 to 300?
(A) 38,243
(B) 45,150
(C) 49,923
(D) 52,024

25. $(y^2)^3 =$
(A) y^5
(B) y^6
(C) y^3
(D) $3y^2$



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Part 6

Electronics Information

Time: 9 minutes; 20 questions

Directions

This part tests your knowledge of electrical, radio, and electronics information. Select the correct response from the choices given and then mark the corresponding space on your answer sheet.

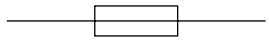
1. Two electrical wires run to a machine. One wire is 6mm thick, and the other is 3mm thick. For the two wires to carry the same current, the larger wire:
   (A) requires less voltage
   (B) requires more voltage
   (C) requires the same voltage
   (D) It can't be determined from the information given.

2. Which of the following isn't a component of a DC motor?
   (A) rotor bars
   (B) armature
   (C) field poles
   (D) yoke

3. A current passed through a muscle in the human body causes the muscle to contract. This is known as:
   (A) the chemical effect of current
   (B) the biological effect of current
   (C) the magnetic effect of current
   (D) the physiological effect of current

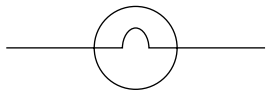
4. In a closed electrical circuit:
   (A) One terminal is always positive, and one terminal is always negative.
   (B) Both terminals can be positive.
   (C) Both terminals can be negative.
   (D) Terminals are neither positive nor negative.

5. What does RMS stand for?
   (A) Root Mean Square
   (B) Resistance Measurement System
   (C) Real Metric Standards
   (D) Realistic Matrix Stems



6. The symbol above is a/an:
   (A) resistor
   (B) fuse
   (C) capacitor
   (D) inductor

7. The television broadcast standard used in the United States is:
   (A) PAL
   (B) NTSC
   (C) SECAM
   (D) SSTC

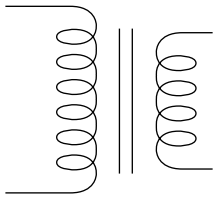


8. The symbol above is a/an:
   (A) lamp
   (B) fuse
   (C) inductor
   (D) bell

9. When a circuit breaker trips, in what position will you find the operating handle?
   (A) on position
   (B) off position
   (C) half way between on and off
   (D) three-fourths of the way between the on position and the off position

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10. Which wire is smallest?
    (A) 00 AWG
    (B) 4 AWG
    (C) 10 AWG
    (D) 12 AWG



11. The symbol above stands for:
    (A) battery
    (B) inductor
    (C) transformer
    (D) diode

12. How many paths of electrical flow can be found in a series circuit?
    (A) one
    (B) two
    (C) two or more
    (D) It can't be determined from the information given.

13. A microwave is rated at 1,200 watts. At 120 volts, how much current does it draw?
    (A) 1 amp
    (B) 10 amps
    (C) 100 amps
    (D) 1,440 amps

14. Electricians use the term *low potential* to refer to:
    (A) electrical circuits with a low potential for overload
    (B) building codes that reduce the risk of fire
    (C) the likelihood of getting a raise this year
    (D) 600 watts or less

15. Which of the following isn't a conductor of electricity?
    (A) water
    (B) graphite
    (C) gold
    (D) glass

16. The ground wire is always:
    (A) green
    (B) black
    (C) whitish
    (D) blue

17. To cause a current of 10 amperes to flow through 20-ohm resistance, the voltage needed is:
    (A) 20 volts
    (B) 1 volt
    (C) 10 volts
    (D) 200 volts

18. Silver is a better conductor than copper. But copper is more often used because of:
    (A) the cost of silver
    (B) the strength of copper
    (C) the low melting point of silver
    (D) the tendency of silver to tarnish

19. Electronic circuits that produce high-frequency AC are called:
    (A) amplifiers
    (B) regulators
    (C) transformers
    (D) oscillators

20. If you plug an appliance designed for AC into a DC power source, the appliance:
    (A) will operate normally
    (B) will produce excessive heat
    (C) won't operate
    (D) will explode into tiny pieces



Part 7

Auto & Shop Information

Time: 11 minutes; 25 questions

Directions

This test is about automobiles, shop practices, and the use of tools. Pick the best answer for each question and then mark the corresponding space on your answer sheet.

1. If a car uses too much oil, which of the following parts may be worn?
   (A) camshaft
   (B) connecting rods
   (C) fuel pump
   (D) piston rings

2. On which automotive system would a "stall test" be performed?
   (A) transmission
   (B) exhaust
   (C) engine
   (D) suspension

3. The alternator:
   (A) starts the engine
   (B) supplies power to the battery
   (C) connects the ignition system to the engine
   (D) can be used as an alternative to motor oil

4. In which automotive system would you find a "wishbone"?
   (A) transmission
   (B) engine
   (C) exhaust
   (D) suspension

5. If the electrolyte solution in a battery is too low, you should add:
   (A) sulfuric acid
   (B) antifreeze
   (C) distilled water
   (D) gasoline

6. What area of your car should be flushed periodically to maintain optimum performance?
   (A) exhaust system
   (B) brake system
   (C) cooling system
   (D) ignition system

7. In a hydraulic brake system, if brake action is soft, a likely explanation is:
   (A) The rotors are worn.
   (B) Air has gotten into the system.
   (C) The master cylinder needs to be replaced.
   (D) The brake calipers need adjustment.

8. Car restorers often seek NOS parts. What does NOS stand for?
   (A) Near Original Specifications
   (B) NASCAR Operating Standards
   (C) New Old Stock
   (D) none of the above

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9. To make spark plugs work effectively, the coil and breaker:
   (A) provide a gap between the electrodes
   (B) ignite the spark
   (C) transfer the electricity to the correct spark plug
   (D) create a very high voltage of electricity

10. Schrader valves can be found in your car's:
   (A) tires
   (B) engine
   (C) transmission
   (D) electronic ignition

11. A bent frame causes:
   (A) improper tracking
   (B) auto accidents
   (C) poor ride
   (D) excessive rust

12. In the tire designation 205/55 R 15 92 H, what does the "H" signify?
   (A) tread type
   (B) tire height
   (C) maximum speed
   (D) turning radius

13. A sheet of aluminum should be cut with:
   (A) a pair of kitchen scissors
   (B) a handsaw
   (C) tin snips
   (D) a coping saw

14. Hammer faces are commonly made of each of the following materials EXCEPT:
   (A) steel
   (B) brass
   (C) plastic
   (D) lead

15. Hammers, mallets, and sledges are all striking tools, but mallets and sledges don't have:
   (A) a claw
   (B) metal parts
   (C) as much durability
   (D) wedges

16. Round objects can be measured most exactly using a:
   (A) rigid steel rule
   (B) folding rule
   (C) caliper
   (D) depth gage

17. The best chisel to use when making a circular cut in metal is a:
   (A) cold chisel
   (B) socket chisel
   (C) butt chisel
   (D) round chisel

18. The term *penny* is used to designate the:
   (A) number of threads per inch on a screw
   (B) length of a nail
   (C) cost of a nail
   (D) material a nail is made from

19. Painting on a surface with too much moisture:
   (A) causes no problems
   (B) causes bubbling
   (C) requires an extra coat of paint
   (D) takes longer

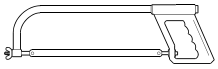
20. To tighten a loose handle on a hammer:
   (A) soak the handle in water
   (B) use wood glue to secure the handle more firmly to the head
   (C) drive another wedge into the head
   (D) replace the hammer because the problem can't be fixed

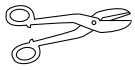
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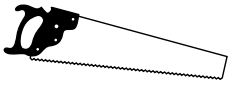
21. An 8-point saw:
    (A) has 8 teeth per inch
    (B) weighs 8 ounces
    (C) can saw 8 kinds of material
    (D) is 8-inches long

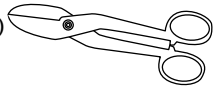
22. Concrete is made by mixing:
    (A) cement and sand
    (B) cement, sand, and water
    (C) cement and water
    (D) cement, sand, gravel, and water

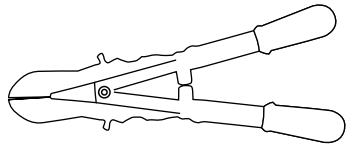
23. Which of the following tools isn't used to cut metal?

(A) 

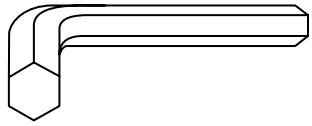
(C) 

(B) 

(D) 



24. The tool above is used to:
    (A) cut tile
    (B) cut wire
    (C) turn screws
    (D) cut bolts



25. The tool above is a(n):
    (A) Phillips screwdriver
    (B) Allen wrench
    (C) socket wrench
    (D) offset screwdriver



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Part 8

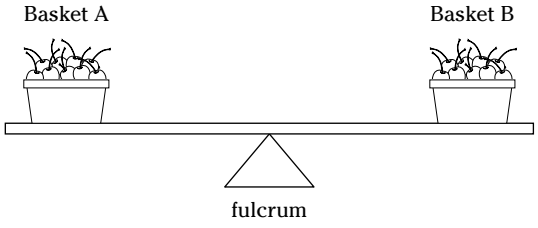
Mechanical Comprehension

Time: 19 minutes; 25 questions

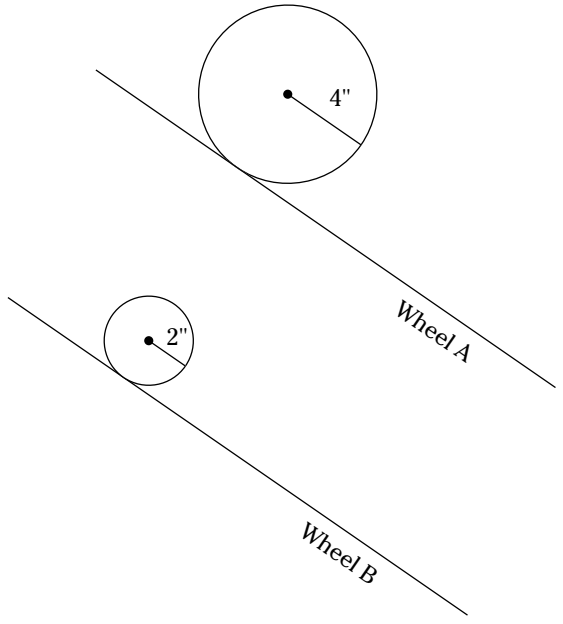
Directions

This test is about mechanical principles. Many of the questions use drawings to illustrate specific principles. Choose the correct answer and mark the corresponding space on the answer sheet.

1. A simple pulley gives a mechanical advantage of:
   (A) 2
   (B) 3
   (C) 1
   (D) unknown



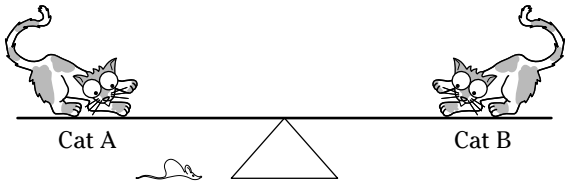
2. The baskets are balanced on the arm in the figure above. If cherries are removed from Basket B, to rebalance the arm:
   (A) The fulcrum will have to be moved to the right.
   (B) Basket B will have to be moved to the right.
   (C) Basket A will have to be moved to the left.
   (D) Basket A will have to be moved to the right.



3. If both Wheel A and Wheel B revolve at the same rate in the figure above, Wheel A will cover a linear distance of 12 feet:
   (A) faster than Wheel B
   (B) slower than Wheel B
   (C) in about the same time as Wheel B
   (D) half as quickly as Wheel B

4. If a force of 200 pounds is exerted over an area of 10-square inches, what's the psi?
   (A) 10
   (B) 15
   (C) 20
   (D) 200

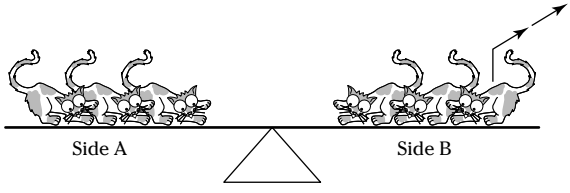
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5. In the figure above, if Cat A moves toward the middle of the seesaw to get a better look at the mouse, Cat B will:
   (A) remain stationary
   (B) move toward the ground
   (C) rise in the air
   (D) instigate a cat fight

6. If a ramp measures 6 feet in length and 3 feet in height, an object weighing 200 pounds requires how much effort to move using the ramp?
   (A) 200 pounds
   (B) 100 pounds
   (C) 50 pounds
   (D) 300 pounds

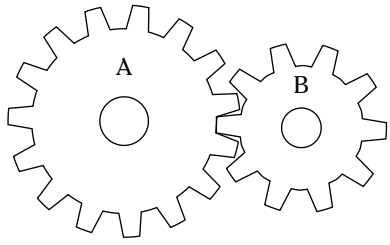
7. A micrometer is used to measure:
   (A) small changes in temperature
   (B) changes in psi
   (C) thicknesses to a few thousandths of an inch
   (D) objects invisible to the unaided eye



8. If a cat is removed from Side B of the seesaw, what happens to the cats on Side A?
   (A) The cat will never move from Side B until it's good and ready.
   (B) The cats on Side A will move up in the air.
   (C) The cats on Side A will move toward the ground.
   (D) Nothing will happen.

9. The force produced when two objects rub against each other is called:
   (A) gravity
   (B) recoil
   (C) magnetism
   (D) friction

10. Normally, atmospheric pressure is approximately:
    (A) 14.7 psi
    (B) 23.2 psi
    (C) 7.0 psi
    (D) 10.1 psi



11. For Gear A and Gear B to mesh properly in the figure above:
    (A) They must be the same size.
    (B) They must turn at different rates.
    (C) They must both turn in the same direction.
    (D) Their teeth must be of equal size.

12. Torsion springs:
    (A) produce a direct pull
    (B) exert no pull
    (C) produce a twisting action
    (D) coil but do not uncoil

13. To move a 400-pound crate from the floor of a warehouse to the bed of a truck 4-feet off the ground, the most efficient device to use is a:
    (A) lever
    (B) incline plane
    (C) fixed pulley
    (D) jackscrew

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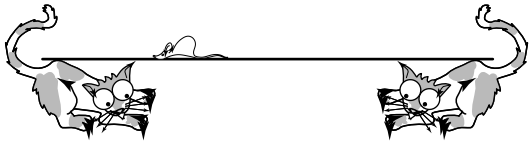
14. Water in an engine can cause damage in winter weather because:

(A) It can vaporize.

(B) Water expands when it freezes.

(C) Ice is heavier than water.

(D) Cold water creates more steam than warm water.



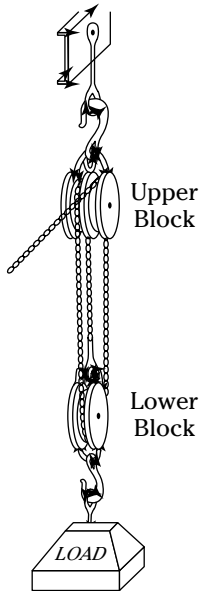
15. The weight of the load is being carried on the backs of the two cats shown in the figure. Which cat is carrying the most weight?

(A) Cat A

(B) Cat B

(C) Both are carrying an equal amount of weight.

(D) It can't be determined without more information.



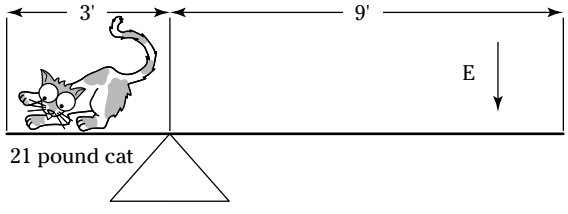
16. When the block-and-tackle arrangement shown in the figure above is used to lift a load, all the following parts remain stationary EXCEPT:

(A) the upper hook

(B) the upper block

(C) the lower block

(D) none; all the parts move



17. In the figure shown above, what effort (E) must be applied to lift the cat?

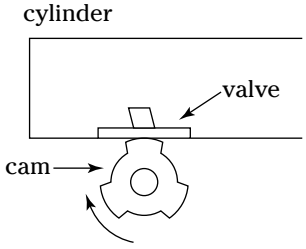
(A) 7.0 pounds

(B) 9.0 pounds

(C) 21.0 pounds

(D) 10.5 pounds

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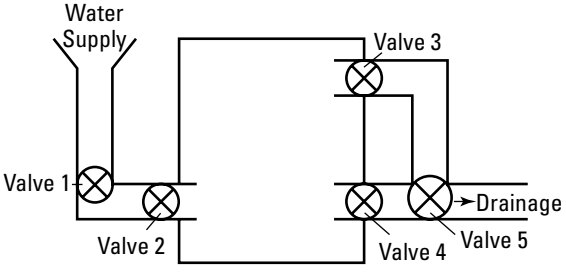
18. In the figure above, for each complete revolution the cam makes, how many times will the valve open?

(A) 1

(B) 6

(C) 3

(D) 2



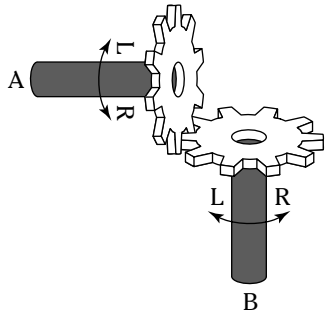
19. In the figure above, assume the valves are all open. Which valves need to be closed for the tank to fill up completely?

(A) 3 and 4 only

(B) 3, 4, and 5

(C) 2, 3, and 4

(D) 4 only



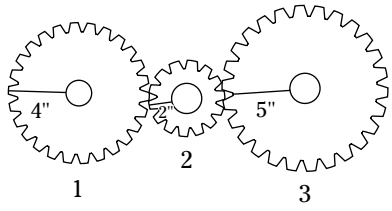
20. If Gear A turns left in the figure above, Gear B:

(A) won't turn

(B) turns left

(C) turns right

(D) It can't be determined.



21. If Gear 1 makes 10 complete clockwise revolutions per minute in the figure above, then:

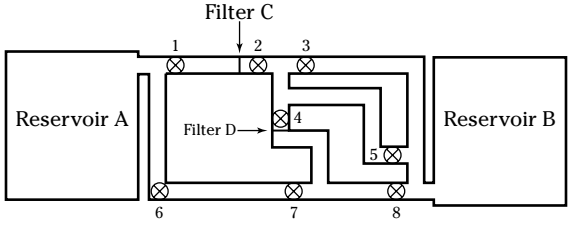
(A) Gear 2 makes 10 complete clockwise revolutions per minute.

(B) Gear 2 makes 20 complete counterclockwise revolutions per minute.

(C) Gear 2 makes 5 complete counterclockwise revolutions per minute.

(D) Gear 3 keeps Gear 2 from making any revolutions.

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22. For the fuel to travel from Reservoir A to Reservoir B, passing through Filters C and D on the way, which valves must be open?

(A) 1, 2, 4, and 8

(B) 1, 2, and 3

(C) 6, 7, and 8

(D) 4, 6, and 7

23. A yellow flame on a gas furnace indicates:

(A) Everything is fine.

(B) The fuel-air mixture is too rich.

(C) The fuel-air mixture is too lean.

(D) The gas pressure is too low.

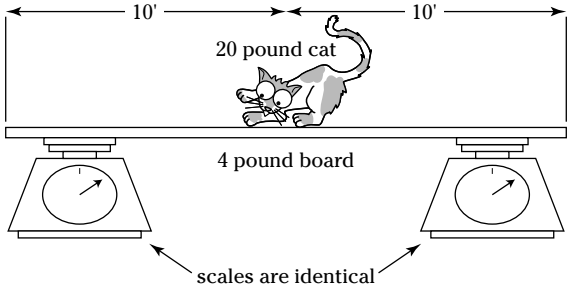
24. If a water tank on a toilet keeps overflowing, the problem is probably a:

(A) defective float

(B) clogged pipe

(C) crimped chain

(D) improper seal



25. In the figure shown above, the board holds the weight of the cat. The board is placed on two identical scales. Each scale reads:

(A) 24

(B) 10

(C) 12

(D) 40

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Part 9

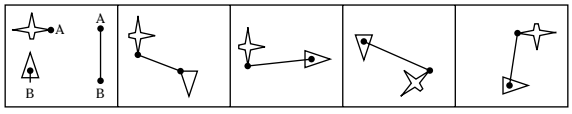
Assembling Objects

Time: 15 minutes; 16 questions

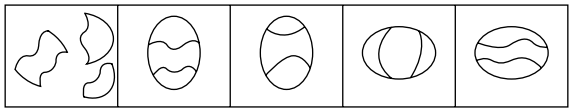
Directions

The Assembling Objects subtest consists of questions that measure your ability to mentally picture items in three dimensions. Each question is comprised of five separate drawings. The problem is presented in the first drawing and the remaining four drawings are possible solutions. Determine which of the choices best solves the problem shown in the first picture, then mark the corresponding choice on your answer sheet.

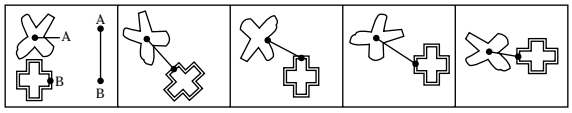
1.



2.



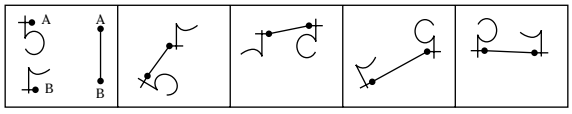
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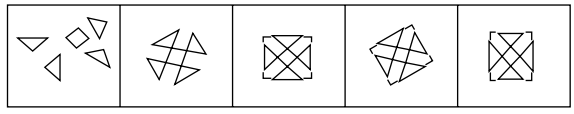
4.



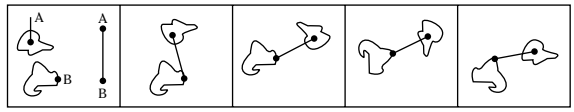
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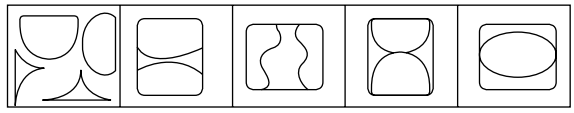
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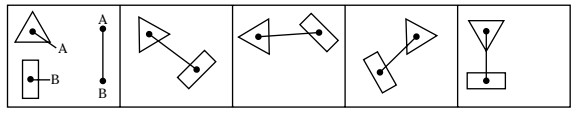
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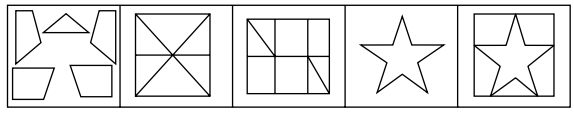
8.



9.

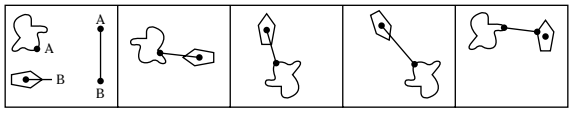


10.



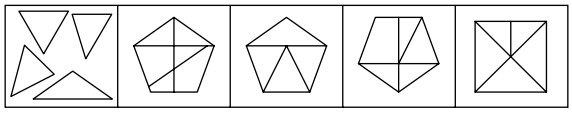
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11.



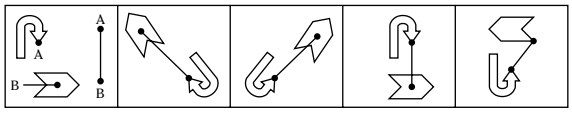
A B C D

12.



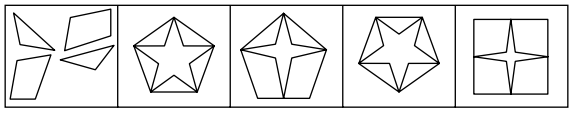
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13.



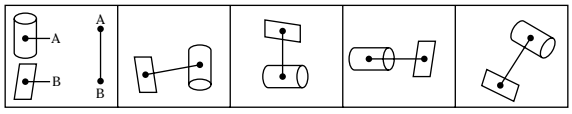
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14.



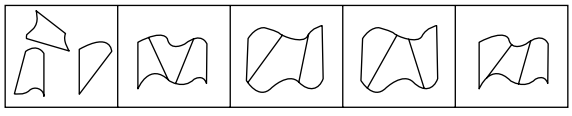
A B C D

15.



A B C D

16.



A B C D



Chapter 19

Practice Exam 2: Answers and Explanations

Read over each question from Chapter 18 as you check the answer key. Doing so reminds you what the question is about and serves as a helpful review. If you look at each question and the possible answers, you can also identify some of the traps that you may run across on the ASVAB. By the time you've taken and scored Practice Exam 2, you should have a good idea of your strengths and weaknesses. Compare your scores from Practice Exam 2 to the scores you got on Practice Exam 1 to see if you're making progress. If some subjects or subtests still give you problems, keep studying.

Part 1: General Science Answers

The answers to the questions on the General Science subtest are fairly straightforward — you either know the answer or you don't. This can be a hard subject to study for because General Science includes the entire scope of scientific disciplines. The good news is you may not even have to score well on this subtest — it depends on the job you're interested in. See the Appendix for military jobs that require a good General Science score.



For more help, consider the following Wiley Publishing books: *Chemistry For Dummies* by John T. Moore, *Biology For Dummies* by Donna Rae Siegfried, *Astronomy For Dummies*, 2nd Edition, by Stephen P. Maran, *Weather For Dummies* by John D. Cox, and *Physics For Dummies* by Steve Holzner, Ph.D. You can also find additional practice questions in Chapter 15.

1. **(B)**	6. **(B)**	11. **(A)**	16. **(B)**	21. **(D)**
2. **(D)**	7. **(D)**	12. **(C)**	17. **(B)**	22. **(A)**
3. **(C)**	8. **(A)**	13. **(C)**	18. **(C)**	23. **(C)**
4. **(A)**	9. **(B)**	14. **(D)**	19. **(A)**	24. **(B)**
5. **(D)**	10. **(B)**	15. **(C)**	20. **(A)**	25. **(C)**

Part 2: Arithmetic Reasoning Answers

This subtest is one of the most important because it makes up a portion of your AFQT score, the score that determines your overall mental qualifications to enlist in the military. Hopefully you missed fewer questions this time around, than you did when you took the first practice exam.



If you think you need more in-depth study, consider *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math for Dummies* by Scott Hatch — all published by Wiley Publishing, Inc. You may also wish to review Chapters 7 and 8, or see if you can find some high-school-level math textbooks at your local library. Chapter 9 has some additional practice questions.

1. **(B).** Simply add the cost of all the books: \$18.00 + \$14.50 + \$9.95 = \$42.45.
2. **(D).** The probability of rolling a 5 is 1 out of 6 (⅙), so the probability of NOT rolling a 5 is 1 – ⅙, or ⅚. The probability of not rolling a 5 twice is ⅚ × ⅚, or 25/36.
3. **(A).** 2 tons = 4,000 pounds. 4,000 × \$0.12 = \$480.00.
4. **(C).** $y = (a + b)^2$. Expanding the equation results in $y = a^2 + b^2 + 2ab$. You know that $a^2 + b^2 = 30$, and $ab = 10$. When you substitute these known values into the equation, you get $y = 30 + 2(10)$. Solving for y, results in $y = 50$.
5. **C.** 8 pints make up a gallon, so a gallon contains 16 half-pints. One half-pint equals 1/16 of a gallon.
6. **(D).** First subtract the old cost from the new cost: \$2.80 – \$2.50 = \$0.30. Then divide the difference by the old cost to find the percent difference: \$0.30 ÷ \$2.50 = 0.12 = 12%.
7. **(C).** The aircraft travels 120 miles in 12 minutes, which is ⅕ of an hour. Therefore, in ⅝ (one) hour, it would travel 5 × 120, or 600 miles. The aircraft is traveling 600 miles per hour.
8. **(D).** Multiply 50 bushels by 8% to find the yield increase in bushels: 50 × 0.08 = 4. Add 4 bushels (the amount of the increase) to 50 bushels (the original yield) to determine that an 8% increase equals 54 bushels.
9. **(B).** Convert the change to dollars or fractions of dollars and add:

14 dollars	= \$14.00
16 half dollars	= \$8.00
12 quarters	= \$3.00
8 dimes	= \$0.80
25 nickels	= \$1.25
10 pennies	= \$0.10
	= \$27.15

   Subtract the total from \$30.00 to determine how much money Junior has to borrow: \$30.00 – \$27.15 = \$2.85.
10. **(B).** Her commission for the week was \$40 (0.05 × 800 = 40). The ratio of her commission to her salary is 40/80, which can be reduced to ½.
11. **(C).** A gallon consists of 4 quarts. 4 × 25 = 100.
12. **(D).** Dividing 4 crewmembers by 2 crewmembers shows that 4 members are twice as many as 2 members. Multiply the number of days it would take 4 people to paint by 2 (3 × 2) to determine how long it would take 2 people to do the same task.
13. **(A).** Brian's hourly wage is ⅘ (\$4.80). Christina's hourly wage is 10.95/3(\$3.65). \$4.80 – \$3.65 = \$1.15.
14. **(C).** The amount of time from 8:30 a.m. to 11:15 a.m. is 2 hours and 45 minutes, or 2 45/60. To reduce the fraction, divide 45 by 60 to get 0.75, or ¾. The total amount of time Margaret has to get ready is 2¾ hours.

15. **(C).** At a rate of 7 documents per minute, the employee can shred 630 documents in 90 minutes. How do you come up with that number? Multiply 7 by 90 (the number of minutes in 1½ hours). Subtract 630 from 900 total documents to determine that after 1½ hours of shredding, 270 documents remain.

16. **(A).** The stereo depreciates $240 the first year ($0.2 \times 1200 - 240$). Therefore, the value of the stereo after the first year is $1200 – $240 = $960. The second year the stereo would depreciate by $192 ($0.2 \times 960$). The value of the stereo after the second year is $960 – $192 = $768.

17. **(A).** Divide the distance (135 miles) by the speed (45 miles per hour) to determine that Janet will take 3 hours to reach the city.

18. **(D).** Multiply the price of the blouse by the amount of the discount: $\$18.50 \times 0.20 = \$3.70$.

19. **(C).** Subtract the original salary from the new salary to get the difference in salary: $360 – $320 = $40. Then divide the difference in salary ($40) by the original salary ($320) to determine the percent increase: $40 \div 320 = 0.125 = 12.5\%$.

20. **(B).** A circle is 360 degrees, so 40 degrees is ⅑ of a circle ($360 \div 40 = 9$). To get the answer of 40 feet, multiply the perimeter of the track ⅑ ($360 \times ⅑ = 40$).

21. **(B).** Subtract $35.98 from $40.00 to get $4.02.

22. **(B).** Subtract the speed of the plane from the speed of the balloon to determine how much longer it took the balloonist:

	13 days	12 hours	16 minutes	13 seconds
–	4 days	10 hours	15 minutes	7 seconds
	9 days	2 hours	1 minute	6 seconds

23. **(A).** Divide the total cost by the number of boxes purchased to determine the cost per box: $\$48 \div 12 = \$4$.

24. **(D).** Multiply 20×0.05 to determine how many more miles per gallon the car will get. The answer is 1. Then add the number of additional miles per gallon the car will get to the original number of miles per gallon the car gets to reach the new average: $1 + 20 = 21$.

25. **(A).** The minimum length of spike is equal to the diameter of the tree. To find the diameter of the tree, use the formula, $C = \div d$, where $C = 43.96$, and $\div = 3.14$. $43.96 = 3.14 \times d$. $d = 43.96 \div 3.14$. $d = 14$.

26. **(D).** Divide 10½ by ¾. You can perform this operation by multiplying 10 ½ by the inverse of ¾: $10½ \times ⅓ = ²½ \times ⅓ = ⁸⁄₆$. This fraction, reduced, becomes 14.

27. **(B).** First multiply length × width to determine the area of the patio: 12 feet × 14 feet = 168 square feet. Next determine the area in square inches that needs to be covered: 168 square feet × 12 inches = 2,016 square inches. Finally, divide that answer by the size of the stones to determine the number of stones needed: $2{,}016 \div 8 = 252$.

28. **(D).** Calculate the amount of the deduction by multiplying her salary by the percent deducted: $\$25{,}000 \times 28\% = \$25{,}000 \times 0.28 = \$7{,}000$. Subtract that product from the salary to determine the net pay: $25,000 – $7,000 = $18,000.

29. **(B).** When the sum of two angles is 180 degrees, the angles are said to be supplemental to each other. To find the supplement, subtract 55 from 180 ($180 – 55 = 125$).

30. **(C).** Multiply the height of the stack in feet by 12 to determine the height of the stack in inches: $6 \times 12 = 72$ inches. Divide that number by 4 inches, the thickness of each board to determine the number of pieces of lumber in the stack: $72 \div 4 = 18$.

Part 3: Word Knowledge Answers

If your score on the Word Knowledge subtest has improved since you took the first test, congratulations! If not, don't be too surprised. Improving your score on this subtest in a short period of time can be difficult. But it can be done. Review the information from Chapter 4 and set aside time each day (maybe several times a day, depending on how soon you plan on taking the ASVAB) to memorize words, roots, prefixes, and suffixes. Your score on the Word Knowledge subtest is important — it counts toward your AFQT score (see Chapter 1).



Vocabulary For Dummies by Laurie E. Rozakis (Wiley) and *SAT Vocabulary For Dummies* by Suzee Vlk (Wiley) may also help improve your vocabulary and increasing your score on this subtest. Chapter 6 has some additional practice questions for you to sink your dictionaries into.

1. **(B)**	8. **(B)**	15. **(B)**	22. **(C)**	29. **(B)**
2. **(A)**	9. **(D)**	16. **(D)**	23. **(C)**	30. **(A)**
3. **(B)**	10. **(C)**	17. **(B)**	24. **(A)**	31. **(B)**
4. **(C)**	11. **(B)**	18. **(C)**	25. **(D)**	32. **(C)**
5. **(A)**	12. **(B)**	19. **(B)**	26. **(B)**	33. **(A)**
6. **(B)**	13. **(A)**	20. **(A)**	27. **(B)**	34. **(B)**
7. **(A)**	14. **(B)**	21. **(D)**	28. **(D)**	35. **(C)**

Part 4: Paragraph Comprehension Answers

Doing well on this subtest is really important if you want to enlist in the military — your Paragraph Comprehension score counts toward your AFQT score. If you're still missing more answers than you should, concentrate on improving your analytical-reading skills as you prepare to take the third practice exam. (Review the information in Chapter 5, too.) For example, when you're reading the evening newspaper, ask yourself what the main point of an article is. Or, when you finish a news story, set the paper down and try to remember what the President said about the budget deficit. Think of this technique as a workout for your mind. You can find more practice questions in Chapter 6.

1. **(C).** Nothing escapes from a black hole, including light, so Choice (A) is incorrect. A black hole occurs when a supernova collapses, but they're not the same thing, so Choice (B) is incorrect. The passage states that the universe might end as a black hole, not that a black hole created the universe, so Choice (D) is incorrect.
2. **(C).** The passage makes no reference about the enforceability of customs and courtesies, so Choice (A) would be incorrect. According to the passage, military customs and courtesies go beyond basic politeness, making Choice (B) incorrect. Choice (D) is incorrect because the passage doesn't reference any individual military service. The last sentence of the passage contains the correct answer.
3. **(B).** The passage states that Panama revolted against Columbia, not that they fought over the canal, so Choice (A) is incorrect. The passage states that the foreign companies were unsuccessful in building the canal, so Choice (C) is incorrect. The United States, not Panama, built the canal, so Choice (D) is wrong.

4. **(D).** According to the passage a torn U.S. Flag can be professionally mended, but a severely torn flag should be destroyed. The preferred method of destruction is by burning.
5. **(D).** The passage states that guilds had economic and social purposes, so Choice (A) is incorrect. The passage states that guilds were similar to labor unions, so Choice (B) is incorrect. The passage states that guilds protected merchants and craftspeople; it says nothing about exploiting workers, so Choice (C) is incorrect.
6. **(D).** According to the passage it took over four years for the Government to believe that anyone had flown a heavier-than-air craft. The historic flight was in December 1903, and the Wright Brothers delivered the first aircraft to the government in August 1908, 4½ years later. All of the other statements are supported by the passage.
7. **(C).** Because the U.S. Constitution prohibits these kinds of laws, Choice (A) is incorrect. The passage doesn't support Choice (B). The passage states that the British Commonwealth allows ex-post-facto laws, so Choice (D) is incorrect.
8. **(A).** The passage describes how troy and common weights are different, so Choice (B) is incorrect. Common and avoirdupois are the same system, so Choice (C) is incorrect. A troy ounce is larger than a common ounce, so Choice (D) is incorrect.
9. **(B).** The passage doesn't address leading by example or use of technology by workers, so Choices (A) and (C) would be incorrect. Maximizing worker performance is a result of leadership involvement, not a principle of leadership, making Choice (D) incorrect. The correct answer is found in the third sentence of the passage.
10. **(C).** The passage doesn't support Choices (A) or (B). The passage states that white blood cells are found in blood and bone marrow, so Choice (D) is wrong.
11. **(C).** High intensity conflict is listed as a type of military operation, not one of the four operational concepts.
12. **(C).** The JV 2020 guides all of the military services with its vision of future war fighting. While Choice (D) would be close, the passage doesn't specifically reference military training.
13. **(B).** Cytogenetics is the study of the cellular basis of inheritance; the text doesn't support Choices (A), (C), or (D).
14. **(A).** Nothing in the passage supports Choices (B) or (D). Although human genetics is an important subfield of genetics, nothing in the passage suggests that it's the only concern of geneticists. Microbial genetics, as mentioned in the passage, is a subfield in genetics that has nothing to do with humans, so Choice (C) is incorrect.
15. **(C).** Nothing in the passage supports Choices (A), (B), or (D).

Part 5: Mathematics Knowledge Answers

While the Military doesn't expect you to be the next Einstein, a solid grasp of mathematics is important because math skills make up one-half of your AFQT score. If you're still struggling on this subtest, it's time to hit the books. (Actually, as much as you may feel like it, we don't recommend that you actually *hit* the books — just study them.)



Some excellent books on the subject include *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch (all books published by Wiley). See Chapter 9 for some more fun practice questions.

1. **(A).** If two exponents have the same base, you can multiply them by keeping the base and adding the exponents together.

2. **(A).** To find area, multiply length times width (A = *lw*). To determine the length, subtract two times the width from the perimeter: 36 – 2(4) = 36 – 8 = 28. Then divide the remainder by 2 to determine the length of one side: 28 ÷ 2 = 14. Then multiply length times width to determine the area: 14 × 4 = 56.
3. **(D).** The cube of 4 = 4 × 4 × 4 = 64, so 4 is the cube root of 64.
4. **(A).** To convert this number to scientific notation, move the decimal point to the left until it's to the immediate right of the first number, while counting the number of moves. In this case, you move it 5 places. The result is then multiplied by 10, raised to the power of the number of places the decimal point was moved.
5. **(C).** A reciprocal is the number by which a number can be multiplied to produce 1. So the reciprocal of ⅙ is 6 because ⅙ × 6 = 1.
6. **(A).** Multiply both sides of the equation by 0.05 to isolate *x*: 0.05 ÷ *x* × 0.05 = 1 × 0.05 or *x* = 0.05. Check by substituting 0.05 for *x* in the original equation.
7. **(C).** $x^2 - 6x + 9 = (x - 3)(x - 3) = (x - 3)^2$
8. **(C).** Solve the left side of the equation first. (6) (5) (8) = 240. Therefore, 240 = (6 × 4)*x,* which equals 240 = 24*x.* Now isolate *x* by dividing both sides of the equation by 24: 240 ÷ 24 = 24*x* ÷ 24 or 10 = *x.* Check your answer by substituting 10 for *x* in the original equation.
9. **(B).** Isolate *x* on one side of the equation:

   $2x - 6 = x + 5$

   $2x - 6 - x = x + 5 - x$

   $x - 6 = 5$

   $x - 6 + 6 = 5 + 6$

   $x = 11$

   Check by substituting 11 for *x* in the original equation.
10. **(D).** Solve for I. I = (1,000) (7%) (1) or I = (1,000) (0.07) (1) = 70.
11. **(B).** $(x - 7)^2 - 4 = (x + 1)^2$

    $(x - 7)(x - 7) - 4 = (x + 1)(x + 1)$

    $x^2 - 7x - 7x + 49 - 4 = x^2 + x + x + 1$

    $x^2 - 14x + 45 = x^2 + 2x + 1$

    $-14x + 45 = 2x + 1$

    $-14x + 45 = 1$

    $-16x = -44$

    $x = -44/-16$

    $x = 11/4$

    $x = 2\frac{3}{4}$
12. **(A).** The area of a circle is A = πr^2. A = $\pi 5^2$. π is approximately 3.14, so 3.14 × 25 means A is approximately 78.5 inches.
13. **(C).** $\frac{2}{3}(6x - 9) + 4 > 5x + 1$

    $4x - 6 + 4 > 5x + 1$

    $4x - 2 > 5x + 1$

    $4x > 5x + 3$

    $-x > 3$

    $x < -3$

14. **(B).** For cylinders, Volume = $\pi r^2(h)$. In this problem, V = $\pi(3^2)(5)$. Assume π is approximately 3.14. V is approximately equal to (3.14)(9)(5) or 141 cubic inches.

15. **(A).** A right triangle has one right angle (one 90-degree angle).

16. **(D).** Parallelograms have opposite sides of equal length.

17. **(D).** Angles measuring more than 90 degrees are obtuse angles.

18. **(B).** This is a quadratic equation, which is solved by factoring.

$-x^2 - x + 30 = 0$

$-(-x^2 - x + 30) = 0$

$x^2 + x - 30 = 0$

$(x + 6)(x - 5) = 0$

$x + 6 = 0 \qquad x - 5 = 0$

$x = -6 \qquad x = 5$

19. **(B).** Volume equals length times width times height (V = *lwh*). In this case, V = 64, so one side of the box is 4-inches long. The cube root of 64 produces this number: $64 = 4 \times 4 \times 4$. Find the perimeter by adding the four sides together: 4 + 4 + 4 + 4 = 16.

20. **(C).** Volume is calculated by multiplying length times width times height (*V* = *lwh*). Because the edges are equal on a cube, each edge is 4 inches. The cube root of 64 produces this number: $64 = 4 \times 4 \times 4$. The area of one side of the cube is $4 \times 4 = 16$, and because a cube has 6 sides, you multiply 16×6 to find the surface area of the cube, 96 inches.

21. **(C).** $(x^3)^3$ is the same as $(x^3)(x^3)(x^3)$. Multiply exponents with the same base by keeping the base and adding the exponents: $(x^3)(x^3)(x^3) = x^9$.

22. **(D).** 4! (4 factorial) = $4 \times 3 \times 2 \times 1 = 24$.

23. **(B).** To solve, subtract a^3 from both sides of the equation:

$a^3 + b^3 - a^3 = a^3 + x^3 - a^3$

$b^3 = x^3$

$b = x$

24. **(B).** The formula to find the sum of a finite arithmetic sequence is S = $n/2(a + b)$, where *n* is the number of terms, *a* is the first term in the sequence, and *b* is the last term in the sequence. In this case there are 300 terms (*n*), and the first term is 1 and the final term is 300.

S = $n/2(a + b)$

S = 300/2(1 + 300)

S = 150(301)

S = 45,150

$x + 3$

$x^2 + 3x$

$+ \qquad \underline{3x + 9}$

$x^2 + 6x + 9$

25. **(B).** $(y^2)^3$ is the same as $(y^2)(y^2)(y^2)$. Multiply exponents with the same base by keeping the base and adding the exponents: $(y^2)(y^2)(y^2) = y^6$.

Part 6: Electronics Information Answers

If you're still having difficulty defining the difference between AC and DC, you may want to spend some additional time studying basic electronic information. On the other hand, you may not be interested in a military job that requires a decent score on this subtest (see the Appendix), in which case, don't bother.



If you do need a solid score in this area for your military dream job, *Electronics For Dummies* by Gordon McComb (Wiley) can have you tracing circuits in no time. Reviewing Chapter 13 can also help. You can also wrap your wires around the practice questions in Chapter 15.

1. **(A).** Larger wires require less electrical pressure to run current.
2. **(A).** Rotor bars are found only on AC induction motors.
3. **(D).** The ability of current to contract muscles is called the physiological effect.
4. **(A).** In a closed circuit, one terminal is always positive, and the other is always negative.
5. **(A).** Root Mean Square is the peak value of voltage multiplied by 0.707 (sine 45)
6. **(B).** The symbol is a *fuse.* Fuses are designed to "blow" (melt) if the current flowing through it exceeds a specified value.
7. **(B).** NTSC stands for National Television Standards Committee. The system is also used in Japan. PAL and SECAM are used in other countries.
8. **(A).** The symbol is a *lamp.* A lamp is a transducer that converts electrical energy to light.
9. **(C).** Conventional circuit breaker handles have four positions: on, off, trip, and reset. When tripped, the handle moves to the middle position.
10. **(D).** The smaller the wire, the larger the number.
11. **(C).** The symbol stands for *transformer.* Transformers are used to step up (increase) and step down (decrease) AC voltages.
12. **(A).** An example of a series circuit would be a string of Christmas lights. If you break the circuit's path at any point, electricity will stop flowing and the lights will not work.
13. **(B).** I (current) = Power (watts)/Effort (volts). In this case, I = 1200/120 = 10 amperes.
14. **(D).** *Potential* equals voltage; *low potential* is anything less than 600 watts.
15. **(D).** Glass is an insulator. Other insulators are plastics, paper, and rubber.
16. **(A).** Ground wires are always green.
17. **(D).** Ohm's law states that V = IR. V = 10 × 20 = 200.
18. **(A).** Silver is a better conductor, but it's prohibitively expensive.
19. **(D).** Oscillators produce high-frequency AC.
20. **(B).** When DC is applied to an AC appliance, the amount of resistance is less, so more current flows through the wire and heat builds up.

Part 7: Auto & Shop Information Answers

Don't forget that you need to do well on this subtest to qualify for certain military jobs (see the Appendix). If you don't care about those jobs, you don't need to care about this subtest. But, if you do care about those jobs, and you're still missing more than a few questions on this subtest, it's time for more extreme measures — like taking your mother's car apart and putting it back together (or going back over Chapter 11).



Auto Repair For Dummies by Deanna Sclar (Wiley) may help steer you in the right direction. Get it? *Steer* you . . . (Gads, we're so funny!) For a good review of tools and their uses, you may want to check out *Home Improvement All-in-One For Dummies* by Roy Barnhart, James Carey, Morris Carey, Gene Hamilton, Katie Hamilton, Donald R. Prestly, and Jeff Strong (Wiley). Drive back to Chapter 15 for more practice questions. (We've got to stop this. We're killing ourselves here.)

1. **(D)**	6. **(D)**	11. **(A)**	16. **(C)**	21. **(A)**
2. **(C)**	7. **(B)**	12. **(D)**	17. **(D)**	22. **(D)**
3. **(B)**	8. **(D)**	13. **(C)**	18. **(B)**	23. **(B)**
4. **(A)**	9. **(D)**	14. **(C)**	19. **(B)**	24. **(D)**
5. **(C)**	10. **(B)**	15. **(A)**	20. **(C)**	25. **(B)**

Part 8: Mechanical Comprehension Answers

If you need to do well on the Mechanical Comprehension subtest (as in you're hoping for a military career that requires a score for this subtest), but you're still missing more answers than you should be, ask yourself whether your math skills need work. (Go back to Chapters 7 and 8 if they do.) Many of the formulas you need to know for this subtest require an understanding of arithmetic and basic algebra.



Usually, improving your arithmetic and basic-algebra skills will improve your score on this subtest. Improving your knowledge of physics will also be beneficial, and *Physics For Dummies* by Steve Holzner, Ph.D. (Wiley) can help with this. Also take another gander at Chapter 12 and the practice questions in Chapter 15.

1. **(C).** A simple pulley gives no mechanical advantage, although it does make work easier by spreading out the work needed over several tries. So the mechanical advantage is 1.
2. **(D).** Moving Basket A to the right counterbalances the loss of cherries from Basket B.
3. **(A).** Wheel B has to make more revolutions to cover the same ground as Wheel A, so it will cover the distance more slowly.
4. **(C).** You can calculate psi as Pressure = Force/Area. So, in this problem, P = 200/10 = 20.
5. **(B).** If Cat A moves toward the center, Cat B will move toward the ground.
6. **(B).** The formula to determine mechanical advantage of an incline plane is Length of Ramp ÷ Height of Ramp = Weight of Object ÷ Effort. Plugging in the numbers gives you:

   6/3 = 200/E

   6E = 600

   E = 100
7. **(C).** Micrometers measure very small but not microscopic objects.
8. **(C).** Reducing the weight on Side B (by removing the cat) will cause Side A to move toward the ground.
9. **(D).** Objects rubbing together produce friction.
10. **(A).** "Normal" atmospheric pressure is 14.7 psi.
11. **(D).** Gears of unequal size can mesh properly as long as their teeth are of equal size.

12. **(C).** Torsion springs coil or uncoil and produce a twisting action, not a direct pull.
13. **(B).** To move a heavy object a few feet in height, the incline plane is the most efficient device (of those listed) to use.
14. **(B).** Water expands when it freezes, possibly damaging engine components.
15. **(A).** The load is closer to Cat A, so he's carrying the greater portion of the weight.
16. **(C).** All the listed parts remain stationary except the lower block.
17. **(A).** Apply the leverage formula: Length of Effort Arm divided by Length of Resistance Arm = Resistance Force divided by Effort Force. Or:

    $9 \div 3 = 21 \div E$ (effort force)

    $3 = 21 \div E$

    $3E = 21 \div E \times E$

    $3E = 21$

    $3E \div 3 = 21 \div 3$

    $E = 7$
18. **(C).** The valve will open each time a high point of the cam hits it. The cam has three high points, so the valve will open three times per revolution.
19. **(A).** Closing only Valves 3 and 4 keeps the water from leaving the tank.
20. **(C).** Gears in mesh always turn in opposite directions.
21. **(B).** If Gear 1 turns at 10 rpm, then Gear 2, which is half the size, turns twice as fast at a rate of 20 rpm.
22. **(A).** Opening Valves 1, 2, 4, and 8 allows the fuel to travel through the filters. Opening Valves 1, 2, and 3 doesn't allow the fuel to travel through the filters. Opening Valves 6, 7, and 9 doesn't allow the fuel to travel through the filters. Opening Valves 4, 6, and 7 will allow fuel to travel through the filters but not to Reservoir B.
23. **(B).** A yellow flame indicates too much fuel or not enough air. More air should be allowed to enter and mix with the gas. Thus, the fuel-air mixture is too rich.
24. **(A).** The float measures the water level in the tank. If the tank overflows, the float is probably defective.
25. **(C).** The 20-pound cat and the 4-pound board weigh 24 pounds total or, divided by 2, 12 pounds per scale.

Part 9: Assembling Objects Answers

If you're planning on joining the navy, and you're interested in a navy career that requires a score on this subtest (see the Appendix), you need to review Chapter 14. So far, only the navy has elected to use scores from this subtest and only for a few navy jobs. For additional practice questions see Chapter 15.

1. **(B)**	5. **(C)**	9. **(C)**	13. **(A)**
2. **(A)**	6. **(A)**	10. **(D)**	14. **(B)**
3. **(C)**	7. **(B)**	11. **(C)**	15. **(D)**
4. **(D)**	8. **(C)**	12. **(B)**	16. **(D)**

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Part 3

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Part 5

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Chapter 20

Practice Exam 3

Take the third practice exam a few days before you're scheduled to take the real ASVAB. Use it to refresh your memory of the material or to cram for any of the subtests that you have to do better on than you've been doing.



Don't forget to use the test-taking strategies and the guessing tips in each of the subtest chapters. And Chapter 3 provides additional information on how to improve your score just by using smart test-taking strategies.

This sample test features nine subtests and follows the same format as the actual ASVAB. To get the most out of this sample test, take it like you'd take the real ASVAB under the same conditions:

1. **Allow yourself about three hours to take the entire exam, and take the whole thing at one time.**
2. **Find a quiet place where you won't be interrupted.**
3. **Bring a timer that you can set for various lengths of time, some scratch paper, and a pencil.**
4. **At the start of each subtest, set your timer for the specified period of time.**

   Don't go on to the next section until the timer has gone off, and don't go back to a previous section. If you finish early, check your work for that section only.
5. **Use the answer sheet that's provided.**
6. **Don't take a break during any subtest.**

   You can take a short one- or two-minute break between subtests if you need it.

After you complete the entire test, check your answers against the answer key in Chapter 21. Then compare the results to your results on Practice Exams 1 and 2. You should see some improvements.

Part 1

General Science

Time: 11 minutes; 25 Questions

Directions

This test challenges your knowledge of general science principles usually covered in high-school classes. Pick the best answer for each question and then mark the space on your answer sheet that corresponds to the question number and the letter indicating your choice.

1. The moon completes a revolution around the earth approximately every:
   (A) 28 days
   (B) 365 days
   (C) 24 hours
   (D) 7 days

2. Carcinogens are chemicals that cause:
   (A) high blood pressure
   (B) gene mutations
   (C) blood clots
   (D) diabetes

3. A paramecium is:
   (A) a one-celled organism
   (B) algae
   (C) bacteria
   (D) a many-celled organism

4. What large halogen is essential for the function of the thyroid gland?
   (A) potassium chloride (salt)
   (B) hemoglobin
   (C) calcium
   (D) iodine

5. The brainstem controls:
   (A) vision
   (B) most muscle movements
   (C) your sense of balance
   (D) some involuntary activities

6. What element is the most abundant one in the atmosphere?
   (A) oxygen
   (B) nitrogen
   (C) helium
   (D) hydrogen

7. Minerals are necessary for:
   (A) respiration
   (B) eliminating waste
   (C) preventing night blindness
   (D) metabolic function

8. What's the only metallic element commonly found as a liquid?
   (A) bromine
   (B) tellurium
   (C) mercury
   (D) silver

9. Which of the following isn't a type of telescope?
   (A) Newtonian
   (B) Copernican
   (C) Gregorian
   (D) Hershelian

10. A dekagram:
    (A) is larger than a kilogram
    (B) is smaller than a kilogram
    (C) is the same as a kilogram
    (D) doesn't exist

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11. The Aurora Borealis can be seen only in the:
    (A) winter
    (B) summer
    (C) Southern Hemisphere
    (D) Northern Hemisphere

12. The three important properties of sound waves are:
    (A) wavelength, speed, and crest
    (B) speed, frequency, and reflection
    (C) wavelength, frequency, and vibration
    (D) wavelength, frequency, and speed

13. Between what two planets can most of the asteroids in the solar system be found?
    (A) Mars and Jupiter
    (B) Saturn and Jupiter
    (C) Earth and Mars
    (D) Mercury and Venus

14. At room temperature, an element is a:
    (A) gas
    (B) liquid or gas
    (C) gas or solid
    (D) liquid, gas, or solid

15. The elements hydrogen and helium comprise what percentage of almost all matter in the Universe?
    (A) 75 percent
    (B) 82 percent
    (C) 90 percent
    (D) 98 percent

16. Compounds are created when:
    (A) atoms of two or more like elements are combined
    (B) atoms of two or more different elements are combined
    (C) two or more compounds are combined
    (D) a compound decomposes

17. What theory suggests the Universe will come to an end when its ever-increasing rate of expansion causes all matter to fly apart?
    (A) The Big Rip
    (B) The Big Bang
    (C) The Big Crunch
    (D) The Big Easy

18. A watt measures:
    (A) how much electricity is consumed
    (B) the number of electrons moving past a specific point
    (C) resistance
    (D) voltage

19. Which of the following planets, known as *gas giants* have no rings?
    (A) Neptune
    (B) Jupiter
    (C) Uranus
    (D) they all have rings

20. Gas particles move:
    (A) more slowly than liquid particles
    (B) more slowly than solid particles
    (C) more quickly than liquid particles
    (D) at the same rate as all other particles

21. Absolute zero is:
    (A) 0 degrees Fahrenheit
    (B) 0 degrees Celsius
    (C) –263 degrees Celsius
    (D) –32 degrees Fahrenheit

22. What does the term *forensic* mean?
    (A) pertaining to law
    (B) pertaining to death
    (C) pertaining to medicine
    (D) pertaining to life

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23. Which of the following statements is <u>not</u> true?

(A) The human female chin is usually more rounded or pointed than the human male chin.

(B) The human female pelvis is usually deeper than the human male pelvis.

(C) The human male skull is usually larger than the human female skull.

(D) The human male skull has a larger brow ridge than the human female skull.

24. A lunar eclipse occurs when:

(A) the earth moves into the moon's shadow

(B) the sun blocks the moon from view

(C) the earth moves into the sun's shadow

(D) the moon moves into the earth's shadow

25. What chemical can be used to detect blood, even if it's been wiped from a surface?

(A) luminol

(B) cyanide

(C) ninhydrin

(D) alcohol



DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

Part 2

Arithmetic Reasoning

Time: 36 minutes; 30 questions

Directions

This test is about arithmetic. Each question is followed by four possible answers. Decide which answer is correct and then mark the space on your answer sheet that has the same number and letter as your choice. Use scratch paper for any figuring you need to do.

1. A baker sells a dozen donuts for $3.99. The cost to make three donuts is $0.45. How much is the total profit on 5-dozen donuts?
   (A) $17.70
   (B) $13.20
   (C) $2.19
   (D) $10.95

2. Your piggy bank contains $19.75 in dimes and quarters. There are 100 coins in all. How many dimes are there?
   (A) 25
   (B) 30
   (C) 35
   (D) 40

3. A bricklayer charges $8 per square foot to lay a patio. How much would it cost for the bricklayer to lay a 12-foot-x-16-foot patio?
   (A) $960
   (B) $192
   (C) $224
   (D) $1,536

4. Terry earns three times more per hour than Tim. Tim earns $2 more per hour than Angie. As a group they earn $43 per hour. What's Angie's hourly wage?
   (A) $7.00
   (B) $8.00
   (C) $9.00
   (D) $10.00

5. If 4 people can run 8 machines, how many machines can 2 people run?
   (A) 2
   (B) 4
   (C) 1
   (D) 3

6. The price of daily admission at an amusement park is $36. The park sells an unlimited season pass for $240. How many trips would you need to make with the season ticket in order for it to cost less than paying the daily admission rate?
   (A) 6
   (B) 7
   (C) 8
   (D) 9

7. A plumber needs four lengths of pipe, each 3-feet, 6-inches long. Pipes are sold by the foot. How many feet does he need to buy?
   (A) 15
   (B) 16
   (C) 14
   (D) 12

8. The product of two consecutive odd numbers is 399. What are the numbers?
   (A) 17 and 19
   (B) 19 and 21
   (C) 21 and 23
   (D) 25 and 27

Go on to next page

9. A personal trainer earns a 65% commission on her training sales. If she sells $530.00 worth of training, how much commission does she make?

   (A) $874.50
   (B) $34.45
   (C) $344.50
   (D) $185.50

10. A rectangle is one inch longer than it is wide. Its diameter is five inches. What's the width of the rectangle?

    (A) 2 inches
    (B) 3 inches
    (C) 4 inches
    (D) 5 inches

11. A treasure map is drawn to a scale of 2 inches = 3 miles. On the map, the distance between Point A and X-marks-the-spot is 9½ inches. How many actual miles does this represent?

    (A) 28½ miles
    (B) 14¼ miles
    (C) 6⅓ miles
    (D) 19 miles

12. A painter has painted a picture on a piece of canvas that measures 10 x 14 inches. In order to accommodate a frame, he has left an un-painted margin of 1 inch all the way around. What part of the canvas has been painted?

    (A) 80%
    (B) 75%
    (C) 25%
    (D) 66%

13. A dog trainer is building a dog run that measures 9 x 16 feet. If she wants to fence the perimeter of the run, how many feet of chain link fence will she need?

    (A) 144 feet
    (B) 25 feet
    (C) 32 feet
    (D) 50 feet

14. A rectangle is 1½ times as long as it is wide. The perimeter of the rectangle is 100 inches. What's the length of the rectangle?

    (A) 20 inches
    (B) 30 inches
    (C) 40 inches
    (D) 45 inches

15. Miguel passed seven of his history-class quizzes and failed three. The fraction of quizzes he passed is correctly expressed as:

    (A) ⅓
    (B) ³⁄₇
    (C) ⁷⁄₁₀
    (D) ⅗

16. A 3-yard-long ribbon was used to trim four dresses. Each dress used the same amount of ribbon. How much ribbon was used for each dress?

    (A) 1 yard
    (B) ⅔ yard
    (C) ½ yard
    (D) ¾ yard

17. Sarah found a wallet containing $500 in the street. She returned the wallet to its owner, who gave her a $30 reward. What percentage of the $500 was the reward?

    (A) 5%
    (B) 6%
    (C) 7%
    (D) 4%

18. A bin of bolts at the hardware store contains 7-dozen bolts when full. The stock clerk is supposed to reorder bolts when the bin is ⅛ full. How many bolts are in the bin when it's time to reorder?

    (A) 14 bolts
    (B) 1 bolt
    (C) 84 bolts
    (D) 12 bolts

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19. Two bicyclists head toward each other from the opposite ends of Main Street, which is six miles long. The first biker started at 2:05 going 12 mph. The second biker began peddling 4 minutes later at a rate of 14 mph. What time will they meet?

(A) 2:13

(B) 2:24

(C) 2:29

(D) 2:34

20. A recipe calls for 8 ounces of black beans or red beans. The cheapest option to buy and use would be:

(A) two 4-ounce cans of black beans at $0.79 each

(B) one 8-ounce can of red beans at $1.49

(C) two 3-ounce cans of black beans at $0.59 each

(D) three 3-ounce cans of red beans at $0.65 each

21. A street vendor sells $25.70 worth of pretzels on Friday, $32.30 on Saturday, and $31.80 on Sunday. He spends a fourth of the money over the weekend. How much money does he have left?

(A) $89.80

(B) $22.45

(C) $44.90

(D) $67.35

22. A recruit has $30.00. He saw some camouflage socks for $3.95 a pair. How many pairs of socks can he buy?

(A) 9

(B) 7

(C) 6

(D) 4

23. A crate containing a puppy weighs 60 pounds, 5 ounces. The puppy weighs 43 pounds, 7 ounces. How much does the crate alone weigh?

(A) 16 pounds, 8 ounces

(B) 16 pounds, 2 ounces

(C) 17 pounds

(D) 16 pounds, 14 ounces

24. In a manufacturing plant that produces new computers, a 0.15 probability exists that a computer will be defective. If five computers are manufactured, what's the probability that all of them will be defective?

(A) 7.6

(B) 0.60

(C) 0.00042

(D) 0.000076

25. A house contains one 12-foot-x-14-foot bedroom, one 12-foot-x-10-foot bedroom, and one 8-foot-x-12-foot bedroom. What's the total amount of carpeting needed to carpet all three bedrooms?

(A) 384 square yards

(B) 128 square yards

(C) 216 square yards

(D) 88 square yards

26. Rafael can type 9 pages an hour. How long will it take him to type 126 pages?

(A) 14 hours

(B) 9 hours

(C) 7 hours

(D) 16 hours

27. In a 60-minute gym class, 40 girls want to play volleyball, but only 10 can play at a time. For each player to get the same amount of playing time, how many minutes should each person play?

(A) 1½ minutes

(B) 6 minutes

(C) 30 minutes

(D) 15 minutes

28. The video-rental store charges $2.00 for the first day a rented video is overdue and $1.25 for each day after that. If a person paid $8.25 in late fees, how many days was the video overdue?

(A) 7 days

(B) 6 days

(C) 4 days

(D) 5 days

Go on to next page

29. Janet is trying to watch her weight. A ½ cup of pudding has 150 calories. The same amount of broccoli has 60 calories. How much broccoli can Janet eat to equal the same number of calories in the ½ cup of pudding?

(A) 2 cups

(B) 2½ cups

(C) 1½ cups

(D) 1¼ cups

30. The neighbor's dog barks at a squirrel every 15 minutes at night. If he first barks at 10 p.m., when you're trying to fall asleep, how many times will he bark by 2 a.m., when you give up trying to sleep and decide to read a book instead?

(A) 16 times

(B) 132 times

(C) 17 times

(D) 15 times



Part 3

Word Knowledge

Time: 11 minutes; 35 questions

Directions

This test is about the meanings of words. Each question has an underlined word. You may be asked to decide which one of the four words in the choices *most nearly means* the same thing as the underlined word or which one of the four words means the opposite. If the underlined word is used in a sentence, decide which of the four choices most nearly means the same thing as the underlined word as used in the context of the sentence. Mark the corresponding space on your answer sheet.

1. Lackadaisical most nearly means:
   (A) lazy
   (B) listless
   (C) promiscuous
   (D) suitable

2. The fruit was edible.
   (A) wax
   (B) expensive
   (C) foreign
   (D) digestible

3. Universities and colleges should be designed to cater to the philomath.
   (A) students
   (B) scholars
   (C) teachers
   (D) faculty

4. Pretense most nearly means:
   (A) polite
   (B) dishonesty
   (C) stress
   (D) appearance

5. At an early age Jane showed a proclivity for music and dancing.
   (A) predisposition
   (B) interest
   (C) dislike
   (D) fever

6. Her conversation was incoherent.
   (A) eloquent
   (B) succinct
   (C) unintelligible
   (D) amusing

7. The week following Joe DiMaggio's death was filled with often mawkish eulogies.
   (A) long
   (B) sentimental
   (C) boring
   (D) detailed

8. She established proof.
   (A) offered
   (B) invented
   (C) demanded
   (D) demonstrated

9. Ephemeral most nearly means:
   (A) short-lived
   (B) mythical
   (C) dead
   (D) exceptional

10. Avocation most nearly means:
    (A) hobby
    (B) occupation
    (C) vacation
    (D) education

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11. Kvetch most nearly means:
    (A) assert
    (B) yell
    (C) complain
    (D) argue

12. Her eyesight was acute.
    (A) sharp
    (B) poor
    (C) unusual
    (D) tested

13. Inamorata most nearly means:
    (A) boyfriend
    (B) mistress
    (C) best friend
    (D) acquaintance

14. Her thoughts on the matter were inconsequential.
    (A) profound
    (B) disturbing
    (C) irrelevant
    (D) confused

15. Debouch most nearly means:
    (A) emerge
    (B) fight
    (C) relax
    (D) capture

16. He was an amateur astronomer.
    (A) veteran
    (B) novice
    (C) interested
    (D) pleased

17. She had no idea how to react to her ludic boyfriend.
    (A) playful
    (B) cheating
    (C) crazy
    (D) lazy

18. The rose was crimson.
    (A) blooming
    (B) colorful
    (C) fragrant
    (D) red

19. The word *most opposite* in meaning to benison is:
    (A) theft
    (B) replaceable
    (C) curse
    (D) heavy

20. She was exempt from gym class.
    (A) banned
    (B) excused
    (C) tired
    (D) refreshed

21. The eldritch light of the desert can play tricks on your eyes.
    (A) bright
    (B) wavering
    (C) strange
    (D) yellow

22. Defective most nearly means:
    (A) flawed
    (B) noticeable
    (C) rare
    (D) durable

23. Allot most nearly means:
    (A) plow
    (B) assign
    (C) property
    (D) test

24. The doctor gave the patient a cursory examination.
    (A) in-depth
    (B) painful
    (C) unnecessary
    (D) superficial

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25. Arcanum most nearly means:
(A) rare
(B) secret
(C) tangible
(D) false

26. Her answer was terse.
(A) defensive
(B) angry
(C) lengthy
(D) brief

27. The dulcet songs of the band got the attention of the audience.
(A) harmonious
(B) love
(C) jazzy
(D) loud

28. He was arrested on a misdemeanor charge.
(A) theft
(B) serious
(C) petty crime
(D) bogus

29. Embonpoint most nearly means:
(A) plump
(B) tall
(C) fast
(D) cold

30. He concocted a story about me.
(A) told
(B) rehearsed
(C) invented
(D) remembered

31. He spent his days searching fruitlessly for that chimera, his true self.
(A) personality
(B) enigma
(C) talent
(D) monster

32. Her former home was in Colorado.
(A) previous
(B) current
(C) second
(D) abandoned

33. Mulct most nearly means:
(A) complain
(B) play
(C) work
(D) defraud

34. My voice is strident.
(A) soft
(B) melodious
(C) harsh
(D) baritone

35. Raffish most nearly means:
(A) clean
(B) serene
(C) tawdry
(D) expensive



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DO NOT RETURN TO A PREVIOUS TEST.

Part 4

Paragraph Comprehension

Time: 13 minutes; 15 questions

Directions

This test measures your ability to understand what you read. This section includes one or more paragraphs of reading material followed by incomplete statements or questions. Read the paragraph and select the choice that best completes the statement or answers the question. Mark your choice on your answer sheet by using the correct letter with each question number.

1. Because leadership is charged with bringing new ideas, methods, or solutions into use, innovation is inextricably connected with the process of being an effective leader. Innovation means change, and change requires leadership. Leaders must be the chief transformation officers in their organizations and learn everything there is to know about the change before it even takes place. Furthermore, they must learn how to deal with the emotions that result from the chaos and fear associated with change.

   According to the passage:

   (A) Leaders should resist making changes that subordinates are likely to resist.

   (B) Innovation and change are distinctly different processes.

   (C) It's not necessary for the leader to know everything about a change before it's implemented.

   (D) Change is often associated with panic and disorder.

2. Cougars are the most wide-ranging big cats in North America, inhabiting a wide variety of environments. A cougar, also called a puma or a mountain lion, lives about 18 years in the wild, can jump 20 feet (in distance) at a time, and can range 50 miles when on the prowl for food.

   According to this passage:

   (A) A cougar isn't the same thing as a mountain lion.

   (B) Cougars are an endangered species.

   (C) Cougars live in many areas of North America.

   (D) Cougars live only a few years in the wild.

3. A helping relationship refers to interactions in which the counselor makes a determined effort to contribute in a positive way to the counselee's improvement. In counseling, the counselor establishes a helping relationship by drawing on practices that help the counselee live more in harmony with himself or herself and others and with a greater self-understanding. The relationship develops because the counselee needs assistance, instruction, or understanding.

   Which of the following statements <u>is not</u> supported by the passage?

   (A) Successful counseling requires developing a relationship.

   (B) Most counselees initially reject advice given by the counselor.

   (C) Counseling helps a counselee develop a greater understanding of him/herself.

   (D) Counseling relationships are developed by relying on helpful practices.

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4. Many small cities and towns rely on volunteer fire departments to put out fires. A professional fire department, however, has more training, more expertise, and more experience in fighting fires and investigating their causes. In many cases, it's worthwhile for even very small towns to hire professional firefighters.

   According to this passage, it's reasonable to assume that:

   (A) Volunteer firefighters have less training, expertise, and experience than professional firefighters.

   (B) Volunteer firefighters have the skills and resources to investigate the causes of fires.

   (C) Professional firefighters don't know what causes fires.

   (D) A professional fire department is cost prohibitive for small towns.

5. The idea being an alarming one, he scrambled out of bed and groped his way to the window. He was obliged to rub the frost off with the sleeve of his dressing-gown before he could see anything and could see very little then. All he could make out was that it was still very foggy and extremely cold and that there was no noise of people running to and fro and making a great stir, as there unquestionably would've been if night had beaten off bright day, and taken possession of the world.

   This story takes place:

   (A) in England

   (B) on a calm summer evening

   (C) on a winter night

   (D) both A and C

6. Epidemiology is the study of what causes diseases, injuries, and other physiological damage to humans and why such problems occur. Epidemiologists examine where and when disease outbreaks occur. By using statistics and other scientific methods, epidemiologists determine what factors affect the frequency and severity of disease patterns. The primary goal of epidemiology is to control or prevent outbreaks of disease — other goals are subordinate.

   What would be the best title for this passage?

   (A) Epidemiology: The Study of Disease Patterns

   (B) Goals for the Future of Epidemiology

   (C) Using Statistical Methods in Epidemiology

   (D) Employment Outlook for Epidemiologists

7. Buddhism is a religion that must be viewed from many angles. Its original form, as preached by Gautama in India and developed in the early years succeeding and as embodied in the sacred literature of early Buddhism, isn't representative of the actual Buddhism of any land today.

   According to this passage:

   (A) Most Buddhists live in India.

   (B) Buddhist teachings have changed over the years.

   (C) Buddhism draws its teachings from early Christianity.

   (D) Buddhist temples can be found in any land of the world.

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Questions 8 and 9 are based on the following passage.

Many criminal-law statutes permit more severe punishment of a person convicted of a crime if he or she intended to harm another person. For example, voluntary manslaughter carries a heavier penalty than involuntary manslaughter in most states. Planned crimes are also punished more severely than spur-of-the-moment crimes.

The problem is that juries find it difficult to know what the intent of a person was at the time he or she committed a crime. Many defendants will deny that they intended to harm the other person and claim that any harm that occurred was "accidental." The law asks too much of juries when it expects them to determine what a person was thinking. Juries should only be asked to weigh objective evidence.

8. The author of this passage would agree that:
   (A) Laws should not punish people based on intention.
   (B) Juries aren't intelligent enough to weigh evidence.
   (C) More laws should distinguish between crimes committed with intent and crimes committed on the spur of the moment.
   (D) Lawyers will lie about anything.

9. According to this passage:
   (A) Most states don't distinguish between voluntary and involuntary manslaughter.
   (B) Punishing people more severely for voluntary manslaughter is unconstitutional.
   (C) It's difficult for juries to determine a defendant's intentions at the time a crime was committed.
   (D) Prosecutors can, through careful questioning, show a defendant's intention at the time a crime was committed.

Questions 10 through 12 are based on the following passage.

Ergonomics is the science of designing and arranging workspaces so that people and objects interact efficiently and safely. Lack of attention to ergonomics causes thousands of workers to suffer repetitive stress injury, eye fatigue, muscle soreness, and many other medical problems each year.

Adequate lighting, well-designed chairs, and clutter-free work areas contribute to effective ergonomic design. The opportunity to take short breaks every hour or two, especially for desk-bound workers, is also helpful. It's also important for workers to avoid performing the same movements over and over for hours at a time. Variety in the type of work being done can decrease the chance of injury.

10. According to this passage:
    (A) Ergonomics can cause injuries.
    (B) Ergonomics is about designing and arranging workspaces efficiently and safely.
    (C) Ergonomics is expensive and time consuming.
    (D) Few people experience problems due to poor ergonomics.

11. According to this passage:
    (A) Adequate lighting and well-designed chairs, although important, have nothing to do with ergonomics.
    (B) Repetition in the type of work people do helps them accomplish their tasks safely and efficiently.
    (C) Short breaks aren't important for desk-bound employees because they do little heavy labor.
    (D) Ergonomic design also includes keeping work areas well lit and clutter free.

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12. According to this passage, it's reasonable to assume that:
    (A) Employers should invest in ergonomic design to protect workers.
    (B) Lack of ergonomic design isn't dangerous.
    (C) Labor unions have opposed ergonomic design.
    (D) Poor design is responsible for most employee accidents.

Questions 13 through 15 are based on the following passage.

Electricity is the most inefficient and costly way to heat a home. One kilowatt-hour of electricity creates about 3,400 British thermal units (BTUs). (BTUs are a standard heat measurement.) The price of electricity per kilowatt-hour is between $0.10 and $0.25 or between $29.35 and $73.13 per million BTUs.

In contrast, fuel oil, which produces 140,000 BTUs per gallon, costs about $8.33 to $13.89 per million BTUs. Natural gas, which produces 100,000 BTUs per therm, can be purchased for $5.00 to $22.50 per million BTUs. Oak firewood, which produces 26,000,000 BTUs per cord, costs $5.77 to $13.46 per million BTUs.

Choosing the right heating method for your home, based on the cost of fuel, may be more expensive at installation but will be cheaper in the long run.

13. According to the above passage, a BTU:
    (A) is an unusual method of measuring heat
    (B) stands for "British thermal unit"
    (C) is the abbreviation for a "big thermal unit"
    (D) can heat a 9 x 12 room

14. According to the above passage:
    (A) Heating with fuel oil is always cheaper than other methods.
    (B) Oak firewood produces fewer BTUs per dollar than the other types of fuel.
    (C) Natural gas costs more than all other fuels except oak firewood.
    (D) Electricity is always the most expensive way to heat a house.

15. The title of this passage should be:
    (A) Choosing the Right Heating Method
    (B) Heating Methods for Houses
    (C) Know Your BTUs
    (D) Price List for Fuel



Part 5

Mathematics Knowledge

Time: 24 minutes; 25 questions

Directions

This section tests your ability to solve general mathematical problems. Select the correct answer from the choices given and then mark the corresponding space on your answer sheet. Use scratch paper to do any figuring you wish.

1. If $y = 6$, then $2y \times y =$
   (A) 12
   (B) 72
   (C) 18
   (D) 242

2. If $0.05x = 1$, then x equals:
   (A) $\frac{1}{20}$
   (B) 20
   (C) 10
   (D) 5

3. $\sqrt{25x^2} =$
   (A) x
   (B) x^2
   (C) $5x^2$
   (D) $-5x^2$

4. Factor $9x^3 + 18x^2 - x - 2$
   (A) $(9x^2 - 1)(x + 2)$
   (B) $(9x^2 + 1)(x - 2)$
   (C) $(9x^2 + 2)(x - 1)$
   (D) $(9x^2 - 2)(x + 1)$

5. Solve for x: $5x + 7 = 6(x - 2) - 4(2x - 3)$
   (A) 1
   (B) –1
   (C) 2
   (D) –2

6. $x \times x^2 =$
   (A) x^2
   (B) $2x$
   (C) $2x^2$
   (D) x^3

7. $\sqrt{(5 + x)^2} =$
   (A) $5 - x$
   (B) $5 + x$
   (C) $\sqrt{5} - \sqrt{x}$
   (D) $\sqrt{5} + \sqrt{x}$

8. $(3 \times 3)(5 - 3)(6 + 2) = x^2$. What's the value of x?
   (A) 6
   (B) 12
   (C) 144
   (D) 64

9. If $-5x = 25$, x equals:
   (A) –5
   (B) 5
   (C) 10
   (D) 0

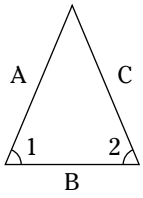
10. A circle measures 12 feet in diameter. What's its area to the nearest foot?
    (A) 452
    (B) 24
    (C) 113
    (D) 48

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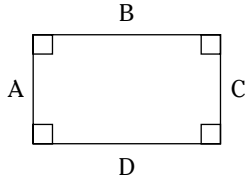
11. A square box has 6-inch sides. What's its volume?
    (A) 18 cubic inches
    (B) 216 cubic inches
    (C) 12 cubic inches
    (D) 36 cubic inches

12. A cylinder has a diameter of 10 inches. What's its approximate area?
    (A) $\pi(10^2)$
    (B) $\pi(25)$
    (C) $\pi(5)$
    (D) $\pi(10^2)(10)$

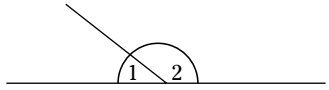
13. A cylinder has a diameter of 12 inches and a height of 10 inches. What's its approximate volume?
    (A) 4,521 cubic inches
    (B) 120 cubic inches
    (C) 1,130 cubic inches
    (D) 1,440 cubic inches



14. Triangle ABC as shown above is a(n):
    (A) equilateral triangle
    (B) right triangle
    (C) scalene triangle
    (D) isosceles triangle



15. The angles of the quadrilateral above:
    (A) are all right angles
    (B) each equal 45 degrees
    (C) are all unequal
    (D) total 180 degrees



16. In the above figure, the sum of Angles 1 and 2 equals:
    (A) 180 degrees
    (B) 90 degrees
    (C) 45 degrees
    (D) 360 degrees

17. $3(2x - 5) - 2(4x + 1) = -5(x + 3) - 2$
    (A) 0
    (B) 1
    (C) 2
    (D) 3

18. A cube has a volume of 64-cubic inches. What's the length of one side of the cube?
    (A) 4 inches
    (B) 16 inches
    (C) 8 inches
    (D) 32 inches

19. $(x^3)^2 =$
    (A) x^5
    (B) x^6
    (C) x^9
    (D) $2x^3$

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20. If I inches of rain fall in one minute, how many inches fall in H hours?
    (A) $IH \div 60$
    (B) $60I - H$
    (C) IH
    (D) $60IH$

21. If $x = y$, $6 + 4(x - y) =$
    (A) $6xy + 4$
    (B) $6 + 4xy$
    (C) $10x - 10y$
    (D) 6

22. $\sqrt{820}$ is a number between:
    (A) 20 and 30
    (B) 10 and 20
    (C) 80 and 90
    (D) 40 and 50

23. $(x + 2)(x + 2) =$
    (A) $x^2 + 2x + 4$
    (B) $x^2 + 4x + 4$
    (C) $x^2 + 4x + 2$
    (D) $x^2 + 2x + 0$

24. Evaluate the expression $6a - 3x - 2y$, if $a = 3$, $x = 7$, and $y = 4$.
    (A) –5
    (B) –40
    (C) 31
    (D) 40

25. $(x + 4)(3x + 5) =$
    (A) $3x^2 + 9x + 20$
    (B) $3x^2 + 17x + 15$
    (C) $3x^2 + 17x + 20$
    (D) $3x^2 + 9x + 20$



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Part 6

Electronics Information

Time: 9 minutes; 20 questions

Directions

This section tests your knowledge of electrical, radio, and electronics information. Select the correct response from the choices given and then mark the corresponding space on your answer sheet. Try the following sample questions:

1. What effect does a speaker wire's gauge have on speaker sound quality?
   (A) higher gauge wires are thicker with better sound quality
   (B) lower gauge wires are thicker with better sound quality
   (C) lower gauge wires are thicker with lesser sound quality
   (D) hire gauge wires are thicker with lesser sound quality

2. What's the primary advantage of a quad-band cell phone over a dual-band cell phone?
   (A) transmission strength
   (B) coverage area
   (C) reception strength
   (D) smaller phone size

3. When working with electricity, you should assume that all electrical equipment is alive unless you know for certain otherwise. This prevents:
   (A) damage to circuits
   (B) personal injury
   (C) unnecessary labor
   (D) overheating the equipment

4. The heat effect of current is created:
   (A) when the pressure of the current in the wire breaks up impurities in the wire, creating heat
   (B) when the current in the wire decays electrons, causing them to move more quickly, creating heat
   (C) when the current overcomes resistance in the wire, creating heat
   (D) The heat effect of current is only theoretical; it has never been proven to exist.

5. What special type of diode is commonly used to regulate voltage?
   (A) capacitor
   (B) transistor
   (C) Zener diode
   (D) LED



6. This symbol means:
   (A) ohm
   (B) ampere
   (C) high voltage
   (D) wattage

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7. Electromotive force is another way of saying:
   (A) frequency
   (B) watts
   (C) cycles per second
   (D) voltage

8. A primary advantage of using a Li-Ion battery instead of a NiMH battery in your cell phone is:
   (A) Li-Ion batteries are lighter
   (B) Li-Ion batteries last longer
   (C) Li-Ion batteries don't interfere with signal quality
   (D) none of the above

9. Transistors contain at least three terminals called the:
   (A) base, emitter, and collector
   (B) base, positive terminal, and negative terminal
   (C) emitter, amplifier, and collector
   (D) base and two gates

10. To control a light fixture from two different wall switches, you should use:
    (A) a single-pole switch and a four-way switch
    (B) two three-way switches
    (C) two four-way switches
    (D) two single-pole switches

11. A transistor is also called a:
    (A) rectifier
    (B) cathode
    (C) crystal amplifier
    (D) semiconductor



12. This symbol means:
    (A) ground
    (B) resistor
    (C) diode
    (D) battery

13. To decrease capacitance, capacitors:
    (A) should have less voltage applied to them
    (B) should be connected in parallel
    (C) should be connected in series
    (D) should be eliminated

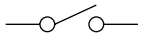
14. A resistor marked 2.5K ohms has the value of:
    (A) 2.5 ohms
    (B) 250 watts
    (C) 2,500 ohms
    (D) 25,000 ohms

15. A 9-volt transistor contains:
    (A) 1 cell
    (B) 6 cells
    (C) 9 cells
    (D) 3 cells

16. The hot wire is always:
    (A) blue
    (B) green
    (C) whitish
    (D) black

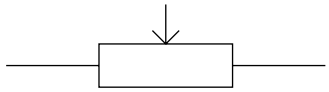
17. How wide is the full AT motherboard?
    (A) 11 inches
    (B) 11.5 inches
    (C) 12 inches
    (D) 12.5 inches

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18. The above symbol represents a/an:
    (A) relay
    (B) on-off switch
    (C) push switch
    (D) connected wire

19. If a 120-volt current is protected by a 25-amp circuit breaker, what's the largest number of watts an appliance can safely use?
    (A) 1,200 watts
    (B) 1,800 watts
    (C) 3,000 watts
    (D) 3,600 watts



20. The above symbol represents a:
    (A) rheostat
    (B) capacitor
    (C) relay
    (D) potentiometer



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Part 7

Auto & Shop Information

Time: 11 minutes; 25 questions

Directions

This test contains questions about automobiles, shop practices, and the use of tools. Pick the best answer for each question and then mark the corresponding space on your answer sheet.

1. A symptom of worn piston rings is:
   (A) a knocking and pinging sound when driving
   (B) soft and spongy acceleration
   (C) the smell of exhaust in the car
   (D) an engine using excessive amounts of oil

2. What term refers to the rebuilding of an engine to precise factory specifications?
   (A) blueprinting
   (B) specing
   (C) gold rebuild
   (D) silver rebuild

3. The number of cranks a crankshaft has on a V-8 engine is:
   (A) 6
   (B) 4
   (C) 3
   (D) 8

4. When an engine runs on after the ignition key is turned off, it's called:
   (A) auto-ignition
   (B) sputtering
   (C) ignition recharge
   (D) ignition malfunction

5. If a radiator fails, the engine:
   (A) will idle roughly
   (B) may burn fuel less efficiently
   (C) works hard to maintain speed
   (D) can quickly overheat

6. On modern automobile engines, what's the purpose of the intake manifold?
   (A) regulate air flow to the cooling system
   (B) provide air flow to the air conditioner and heater
   (C) connect the air/fuel management device to the head
   (D) regulate fuel pump pressure

7. Brake systems work by:
   (A) applying friction to the wheels to stop their rotation
   (B) reversing power to the wheels
   (C) applying pressure to the axle
   (D) interrupting power to the transmission

8. Which of the following isn't a component of the cooling system?
   (A) freeze plugs
   (B) radiator
   (C) thermostat
   (D) hydrator

9. A catalytic converter:
   (A) combines the fuel-air mixture
   (B) reduces dangerous exhaust emissions
   (C) converts the up-and-down motion of the pistons to rotary motion
   (D) charges the battery when the engine is in operation

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10. If the steering wheel vibrates at high speeds, the most likely problem is:
    (A) front end alignment
    (B) front tire balance
    (C) cracked steering column
    (D) over-inflated tires

11. During the compression stroke on a four-cycle engine:
    (A) The intake valve opens to fill the cylinder with fuel.
    (B) The burning fuel mixture forces the piston to the bottom of the cylinder.
    (C) The intake valve closes, and the piston moves to the top of the cylinder.
    (D) The exhaust valve releases the burned gas.

12. On older cars, the air filter can be found:
    (A) on top of the engine
    (B) under the engine
    (C) behind the engine
    (D) on the left or right side of the engine

13. Glazing is the process of:
    (A) cutting glass to size
    (B) using putty to hold glass to a window frame
    (C) polishing glass before using
    (D) removing glass from a window

14. A wrench with fixed, open jaws is called a(n):
    (A) adjustable wrench
    (B) Allen wrench
    (C) socket wrench
    (D) open-end wrench

15. All hammers have a:
    (A) head, face, and handle
    (B) head, toe, and handle
    (C) head and foot
    (D) head and claw

16. To determine the number of threads per inch on a fastener, use a:
    (A) depth gauge
    (B) thread gauge
    (C) thickness gauge
    (D) wire gauge

17. To chip or cut wood in close, the best tool is a:
    (A) screwdriver
    (B) butt chisel
    (C) framing chisel
    (D) mortising chisel

18. Machine screws:
    (A) are made by machines
    (B) can be used interchangeably with wood screws
    (C) fasten metal parts
    (D) are machined to fine tolerances

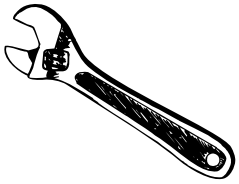
19. Double-headed nails are used:
    (A) to reinforce a joint
    (B) on temporary construction
    (C) to make frames for furniture
    (D) when a larger striking surface is needed

20. To thin paint, use:
    (A) turpentine
    (B) mineral spirits
    (C) benzene
    (D) varnish

21. When finishing a piece of wood, it's best to sand:
    (A) diagonal to the grain
    (B) against the grain
    (C) with the grain
    (D) in small circles

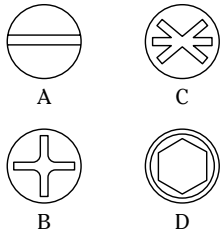
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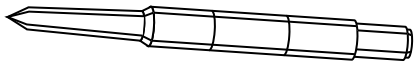
22. To measure an angle other than a 90-degree angle, the best tool to use is a:
    (A) square
    (B) caliper
    (C) level
    (D) sliding T-bevel



23. The above tool is a(n):
    (A) pipe wrench
    (B) socket wrench
    (C) adjustable crescent wrench
    (D) box-end wrench

24. Which of the following screw heads requires a Phillips screwdriver?





25. The above tool is used to:
    (A) punch holes
    (B) drive nails
    (C) measure thickness
    (D) set nails



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Part 8

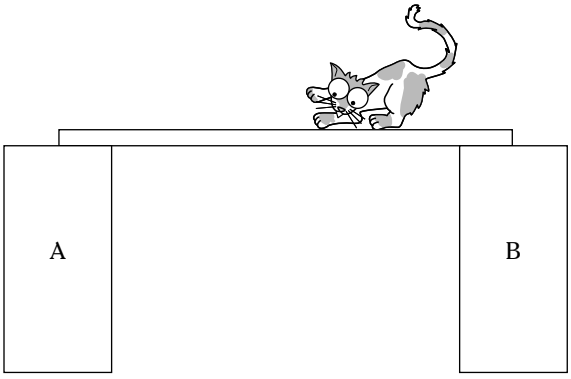
Mechanical Comprehension

Time: 19 minutes; 25 questions

Directions

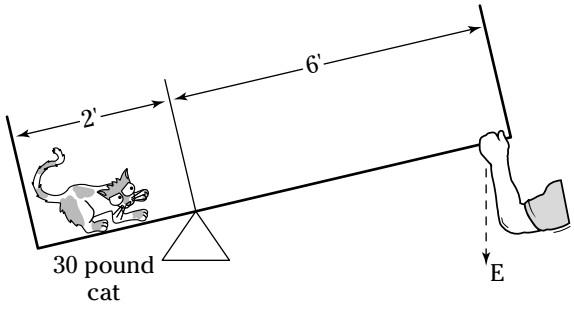
This test is about mechanical principles. Many of the questions use drawings to illustrate specific principles. Choose the correct answer and mark the corresponding space on the answer sheet.

1. Helical gears have:
   (A) straight teeth
   (B) slanted teeth
   (C) teeth of unequal size
   (D) no advantage over spur gears



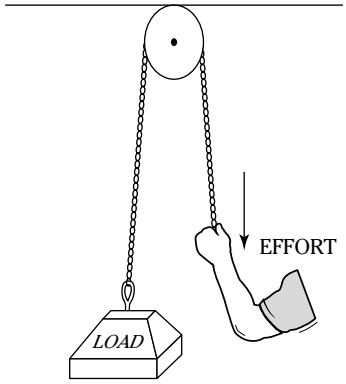
2. In the figure above, which pillar supports the greater load of the cat?
   (A) Pillar A
   (B) Pillar B
   (C) Both pillars support the cat equally.
   (D) It's impossible to determine from the information given.

3. Wheel A has a diameter of 10 feet. Wheel B has a diameter of 8 feet. If both wheels revolve at the same rate, Wheel B will cover a linear distance of 16 feet:
   (A) at the same time as Wheel A
   (B) more slowly than Wheel A
   (C) in twice the time as Wheel A
   (D) faster than Wheel A



4. What effort must be used to lift a 30-pound cat (see the figure above) using a first-class lever? (Don't include the weight of the lever in your calculations.)
   (A) 10 pounds
   (B) 15 pounds
   (C) 50 pounds
   (D) 5 pounds

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5. What mechanical advantage does the block-and-tackle arrangement in the above figure give?

(A) 1
(B) 3
(C) 2
(D) 4

6. If a ramp is 8-feet long and 4-feet high, how much effort is required to move a 400-pound object up the ramp?

(A) 35 pounds
(B) 150 pounds
(C) 800 pounds
(D) 200 pounds

7. 33,000 foot-pounds of work done in one minute is called:

(A) a job for an enlisted soldier
(B) one horsepower
(C) 330 psi
(D) meaningful force

8. A 130-pound woman is wearing shoes with high heels that measure 1-inch square. If the woman is standing on one heel, what psi does the heel exert as it rests on the ground? (Disregard atmospheric pressure from your calculations.)

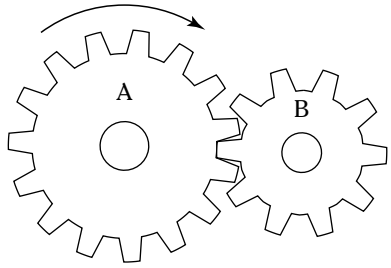
(A) 130
(B) 65
(C) 260
(D) 11

9. The force that causes clothes from the dryer to stick together is called:

(A) gravity
(B) magnetism
(C) friction
(D) static electricity

10. An aneroid barometer measures:

(A) atmospheric pressure
(B) water pressure
(C) hydraulic-fluid pressure
(D) the ambient temperature



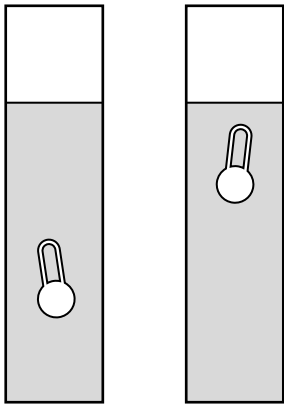
11. If Gear A is revolving in a clockwise manner, as seen in the figure above, Gear B:

(A) remains stationary
(B) revolves in a clockwise manner
(C) revolves in a counterclockwise manner
(D) turns more slowly than Gear A

12. Springs are used for the following purposes EXCEPT:

(A) to store energy for part of a mechanical cycle
(B) to force a mechanical component to maintain contact with another component
(C) to reduce shock or impact
(D) to increase the weight of a mechanism

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13. The floats in Tubes A and B measure specific gravity. Which tube contains the liquid with the higher specific gravity?

(A) Tube A

(B) Tube B

(C) It can't be determined.

(D) Both Tube A and Tube B have the same specific gravity.

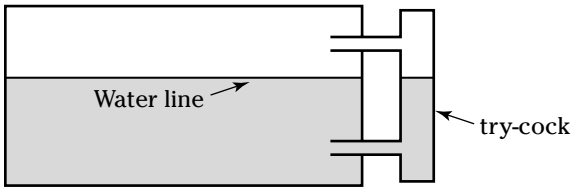
14. Universal joints are used to:

(A) connect ball bearings

(B) fix two shafts so they don't pivot or rotate

(C) connect shafts in a U-shape

(D) couple two shafts set at different angles



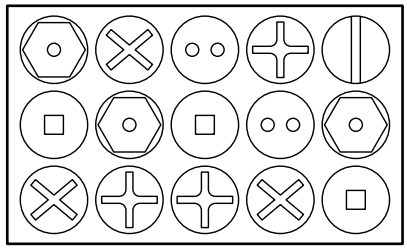
15. The try-cock in the schematic above measures:

(A) temperature of water

(B) pressure of water

(C) pressure of steam buildup

(D) level of water



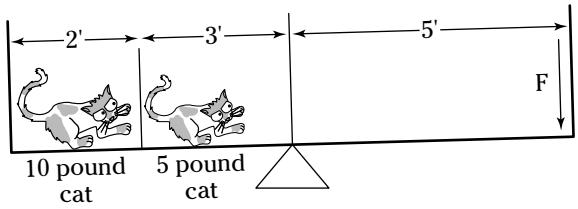
16. The steel plate above is held in place by different machine screws, each indicated by different symbols. How many different types of machine screws have been used?

(A) 6

(B) 15

(C) 5

(D) 9



17. The amount of force (F) needed to balance the lever in the figure above is most nearly:

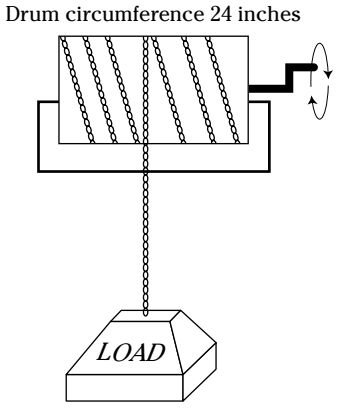
(A) 15 pounds

(B) 13 pounds

(C) 7.5 pounds

(D) 20 pounds

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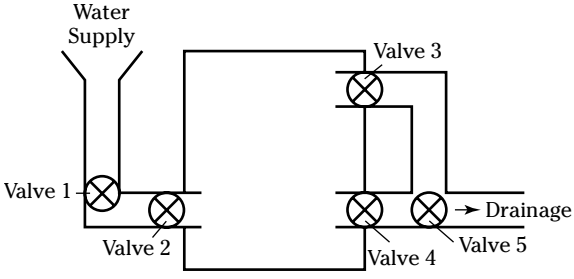
18. With one complete revolution of the cable winch shown above, the load will move:

(A) 12 inches

(B) 6 inches

(C) 24 inches

(D) 36 inches



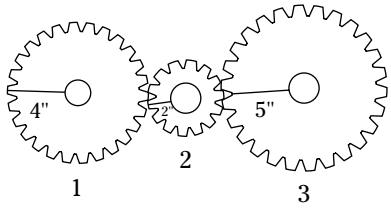
19. In the figure above, assume the valves are all closed. Which valves need to be open to fill the tank entirely?

(A) 1 and 2 only

(B) 1 only

(C) 1, 2, and 3

(D) 2 only



20. If Gear 1 in the figure above makes 10 complete clockwise revolutions per minute, then:

(A) Gear 2 makes 2 clockwise revolutions per minute.

(B) Gear 3 makes 8 clockwise revolutions per minute.

(C) Gear 3 makes 30 clockwise revolutions per minute.

(D) Gear 3 makes 9 counterclockwise revolutions per minute.

21. A gear and pinion have a ratio of 4 to 1. If the gear makes 200 revolutions per minute, the speed of the pinion is:

(A) 50 rpm

(B) 800 rpm

(C) 400 rpm

(D) 200 rpm

22. The gas gauge in an auto relies on what mechanical device to measure the amount of gas in the tank?

(A) ball and cock

(B) automatic valve

(C) float

(D) mechanical switch

23. Using a runner gives you a mechanical advantage of:

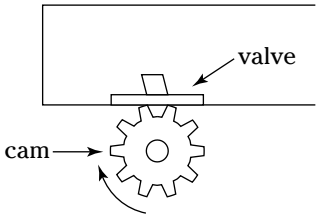
(A) 4

(B) 2

(C) 3

(D) 1

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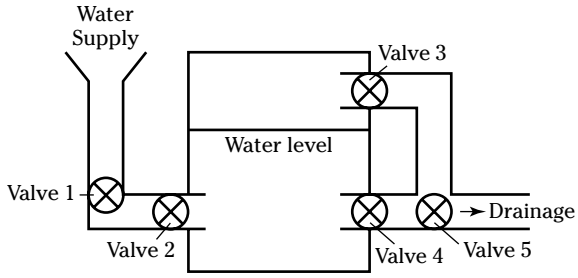
24. For the valve shown in the figure above to open once each second, the cam must revolve at a rate of:

(A) 6 rpm

(B) 10 rpm

(C) 15 rpm

(D) 3 rpm



25. The figure above represents a water tank. Which of the following statements is <u>not</u> true?

(A) If Valves 1 and 2 are open and Valves 3, 4, and 5 are closed, the tank will eventually overflow.

(B) If all valves are open, the water remains at a constant level as long as the rate of intake is equal to the rate of discharge.

(C) Water in the tank will rise if Valves 1 and 2 are open and Valves 3 and 4 are closed.

(D) The tank will empty entirely if Valves 1 and 2 are closed and Valves 4 and 5 are open.



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Part 9

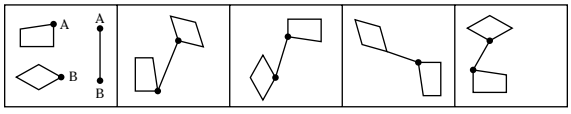
Assembling Objects

Time: 15 minutes; 16 questions

Directions

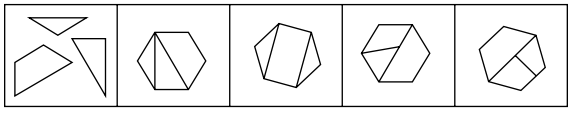
The Assembling Objects subtest consists of questions that measure your ability to mentally picture items in three dimensions. Each question is comprised of five separate drawings. The problem is presented in the first drawing and the remaining four drawings are possible solutions. Determine which of the choices best solves the problem shown in the first picture, then mark the corresponding choice on your answer sheet.

1.



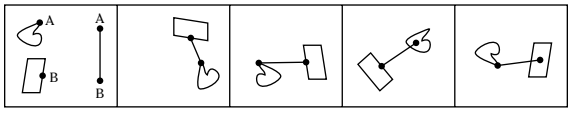
A B C D

2.



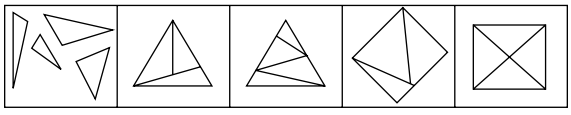
A B C D

3.



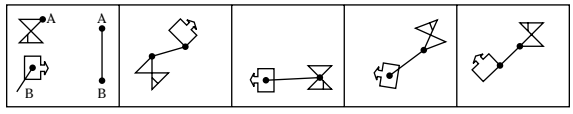
A B C D

4.



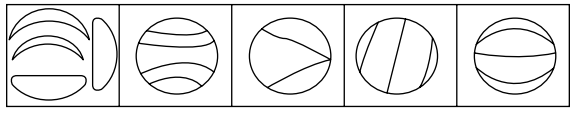
A B C D

5.



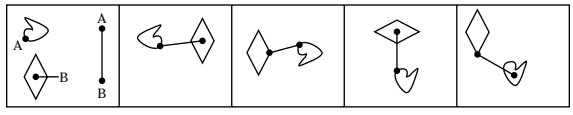
A B C D

6.



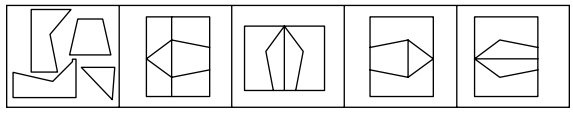
A B C D

7.



A B C D

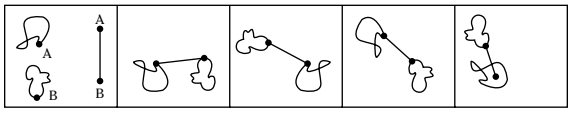
8.



A B C D

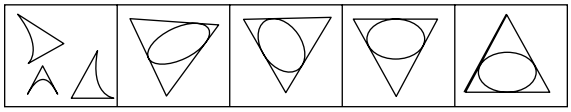
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9.



A B C D

10.



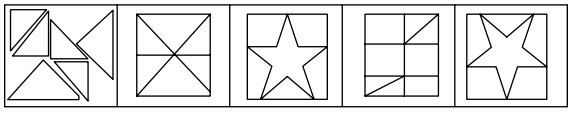
A B C D

11.



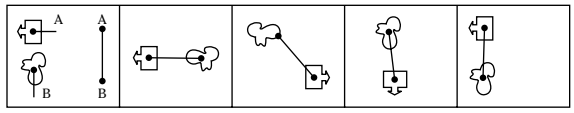
A B C D

12.



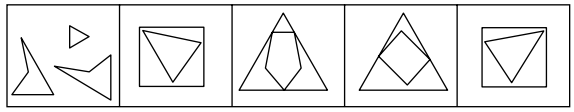
A B C D

13.



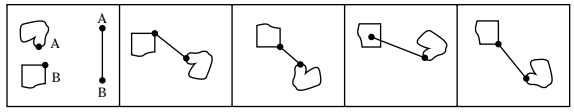
A B C D

14.



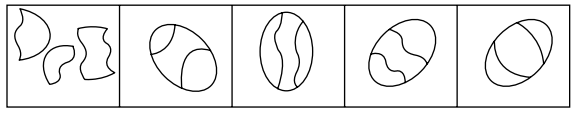
A B C D

15.



A B C D

16.



A B C D

STOP

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Chapter 21

Practice Exam 3: Answers and Explanations

Read over each question from Chapter 20 as you check the answer key. This test is the last full-length practice exam before you fly out of the nest to take the actual ASVAB. However, because we're really nice people, you'll find a bonus AFQT practice exam in the next chapter just in case you think you need a little more practice on the four subtests that make up the "test within the test."

Part 1: General Science Answers

If you're still having problems figuring out the difference between an isotope and a planet, remember you may not have to do well on this subtest. It depends on the military career you're interested in. (See the Appendix for a list of military jobs that require a competent General Science score.) If this subtest is important to your military career aspirations, consider putting in some extra study.



Chemistry For Dummies by John T. Moore, *Biology For Dummies* by Donna Rae Siegfried, *Astronomy For Dummies*, 2nd Edition, by Stephen P. Maran, *Weather For Dummies* by John D. Cox, and *Physics For Dummies* by Steve Holzner, Ph.D. (all books published by Wiley) are great references. Additional information can be found in Chapter 10, and Chapter 15 has a few more practice questions.

1. **(A)**	6. **(B)**	11. **(D)**	16. **(B)**	21. **(C)**
2. **(B)**	7. **(D)**	12. **(D)**	17. **(A)**	22. **(A)**
3. **(A)**	8. **(C)**	13. **(A)**	18. **(A)**	23. **(B)**
4. **(D)**	9. **(B)**	14. **(D)**	19. **(D)**	24. **(D)**
5. **(B)**	10. **(B)**	15. **(D)**	20. **(C)**	25. **(A)**

Part 2: Arithmetic Reasoning Answers

You have to do well on this subtest in order to qualify for military enlistment — your score from the Arithmetic Reasoning subtest counts toward your AFQT score. If you're still doing poorly on this test, you may want to postpone taking the ASVAB until you have more study time under your belt (and perhaps take a math class or two).



You have one more opportunity to practice this subtest in the next chapter, but before then consider some extra study aids, such as *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math for Dummies* by Scott Hatch — all published by Wiley Publishing, Inc. You may also wish to review Chapters 7 and 8 and the practice questions in Chapter 9.

1. **(D).** Multiply \$0.45 (the cost of making 3 donuts) by 4 to find the cost of making a dozen donuts: $\$0.45 \times 4 = \$1.80$. Then multiply the cost of making a dozen donuts by 5 to determine the cost per 5 dozen: $\$1.80 \times 5 = \$9.00$. Next, multiply the selling price per dozen times 5, the number of dozens sold: $\$3.95 \times 5 = \$19.95$. Finally subtract the cost of making 5-dozen donuts from the price the baker sells them for to determine the profit: $\$19.95 - \$9.00 = \$10.95$.

2. **(C).** Let x equal the number of dimes. Then $100 - x$ represents the number of quarters. There is $\$0.10x$ in dimes and $\$0.25(100 - x)$ in quarters.

   $0.10x + 0.25(100 - x) = 19.75$

   $0.10x + 25 - 0.25x = 19.75$

   $-0.15x = -5.25$

   $x = -5.25/-0.15$

   $x = 35$

3. **(D).** First determine the square footage of the patio: 12 feet $\times$ 16 feet = 192 square feet. Then multiply this number by the cost per square foot to determine what the brick layer charges: $192 \times \$8 = \$1,536$.

4. **(A).** Let x equal Angie's hourly wage. $x + 2$ would then represent Tim's hourly wage, and $3(x + 2)$ would represent Terry's hourly wage.

   $x + (x + 2) + 3(x + 2) = 43$

   $x + x + 2 + 3x + 6 = 43$

   $5x + 8 = 43$

   $5x = 35$

   $x = 35/5$

   $x = 7$

5. **(B).** Two people is ½ as many as 4 people: $2 \div 4 = ½$. Multiply the number of machines 4 people can run by ½ to determine how many machines 2 people can run: $8 \times ½ = 4$.

6. **(B).** Let x equal the number of daily tickets you would purchase. $36x$ = the daily ticket cost.

   $240 < 36x$

   $240/36 < x$

   $6\frac{2}{3} < x$

   You would need to use the ticket more than $6\frac{2}{3}$ times (or 7 times) in order for it to be cheaper to use the season ticket.

7. **(C).** Convert the pipe length to inches: 3 feet, 6 inches = 42 inches. Multiply 42 inches by the number of pipes needed to find the number of inches of pipe needed: $42 \times 4 = 168$. Divide the total amount of pipe needed in inches by 12 to determine how many feet of pipes are needed: $168 \div 12 = 14$.

8. **(B).** The fastest way to solve this would be to simply multiply the possible choices together ($19 \times 21 = 399$). You can also solve this with algebra. Let x equal the first number and $x + 2$ the second number.

   $x(x + 2) = 399$

   $x^2 + 2x = 399$ (Note: This is a quadratic equation that can be solved by setting it equal to zero and factoring.)

   $x^2 + 2x - 399 = 0$

   $(x - 19)(x + 21) = 0$

   $x - 19 = 0 \qquad x + 21 = 0$

   $x = 19 \qquad x = -21$

   $x + 2 = 21 \qquad x + 2 = -19$

   Two solutions are possible: 19 and 21, and –21 and –19. Because the latter pair isn't one of the answer choices, the first pair is the correct answer.

9. **(C).** Multiply her total sales by her percent commission to find her commission: $\$530.00 \times 0.65 = \$344.50$.

10. **(B).** The diagonal formula for a rectangle is $D^2 = L^2 + W^2$. In this case, $D = 5$, and $L = W + 1$. Substituting the known values into the formula results in $5^2 = (W + 1)^2 + W^2$.

    $25 = (W + 1)(W + 1) + W^2$

    $25 = W^2 + 2W + 1 + W^2$

    $25 = 2W^2 + 2W + 1$ (Note: This equation is a quadratic equation and can be solved by setting it equal to zero and factoring.)

    $0 = 2W^2 + 2W - 24$

    $½(0) = ½(2W^2 + 2W - 24)$

    $0 = W^2 + W - 12$

    $0 = (W - 3)(W + 4)$

    $W - 3 = 0 \qquad W + 4 = 0$

    $W = 3 \qquad W = -4$ (not a possible solution)

11. **(B).** If 2 inches = 3 miles, then 1 inch equals 1½ miles: $3 \div 2 = 1.5$. Multiply 1½ miles × 9½ inches to determine the actual distance: $1.5 \times 9.5 = 14.25$ or 14¼ miles.

12. **(A).** The area of the entire piece of canvas = 10 inches × 14 inches = 140 square inches. The portion painted on equals 8 inches × 12 inches = 112 square inches. (This is determined by subtracting 1 inch from the length of each side to account for the margin.) The portion used for painting can be expressed as a fraction: $^{112}/_{140}$. Reduce this fraction (divide 112 by 140) to determine that 80% of the canvas is covered with paint.

13. **(D).** Calculate perimeter by adding the lengths of all four sides of a quadrilateral: $9 + 9 + 16 + 16 = 50$ feet.

14. **(B).** The formula for the perimeter of a rectangle is $P = 2L + 2W$. In this case, $P = 100$ and $L = 1.5W$.

    $100 = 2(1.5W) + 2W$

    $100 = 3W + 2W$

    $100 = 5W$

    $W = {}^{100}/_{5}$

    $W = 20$. The width of the rectangle is 20 inches. Becuase the length is 1½ the width, $1.5 \times 20 = 30$.

15. **(C).** The total number of quizzes is 10. If he passed seven of them, the fraction would be expressed as $\frac{7}{10}$.

16. **(D).** Convert the measurement to inches: 1 yard = 36 inches; 36 inches × 3 = 108 inches. Divide the total number of inches by the number of dresses being trimmed to determine the length of each piece of ribbon: 108 inches ÷ 4 = 27 inches. Convert the quotient (27 inches) to a fraction of a yard: $\frac{27}{36}$ = 27 ÷ 36 = 75% = $\frac{3}{4}$ of a yard.

17. **(B).** Divide $30 by $500 to determine the percentage of $500 that the reward comprised.

18. **(A).** First find how many bolts a full bin contains: 7 × 12 = 84 bolts. Then multiply the total number of bolts in a full bin by $\frac{1}{6}$ to find how many bolts are in the bin when it's $\frac{1}{6}$ full: $\frac{84}{1} \times \frac{1}{6} = \frac{84}{6}$ = 14 bolts.

19. **(C).** The first bike got a $\frac{1}{5}$ mile head start ($12 \times \frac{1}{60}$). Therefore, by the time the second bike leaves, there are $5\frac{1}{5}$ miles between them ($6 - \frac{1}{5}$). Their combined rate of travel is 12 + 14 = 26 mph. Let t = the number of hours the second bike travels.

    $26t = 5\frac{1}{5}$

    $26t = \frac{26}{5}$

    $t = \frac{26}{5} \div \frac{26}{1}$

    $t = \frac{26}{5} \times \frac{1}{26}$

    $t = \frac{1}{5}$

    $\frac{1}{5}$ of an hour = 20 minutes. The second bike left at 2:09, so both bikes will meet at 2:29.

20. **(B).** Choice (B) is the cheapest option. Calculate each answer option and compare:

    Choice (A): 2 × $0.79 = $1.58.

    Choice (B): $1.49.

    Choice (C): Two 3-ounce cans don't equal 8 ounces, so this answer can't be correct.

    Choice (D): 3 × $0.65 = $1.95.

21. **(D).** Add the sales amounts together: $25.70 + $32.30 + $31.80 = $89.80. Then multiply the total sales by $\frac{3}{4}$ to determine how much money he has left: $89.80 × 0.75 = $67.35.

22. **(B).** Divide $30.00 by $3.95. The whole number is the number of pairs of socks he could buy: $30.00 ÷ $3.95 = 7.59 or 7 pairs of socks.

23. **(D).** 16 ounces make a pound. Subtract 43 pounds, 7 ounces (the weight of the puppy) from 59 pounds, 21 ounces (the weight of the crate). 59 pounds, 21 ounces is the same as 60 pounds, 5 ounces, but converting an additional pound to ounces makes the subtraction possible.

    59 pounds, 21 ounces
    – 43 pounds, 7 ounces
    16 pounds, 14 ounces

24. **(D).** The probability that all five computers will be defective is 0.15 × 0.15 × 0.15 × 0.15 × 0.15 = 0.0000759 (round up to 0.000076).

25. **(B).** Find the area of each bedroom and add them together: 12 × 14 = 168; 12 × 10 = 120; 8 × 12 = 96. 168 + 120 + 96 = 384 square feet. Then, because 3 feet make up a yard, divide the total area in square feet by 3 to determine the number of square yards needed: 384 ÷ 3 = 128 square yards.

26. **(A).** Divide the total number of pages to be typed by the number of pages Rafael can type per hour to find the number of hours it will take him to type the pages: 126 pages ÷ 9 pages per hour = 14 hours.

27. **(D).** Divide the group of 40 girls by the number of girls who can play at the same time: 40 ÷ 10 = 4. This means 4 groups of girls have to share the 60 minutes or 60 minutes ÷ 4 = 15 minutes. Thus, each girl plays for 15 minutes.

28. **(B).** Subtract the first day's late charge from the total: $8.25 – $2.00 = $6.25. Then divide the remainder by $1.25 to determine the number of additional days the video was overdue: $6.25 ÷ $1.25 = 5. Add those 5 days to the first day the video was late, to find that the video was 6 days overdue.

29. **(D).** Divide the number of calories in the pudding by the number of calories in the broccoli: 150 ÷ 60 = 2½. Janet can eat 2½ times the amount of broccoli as she can eat pudding for the same number of calories. Multiply 2½ by ½ cup (the amount of pudding that contains 150 calories) to find how many cups of broccoli she can eat for 150 calories: $2.5 \times 0.5 = 1.25$ or 1¼ cups.

30. **(C).** The time between 10 p.m. and 2 a.m. is 4 hours or 240 minutes. Divide the total number of minutes in the time period by 15 minutes — the interval that the dog barks. Then add 1 because the dog started barking at the beginning of the period: (240 ÷ 15) + 1 = 17.

Part 3: Word Knowledge Answers

The Word Knowledge subtest is another one of the "big four" that counts toward your AFQT Score. If you're not seeing the improvement in your scores that you need to see, work with a partner who can quiz you on vocabulary. Review your vocabulary words intensely, even several times a day, to ensure your success on this subtest.



See Chapter 4 for more help on improving your word knowledge. You may also find *Vocabulary For Dummies* by Laurie E. Rozakis (Wiley) and *SAT Vocabulary For Dummies* by Suzee Vlk (Wiley) to be useful. While additional practice questions are available in Chapter 6, you also have one more chance to practice this subtest in the practice AFQT in Chapter 22.

1. **(B)**	8. **(D)**	15. **(A)**	22. **(A)**	29. **(A)**
2. **(D)**	9. **(A)**	16. **(B)**	23. **(B)**	30. **(C)**
3. **(B)**	10. **(A)**	17. **(A)**	24. **(D)**	31. **(D)**
4. **(B)**	11. **(C)**	18. **(D)**	25. **(B)**	32. **(A)**
5. **(A)**	12. **(A)**	19. **(C)**	26. **(D)**	33. **(D)**
6. **(C)**	13. **(B)**	20. **(B)**	27. **(A)**	34. **(C)**
7. **(B)**	14. **(C)**	21. **(C)**	28. **(C)**	35. **(D)**

Part 4: Paragraph Comprehension Answers

Because the military bigwigs use the Paragraph Comprehension subtest to determine if you even qualify for enlistment (it counts toward your AFQT score), you need to do well here. If you're still struggling, remember to take your time when you read the passages. And, after you read each question, you can quickly reread the passage just to make sure you're on the money. The information is in the paragraph; you just have to concentrate to pull it out. Turn

to Chapter 5 and the practice questions in Chapter 6 if you still need additional help to pull off a good score on this subtest. An additional opportunity to practice taking this subtest is in the next chapter.

1. **(D).** The passage states that leaders must learn to deal with negative emotions connected with change, making Choice (A) incorrect. The second sentence makes it clear that innovation means change, so Choice (B) is incorrect. The third sentence clearly states that leaders must learn everything there is to know about the change, making Choice (C) the wrong choice.
2. **(C).** The passage states that pumas, mountain lions, and cougars are the same thing, so Choice (A) is incorrect. Nothing in the passage supports Choice (B). The passage states that cougars live about 18 years in the wild, so Choice (D) is incorrect.
3. **(B).** The counseling process works because the counselee feels the need for assistance, instruction, or understanding. Therefore, Choice (B) isn't supported by the passage. The other three choices are all supported by the contents of the paragraph.
4. **(A).** The passage says that professionals, not volunteers, have the skills needed to investigate fires, so Choice (B) is incorrect. The passage states that professional firefighters have more experience investigating the causes of fires, so Choice (C) is incorrect. The passage states that hiring professional firefighters is worthwhile, so Choice (D) is incorrect.
5. **(C).** The passage doesn't state the locale of the story, so Choices (A) and (D) are incorrect. The references to extreme cold and lack of light makes Choice (B) an incorrect answer.
6. **(A).** The main point of the passage is to define epidemiology. Choices (B), (C), and (D) aren't the main points of the passage.
7. **(B).** The only statement that's supported by the passage is Choice (B). In fact, this sentence is the primary theme of the passage. The other choices aren't supported by information contained in the paragraph.
8. **(A).** Choice (B) isn't supported by the passage. Choice (C) is the opposite of what the author argues. The text doesn't support Choice (D).
9. **(C).** The passage says that most states punish voluntary manslaughter more severely than involuntary manslaughter, so Choice (A) is incorrect. The argument that punishing people more severely for voluntary manslaughter is unconstitutional isn't made in the passage, so Choice (B) is incorrect. The passage doesn't support Choice (D).
10. **(B).** Lack of attention to ergonomics, not ergonomics itself, can cause injury, so Choice (A) is incorrect. The passage doesn't support Choice (C). The passage states that many people suffer injuries when sufficient attention isn't paid to ergonomics, so Choice (D) is incorrect.
11. **(D).** The passage states that adequate lighting and well-designed chairs are part of ergonomic design, so Choice (A) is incorrect. The passage states that repetitious work can cause injury, so Choice (B) is incorrect. The passage states that desk-bound workers should take breaks, so Choice (C) is incorrect.
12. **(A).** The passage makes it clear that lack of ergonomic design is dangerous, so Choice (B) is incorrect. Nothing in the passage supports Choice (C). Although the passage claims that lack of ergonomic design causes injury, nothing in the passage supports Choice (D).
13. **(B).** The passage says that BTUs are the standard measure of heat, so Choice (A) is incorrect. BTU stands for British thermal unit, so Choice (C) is incorrect. Nothing in the passage supports Choice (D).
14. **(D).** The passage shows that fuel oil can be more expensive than other heating methods, so Choice (A) is incorrect. Oak firewood is sometimes less expensive than other types of fuel, so Choice (B) is incorrect. Natural gas can sometimes cost less than firewood, so Choice (C) is incorrect.
15. **(A).** The main point of this passage deals with choosing the right fuel based on price; only Choice (A) summarizes this point. Choices (B), (C), and (D) are less important points.

Part 5: Mathematics Knowledge Answers

The Mathematics Knowledge subtest is used to determine whether you qualify for enlistment, so you need to do well. If you're still missing too many questions, you may need to take more drastic measures like enrolling in a basic-algebra class at a local community college.



You may also want to consider *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch (all books published by Wiley Publishing, Inc.). If your scores are improving, keep hitting the books and testing yourself up until the day of the ASVAB. Turn to Chapter 7 and the practice questions in Chapter 9 for more information. The practice AFQT in Chapter 22 also gives you a chance to gauge your progress.

1. **(B).** Substitute 6 for y in the equation: $2(6) \times 6 = 12 \times 6 = 72$.
2. **(B).** Divide both sides of the equation by 0.05 to isolate x: $0.05x \div 0.05 = 1 \div 0.05$, or $x = 20$. To check your answer, substitute 20 for x in the original equation.
3. **(C).** $\sqrt{25x^2} = \sqrt{(5x)^2} = 5x$
4. **(C).** $9x^3 + 18x^2 - x - 2 = 9x^2(x + 2) - 1(x + 2) = (9x^2 - 1)(x + 2)$
5. **(B).** $5x + 7 = 6(x - 2) - 4(2x - 3)$

   $5x + 7 = 6x - 12 - 8x + 12$

   $5x + 7 = -2x$

   $7x + 7 = 0$

   $7x = -7$

   $\frac{7}{7}x = \frac{-7}{7}$

   $x = -1$
6. **(D).** If two powers have the same base, they can be multiplied by keeping the base and adding the exponents together. In this case, x is the same as x^1.
7. **(B)**. This is so easy that it may tempt you to think that the correct answer is *too* obvious. The square root of $(5 + x)^2$ is simply $5 + x$.
8. **(B).** First solve the left side of the equation: $(9)(2)(8) = 144$. So $x^2 = 144$. Find the square root of each side: $x = 12$.
9. **(A).** Isolate x by dividing each side of the equation by –5:

   $-5x \div -5 = 25 \div -5$

   $x = -5$
10. **(C).** The area of a circle equals π times the radius squared. The radius is ½ the diameter. $A = \pi r^2$. $A = \pi 6^2 = \pi 36$. If π is approximately 3.14, the area of the circle is approximately 3.14×36 or 113 feet.
11. **(B).** Volume equals length × width × height ($V = lwh$): $6 \times 6 \times 6 = 216$ cubic inches.
12. **(B).** The area of a cylinder is $A = \pi r^2$. In this problem, $A = \pi 5^2 = \pi(25)$. Radius is half the diameter.
13. **(C).** For cylinders, Volume = πr^2(h). Since the radius is half the diameter, the problem can be calculated this way: $V = \pi(6^2)10$. $V = \pi(36)10$. If π is approximately 3.14, then $3.14 \times 36 \times 10 = 1{,}130$ cubic inches.
14. **(D).** In an isosceles triangle, Sides A and C are equal, and Angles 1 and 2 are equal.
15. **(A).** Rectangles have four equal angles, and all angles are right angles.
16. **(A).** Supplementary angles always equal 180 degrees.

17. **(A).** $3(2x - 5) - 2(4x + 1) = -5(x + 3) - 2$

$6x - 15 - 8x - 2 = -5x - 15 - 2$

$-2x - 17 = -5x - 17$

$3x - 17 = -17$

$3x = 0$

$\frac{3}{3x} = \frac{0}{3}$

$x = 0$

18. **(A).** Volume equals length × width × height (V = *lwh*). Finding the cube root of 64 shows that each edge measures 4 inches.

19. **(B).** $(x^3)^2$ is the same as $(x^3)(x^3)$. To multiply exponents with the same base, keep the base and add the exponents: $(x^3)(x^3) = x^6$.

20. **(D).** To find out how much rain falls in an hour, multiply the amount that falls in one minute by 60 because 60 minutes make up an hour. In H hours, the amount of rain is 60lH.

21. **(D).** $6 + 4(x - y) = 6 + 4x - 4y$. Because $x = y$, $4x = 4y$. Therefore, $4x - 4y = 4x - 4x = 0$, and $6 + 0 = 6$.

22. **(A).** $20^2 = 400$, and $30^2 = 900$, so the range of 20 to 30 is correct.

23. **(B).**

$$\begin{array}{r} x + 2 \\ \underline{x + 2} \\ x^2 + 2x \\ \underline{+ 2x + 4} \\ x^2 + 4x + 4 \end{array}$$

24. **(A).** Replace the unknowns with the numbers given. $(6 \times -3) - (3 \times -7) - (2 \times 4) = -18 + 21 - 8 = -5$.

25. **(C).**

$$\begin{array}{r} x + 4 \\ \underline{3x + 5} \\ 3x^2 + 12x \\ \underline{+5x + 20} \\ 3x^2 + 17x + 20 \end{array}$$

Part 6: Electronics Information Answers

If you need to do well on the Electronics Information subtest to qualify for a certain military career (see the Appendix), and you're still missing questions, review Chapter 13 again and spend some time memorizing key electronics concepts, including the mathematical formulas (like Power = Voltage × Amperes) that help you solve all kinds of electronics problems.



Electronics For Dummies by Gordon McComb (Wiley) is another useful study aid that can help with your score in this area. Additional practice questions can be found in Chapter 15.

1. **(B).** Unless a specific gauge is specified by the speaker manufacturer, you should always choose lower gauges for better sound quality.
2. **(B).** There are four frequency bands used throughout the world. A quad-cell phone would be able to access any of these frequency bands.
3. **(B).** The greatest concern when dealing with electricity is personal injury.
4. **(C).** Heat effect occurs when electrical current must overcome the resistance of the wire. Heat effect can be quite obvious or very subtle.
5. **(C).** Zener diodes are available in a variety of voltages.
6. **(A).** The symbol stands for *ohm*.
7. **(D).** Electromotive force is the pressure of the current, so the term is another way of saying *voltage*.
8. **(A).** Lithium-Ion batteries are much lighter than Nickel Metal Hydride batteries.
9. **(A).** The three terminals a transistor must have are the base, emitter, and collector.
10. **(B).** To control a light fixture from two different positions, use two three-way switches.
11. **(C).** *Crystal amplifier* is another name for *transistor*.
12. **(A).** The symbol means *ground*.
13. **(C).** Capacitors connected in series reduce the amount of capacitance.
14. **(C).** 2.5K ohms is 2,500 ohms. K = one kilo or 1,000.
15. **(B).** A cell is equal to about 1.5 volts, so $9 \div 1.5 = 6$.
16. **(D).** Live wires are black.
17. **(C).** A motherboard is the physical arrangement in a computer that contains the computer's basic circuitry and components.
18. **(B).** An on-off switch allows current to flow only when it's in the closed (on) position.
19. **(C).** Determine the wattage that could cause the circuit breaker to trip with this formula: Watts = Amperes × Volts or $25 \times 120 = 3{,}000$ watts.
20. **(A).** This type of variable resister is usually used to control voltage.

Part 7: Auto & Shop Information Answers



If you have your heart set on fixing jeeps and tanks or other related military jobs (see the Appendix), and you're still struggling on this test, *Auto Repair For Dummies* by Deanna Sclar (Wiley) and *Home Improvement All-in-One For Dummies* by Roy Barnhart, James Carey, Morris Carey, Gene Hamilton, Katie Hamilton, Donald R. Prestly, and Jeff Strong (Wiley) may be just what the mechanic ordered. You may also want to review Chapter 11 and do the practice questions in Chapter 15.

1. **(D)**	6. **(C)**	11. **(C)**	16. **(B)**	21. **(C)**
2. **(A)**	7. **(A)**	12. **(A)**	17. **(B)**	22. **(D)**
3. **(D)**	8. **(D)**	13. **(B)**	18. **(C)**	23. **(C)**
4. **(A)**	9. **(B)**	14. **(D)**	19. **(B)**	24. **(B)**
5. **(D)**	10. **(B)**	15. **(A)**	20. **(A)**	25. **(A)**

Part 8: Mechanical Comprehension Answers

If you need to do well on the Mechanical Comprehension subtest, don't forget to apply your math skills to the concepts. (A little extra physics study, such as *Physics For Dummies* by Steve Holzner, Ph.D. [Wiley] wouldn't hurt, either.) But simply using your common sense can help you quite a bit, too. For example, you may not know exactly *why* a metal spoon feels colder than a wooden spoon when they're at the same temperature, but at least you know that it feels colder. And knowing that may help you answer a question correctly. (A metal spoon is a better conductor of heat — now you also know the reason.) See Chapter 12 and the additional practice questions in Chapter 15 for more information on Mechanical Comprehension.

1. **(B).** The teeth of helical gears are slanted.
2. **(B).** The cat is closer to Pillar B, so Pillar B bears more weight.
3. **(B).** Wheel B has to make more revolutions than Wheel A to cover the same amount of distance, so it will go slower.
4. **(A).** E stands for *effort needed.* 30 (weight of the cat) × 2 (length of resistance arm) = $x \times 6$ (length of effort arm). Do a little multiplication, and you get $60 = 6x$. To isolate x, divide each side by 6: $60 \div 6 = 6x \div 6$, or $10 = x$.
5. **(A).** A fixed, simple pulley gives no mechanical advantage, so its mechanical-advantage number is 1.
6. **(D).** The formula to determine the mechanical advantage of an incline plane is Length of Ramp ÷ Height of Ramp = Weight of Object ÷ Effort.

   $8 \div 4 = 400 \div E$

   $\frac{8}{4} = \frac{400}{E}$

   $8E = 1{,}600$

   $\frac{8E}{8} = \frac{1{,}600}{8}$

   $E = 200$
7. **(B).** Scientists agree that 33,000 foot-pounds per minute is one horsepower.
8. **(A).** Power = Force/Area. P = 130/1 = 130.
9. **(D).** Static electricity causes materials to "stick" together this way.
10. **(A).** An aneroid barometer measures atmospheric pressure.
11. **(C).** Meshed gears always turn in opposite directions.
12. **(D).** Springs are used for all the listed purposes except to add weight.
13. **(B).** Specific gravity is a comparison between the weight of a liquid and the weight of water. The liquid with the higher specific gravity will have a float that rises higher.
14. **(D).** Universal joints are used to connect shafts that aren't in the same plane.
15. **(D).** Try-cocks measure water level. Water seeks a level throughout a system, so in the schematic, the try-cock correctly indicates the water level.
16. **(A).** There are 6 different symbols, so 6 different types of machine screws were used.
17. **(B).** To determine the amount of force exerted by the cats, first multiply the length of the resistance arm (as it applies to the cat) by the weight of each cat and add the products together. The 10-pound cat is supported by the entire weight of the resistance arm, so $5 \times 10 = 50$. The 5-pound cat is being supported by 3 feet of the resistance arm, so $3 \times 5 = 15$. Add 'em up: $50 + 15 = 65$. This number is equal to the length of the resistance arm times effort (force) or $65 = 5F$. To isolate F, divide both sides by 5: $65 \div 5 = 5F \div 5$ or $13 = F$.

18. **(C).** One revolution of the winch will move the weight 24 inches, the circumference of the winch drum.
19. **(A).** Valves 1 and 2 need to be open to fill the tank.
20. **(B).** Gear 1 makes 10 clockwise revolutions per minute. Gear 2, which is half the size, makes 20 counterclockwise revolutions per minute. (The number of revolutions it makes is inversely proportional to its difference in size.) Gear 2 is half the size of Gear 1, so to determine the number of revolutions it makes, multiply the number of revolutions Gear 1 makes by the inverse of ½: $10 \times \frac{2}{1}$ (or just 2) = 20. Gear 3 is 2.5 times the size of Gear 2. In other words, it is $\frac{5}{2}$ the size of Gear 2. To determine the number of revolutions Gear 3 makes, multiply the inverse of $\frac{5}{2}$ by the number of revolutions Gear 2 makes: $\frac{2}{5} \times 20$. This can be stated as $\frac{20}{1}$ (the number of revolutions Gear 2 makes per minute) $\times \frac{2}{5}$ (the fraction of revolutions Gear 3 makes) = $\frac{40}{5}$ or 8 revolutions per minute.
21. **(B).** The pinion turns 4 times as often as the gear: $4 \times 200 = 800$.
22. **(C).** A float indicates the level of liquid in a container.
23. **(B).** Using a runner (a single, moveable pulley) gives a mechanical advantage of 2.
24. **(A).** Because 60 seconds comprise a minute, the valve must open 60 times per minute. The cam will open the valve 10 times per revolution, so $60 \div 10 = 6$. The cam must make 6 revolutions per minute to raise the valve 60 times per minute.
25. **(D).** Because Valve 4 is above the bottom of the tank, some water will remain in the tank below the level of the valve, so the tank will never be completely empty.

Part 9: Assembling Objects Answers

At present, only the navy uses the scores from this subtest. If you plan to sail the seven seas and you want one of the few navy jobs that requires you to put parts A and B together, you may wish to go over the practice subtests again. For additional practice questions see Chapter 15.

1. **(C)**	5. **(C)**	9. **(B)**	13. **(C)**
2. **(A)**	6. **(D)**	10. **(A)**	14. **(B)**
3. **(A)**	7. **(C)**	11. **(D)**	15. **(D)**
4. **(B)**	8. **(C)**	12. **(A)**	16. **(C)**

Part 1

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Part 2

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Part 3

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Part 4

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Chapter 22

Practice AFQT Exam

If you're wondering what in the world this exam with the strange acronym is doing in a book on the ASVAB, don't be confused. The Armed Forces Qualification Test, or AFQT, is actually part of the ASVAB — in a way, it's a test within a test. Your scaled AFQT score derives from four subtests of the ASVAB, and it determines your overall mental qualification to join the service branch of your choice. Each of the five branches of military service has set its own minimum AFQT score in order to qualify for enlistment. The four subtests that can make or break your chances of joining the military are Arithmetic Reasoning, Word Knowledge, Paragraph Comprehension, and Mathematics Knowledge.

Because we like you (and because you were kind enough to buy this book), we've included an extra chance for you to evaluate your communication and math skills before you head over to MEPS, or your school, or the local National Guard Armory for the real deal.

After you complete the entire sample test, check your answers against the answer key in Chapter 23. Remember that the test is scored by comparing your raw score to the scores of other people. This process produces a scaled score. So just because you missed a total of 20 questions doesn't mean that your score is 80 (that would be too simple). Turn to Chapter 1 to find out how the AFQT score is derived from these four subtests.



Your goal here is to determine where you may still need to spend some more study time. If you only miss one question on the Word Knowledge subtest but you miss 15 on Arithmetic Reasoning, you may wish to dedicate some extra study time to further develop your math skills before you take the actual ASVAB.

Part 1

Arithmetic Reasoning

Time: 36 minutes; 30 questions

Directions

This test contains questions about arithmetic. Each question is followed by four possible answers. Decide which answer is correct and then mark the space on your answer sheet that has the same number and letter as your choice. Use scratch paper for any figuring you need to do.

1. If a barber is capable of cutting the hair of 35 people per day, and he works 7 days per week, how many haircuts could he give during the months of April, May, and June?
   (A) 3185
   (B) 3150
   (C) 2545
   (D) 2555

2. If you typed 45 words per minute, how many words would you be able to type in 12 minutes?
   (A) 490
   (B) 540
   (C) 605
   (D) 615

3. Tom is flying a kite at the end of a 500-foot string. His friend Kathy is standing directly under the kite 300 feet away from Tom. How high is the kite flying?
   (A) 300 feet
   (B) 350 feet
   (C) 400 feet
   (D) 450 feet

4. Amy wants to fence in a yard using 400 feet of fencing. If she wants the yard to be 30-feet wide, how long will it be?
   (A) 170 feet
   (B) 175 feet
   (C) 180 feet
   (D) 185 feet

5. A three-digit code must be used to access a computer file. The first digit must be an A or a B. The second digit must be a number between 0 and 9. The final digit is a single letter from the alphabet from A to Z. How many possible access codes can there be?
   (A) 38
   (B) 468
   (C) 520
   (D) 640

6. The sun is 93 million miles from Earth and light travels at a rate of 186,000 miles per second. How long does it take for light from the sun to reach the Earth?
   (A) 5 minutes
   (B) 6½ minutes
   (C) 7 minutes
   (D) 8½ minutes

7. A tanning-bed pass for unlimited tanning costs $53 per month this year, but it was only $50 per month last year. What was the percentage of increase?
   (A) 5%
   (B) 5.5%
   (C) 6%
   (D) 6.5%

8. Eleven plus forty-one is divided by a number. If the result is 13, what's the number?
   (A) 2
   (B) 4
   (C) 6
   (D) 8

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9. Mark received an hourly wage of $9.25. His boss gave him a 4% raise. How much does Mark make per hour now?
   (A) $9.29
   (B) $9.62
   (C) $9.89
   (D) $9.99

10. How many pounds of nails costing $7 per pound must be mixed with 6 pounds of nails costing $3 per pound to yield a mixture costing $4 per pound?
   (A) 2 pounds
   (B) 2.5 pounds
   (C) 3 pounds
   (D) 3.5 pounds

11. Theodore has 20 baseball cards. He sells ¼ of his cards to Tom, ⅓ of his cards to Larry, and his Mom accidently throws away ⅙ of his cards. How many baseball cards does Theodore have left?
   (A) ¾
   (B) 15
   (C) 12
   (D) 5

12. Theresa bought 5 karaoke CDs on sale. A karaoke CD normally costs $24, but she was able to purchase the CDs for $22.50 each. How much money did Theresa save on her entire purchase?
   (A) $7.50
   (B) $1.50
   (C) $8.00
   (D) $22.50

13. On a trip to the beach you travel 200 miles in 300 minutes. How fast did you travel?
   (A) 30 mph
   (B) 40 mph
   (C) 50 mph
   (D) 60 mph

14. 21 students, or 60% of the class, passed the final exam. How many students are in the class?
   (A) 45
   (B) 40
   (C) 35
   (D) 30

15. Joan invests $4,000 in an account that earns 3% simple interest. How much will Joan have in the account in 10 years?
   (A) $4,500
   (B) $4,800
   (C) $5,200
   (D) $5,400

16. A rectangle has a perimeter of 36 inches. It's length is 3 inches greater than twice the width. What's the rectangle's length?
   (A) 5 inches
   (B) 13 inches
   (C) 18 inches
   (D) 20 inches

17. A back yard is 50 feet by 100 feet. What's its area?
   (A) 150 square feet
   (B) 500 square feet
   (C) 2,500 square feet
   (D) 5,000 square feet

18. Eric is driving a car in which the speedometer is calibrated in kilometers per hour (kph). He notes that his car is traveling at a rate of 75 kph, when he passes a speed limit sign stating the limit is 40 miles per hour (mph). He knows that a kilometer is about ⅝ of a mile. If a police officer stops him at this point, how many mph over the limit will the ticket read?
   (A) 5
   (B) 7
   (C) 9
   (D) 11

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19. Three apples and twice as many pears add up to one-half the number of grapes in a fruit basket. How many grapes are in the basket?

(A) 8

(B) 18

(C) 28

(D) 38

20. Apples are on sale for "Buy 2 get 1 free." How many pounds must Janet purchase to get 2 pounds free?

(A) 2 pounds

(B) 4 pounds

(C) 6 apples

(D) 3 pounds

21. If 4 pipes of equal length measure 44 feet when they're connected together, how long is each pipe?

(A) 11 feet

(B) 4 feet

(C) 22 feet

(D) 9 feet

22. A German shepherd and an Alaskan Malamute are both headed toward the same fire hydrant. The German Shepherd is 120 feet away from the hydrant and the Alaskan Malamute is 75 feet away from the hydrant. How much closer to the hydrant is the Alaskan Malamute?

(A) 45 feet

(B) 25 feet

(C) 75 feet

(D) 195 feet

23. A recruit reporting to boot camp took a bus from her home to the military processing center in another city. The trip took 14 hours. If she left at 6 a.m., what time did she arrive at the processing center?

(A) 7 p.m.

(B) 12 a.m.

(C) 8 p.m.

(D) 9 p.m.

24. A farmer sold 3 pints of strawberries for $1.98 each, 5 pints of raspberries for $2.49 each, and a bushel of peaches for $5.50 at his roadside stand. How much money did the farmer make?

(A) $9.97

(B) $23.89

(C) $18.39

(D) $18.91

25. A librarian wants to shelve 532 books. If 4 books fit on a 1-foot length of shelving, how many feet of shelving does she need to shelve all the books?

(A) 13

(B) 45

(C) 33

(D) 133

26. A student buys a science textbook for $18.00, a math textbook for $14.50, and a dictionary for $9.95. What's the total cost of the books?

(A) $27.95

(B) $42.45

(C) $41.95

(D) $38.50

27. Debra works an 8-hour shift on Friday. How many minutes does she work on Friday?

(A) 480 minutes

(B) 800 minutes

(C) 240 minutes

(D) 400 minutes

28. Six people can run 3 machines in the factory. How many machines can 18 people run?

(A) 7

(B) 9

(C) 6

(D) 8

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29. On a map drawn to scale, ½ inch equals 1 mile. What length on the map equals 5 miles?

(A) 2.5 inches

(B) 5.0 inches

(C) 10.0 inches

(D) 1.5 inches

30. A man bought a pair of jeans for $23.00, a shirt for $14.95, and two ties for $7.98 each. What was the total cost of his clothing?

(A) $53.91

(B) $45.93

(C) $51.99

(D) $54.50



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Part 2

Word Knowledge

Time: 11 minutes; 35 questions

Directions

This test has questions about the meanings of words. Each question has an underlined word. You need to decide which one of the four words in the choices *most nearly means* the same thing as the underlined word and then mark the corresponding space on your answer sheet.

1. The abhorrent smell from the lake overpowered the picnickers gathered on the shore.
   (A) strong
   (B) pleasant
   (C) offensive
   (D) tantalizing

2. Regale most nearly means:
   (A) pleasure
   (B) rule
   (C) pretend
   (D) lecture

3. The water was calm that day with detritus slowly moving in the small eddies.
   (A) fish
   (B) lily pads
   (C) plants
   (D) debris

4. The Prime Minister was always cautious about leaving his redoubt in Belgrade.
   (A) city
   (B) stronghold
   (C) house
   (D) country

5. Mike was afraid he might be ostracized for stepping out of line.
   (A) banished
   (B) scolded
   (C) assaulted
   (D) arrested

6. The hotel was specifically designed for the wayworn traveler.
   (A) lost
   (B) weary
   (C) demanding
   (D) happy

7. The park has no showers and no potable water.
   (A) usable
   (B) clear
   (C) drinkable
   (D) tasty

8. Umbrage most nearly means:
   (A) headfirst
   (B) injury
   (C) doubtful
   (D) recklessly

9. Vie most nearly means:
   (A) quest
   (B) particular
   (C) delayed
   (D) contend

10. Sustenance most nearly means:
    (A) food
    (B) shelter
    (C) fish
    (D) reliant

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11. Revelation most nearly means:
    (A) sermon
    (B) participate
    (C) inside
    (D) disclose

12. Puerile most nearly means:
    (A) dangerous
    (B) illegal
    (C) childish
    (D) automatic

13. Nomic most nearly means:
    (A) old
    (B) logical
    (C) customary
    (D) uninformed

14. Magnitude most nearly means:
    (A) importance
    (B) peculiar
    (C) alone
    (D) tantamount

15. His vapid presentation earned him a C in the class.
    (A) mediocre
    (B) plagiarized
    (C) dull
    (D) polished

16. Percil was popular at the meeting because of the extraneous information he provided.
    (A) interesting
    (B) exciting
    (C) outside
    (D) informative

17. She was often solicitous of her father's feelings.
    (A) careful
    (B) ignorant
    (C) forgetful
    (D) abusive

18. I could never get over her liquid blue, limpid eyes.
    (A) bright
    (B) clear
    (C) attentive
    (D) dull

19. The goal of the treaty is to develop international amity and reciprocal trade.
    (A) agreement
    (B) friendship
    (C) standards
    (D) understanding

20. He often bragged about the bravery of his favorite cohort.
    (A) person
    (B) teacher
    (C) companion
    (D) employee

21. Lapse most nearly means:
    (A) drama
    (B) deviation
    (C) evil
    (D) unhappy

22. Indigenous most nearly means:
    (A) poor
    (B) rich
    (C) immigrant
    (D) native

23. Illusive most nearly means:
    (A) insignificant
    (B) deceptive
    (C) useful
    (D) hidden

24. Hesitant most nearly means:
    (A) slam
    (B) pause
    (C) foreclose
    (D) end

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25. Gravity most nearly means:
(A) planet
(B) relationship
(C) earn
(D) seriousness

26. Fondle most nearly means:
(A) passionate
(B) handle
(C) uncensored
(D) concise

27. Fete most nearly means:
(A) festival
(B) criticize
(C) approve
(D) eat

28. Encore most nearly means:
(A) play
(B) applause
(C) repetition
(D) excite

29. Diverse most nearly means:
(A) various
(B) hide
(C) nestle
(D) pastime

30. Detest most nearly means:
(A) anger
(B) hate
(C) surprise
(D) excite

31. Tim was known as a smart aleck, able to deliver acerbic one-liners with no effort.
(A) funny
(B) cheap
(C) sharp
(D) poetic

32. It took a great degree of inexorable overwhelming force to break into the cavern.
(A) strong
(B) unyielding
(C) acute
(D) powerful

33. Attendents were stationed at intervals, with the obvious intent to hector those who moved too slowly.
(A) hurry
(B) harass
(C) encourage
(D) note

34. Reggy was as gauche in this group of polite company as he always had been.
(A) funny
(B) entertaining
(C) tactless
(D) embarrassed

35. Confident most nearly means:
(A) assured
(B) positive
(C) intelligent
(D) educated



Part 3

Paragraph Comprehension

Time: 13 minutes; 15 questions

Directions

This test contains items that measure your ability to understand what you read. This section includes one or more paragraphs of reading material followed by incomplete statements or questions. Read the paragraph and select the choice that best completes the statement or answers the question. Mark your choice on your answer sheet by using the correct letter with each question number.

1. On June 22, 1944, President Franklin Delano Roosevelt signed into law one of the most significant pieces of legislation ever produced by the United States government: The Servicemembers' Readjustment Act of 1944, commonly known as the GI Bill of Rights. By the time the original GI Bill ended in July 1956, 7.8 million World War II veterans had participated in an education or training program, and 2.4 million veterans had home loans backed by the Veterans Administration (VA).

   The G.I. Bill provided:

   (A) free housing, training, and education

   (B) medical coverage, education, and assistance to veterans

   (C) home loan guarantees, training, and education for many former military members

   (D) a means to exempt veterans from social security taxes

2. You can put up to $3,000 a year into an individual retirement account (IRA) on a tax-deductible basis if your spouse isn't covered by a retirement plan at work or as long as your combined incomes aren't too high. You also can put the same amount tax-deferred into an IRA for a nonworking spouse if you file your income tax return jointly.

   The maximum amount that a married couple could possibly save in a tax-deferred IRA during a year is:

   (A) $3,000

   (B) $6,000

   (C) $9,000

   (D) The question can't be answered based on the information contained in the passage.

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3. Presidential appointments are an ongoing effort. Some of a president's appointments require Senate confirmation. These appointments are for positions throughout the federal government, for the Cabinet and subcabinet, for members of regulatory commissions, for ambassadorships, for judgeships, and for members of numerous advisory boards.

   Which of the following statements isn't true?

   (A) Presidential appointments require Senate confirmation.

   (B) A position on a regulatory commission is an example of a Presidential appointment.

   (C) Presidential appointments happen throughout the President's term in office.

   (D) All of the above statements are true.

4. A link between advertising and alcohol consumption is intuitively compelling but hasn't been consistently supported by research. Because alcohol advertising is pervasive, econometric studies may not be sensitive to change or assess in a range where change actually makes a difference. In dealing with advertising, partial bans aren't likely to be effective, and total bans aren't practical. Advertising bans in one medium also are weakened by substitution of increased advertising in alternative media and/ or other promotions.

   The author of this passage believes:

   (A) Advertisement of alcoholic beverages should be illegal.

   (B) Partial bans on alcohol advertising could be effective in some cases.

   (C) Bans on alcohol advertising aren't likely to work.

   (D) Clear links have been established between alcohol consumption and advertising.

5. The etymology of the word or name, *Alabama,* has evoked much discussion among philological researchers. It was the name of a noted southern Indian tribe whose habitat when first known to Europeans was in what is now central Alabama. One of the major waterways in the state was named for this group and from this river, in turn, the name of the state was derived. According to some investigations, the tribal name Alabama must be sought in the Choctaw tongue, because it isn't uncommon for tribes to accept a name given them by a neighboring tribe.

   The state of Alabama was named after:

   (A) a Choctaw Indian tribe

   (B) European settlers

   (C) a river

   (D) an Indian Chief

6. Each of the 94 federal judicial districts handles bankruptcy matters, and in almost all districts, bankruptcy cases are filed in the bankruptcy court. Bankruptcy cases can't be filed in state court. Bankruptcy laws help people who can no longer pay their creditors get a fresh start by liquidating their assets to pay their debts or by creating a repayment plan. Bankruptcy laws also protect troubled businesses and provide for orderly distributions to business creditors through reorganization or liquidation.

   Which of the following statements isn't supported by the above passage?

   (A) Bankruptcy must be filed in a federal court.

   (B) Bankruptcy is designed to help individuals and protect businesses.

   (C) Businesses can be reorganized or liquidated through bankruptcy.

   (D) Bankruptcy must be filed in the bankruptcy court.

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Questions 7 and 8 are based on the following passage.

The U.S. Department of Justice has prepared a report about hate crimes in the United States between 1997 and 1999. In 60% of hate crime incidents, the most serious offense was a violent crime, most commonly intimidation or simple assault. The majority of incidents motivated by race, ethnicity, sexual orientation, or disability involved a violent offense, while two-thirds of incidents motivated by religion involved a property offense, most commonly vandalism. Younger offenders were responsible for most hate crimes. Thirty-one percent of violent offenders, and 46% of property offenders were under age 18.

7. Most property offense hate crimes were motivated by:

   (A) religion

   (B) race

   (C) sexual orientation

   (D) abortion

8. The majority of hate crimes during this period can be classified as:

   (A) property offenses

   (B) violent crimes

   (C) assault

   (D) intimidation

9. Linewatch operations are conducted near international boundaries and coastlines in areas of Border Patrol jurisdiction to prevent the illegal entry and smuggling of aliens into the United States and to intercept those who do enter illegally before they can escape from border areas. Signcutting is the detection and the interpretation of any disturbances in natural terrain conditions that indicate the presence or passage of people, animals, or vehicles.

   The operation that's designed to detect changes in the natural environment, which may indicate passage of illegal aliens is called:

   (A) Linewatching

   (B) Signcutting

   (C) Border Patrol Operations

   (D) Terrain Observation

10. Wales was in ancient times divided into three parts nearly equal, consideration having been paid, in this division, more to the value than to the just quantity or proportion of territory. They were Venedotia, now called North Wales; Demetia, or South Wales, which in British is called Deheubarth, that is, the southern part; and Powys, the middle or eastern district. Roderic the Great, or Rhodri Mawr, who was king over all Wales, was the cause of this division. He had three sons, Mervin, Anarawt, and Cadell, amongst whom he partitioned the whole principality.

    Wales was divided into divisions because:

    (A) Natural boundaries, such as rivers and mountains made the division necessary.

    (B) Wales was too large for the King to oversee personally.

    (C) The King of Wales wanted his sons to rule.

    (D) all of the above

Questions 11 and 12 are based on the following passage.

The fierce and warlike tribe, called the Huns, who'd driven the Goths to seek new homes, came from Asia into Southeastern Europe and took possession of a large territory lying north of the River Danube. During the first half of the fifth century, the Huns had a famous king named Attila. He was only 21 years old when he became their king. But although he was young, he was very brave and ambitious, and he wanted to be a great and powerful king. As soon as his army was ready, he marched with it into countries, which belonged to Rome. He defeated the Romans in several great battles and captured many of their cities. The Roman Emperor Theodosius had to ask for terms of peace. Attila agreed that there should be peace, but soon afterwards he found out that Theodosius had formed a plot to murder him. He was so enraged at this that he again began war. He plundered and burned cities wherever he went, and at last the emperor had to give him a large sum of money and a portion of the country south of the Danube.

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11. A good title for the above paragraph would be:
    (A) The Burning of Rome
    (B) Emperor Theodosius
    (C) Attila the Hun
    (D) Rome for Dummies

12. After terms of peace were offered, Attila resumed the war against Rome because:
    (A) He discovered the Emperor wanted to assassinate him.
    (B) He wanted to further expand his kingdom.
    (C) The Emperor of Rome offered too little money in the peace terms.
    (D) Danube, his second-in-charge, advised him not to accept the peace terms.

Questions 13 through 15 are based on the following passage.

In the military, as in all professions, the issue of competence is directly relevant to professional integrity. Because human life, national security, and expenditures from the national treasury are so frequently at issue when the military acts, the obligation to be competent isn't merely prudential. That obligation is a moral one, and culpable incompetence here is clearly a violation of professional integrity. Part of the social aspect of professional integrity involves the joint responsibility for conduct and competence shared by all members of the profession. Only fellow professionals are capable of evaluating competence in some instances; hence, fellow professionals must accept the responsibility of upholding the standards of the profession. Fellow military members can spot derelictions of duty, failures of leadership, failures of competence, and the venalities of conduct that interfere with the goals of the military mission. Often, the obligations of professional integrity may be pitted against personal loyalties or friendships; and, where the stakes for society are so high, professional integrity should win out.

13. One word that best describes the primary theme of the above passage would be:
    (A) proficiency
    (B) equality
    (C) evaluations
    (D) relationships

14. Professional competence is:
    (A) a moral obligation
    (B) directly relevant to professional integrity
    (C) essential because military operations impact human life, national security, and use of taxpayer funds
    (D) all of the above

15. The author of the above passage would agree that:
    (A) Friendship must often take a back seat to professional integrity.
    (B) Only fellow professionals should evaluate competence.
    (C) Professional competence is a direct result of effective training programs.
    (D) all of the above



Part 4

Mathematics Knowledge

Time: 24 minutes; 25 questions

Directions

This section is a test of your ability to solve general mathematical problems. Select the correct answer from the choices given and then mark the corresponding space on your answer sheet. Use scratch paper to do any figuring.

1. Solve for x: $5x - 2x = 7x + 2x - 24$
   (A) 2
   (B) –2
   (C) 4
   (D) –4

2. The cube of 6 is
   (A) 125
   (B) 225
   (C) 216
   (D) 238

3. In the equation $3x + 7y = 21$, at what point is the x-axis intersected?
   (A) (7, 0)
   (B) (0, 7)
   (C) (0, 4)
   (D) (4, 0)

4. $x + y = 6$ and $x - y = 4$. Solve for x.
   (A) 3
   (B) 5
   (C) 7
   (D) 8

5. Solve for y: $4(y + 3) + 7 = 3$
   (A) 2
   (B) –2
   (C) 4
   (D) –4

6. 12 yards + 14 feet ÷ by 2 =
   (A) 25 feet
   (B) 12 feet
   (C) 32 feet
   (D) 8 feet

7. $x^3 \times x^3 =$
   (A) x^9
   (B) $2x^9$
   (C) $2x^6$
   (D) x^6

8. $4\frac{1}{5} + 1\frac{2}{5} + 3\frac{3}{10} =$
   (A) $6\frac{1}{5}$
   (B) $8\frac{9}{10}$
   (C) $5\frac{1}{2}$
   (D) $7\frac{1}{5}$

9. $1.5 \times 10^2 =$
   (A) 45
   (B) 150
   (C) 1,500
   (D) 15

10. The average of 54, 61, 70, and 75 is:
    (A) 50
    (B) 52
    (C) 55
    (D) 58

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11. 2 feet 4 inches + 4 feet 8 inches =
    (A) 6 feet 8 inches
    (B) 7 feet
    (C) 7 feet 2 inches
    (D) 8 feet

12. If $x = 4$, then $x^4 \div x =$
    (A) 12
    (B) 36
    (C) 64
    (D) 72

13. Solve for x: $5 - 3x \geqq 14 + 6x$
    (A) $x \geqq -1$
    (B) $x \leqq -1$
    (C) $x > -1$
    (D) $x < -1$

14. $(900 \times 3) \div 6 =$
    (A) 45
    (B) 450
    (C) 55
    (D) 550

15. If $x = 2$, then $x^x \times x^x =$
    (A) 16
    (B) $2x^x$
    (C) 8
    (D) 24

16. Solve for x: $x^2 - 2x - 15 = 0$
    (A) 4, –2
    (B) 3, –3
    (C) 5, –3
    (D) –1, 1

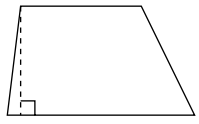
17. $\sqrt{49} \div \sqrt{64} =$
    (A) ¼
    (B) ½
    (C) ⅓
    (D) ⅞

18. If $5y^2 = 80$, y is:
    (A) a positive number
    (B) a negative number
    (C) either a positive or negative number
    (D) an imaginary number

19. If $2 + x \geq 15$, what's the value of x?
    (A) $x < 13$
    (B) $x > 13$
    (C) $x \geqq 13$
    (D) $x \leqq 13$

20. If a circle has a radius of 15 feet, what is its circumference most nearly?
    (A) 24 feet
    (B) 72 feet
    (C) 94 feet
    (D) 36 feet

21. What's the volume of a box measuring 12-inches long by 8-inches deep by 10-inches high?
    (A) 960 cubic inches
    (B) 128 cubic inches
    (C) 42 cubic inches
    (D) 288 cubic inches



22. The figure above is a(an):
    (A) parallelogram
    (B) obtuse triangle
    (C) trapezoid
    (D) rectangle

23. The sum of the measures of the angles of a parallelogram is:
    (A) 360 degrees
    (B) 540 degrees
    (C) 180 degrees
    (D) 720 degrees

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24. What is the prime factorization of 100?
(A) 2×50
(B) $2^2 \times 5^2$
(C) 4×25
(D) 25^2

25. $\sqrt{-9}$ is an example of a(an):
(A) real number
(B) imaginary number
(C) irrational number
(D) sloping number



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DO NOT RETURN TO A PREVIOUS TEST.

Chapter 23

Practice AFQT Exam: Answers and Explanations

Use this answer key to score the Practice AFQT Exam in Chapter 22. Hopefully, by now you are ready to take on the actual ASVAB. (Don't you just love it when a plan comes together?) Keep in mind, however, that these four subtests determine whether you can even get into the military. You should be confident in your math and communicative abilities before taking the actual exam. If you find you're still struggling in any of these subtest areas, you may wish to concentrate some additional study effort before knocking on the recruiter's door to say, "I'm ready!"

Part 1: Arithmetic Reasoning Answers

Mathematical word problems can be tough for some people. You have to develop a skill for determining what factors are relevant to the problem and then be able to convert those factors into a mathematical formula to arrive at a correct solution. Yikes! No wonder there are so many math books on the market! A few good ones that may help are *Algebra For Dummies* and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch — all published by Wiley. Reviewing Chapters 7 and 8 and the additional practice questions in Chapter 9 may also help.

1. **(A).** There are 30 days in April, 31 days in May, and 30 days in June for a total of 91 days. $91 \times 35 = 3185$.
2. **(B).** Multiply the number of words you can type per minute (45) by the number of minutes you will be typing (12). $45 \times 12 = 540$.
3. **(C).** Visualize a triangle, where the string represents the hypotenuse and the line between Tom and Kathy represents one of the legs. The Pythagorean theorem states that if one knows the length of two sides of a triangle, the length of the third side can be determined, using the formula $a^2 + b^2 = c^2$. In this case, $300^2 + b^2 = 500^2$.

   $90{,}000 + b^2 = 250{,}000$

   $b^2 = 250{,}000 - 90{,}000$

   $b^2 = 160{,}000$

   $b = \sqrt{160{,}000}$

   $b = 400$

4. **(A).** The formula used to determine the perimeter of a rectangle is $P = 2(L + W)$. The width is 30, and the parameter is 400. $400 = 2(L + 30)$.

   $400 = 2L + 60$

   $340 = 2L$

   $L = 170$

5. **(C).** There are 2 possibilities for the first digit (A or B), 10 possibilities for the second digit (0 to 9) and 26 possibilities for the third digit. Using the multiplication principle, $2 \times 10 \times 26 = 520$.

6. **(D).** The distance formula is distance equals rate times time, or $d = rt$. Substituting the known values results in 93,000,000 = 186,000t. So, $t = 500$ seconds. Divide 500 by 60 to convert to minutes (8½ minutes).

7. **(C).** The difference in the price is \$3. \$3 ÷ \$50 = 0.06 or 6%.

8. **(B).** Let x = the unknown number. Set up the formula as $(11 + 41) \div x = 13$.

   $52 \div x = 13$

   $52 = 13x$

   $x = 4$

9. **(B).** To calculate the new wage, start off by taking $\$9.25 \times 0.04 = \$0.37$. Then add that number (the amount of Mark's raise) to his original hourly wage. Mark's new hourly wage is \$9.25 + \$0.37 = \$9.62.

10. **(A).** Let x = number of nails costing \$7 per pound. The total cost of the mixture equals the sum of the cost for each type of nail or $M = A + B$, where $A = 7x$, $B = 3(6)$, and $M = 4(6 + x)$. Substitute the known values into the equation. $4(6 + x) = 7x + 18$.

    $24 + 4x = 7x + 18$

    $24 - 18 = 7x - 4x$

    $3x = 6$

    $x = 2$

11. **(D).** Convert the different denominators to a common denominator that all the denominators can divide into evenly. 4, 3, and 6 all divide evenly into 12. To convert ¼ to ⁄₁₂, divide 12 (the new common denominator) by 4 (the old common denominator) to get 3. Then multiply ¼ by ⅗ (another way of saying 1). The product is ⁄₁₂. (¼ = ⁄₁₂).

    Do the same calculation for the other fractions: ⅓ = ⁄₁₂ and ⅙ = ⁄₁₂. Then add the new numerators together: 3 + 4 + 2 = 9. This gives you your new added numerator. Place the added numerator over the new denominator, and you can see that ⁄₁₂ of the cards have been sold or lost. ⁄₁₂ can be reduced to ¾. ¾ or 75% of the cards have been sold or lost. $20 \times 0.75 = 15$. 15 of 20 cards have been sold or lost. 20 – 15 = 5 cards remaining.

12. **(A).** Subtract the sale price from the regular price: \$24.00 – \$22.50 = \$1.50. Multiply the remainder by the number of CDs to get your answer: $\$1.50 \times 5 = \$7.50$.

13. **(B).** First convert the 300 minutes to hours by dividing by 60 (300 ÷ 60 = 5 hours). Use the distance formula ($d = rt$) and substitute the known values. $300 = 5r$. $r = 40$.

14. **(C).** Let x = the number of people in the class. 60% of $x = 21$, so $0.60x = 21$. $x = 35$.

15. **(C).** Use the interest formula ($I = Prt$) to determine the amount of interest earned, where the principle (P) is 4,000, the rate (r) is .03 (3%) and the time (t) is 10. $I = 4{,}000(.03)(10)$, or $I = \$1{,}200$. Add the interest earned to the original amount invested. \$4,000 + \$1,200 = \$5,200.

16. **(B).** A rectangle's perimeter is determined by the formula $P = 2(l + w)$. The length of this rectangle is $3 + 2w$. Substituting the known values into the formula results in $36 = 2(w + 3 + 2w)$.

    $36 = 2(3w + 3)$

    $18 = 3w + 3$

    $15 = 3w$

    $w = 5$

    As the length is $3 + 2w$, then $l = 3 + 2(5)$, or $l = 13$.

17. **(D).** The area of a rectangle is the length × the width of the rectangle. $50 \times 100 = 5{,}000$.

18. **(B).** A kilometer is ⅝ of a mile, so multiply $75 \times ⅝$, or $^{75}⁄_{1} \times ⅝ = {}^{375}⁄_{8}$. Divide 8 into 375 to reduce the fraction and determine that Eric was traveling at 47 miles per hour, 7 mph over the 40 mph posted limit.

19. **(B).** Let x = the number of grapes. 3 apples and 6 pears equals ½ of x or $½(x) = 9$. $x = 2(9)$ or $x = 18$.

20. **(B).** If Janet must purchase 2 pounds of apples to get 1 free pound, to get 2 free pounds, she would need to purchase twice as many apples or 4 pounds of apples.

21. **(A).** Divide the total length, 44 feet, by the total number of pipes, 4, because all the pipes are equal in length. The quotient, 11, is the length of each individual pipe. You can check this answer by multiplying: $4 \times 11 = 44$.

22. **(A).** Subtract the Malamute's distance from the German Shepherd's distance (120 – 75) to determine how much closer the Malamute is to the hydrant.

23. **(C).** Simply add 14 hours to 6 a.m. to reach 8 p.m.

24. **(B).** Multiply three pints of strawberries at \$1.98 ($3 \times \$1.98 = \$5.94$); 5 pints of raspberries at \$2.49 ($5 \times \$2.49 = \$12.45$) and 1 bushel of peaches at \$5.50 ($1 \times \$5.50 = \$5.50$). Add the products together to determine the amount of cash the farmer earned: \$5.94 + \$12.45 + \$5.50 = \$23.89.

25. **(D).** Divide 532 by 4 to determine how many feet of shelving will be needed.

26. **(B).** Simply add the cost of all the books: \$18.00 + \$14.50 + \$9.95 = \$42.45.

27. **(A).** 8 hours × 60 minutes per hour = 480 minutes.

28. **(B).** If 6 people can run 3 machines, then 18 people can run 3 times the number of machines 6 people can run because $18 = 3 \times 6$ (divide 18 by 6). 3×3 machines = 9 machines. 18 people can run 9 machines.

29. **(A).** Multiply the scale measurement for 1 mile (½ inch per mile) by 5 miles: $½ \times 5$ or $½ \times {}^{5}⁄_{1} = {}^{5}⁄_{2}$. Reduce this fraction, and you get 2.5 inches.

30. **(A).** Simply add the cost of all the items: \$23.00 + \$14.95 + \$7.98 + \$7.98 = \$53.91.

Part 2: Word Knowledge Answers

We hope you did well on this subtest. (We were crossing our fingers the whole time!) If not, you may want to take another gander at Chapter 4 and the practice questions in Chapter 6.



If you need additional study references to improve your vocabulary ability, you may wish to consider *Vocabulary For Dummies* by Laurie E. Rozakis (Wiley) and *SAT Vocabulary For Dummies* by Suzee Vlk (Wiley).

1. **(C)**	8. **(B)**	15. **(C)**	22. **(D)**	29. **(A)**
2. **(A)**	9. **(D)**	16. **(C)**	23. **(B)**	30. **(B)**
3. **(D)**	10. **(A)**	17. **(A)**	24. **(B)**	31. **(C)**
4. **(B)**	11. **(D)**	18. **(B)**	25. **(D)**	32. **(B)**
5. **(A)**	12. **(C)**	19. **(B)**	26. **(B)**	33. **(B)**
6. **(B)**	13. **(C)**	20. **(C)**	27. **(A)**	34. **(C)**
7. **(C)**	14. **(A)**	21. **(B)**	28. **(C)**	35. **(A)**

Part 3: Paragraph Comprehension Answers

So, how did you do? We certainly hope you did very well on this subtest. If not, you may wish to engage in some more reading practice. Improving your vocabulary can also help improve your reading comprehension skills. See Chapter 5 for some tips. You may also wish to try a few of the practice questions in Chapter 6.

1. **(C).** According to the passage millions of veterans received home loan guarantees, education, and training, making Choice (C) the correct answer. Be careful here, as Choice (A) is tempting, but nothing in the passage indicates that the housing, education, and training were totally free.
2. **(B).** The paragraph states that the maximum amount one can place into a tax-deferred IRA is $3,000, plus an additional $3,000 if the spouse isn't employed.
3. **(A).** While many Presidential appointments require Senate confirmation, not all do, so Choice (A) is an incorrect statement.
4. **(C).** The author specifically states that partial bans on alcohol advertising isn't likely to be effective and total bans wouldn't be practical.
5. **(C).** According to the passage, a river was named after the Alabama Indian Tribe, and the state derived its name from this river.
6. **(D).** The first sentence states that bankruptcy is usually (not always) filed in bankruptcy court, making Choice (D) an incorrect statement.
7. **(A).** The second sentence states that most violent crimes were motivated by such factors as race and sexual orientation, while most property crimes were motivated by religion.
8. **(B).** 60% of all hate crimes during the period were violent crimes. Assault and intimidation are examples of this category.
9. **(B).** The last sentence in the passage describes the signcutting operation.
10. **(C).** The rationale for the division is explained in the final sentence. The passage makes no reference to the size of Wales or the natural boundaries.
11. **(C).** The primary theme of this paragraph is about Attila, who was King of the Huns.
12. **(A).** Attila agreed to peace but soon after discovered that the Roman Emperor had launched a plot to kill him.
13. **(A).** The primary theme of the passage is stated in the first sentence. *Proficiency* is closest in meaning to the word *competence,* which is the primary theme of the passage.

14. **(D).** All of the statements are directly supported by the passage.

15. **(A).** The author specifically states that when pitted against friendship, professional integrity must often win out. The author explains that only fellow professionals can evaluate other professionals in some (not all) cases, making Choice (B) incorrect. Choice (C) isn't supported by information in the passage.

Part 4: Mathematics Knowledge Answers

It's too bad the ASVAB folks don't allow the use of calculators! That would make this subtest a breeze. Don't be discouraged. The problems are purposely designed so that they can be solved using only a scratch paper, the ol' number two pencil, and a little brain sweat. If you're still having difficulty, give Chapter 7 another gander.



Algebra For Dummies and *Algebra II For Dummies* by Mary Jane Sterling, *Geometry For Dummies* by Wendy Arnone, *Calculus For Dummies* by Mark Ryan, and *SAT II Math For Dummies* by Scott Hatch (all books published by Wiley Publishing, Inc.) can also help you improve your math knowledge score. There are additional practice questions in Chapter 9.

1. **(C).** $5x - 2x = 7x + 2x - 24$. $3x = 9x - 24$. $-6x = -24$. $6x = 24$. $x = 4$.

2. **(C).** The cube of $6 = 6 \times 6 \times 6 = 216$.

3. **(A).** The x access is intersected at the point where the y-coordinate is 0 ($y = 0$). Substitute 0 for the y variable in the equation. $3x + 7y = 21 = 3x + 7(0) = 21 = 3x = 21$. Therefore, $x = 7$. The point's coordinates are (7, 0).

4. **(B).** $x + y = 6$, so $y = 6 - x$. Substitute this known value for y in the second equation.

   $x - y = 4$

   $x - (6 - x) = 4$

   $x - 6 + x = 4$

   $2x - 6 = 4$

   $2x = 10$

   $x = 5$

5. **(D).** $4(y + 3) + 7 = 3$

   $4y + 12 + 7 = 3$

   $4y + 19 = 3$

   $4y = -16$

   $y = -4$

6. **(A).** Convert 12 yards and 14 feet to feet: (12 yards $\times$ 3 feet per yard) + 14 feet = 36 feet + 14 feet = 50 feet. Divide by 2 as instructed: 50 feet $\div$ 2 = 25 feet.

7. **(D).** If two powers have the same base, the numbers can be multiplied by keeping the base and adding the powers together.

8. **(B).** Convert to the lowest common denominator (which is 10), then add. $4\frac{1}{2} + 1\frac{2}{5} + 3\frac{3}{10} = 4\frac{5}{10} + 1\frac{4}{10} + 3\frac{3}{10} = 8\frac{2}{10}$.

9. **(B).** $1.5 \times 10^2 = 1.5 \times (10 \times 10) = 1.5 \times 100 = 150$.

10. **(B).** Add the number and then divide by the number of terms. 54 + 61 + 70 + 75 = 260. 260 $\div$ 5 = 52.

11. **(B).** 2 feet + 4 feet = 6 feet, and 4 inches plus 8 inches = 12 inches (the equivalent to 1 foot).
12. **(C).** Substitute 4 for all x's in the problem. $4^4 \div 4 = (4 \times 4 \times 4 \times 4) \div 4 = 256 \div 4 = 64$.
13. **(B).** $5 - 3x \geq 14 + 6x$

    $5 - 3x - 6x \geq 14$

    $-9x \geq 14 - 5$

    $-9x \geq 9$

    $x \leq -1$

    Remember, if you multiply or divide an inequity by a negative number you must reverse the inequity.
14. **(B).** $(900 \times 2) \div 6 = 2{,}700 \div 6 = 450$.
15. **(A).** Substitute 2 for all the x's. $x^x \times x^x = 2^2 \times 2^2 = 4 \times 4 = 16$
16. **(C).** This is a quadratic equation that can be solved by factoring and setting each factor equal to zero.

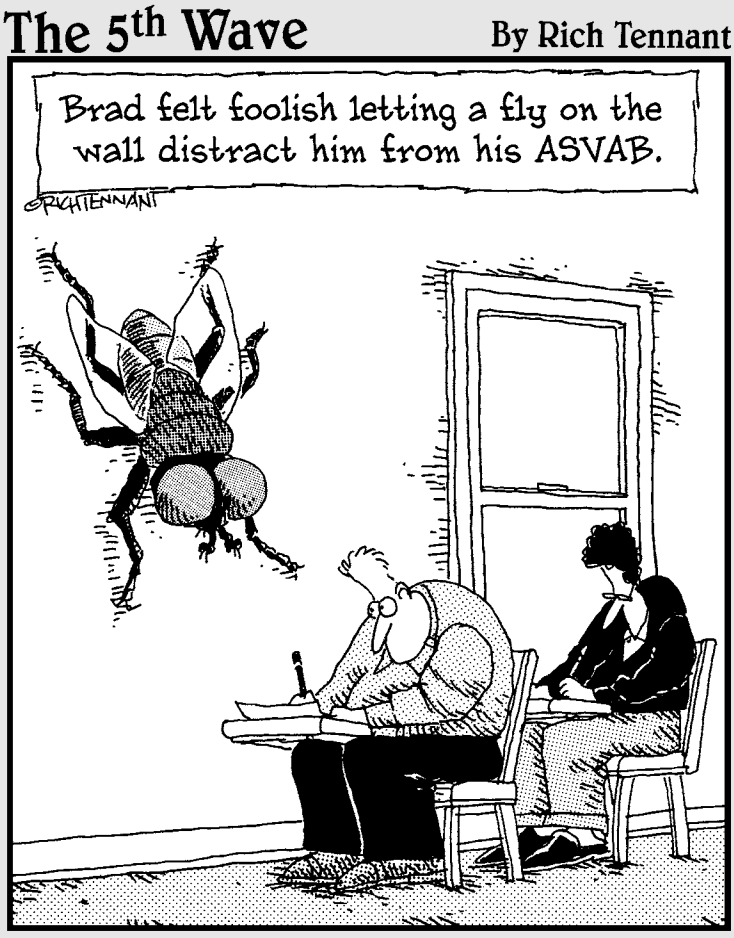
    $x^2 - 2x - 15 = 0$

    $(x - 5)(x + 3) = 0$

    $x - 5 = 0 \qquad x + 3 = 0$

    $x = 5 \qquad x = -3$
17. **(A).** The square root of 49 is 7; the square root of 64 is 8. $7 \div 8 = \frac{7}{8}$.
18. **(C).** The square root of a squared positive number can either be positive or negative.
19. **(C).** Solving this equation doesn't require multiplying or dividing by a negative number, so the inequity sign remains the same.
20. **(C).** Circumference equals π times diameter, and diameter is equal to two times the radius. Or $C = \pi d$, and $d = 2r$. $C = \pi 30$. If you round π to 3.14, the answer is about 94.2 or about 94 feet.
21. **(A).** Volume equals length times width times height ($V = lwh$). $12 \times 8 \times 10 = 960$ cubic inches.
22. **(C).** In an equilateral triangle, all sides are equal, and all angles are equal.
23. **(A).** All quadrilaterals have angles that total 360 degrees.
24. **(B).** $100 = 4 \times 25 = 2 \times 2 \times 5 \times 5 = 2^2 \times 5^2$.
25. **(B).** The square root of a negative number doesn't exist as far as real numbers are concerned. In mathematics, this is called an imaginary number.

Part VI
The Part of Tens



In this part . . .

You can put your pencil down now — no more quizzes or sample tests like the ones in Part V. This part is the Part of Tens, which features our personal ASVAB top-ten lists. We couldn't write a *For Dummies* book and not include this part.

We give you important information for doing well on the ASVAB, offer some pointers for memorizing crucial concepts, and point you in the right direction for finding more information if you need it. This part presents material in quick tidbits, so you can get into the chapters and then get out! Good luck taking your ASVAB. We hope you get stationed in Hawaii!

Chapter 24

Ten Sure-Fire Ways to Fail the ASVAB

In This Chapter

- Avoiding common ASVAB-preparation mistakes
- Steering clear of other people's mistakes

Technically, you can't "fail" the ASVAB. It's not a pass/fail test but instead a tool the military uses to measure your potential for learning military duties and military occupations. Realistically, each of the branches have established minimum AFQT scores to qualify for enlistment and minimum line scores to qualify for certain military jobs. If you don't qualify to join the service branch of your choice or don't qualify for the job you want, you didn't technically "fail," but you may have to try to take the test again (after some study sessions) to get into the branch of service your heart desires.

But if you avoid the mistakes outlined in this chapter, you can improve your chances of qualifying for enlistment and getting the military job of your dreams.

Choosing Not to Study at All

Many people think that they don't need to study for the ASVAB. They assume that because they studied many of the subjects in high school, they'll do fine even if they just wing it.

This train of thought isn't true (and it's kind of crazy). Why wouldn't you study? At the very least, brushing up on vocabulary and math concepts definitely helps you score higher on the ASVAB.

Failing to Realize How Scores Are Used

The military powers-that-be use the nine subtests on the ASVAB to determine what military jobs you qualify for. If you don't know how the scores are used, you can't decide which parts of the exam are most important for you to study.

Check out Chapters 1 and 2 for an explanation of how the military uses ASVAB subtest scores to determine your qualifications. Also head to the Appendix to see the scores that you need to get into certain branches of and careers in the military.

Studying for Unnecessary Subtests

If you don't want to be a mechanic in the military, what are you doing studying for the Auto & Shop Information subtest? You should be spending your time on the math and vocabulary review because the math and vocabulary subtests of the ASVAB are used to compute the all-important AFQT score, which determines whether you can join the military branch of your choice.

It's easier to study subject areas that you find easy or have an interest in, but if you're already an electronics wiz, don't waste your time studying a subject area that you're already going to ace. Spend your time studying subject areas that you aren't quite so confident of.

Losing Focus

We're not going to sugarcoat this: The ASVAB is tiring. You have to take nine subtests that cover some really diverse subjects. You have about two hours to complete the actual test, so if you lose focus while you're taking the test, time has a tendency of slipping away, and you may not get to all the questions. It's hard, but keep your mind focused on the task at hand throughout the whole test. It'll be over soon.



Here are some tips that can help you maintain focus:

- **Arrive at the test location with time to spare.** This gives you a few minutes to sit and relax before you have to dive into the test questions.
- **Leave your baggage at the door.** Don't worry about whether you'll get the military job you want or whether you'll pass the physical the next morning. You'll have plenty of time to worry about that after you've finished the test.
- **Concentrate on one subtest at a time.** Don't waste time rehashing the questions on the previous subtest or trying to anticipate the questions on the next subtest. Focus on the subtest you're taking at the time.
- **Take a few moments to relax and refocus between subtests.** If you finish a subtest with time to spare, close your eyes for a bit and take some deep breaths before you begin the next subtest.



On the CAT-ASVAB, when you answer the final question on one subtest you move immediately to the next subtest. If the timer on the computer screen says you have a few minutes of time left on the subtest, use that time to relax and refocus before submitting that final answer.

Panicking Over Time

Yes, you only have a limited time to do the test, but don't worry about it. The more you panic, the more likely you are to make mistakes. Just work at a steady pace, and you'll do fine.



Don't spend too much time on any single question. If you're drawing a blank, make a guess and move on. (See "Making Wild Guesses or Not Guessing at All," later in this chapter).

If you're taking the CAT-ASVAB, there will be a timer on the computer screen, counting down the number of minutes and seconds you have to finish that subtest. If you're taking the

pencil and paper version of the test, check the clock on the wall, and the proctor will generally write the start and finish time for the current subtest on a chalk board. Keep your eye on the time remaining, but don't panic over it.

Deciding Not to Check the Answers

You should always double-check your answers before you commit to them — you don't want to be tripped up by silly mistakes. Don't mark your answer and then check your work. Check your work first.

Do *not* second-guess yourself (see "Changing Answers" later in this chapter). Just check for accuracy (like in mathematical equations). Be sure to mark your answer sheet correctly, too — making sure that the number of the questions matches the number on your answer sheet (you don't have to worry about this with the computerized version of the ASVAB). Getting just one question off can mess up the rest of the answer sheet.

Making Wild Guesses or Not Guessing at All

Take the time to eliminate answers you know are incorrect before choosing among the remaining answer options. And here's the number one rule: *Don't leave any blank spaces.* In most cases, guessing if you have to is the way to go — at least you have a higher chance at getting the right answer as opposed to a zero percent chance if you leave the answer blank. If you can eliminate answers you know are wrong before guessing, you increase your chances of answering correctly even more.

For tips on smart guessing, see Chapter 3.

Changing Answers

If you're taking the paper version of the ASVAB, after you double-check your math, decide that Choice (C) is correct, and mark it on the answer sheet, don't change your answer! You're almost certain to change a right answer to a wrong one when you play that game. Plus, you can drive yourself crazy by second-guessing (and third- and fourth-guessing) your decision. Mark the answer and move on.

Memorizing the Practice Test Questions

Don't waste your time trying to memorize the practice questions in this book. We can almost guarantee you won't see any of the practice questions in this book (or any other study guide) on the actual ASVAB. Military test materials are highly-controlled items, and no author of an ASVAB preparation book has access to them. In fact, military members and military civilian employees who disclose actual ASVAB test questions or answers can go to jail — and we're not planning on going to the big house any time soon!

So just use the practice questions in this book as a measurement tool of what subject areas you should spend your time concentrating on.

Misunderstanding the Problem

Make sure that you know what the question wants from you and then give the question what it wants. If the problem asks for the *sum* of two numbers, don't *multiply* the numbers. Don't mistake a division sign for an addition sign. By familiarizing yourself with the types of questions on the ASVAB, you'll be able to zero in on what it is you're supposed to do a lot quicker than those poor folks who didn't have the brilliant idea to buy this book.

Chapter 25

Ten Easy Ways to Improve Your ASVAB Score

In This Chapter

- Brushing up on math concepts
- Uncovering the hidden meaning of vocabulary words
- Improving your reading comprehension
- Coming to conclusions

Commonly referred to as the *ASVAB Score,* the Armed Forces Qualification Test (AFQT) score is actually only computed from the reading and math skills subtests of the ASVAB. The AFQT score is your most important score because it determines whether you're even qualified to enlist in the service of your choice. For the full scoop, see Chapter 1.

The ten concepts presented in this chapter help you score better on the four subtests of the ASVAB that are used to calculate your AFQT score.

Changing Percents

In order to perform math operations, you often have to change a percent to a fraction or a decimal. To change a percent to a fraction, multiply the percent by $\frac{1}{100}$ and drop the percent sign:

$$5\% \times \frac{1}{100} = \frac{5}{100}$$

To change a percent to a decimal, move the decimal point over two places to the left and drop the percent sign:

$$5\% = 5.0\% = 0.05$$

Clearing Up Inverse Confusion

Inverse operations are opposite operations. The opposite of addition is subtraction and vice versa. And the opposite of multiplication is division and vice versa. But, when it comes to numbers, the term *inverse* is *not* the same as *opposite.* The *opposite* of 5 is –5, but the *inverse* of 5 is $\frac{1}{5}$. When you deal with numbers, think of the inverse of a number as standing the number on its head: The inverse of 5 (or $\frac{5}{1}$) is $\frac{1}{5}$.

Outlining the Order of Operations

When a math problem asks you to perform more than one operation, make sure to perform the operations in the *set-in-stone* correct order:

1. **Grouping symbols**

   On the ASVAB, the grouping symbols you run across are the fraction bar and the square root sign. Do the square root first. Do any operation above the fraction bar and then any operation below the fraction bar and then divide.

2. **Parentheses**

   Do any mathematical operations contained within parentheses.

3. **Multiplication and division**

   Always operate from left to right.

4. **Addition and subtraction**

   Always operate from left to right.

Reviewing Ratios, Rates, and Scales

You need to understand the differences between ratios, rates, and scales in order to calculate the answer to math questions correctly:

- A *ratio* represents a relationship between two *like* objects. If Luis invested $10 in Lotto tickets, and Joe invested $20 in Lotto tickets, then for every one dollar Luis invested, Joe invested two. That's a ratio of 1:2.
- A *rate* is an expression of the relationship between two *unlike* elements. For example, if Anna's car can travel a distance of 450 miles per tank of gas, and her gas tank holds 15 gallons, then her car consumes gas at a rate of 30 miles to the (per) gallon or 30 mpg (miles and gallons being unlike elements). Or, 450 (miles) ÷ 15 (gallons in the tank) = 30 miles to the gallon.
- A *scale,* like a ratio, expresses a relationship between two *like* elements, although the units of measure may differ. A map drawn to scale may use one inch to represent one mile. Although an inch and a mile aren't the same unit of measure, they measure the same thing (distance).

Calculating Area, Perimeter, and Volume

You encounter some math questions on the ASVAB that require you to calculate area, perimeter, and volume. Remember the following rules:

- For any rectangle, area = base × height.
- For triangles, area = base × altitude (the height of the triangle at its highest point) divided by two.
- For circles, area is πr^2.

- The perimeter of any quadrilateral (four-sided figure) or triangle is calculated by adding the lengths of all the sides together.
- The perimeter (also called circumference) of a circle is found by multiplying $\pi \times$ diameter.
- The volume of a rectangular unit is found by multiplying length $\times$ width $\times$ height.
- The volume of a cylinder is found by multiplying the square of the radius of the base by the height or $V = \pi r^2 h$.

Finding the Word Closest in Meaning

The Word Knowledge subtest of the ASVAB contains questions that ask you to find the word that is *closest in meaning* to a given word. Don't get confused and think that you have to find the word that means *exactly* the same thing as the given word. Just follow the directions. Because some of the answer options may have similar meanings, you need to choose the answer that's closest in meaning to the given word — the answer that's most right.

Using Roots, Prefixes, and Suffixes

If you see an unfamiliar word on the Word Knowledge section, try to figure out its root. For example, if you know the meaning of *mercy,* you can figure out the meaning of *merciful.* Remember that prefixes and suffixes that can change the meaning of a word can be added onto a root: Here are some examples:

- The prefix *a-* usually means opposite, so the word *atypical* means *the opposite of typical* not *a typical thing.*
- *Establish* is a verb meaning *to make stable* or *to prove,* whereas *establishment* (with a suffix) is a noun meaning *a thing that has been established.*

Getting to the Point



On the Paragraph Comprehension subtest, you can pretty much win the battle if you figure out the main point of the paragraph. The main point is the essence of what the paragraph is trying to communicate. The other information in the paragraph simply supports this point.

The main point is often, but not always, the first or last sentence in a paragraph.

Finding Specific Information

The Paragraph Comprehension subtest often asks you to find specific information in a passage. You shouldn't have to guess what this information is — it's written in the passage, or you can easily deduce it from the passage. For instance, if a paragraph includes the sentence, "Six out of ten smokers will contract some form of cancer," and a question asks, "How many smokers won't contract some form of cancer?" you can easily deduce that four is the correct number. Go back and reread the paragraph when you're asked to find specific information.

Drawing Conclusions

You may have to draw inferences or conclusions from what you've read. You must use only the information presented in the paragraph to reach this conclusion instead of relying on your own ideas and opinions. In other words, ask yourself, "Would the author agree with this statement, based on what he or she has written in this paragraph?" Apply this test to each answer option to choose the best answer.

Appendix

Matching ASVAB Scores to Military Jobs

The military has hundreds of enlisted job opportunities, ranging from washing and sewing clothing items to translating foreign languages. Each of the military services has established its own individual *line score* requirements (a combination of various ASVAB subtest scores) to qualify for specific enlisted jobs. The tables in this appendix show the minimum line scores that the services have established for entry-level enlisted jobs.



Just because you achieve the minimum ASVAB line score for the job of your choice doesn't mean you'll absolutely get that job. Other factors are considered, including the current needs of the service, security clearance qualification, and medical exam results.

The charts in this appendix are as accurate as they can be at press time. However, military jobs and qualification standards are subject to change with little or no notice. For the most up-to-date information and for complete job descriptions and qualification factors, see your local military recruiter or visit the military enlisted-job pages on the About.com U.S. Military Information site at `http://usmilitary.about.com`.

Army Enlisted Jobs

The army calls its enlisted jobs *Military Occupation Specialties* (MOS), and over 150 such specialties exist for entry-level recruits. Table A-1 shows entry-level army MOSs and the army ASVAB line scores required to qualify for the jobs. Scan the table and see if you find a job that interests you.

Line scores are abbreviated as follows: Clerical Score (CL), Combat Score (CO), Electronics Score (EL), Field Artillery Score (FA), General Maintenance Score (GM), General Technical Score (GT), Mechanical Maintenance Score (MM), Operators and Food Score (OF), Surveillance and Communications Score (SC), and Skilled Technical Score (ST). See Chapter 2 for an explanation of which ASVAB subtest scores are used to calculate each of the line scores.

Table A-1 U.S. Army Enlisted Jobs and Required ASVAB Scores

MOS	*Title*	*Score*	*MOS*	*Title*	*Score*	*MOS*	*Title*	*Score*
11B	Infantryman	CO-90	11C	Indirect Fire Infantryman	CO-90	13B	Cannon Crewmember	FA-95
13C	Tactical Automated Fire Control Systems	FA-95	13D	Field Artillery Automated Tactical Data Systems Specialist	FA-100	13E	Cannon Fire Direction Specialist	FA-95
13F	Fire Support Specialist	FA-100	13M	Multiple Launch Rocket System Crewmember	FA-105	13P	Multiple Launch Rocket System Automated Tactical Data Systems Specialist	FA-100
13R	Field Artillery Firefinder Radar Operator	EL-100 and SC-100	13W	Field Artillery Meteor-ological Crewmember	EL-95	14E	PATRIOT Missile System Enhanced Operator/ Maintainer	MM-105
14J	Air Defense Tactical Operations Center Operator	MM-100	14M	Man Portable Air Defense System Crewmember	OF-90	14R	Bradley Linebacker Crewmember	OF-100
14S	AVENGER Crewmember	OF-90	14T	PATRIOT Launching Station Enhanced Operator/ Maintainer	OF-100	15B	Aircraft Power plant Repairer	MM-105
15D	Aircraft Powertrain Repairer	MM-105	15F	Aircraft Electrician	MM-105	15G	Aircraft Structural Repairer	MM-105
15H	Aircraft Pneudraulics Repairer	MM-105	15J	Aircraft Armament/ Electronic/ Avionics Systems Repairer	EL-95 and MM-100	15M	Utility Helicopter Repairer	MM-105
15N	Avionic Mechanic	EL-95	15P	Aviation Operations Specialist	ST-95	15Q	Air Traffic Control Operator	ST-100
15R	AH-64 Attack Helicopter Repairer	MM-100	15S	OH-58D Helicopter Repairer	MM-100	15T	UH-60/ Helicopter/ Utility Airplane Repairer	MM-105

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
15U	Medium Helicopter Repairer	MM-105	15V	Scout/ Observation/ Attack Helicopter Repairer	MM-105	15X	AH-64 Armament/ Electrical Systems Repairer	EL-100
15Y	Armament/ Electrical/ Avionic Systems Repairer	EL-100	18B	Special Forces (Weapons)	GT-110 and CO-100	18C	Special Forces (Engineer)	GT-110 and CO-100
18D	Special Forces (Medical)	GT-100 and CO-100	18E	Special Forces (Communi-cations)	GT-100 and CO-100	19D	Cavalry Scout	CO-90
19K	Armor Crewman	CO-90	21B	Combat Engineer	CO-90	21C	Bridge Crewmember	CO-90
21D	Diver	GM-100 and ST or GT of 110	21E	Heavy Construction Equipment Operator	GM-90	21F	Crane Operator	GM-90
21G	Quarrying Specialist	GM-95	21J	General Construction Equipment Operator	GM-90	21K	Plumber	GM-90
21L	Lithographer	ST-85	21M	Firefighter	GM-90	21P	Prime Power Production Specialist	ST-110
21Q	Transmission and Distribution Specialist	EL-95	21R	Interior Electrician	EL-95	21T	Technical Engineering Specialist	ST-95
21U	Topographic Analyst	ST-85	21V	Construction and Asphalt Equipment Operator	GM-90	21W	Carpentry and Masonry Specialist	GM-90
25B	Information Systems Operator-Analyst	ST-100	25C	Radio Operator-Maintainer	SC-100 and EL-100	25D	Telecom-munications Operator-Maintainer	SC-90 and EL-90
25F	Network Switching Systems Operator/ Maintainer	SC-105 and EL-105	25L	Cable Systems Installer/ Maintainer	SC-90 and EL-90	25M	Multimedia Illustrator	SC-95 and EL-95
25P	Microwave Systems Operator/ Maintainer	EL-110	25Q	Multichannel Transmission Systems Operator-Maintainer	SC-100 and El-100	25R	Visual Information Equipment Operator-Maintainer	EL-110

(continued)

Table A-1 *(continued)*

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
25S	Satellite Communication Systems Operator – Maintainer	EL-120	25U	Signal Support Systems Specialist	ST-95 and EL-95	33W	Military Intelligence Systems Maintainer/ Integrator	ST-115
37F	Psychological Operations Specialist	ST-105	38A	Civil Affairs Specialist	ST-100	42A	Human Resources Specialist	CL-95
42F	Information Systems Technician	CL-105	42L	Administrative Specialist	CL-95	42R	Band Member	N/A
44C	Finance Specialist	CL-105	45B	Small Arms/ Artillery Repairer	GM-90	45D	Self-propelled Field Artillery Turret Mechanic	GM-100
45G	Fire Control System Repairer	EL-95	45K	Armament Repairer	GM-100	45M	M60A1/A3 Tank Turret Mechanic	MM-100
46Q	Journalist	GT-110	46R	Broadcast Journalist	GT-110	52C	Utilities Equipment Repairer	GM-100
52D	Power-Generation Equipment Repairer	GM-100	52F	Turbine Engine Drive/ Generator Repairer	GM-100	56M	Chaplain Assistant	CL-95
63A	M1 ABRAMS Systems Maintainer	MM-100	63B	Light-Wheel Vehicle Mechanic	MM-90	63D	Self-propelled Field Artillery Repairer	MM-105
63G	Fuel and Electrical Systems Repairer	MM-105	63H	Track Vehicle Repairer	MM-90	63J	Quarter-master and Chemical Equipment Repairer	MM-90
63M	M2/3 Bradley Fighting Vehicle System Maintainer	MM-105	63N	M60A1/A3 Tank System Mechanic	MM-100	63S	Heavy-Wheel Vehicle Mechanic	MM-105
63W	Wheel Vehicle Repairer	MM-90	63Y	Track Vehicle Mechanic	MM-105	68A	Medical Equipment Repairer	EL-110
68D	Operating Room Specialist	ST-95	68E	Dental Specialist	ST-95	68G	Patient Administration Specialist	CL-95

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
68H	Optical Laboratory Specialist	GM-100	68J	Medical Supply Specialist	CL-95	68K	Medical Laboratory Specialist	ST-110
68M	Hospital Food Service Specialist	OF-100	68P	Radiology Specialist	ST-110	68Q	Pharmacy Specialist	ST-95
68R	Veterinary Food Inspection Specialist	ST-100	68S	Preventive Medicine Specialist	ST-105	68T	Animal Care Specialist	ST-105
68V	Respiratory Specialist	ST-105	68W	Healthcare Specialist	ST-95	68X	Mental Health Specialist	ST-105
74D	Chemical Operations Specialist	ST-95	88H	Cargo Specialist	GM-90	88K	Watercraft Operator	MM-100
88L	Watercraft Engineer	MM-105	88M	Motor Transport Operator	OF-90	88N	Transportation Management Coordinator	CL-100
88P	Railway Equipment Repairer	MM-100	88T	Railway Section Repairer	MM-90	88U	Railway Operations Crewmember	MM-95
89B	Ammunition Specialist	ST-100	89D	Explosive Ordnance Disposal (EOD) Specialist	GM-105	92A	Automated Logistical Specialist	CL-95
92F	Petroleum Supply Specialist	CL-90 and OF-90	92G	Food Service Operations	OF-90	92L	Petroleum Laboratory Specialist	ST-105
92M	Mortuary Affairs Specialist	GM-90	92R	Parachute Rigger	GM-90 and CO-90	92S	Laundry and Textile Specialist	GM-85
92W	Water Treatment Specialist	GM-90	92Y	Unit Supply Specialist	CL-95	94A	Land Combat Electrician	EL-105
94D	Air Traffic Control Equipment Repairer	EL-105	94E	Radio and Communications Security Repairer	EL-110	94F	Special Electronic Devices Repairer	EL-105
94H	Test Measurement and Diagnostic Equipment Support Specialist	EL-110	94K	Automatic Test Equipment Operator and Maintainer	EL-110	94L	Avionic Communications Equipment Repairer	EL-100

(continued)

Table A-1 *(continued)*

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
94M	Radar Repairer	EL-110	94P	Multiple Launch Rocket Repairer	EL-100	94R	Avionic Radar Repairer	EL-100
94S	Patriot System Repairer	EL-100	94T	Avenger System Repairer	EL-100	94Y	Integrated Family of Test Equipment Operator and Maintainer	EL-110
96B	Intelligence Analyst	ST-105	96D	Imagery Analyst	ST-95	96H	Common Ground Station (CGS) Operator	SC-95 and ST-105
96R	Ground Surveillance Systems Operator	EL-85 and SC-95	96U	Tactical Unmanned Aerial Vehicle Operator	SC-105	97E	Human Intelligence Collector	ST-105
97L	Translator/ Interpreter	ST-95	98C	Signals Intelligence Analyst	ST-105	98G	Cryptologic Linguist	ST-105
98H	Communi-cations Locator/ Interceptor	ST-95	98J	Electronic Intelligence Interceptor/ Analyst	ST-105	98K	Signals Collection/ Identification Analyst	ST-105

Air Force Enlisted Jobs

The United States Air Force has about 120 entry-level enlisted jobs for new recruits. The air force refers to enlisted jobs as *Air Force Specialty Codes* (AFSC). Table A-2 shows the air force entry-level AFSCs and the line scores required to qualify for the job. The table is organized by AFSC number, so browse the table and see which AFSCs pique your interest.

Line scores are abbreviated as follows: General (G), Electronic (E), Mechanical (M) and Administrative (A). See Chapter 2 for information about which ASVAB subtest scores are used by the air force to calculate the various line scores.

Table A-2 U.S. Air Force Enlisted Jobs and Required ASVAB Scores

AFSC	Title	Score	AFSC	Title	Score	AFSC	Title	Score
1A0X1	In-Flight Refueling	G-55	1A1X1	Flight Engineer	M-47 or E-38	1A2X1	Aircraft Loadmaster	G-57
1A3X1	Airborne Communi-cations and Electronic Systems	E-70	1A4X1	Airborne Battle Management Systems	G-55	1A5X1	Airborne Missions Systems	E-70

AFSC	Title	Score	AFSC	Title	Score	AFSC	Title	Score
1A7X1	Aerial Gunner	M-60 or E-45	1A8X1	Airborne Cryptologic Linguist	G-72	1C0X1	Airfield Management	A-41
1C0X2	Aviation Resource Mgt	A-41	1C1X1	Air Traffic Control	G-55	1C2X1	Combat Control	G-44
1C3X1	Command Post	G-49	1C4X1	Tactical Air Command & Control	G-49	1C5X1	Aerospace Control & Warning Systems	G-55
1C6X1	Space Systems Operations	E-60	1N0X1	Operations Intelligence	G-57	1N1X1	Imagery Analysis	G-66
1N2X1	Communica-tions Signals Intelligence Production	G-53	1N3XX	Cryptologic Linguist	G-72	1N4X1	Network Intelligence Analysis	G-62
1N5X1	Electronic Signal Intelligence Exploitation	G-72	1N6X1	Electronic Systems Security Assessment	G-62	1T0X1	Survival, Evasion, Resistance, and Escape Operations	G-55
1T1X1	Aircrew Life Support	G-34	1T2X1	Pararescue	G-44	1W0X1	Weather	G-66 and E-50
2A0X1	Avionics Test Stations & Components	E-70	2A3X1	A-10, F-15, AND U-2 Avionics Systems	E-70	2A3X2	F-16, F-117, RQ-1, and CV-22 Avionics Systems	E-70
2A3X1	Tactical Aircraft Maintenance	M-47	2A5X1	Aerospace Maintenance	M-47	2A5X2	Helicopter Maintenance	M-47
2A5X3	Integrated Avionics Systems	E-70	2A6X1	Aerospace Propulsion	M-40	2A6X2	Aerospace Ground Equipment	M-47
2A6X3	Aircrew Egress Systems	M-56	2A6X4	Aircraft Fuel Systems	M-47	2A6X5	Aircraft Hydraulic Systems	M-56
2A7X1	Aircraft Metals Technology	M-47	2A7X2	Nondestruc-tive Inspection	G-44	2A7X3	Aircraft Structural Maintenance	M-47
2A7X4	Survival Equipment	M-40	2E0X1	Ground Radar Systems	E-70	2E1X1	Satellite, Wideband, and Telemetry Systems	E-70

(continued)

Table A-2 *(continued)*

AFSC	*Title*	*Score*	*AFSC*	*Title*	*Score*	*AFSC*	*Title*	*Score*
2E1X2	Meteoro-logical & Navigations Systems	E-70	2E1X3	Ground Radio Communi-cations	E-70	2E1X4	Visual Imagery & Intrusion Detection Systems	E-70
2E2X1	Computer, Network, Switching, and Crypto-graphic Systems	E-70	2E6X2	Communi-cations Cable and Antenna Systems	M-47	2E6X3	Telephone Systems	E-45
2F0X1	Fuels	M-47 and G-38	2G0X1	Logistics Plans	A-56	2M0X1	Missile & Space Systems Electrical Maintenance	E-70
2M0X2	Missile & Space Systems Maintenance	M-47	2M0X3	Missile & Space Facilities	E-50	2P0X1	Precision Measurement Equipment Laboratory	E-70
2R0X1	Maintenance Management Analysis	G-55	2R1X1	Maintenance Management Production	G-44	2S0X1	Supply Management	A-41 or G-44
2S0X2	Supply Systems Analysis	A-47	2T0X1	Traffic Management	A-35	2T1X1	Vehicle Operations	M-40
2T2X1	Air Trans-portation Air Trans-portation	M-47 and A-28	2T3X1	Vehicle and Vehicular Equipment Maintenance	M-47	2T3X2	Special Vehicle Maintenance	M-40
2T3X5	Vehicle Body Maintenance	M-56	2T3X7	Vehicle Management & Analysis	A-41	2W0X1	Munitions Systems	M-60 or G-57
2W1X1	Aircraft Armament Systems	M-60 or E-45	2W2X1	Nuclear Weapons	M-60	3A0X1	Information Management	A-28
3C0X1	Computer Systems Operations	G-64	3C0X2	Computer Systems Programming	G-64	3C1X1	Radio Com-munication Systems	A-41
3C1X2	Electro-magnetic Spectrum Management	G-44	3C2X1	Computer Systems Control	E-70	3C3X1	Computer Systems Planning & Implemen-tation	G-62
3M0X1	Services	G-24	3N0X1	Public Affairs	G-72	3N0X2	Radio & TV Broadcasting	G-72

AFSC	Title	Score	AFSC	Title	Score	AFSC	Title	Score
3N1X1	Regional Band	A-21 or G-24	3P0X1	Security Forces	G-33	3E0X1	Electrical Systems	E-28
3E0X2	Electric Power Production	M-56 and E-40	3E1X1	Heating, Ventilation, Air Conditioning, & Refrigeration	M-47 or E-28	3E2X1	Pavements & Construction Equipment	M-40
3E3X1	Structural	M-47	3E4X1	Utilities Systems	M-47	3E4X2	Liquid Fuel Systems Maintenance	M-47
3E4X3	Pest Management	G-38	3E5X1	Engineering	G-49	3E6X1	Operations Management	G-44
3E7X1	Fire Protection	G-38	3E8X1	Explosive Ordnance Disposal	G-64 and M-60	3E9X1	Readiness	G-62
3S0X1	Personnel	A-41	3V0X1	Visual Information	G-44	3V0X2	Still Photography	G-44
3V0X2	Visual Information Production-Documentation	G-62	4A0X1	Health Services Management	G-44	4A1X1	Medical Materiel	G-44
4A2X1	Biomedical Equipment	E-70	4B0X1	Bio-environmental Engineering	G-49	4C0X1	Mental Health Service	G-55
4D0X1	Diet Therapy	G-44	4E0X1	Public Health	G-44	4H0X1	Cardiopulmonary Lab	G-44
4J0X2	Physical Medicine	G-49	4M0X1	Aerospace Physiology	G-44	4N0X1	Aerospace Medical Service	G-44
4N1X1	Surgical Services	G-44	4P0X1	Pharmacy	G-44	4R0X1	Diagnostic Imaging	G-44
4T0X1	Medical Laboratory	G-62	4T0X2	Histo-pathology	G-44	4T0X3	Cytotechnology	G-44
4V0X1	Optometry	G-55	4Y0X1	Dental Assistant	G-44	4Y0X2	Dental Lab	G-66
5R0X1	Chaplain Assistant	G-44 or A-35	6C0X1	Contracting	G-72	6F0X1	Financial Management and Comptroller	G-57
9S100	Technical Applications Specialist	M-88 and E-85						

Navy Enlisted Jobs

The navy calls its enlisted jobs *Ratings* and has about 75 available for entry-level recruits. They don't use line scores for job qualification purposes. Instead, the navy combines scores from the various ASVAB subtests for each of its enlisted ratings.

Table A-3 (in Ratings order) shows combinations of ASVAB subtest scores that are required to qualify for navy enlisted jobs. Peruse the list and see what jobs might best suit you. The ASVAB subtests are abbreviated as follows: General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Auto & Shop (AS), Mathematics Knowledge (MK), Mechanical Comprehension (MC), Electronics Information (EI), Assembling Objects (AO), and Verbal Expression Score (VE).

Table A-3 Navy Enlisted Jobs and Required ASVAB Scores

Rating	*Title*	*Score*	*Rating*	*Title*	*Score*	*Rating*	*Title*	*Score*
ABE	Aviation Boatswain's Mate — Equipment	VE + AR + MK + AS = 184	ABF	Aviation Boatswain's Mate — Fuels	VE + AR + MK + AS = 184	ABH	Aviation Boatswain's Mate — Handling	VE + AR + MK + AS = 184
AC	Air Traffic Controlman	VE + AR + MK + MC = 220 or VE +MK + MC + CS = 220	AD	Aviation Machinist Mate	VE + AR + MK + AS = 210 or VE + AR + MK + MC = 210	AE	Aviation Electrician's Mate	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222
AECF	Advanced Electronics Computer Field	AR + MK + EI + GS = 222	AG	Aviation Aero-grapher's Mate	VE + MK + GS = 162	AIR-CREW	Aircrew Program	VE + AR + MK + MC = 210 or VE + AR + MK + AS = 210
AM	Aviation Structural Mechanic	VE + AR + MK + AS = 210 or VE + AR + MK + MC = 210	AME	Aviation Structural Mechanic — Equipment	VE + AR + MK + AS = 210 or VE + AR + MK + MC = 210	AO	Aviation Ordnance-man	VE + AR + MK + AS = 185 or MK + AS + AO = 140

Rating	*Title*	*Score*	*Rating*	*Title*	*Score*	*Rating*	*Title*	*Score*
AS	Aviation Support Equipment Technician	VE + AR + MK + AS = 210 or VE + AR + MK + MC = 210	AT	Aviation Electronics Technician	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222	AW	Aviation Warfare Systems Operator	VE + AR + MK + MC = 210 or VE + AR + MK + AS = 210
AZ	Aviation Maintenance Administra-tionman	VE + AR = 102	BM	Boatswain's Mate	VE + AR + MK + AS = 175 or MK + AS + AO = 135	BU	Builder	AR + MC + AS = 145
CE	Construction Electrician	AR + MK + EI + GS = 201	CM	Construction Mechanic	AR + MC + AS = 162	CS	Culinary Specialist	VE + AR = 88
CS(SS)	Culinary Specialist (Submarine)	AR + MK + EI + GS = 200 or VE + AR + MK + MC = 200	CTA	Cryptologic Technician — Admini-stration	VE + MK + 102	CTI	Cryptologic Technician — Interperative	VE + MK + GS = 162
CTM	Cryptologic Technician — Maintenance	AR + MK + EI + GS = 223	CTN	Cryptologic Technician — Networks	AR + 2MK + GS = 222	CTR	Cryptologic Technician — Collection	VE + AR = 109
CTT	Cryptologic Technician — Technical	CTT VE + MK + GS = 162						

(continued)

Table A-3 *(continued)*

Rating	*Title*	*Score*	*Rating*	*Title*	*Score*	*Rating*	*Title*	*Score*
DC	Damage Controlman	VE + AR + MK + AS = 205 or VE + AR + MK + MC = 205	EA	Engineering Aid	AR + 2MK + GS = 207	EM	Electricians Mate	VE + AR + MK + MC = 210 or AR + MK + EI + GS = 210
EN	Engineman	VE + AR + MK + AS = 200 or VE + AR + MK + AO = 205	EO	Equipment Operator	AR + MC + AS = 145	EOD	Explosive Ordnance Disposal	AR + VE = 109 and MC = 51
ET	Electronics Technician	AR + MK + EI + GS = 223	ET(SS)	Electronics Technician (Submarine)	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222	FC	Fire Controlman	AR + MK + EI + GS = 223
FT(SS)	Fire Control Technician (Submarine)	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222	GM	Gunner's Mate	AR + MK + EI + GS = 205	GSE	Gas Turbine Systems Technician — Electrical	VE + AR + MK + MC = 210 or AR + MK + EI + GS = 210
GSM	Gas Turbine Systems Technician — Mechanical	VE + AR + MK + AS = 200 or VE + AR + MK + AO = 205	HM	Hospital Corpsman	VE + MK + GS = 146	HT	Hull Technician	VE + AR + MK + AS = 205 or VE + AR + MK + MC = 205

Rating	*Title*	*Score*	*Rating*	*Title*	*Score*	*Rating*	*Title*	*Score*
IC	Interior Communi-cationman	VE + AR + MK + MC = 209	IS	Intelligence Specialist	VE + AR = 107	IT	Information System Technician	AR + 2MK + GS = 222 or AR + MK + EI + GS = 222
MA	Master at Arms	AR + WK = 95 –and– WK = 43	MC	Mass Communi-cations Specialist	VE + AR + 109	MM	Machinist Mate	VE + AR + MK + AS = 200 or VE + AR + MK + AO = 205
MM(SS)	Machinist Mate (Submarine)	VE + AR + MK + MC = 210	MN	Mineman	VE + AR + MK + MC = 210 or VE + AR + MK + AS = 210	MR	Machinery Repairman	VE + AR + MK + AS = 205 or VE + AR + MK + MC = 205
MT	Missile Technician	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 22	ND	Navy Diver	AR + VE = 103 and MC = 51	NUC	Nuclear Program	AR + MK + EI + GS = 252 or VE + AR + MK + MC = 252
OS	Operations Specialist	VE + MK + CS = 157 or AR + 2MK + GS = 210	PC	Postal Clerk	VE + AR = 107	PR	Aircrew Survival Equipment-man	VE + AR + MK + AS = 185 or MK + AS + AO = 140

(continued)

Table A-3 *(continued)*

PS	Personnel Specialist	VE + MK = 105 or VE + MK + CS = 157	QM	Quarter-master	VE + AR = 96	RP	Religious Program Specialist	VE + MK = 105 or VE + MK + CS = 157
SB	Special Warfare Boat Operator	AR + VE = 103 and MC = 51	SECF	Submarine Electronics Computer Field	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222	SH	Ship's Serviceman	VE + AR = 95
SK	Storekeeper	VE + AR = 102	SK(SS)	Storekeeper (Submarines)	AR + MK + EI + GS = 200 or VE + AR + MK + MC = 200	SN(SS)	Seaman (Submarine)	AR + MK + EI + GS = 200 or VE + AR + MK + MC = 200
STG	Sonar Technician	AR + MK + EI + GS = 223	ST(SS)	Sonar Technician (Submarine)	AR + MK + EI + GS = 222 or VE + AR + MK + MC = 222	S0	Special Warfare Operator (SEAL)	GS + MC + EI = 165 or VE + MK + MC + CS = 220
SW	Steelworker	AR + MC + AS = 145	TM	Torpedoman's Mate	AR + 2MK + GS = 194	UT	Utilitiesman	AR + MK + EI + GS = 201
YN	Yeoman	VE + MK = 105 or VE + MK + CS = 157	YN(SS)	Yeoman (Submarine)	AR + MK + EI + GS = 200 or VE + AR + MK + MC = 200			

Marine Corps Enlisted Jobs

The United States Marine Corps needs a few good men (and women) to fill about 120 enlisted entry-level job specialties. Like the army, the Marine Corps calls its enlisted jobs *Military Occupation Specialties* (MOS). The Marine Corps has only three line scores, and they're abbreviated in Table A-4 as follows: Mechanical Maintenance (MM), Electronics (EL), and General Technical (GT).

See Chapter 2 for information regarding which subtest scores of the ASVAB are used to comprise these line scores.

Table A-4 Marine Corps Enlisted Jobs and Required ASVAB Scores

MOS	*Title*	*Score*	*MOS*	*Title*	*Score*	*MOS*	*Title*	*Score*
0121	Personnel Clerk	GT-100	0151	Administrative Clerk	GT-100	0161	Postal Clerk	GT-90
0231	Intelligence Specialist	GT-100	0241	Imagery Analysis Specialist	GT-100	0251	Interrogator/ Debriefer	GT-100
0261	Geographic Intelligence Specialist	EL-100	0311	Rifleman	GT-80	0313	LAV Crewman	GT-90
0321	Reconnaissance Man	GT-105	0341	Mortarman	GT-80	0351	Assaultman	GT-80
0352	Antitank Assault Guided Missileman	GT-90	0411	Maintenance Management Specialist	GT-100	0431	Logistics/ Embarkation and Combat Service Support (CSS) Specialist	GT-100
0451	Air Delivery Specialist	GT-100	0481	Landing Support Specialist	GT-95 and MM-100	0511	MAGTF Planning Specialist	GT-110
0612	Field Wireman	EL-90	0613	Construction Wireman	EL-90	0614	Unit Level Circuit Switch (ULCS) Operator/ Maintainer	EL-100
0621	Field Radio Operator	EL-90	0622	Mobile Multichannel Equipment Operator	EL-100	0624	High Frequency Communication Central Operator	EL-100
0626	Fleet SATCOM Terminal Operator	EL-100	0627	Ground Mobile Forces SATCOM Operator	EL-100	0811	Field Artillery Cannoneer	GT-90

(continued)

Table A-4 *(continued)*

MOS	*Title*	*Score*	*MOS*	*Title*	*Score*	*MOS*	*Title*	*Score*
0842	Field Artillery Radar Operator	GT-105	0844	Field Artillery Fire Control Man	GT-105	0847	Artillery Meteoro-loqical Man	GT-105
1141	Electrician	EL-90	1142	Electrical Equipment Repair Specialist	EL-100	1161	Refrigeration Mechanic	MM-105
1171	Hygiene Equipment Operator	MM-85	1181	Fabric Repair Specialist	MM-85	1316	Metal Worker	MM-95
1341	Engineer Equipment Mechanic	MM-95	1345	Engineer Equipment Operator	MM-95	1361	Engineer Assistant	GT-100
1371	Combat Engineer	MM-105	1391	Bulk Fuel Specialist	MM-85	1812	M1A1 Tank Crewman	GT-90
1833	Assault Amphibious Vehicle (AAV) Crewman	GT-90	2111	Small Arms Repairer/ Technician	MM-95	2131	Towed Artillery Systems Technician	MM-95
2141	Assault Amphibious Vehicle (AAV) Repairer/ Technician	MM-105	2146	Main Battle Tank (MBT) Repairer/ Technician	MM-105	2147	Light Armored Vehicle (LAV) Repairer/ Technician	MM-105
2161	Machinist	MM-105	2171	Electro-Optical Ordnance Repairer	MM-105 and EL-105	2311	Ammunition Technician	GT-100
2336	Explosive Ordnance Disposal Technician	GT-110	2621	Communica-tions Signal Collection/ Manual Morse Operator/ Analyst	GT-100	2631	Electronic Intelligence (ELINT) Intercept Operator/ Analyst	GT-100
2651	Special Intelligence System Administrator/ Communicator	GT-100	267X	Cryptologic Linguist	GT-105	2811	Telephone Technician	EL-115
2818	Personal Computer (PC)/Tactical Office Machine Repairer	EL-115	2821	Computer Technician	EL-115	2822	Electronic Switching Equipment Technician	EL-115

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
2831	Multichannel Equipment Repairer	EL-115	2832	Multichannel Equipment Technician	EL-115	2834	Satellite Communications (SATCOM) Technician	EL-115
2841	Ground Radio Repairer	EL-115	2844	Ground Communications Organizational Repairer	EL-115	2846	Ground Radio Intermediate Repairer	EL-115
2871	Test Measurement and Diagnostic Equipment Technician	EL-115	2881	Communication Security Equipment Technician	EL-115	2886	Artillery Electronic System Repairer	EL-115
2887	Counter Mortar Radar Repairer	EL-115	3043	Supply Administration and Operations Clerk	GT-110	3051	Warehouse Clerk	GT-90
3052	Packaging Specialist	GT-80	3112	Traffic Management Specialist	GT-90	3361	Subsistence Supply Clerk	GT-90
3381	Food Service Specialist	GT-90	3432	Finance Technician	GT-110	3441	NAF Audit Technician	GT-110
3451	Fiscal/Budget Technician	GT-110	3521	Organizational Automotive Mechanic	MM-95	3531	Motor Vehicle Operator	MM-85
4066	Small Computer Systems Specialist	GT-110	4067	Programmer	GT-110	4113	Morale, Welfare, Recreation (MWR) Specialist	GT-110
4341	Combat Correspondent	GT-105 AND VE-40	4421	Legal Services Specialist	GT-100	46XX	Visual Information	GT-100
55XX	Band	GT-50	5711	Nuclear Biological and Chemical (NBC) Defense Specialist	GT-110	5811	Military Police	GT-100
5821	Criminal Investigator	GT-110	5831	Correctional Specialist	GT-100	5937	Aviation Radio Repairer	EL-105

(continued)

Table A-4 *(continued)*

MOS	*Title*	*Score*	*MOS*	*Title*	*Score*	*MOS*	*Title*	*Score*
5942	Aviation Radar Technician	EL-105	5952	Air Traffic Control Navigational Aids Technician	EL-105	5953	Air Traffic Control Radar Technician	EL-105
5954	Air Traffic Control Communications Technician	EL-105	5962	Tactical Data Systems Equipment (TDSE) Repairer	EL-105	5963	Tactical Air Operations Module Repairer	EL-105
6042	Individual Material Readiness List (IMRL) Asset Manager	GT-100	6046	Aircraft Maintenance Administration Specialist	GT-100	6048	Flight Equipment Technician	MM-105
6061	Aircraft Intermediate Level Hydraulic/ Pneumatic Mechanic	MM-105	6071	Aircraft Maintenance Support Equipment (SE) Mechanic	MM-105	6091	Aircraft Intermediate Level Structures Mechanic	MM-105
611X	Helicopter Mechanic	MM-105	612X	Helicopter Power Plants Mechanic	MM-105	615X	Helicopter/ Tiltrotor Airframe Mechanic	MM-105
617X	Helicopter Crew Chief	MM-105	621X	Fixed-wing Aircraft Mechanic	MM-105	622X	Fixed-Wing Aircraft Power Plants Mechanic	MM-105
6232	Fixed-Wing Aircraft Flight Mechanic	MM-105	625X	Fixed-Wing Aircraft Airframe Mechanic	MM-105	628X	Fixed-Wing Aircraft Safety Equipment Mechanic	MM-105
63XX	Aircraft Communications/ Navigation/ Electrical/ Weapon Systems Technician	EL-105	64XX	Aircraft Communications/ Navigation Systems Technician	EL-105	6511	Aircraft Ordnance Technician	GT-105
6672	Aviation Supply Clerk	GT-100	6673	Automated Information Systems (AIS) Computer Operator	GT-100	6821	Weather Observer	GT-105

MOS	Title	Score	MOS	Title	Score	MOS	Title	Score
7011	Expeditionary Airfield Systems Technician	MM-105	7041	Aviation Operations Specialist	GT-100	7051	Aircraft Firefighting and Rescue Specialist	MM-95
7212	Low Altitude Air Defense (LAAD) Gunner	GT-90	7234	Air Control Electronics Operator	GT-105	7242	Air Support Operations Operator	GT-100
7251	Air Traffic Controller	GT-105	7314	Unmanned Aerial Vehicle (UAV) Air Vehicle Operator	GT-105	7371	Aerial Navigator	GT-110
7381	Airborne Radio Operator/ In-flight Refueling Observer/ Loadmaster	GT-110						

Coast Guard Enlisted Jobs

The smallest U.S. Military service, the Coast Guard only has 19 entry-level jobs for enlisted members. Like the navy, the Coast Guard calls its enlisted jobs *Ratings.* Also like the navy, the Coast Guard doesn't use line scores for job qualification purposes. Instead it uses the sums of various ASVAB subtest scores.

Table A-5 shows combinations of ASVAB subtest scores that are required to qualify for Coast Guard enlisted jobs. The ASVAB subtests are abbreviated as follows: General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), Paragraph Comprehension (PC), Auto & Shop (AS), Mathematics Knowledge (MK), Mechanical Comprehension (MC), Electronics Information (EI), Assembling Objects (AO), and Verbal Expression Score (VE).

Table A-5 U.S. Coast Guard Enlisted Jobs and Required ASVAB Scores

Rating	Title	Score	Rating	Title	Score	Rating	Title	Score
AMT	Aviation Maintenance Technician	AR + MC + AS + EI = 213 (minimum AR = 52)	AST	Aviation Survival Technician	VE + MC + AS = 159 (minimum AR = 52)	AV	Avionics Technician	MK + EI + GS = 171 (minimum AR = 52)

(continued)

Table A-5 *(continued)*

Rating	*Title*	*Score*	*Rating*	*Title*	*Score*	*Rating*	*Title*	*Score*
BM	Boatswain's Mate	VE + AR = 101	DC	Damage Controlman	VE + MC + AS = 152	EM	Electrician's Mate	MK + EI + GS = 152 (minimum AR = 52)
ET	Electronics Technician	MK + EI + GS = 171 (minimum AR = 52) or AFQT = 66	FS	Food Service Specialist	VE + AR = 106	GM	Gunner's Mate	AR + MK + EI + GS = 208
HS	Health Services Technician	VE + MK + GS = 154	IT	Information Systems Technician	MK + EI + GS = 171 (Minimum AR = 52)	MK	Machinery Technician	AR + MC + AS = 150 or VE + AR = 106
MST	Marine Science Technician	VE + AR = 115 (minimum MK = 58)	MU	Musician	N/A	OS	Operations Specialist	VE + AR = 106
PA	Public Affairs Specialist	VE + AR = 110 (minimum VE = 60)	PS	Port Security Specialist (CG Reserves, Only)	VE + AR = 101	SK	Storekeeper	VE + AR = 106 (minimum VE = 52)
YN	Yeoman	VE + AR 106						

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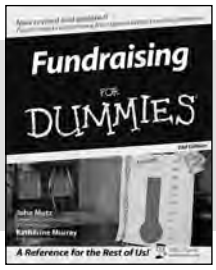
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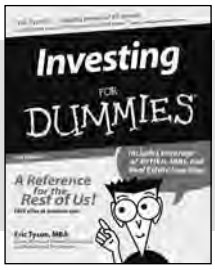
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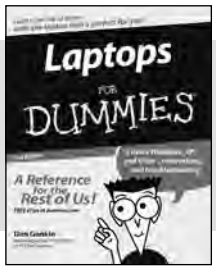


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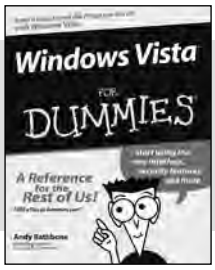
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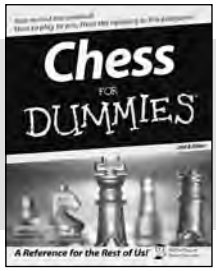


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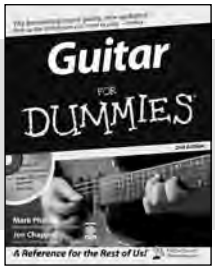
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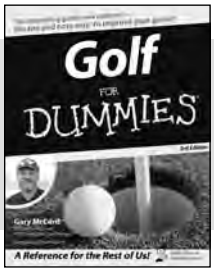
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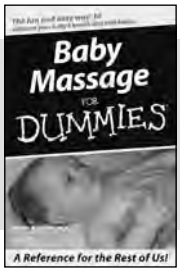
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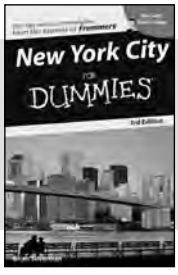
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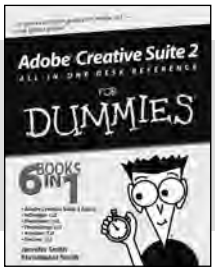


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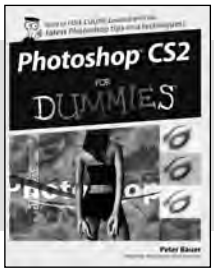
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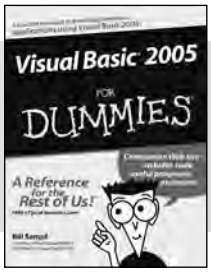


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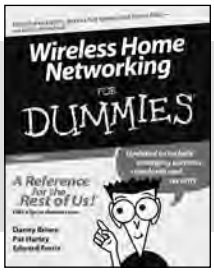
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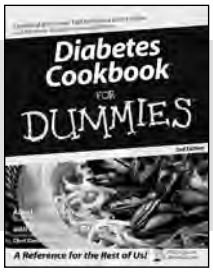


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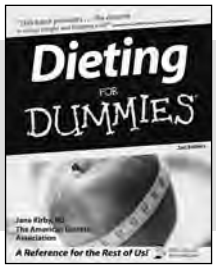
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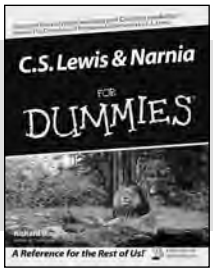


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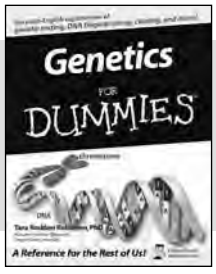
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