BREVARD PUBLIC SCHOOLS

SAFE SCIENCE

Science Safety for Schools

SUMMER 2015
BREVARD PUBLIC SCHOOLS
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Brevard Public Schools - Safe Science 2015
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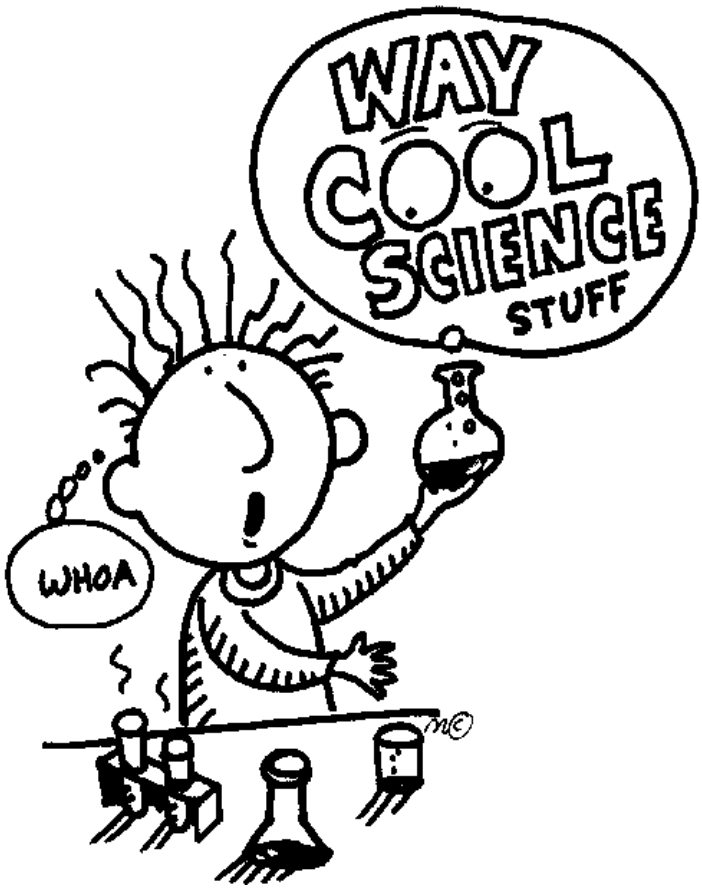
Table of Contents



Brevard Public Schools - Safe Science

Introduction

The National Science Teachers Association (NSTA) recommends that forty to eighty percent of science classroom instruction time should be spent in laboratory activities. It is through this variety of hands-on experiences that students gain a true understanding of science. To be educational, meaningful, and valuable to students, science instruction must include a wealth of hands-on experiences that guide students to discover and construct science concepts.

Experimental sciences not only lend themselves well to Florida Standards, but it can be argued that science historically emerged from the unique interactions of multiple disciplines. In fact, there is compelling evidence that scientists helped to catalyze the development and advancement of mathematics (Isaac Newton), literature (Rachel Carson) and society (Albert Einstein, Time's Person of the Century). Thus it is clear that the historically forged relationship between science and its associated disciplines is inextricably intertwined. It therefore follows that any science curriculum of merit must also reflect the same relationship. For example, the Florida Standards construct a strong foundation for experiencing the processes of scientific inquiry: research, hypothesis formation, communication and collaboration, written analysis, evaluation, and formal presentation of results and conclusions. Any laboratory investigation, inquiry activity or related student-oriented hands-on task must therefore address a significant compliment of Florida Standards. For both the teacher and the student, utilizing Florida Standards simply makes teaching and learning science more relevant, more meaningful, more interesting and of course, more fun.

A science program that includes many laboratory and hands-on activities inherently requires a comprehensive safety program. The purpose of this document is to articulate and promote safe practices in the science classroom. This will ensure that lab experiences at all grade levels are both educational and safe.

This manual provides current safety information about materials, equipment, activities, organisms, chemical substances, and practices in all science classrooms. This publication also reflects the Brevard Public Schools' commitment to hands-on learning activities as an integral part of science instruction. The intent of this manual is to advocate hands-on classroom instruction in a safe and appropriate manner.

It is of paramount importance that the teacher understands the absolute necessity of being fully prepared to manage laboratory activities with safety as the very highest priority.

Laboratory Safety

Lesson Plans

In the science laboratory classroom, science teachers are required to incorporate health and safety as an integral part of their instruction. Ultimately, it is the teacher's responsibility to ensure that proper safety considerations have been implemented and that appropriate precautions have been taken. These safety features should be reflected in documented lesson plans.
Teachers should answer the following questions before conducting every laboratory experiment:

- What are the risks/educational benefits associated with this activity?
- What are its worst-case scenario outcomes?
- What actions do I need to be prepared to take if these outcomes should occur?
- What practices, equipment and facilities would reduce risks?
- What specific training, techniques, information and safety instructions must be taught to the students prior to the laboratory experience?

Teacher Responsibility

Science teachers must become safety conscious advocates. It is dangerous to assume that students remember safety procedures and equipment discussed at the beginning of the school year. Teachers must emphasize safety techniques that pertain to specific laboratory activities at the time these events occur. The science instructor should always be aware of all possible safety hazards and conditions associated with an activity. Laboratory exercises should be modified--or even terminated--and students reminded of proper lab procedure every time a potentially hazardous situation is encountered.

The following steps should be taken by the teacher to fulfill safety objectives:

- The teacher should perform all experiments prior to allowing students to perform them so that special safety precautions and potential hazards may be noted and passed on to the students.
- The Brevard Public Schools LABORATORY SAFETY AGREEMENT POSTER can be found on BSEND: under all discussion boards, 21st century Curriculum Guides, and Science Research. Posters must be displayed in all science laboratory classrooms.
- Make safety practices a major emphasis in the science curriculum.
- Incorporate the use of the Brevard Public Schools Science Safety Agreement, which the student and parent (or guardian) must read and sign.
- Students should be able to identify the location of safety equipment and indicate its use. Explain under what conditions safety equipment is to be used.

- Explain the specific consequences for violating safety regulations.
- Instruct students in proper evacuation procedures during an emergency.
- Point out specific safety considerations in a particular lab activity.
- Explain the proper handling, dispensing and disposal procedures for chemicals, including the possible hazards associated with each substance.
- Never leave students alone and/or unsupervised in the lab.
- Frequently remind the students that they are not allowed in chemical storerooms or lab preparation areas.
- Prohibit students from bringing any food or drink into the lab.
- Discuss laboratory activities with students prior to experimentation so that safety situations and possible hazards can be clarified.
- Notify the administration, in writing, of any safety hazard that exists in the laboratory facility.
- Provide only immediate and prudent care in case of an accident to prevent additional complications from arising. Contact your administration and call 911 immediately.
- Science fair projects should be scrutinized for safety hazards and corrected before teacher approval is given. Remember the science teacher is ultimately responsible for all assigned science activities.

Science Lab Safety Equipment

It is the responsibility of the school to provide all science classrooms with proper safety equipment. Students should know the location and use of safety equipment. Good laboratory practice requires regular inspection of the equipment by the teacher to ensure the equipment is in good working order.

Rooms used for laboratory investigations should be equipped with the following items. (A safety equipment checklist is provided at the end of this section):

- ABC type fire extinguisher
- Broom and dust pan
- Chemical spill materials
- Containers for broken glassware and chemical waste, clearly labeled
- Deluge shower
- Emergency exhaust fan separate from the regular air system
- Emergency lighting
- Eye wash station
- Fire blanket
- Ground fault interrupter circuit (GFI) for electrical outlets in proximity of water splash areas
- Master electrical cut-off switch, readily accessible and clearly labeled
- Master gas cut-off switch, readily accessible and clearly labeled
- Signs clearly marking all safety equipment, hazardous areas and fire exits
- Eyewash and deluge showers must be inspected during preplanning and quarterly thereafter using the Secondary Science Laboratories Checklist, located in the appendix. The checklist must be displayed in the vicinity of the shower/eyewash.

The following equipment should be available to the teacher at least as a department set:

- Fume hood with a spark proof motor
- Sanitizing cabinet for safety glasses (Z87+) and safety goggles (Z87+).

Personal Protection Equipment

It is the responsibility of the school to provide special protective equipment and to require its use during classroom laboratory activities involving potentially hazardous situations including: glassware, chemicals, heating agents, compressed gases, liquids and potential projectiles or any other situation that could pose a hazard.

Aprons

Chemical resistant laboratory aprons should be provided to protect clothing and underlying skin from chemical spills and splattering. Disposable aprons may not be chemically resistant. Aprons should be wiped down with disinfectant after use.

Gloves

Due to the nature of the science classroom, there will be times when gloves are necessary for the safety of students and teachers. Care should be taken to ensure that the proper glove is being used for its intended purpose. Teachers should be aware of the growing problem of allergic reactions to latex gloves and the powder on these gloves. These allergies can range from mild to severe, including anaphylactic shock. Students may not be aware that they are allergic to Latex until exposed. Continued exposure to latex increases the severity of the reaction; if a student is allergic to latex, alternative gloves should be available and provided to the entire class. These options include:

- PVC- Also known as *vinyl*, these gloves can be used for experiments dealing with acids and alcohols, but not petroleum solvents.
- Nitrile- A synthetic rubber with superior puncture and abrasion resistance in addition to chemical protection.

For working with heated objects, students should have access to heat resistant gloves. Heat resistant gloves should not be allowed to get wet as they will lose their heat resistance. Gloves of any type must be kept well away from open flames.

Eye protection

Florida DOE require that goggles and safety glasses have an appropriate ANSI rating, safety glasses (Z87+) and safety splash goggles (Z87+).

- Provide adequate protection against the hazards for which it is designed
- Be reasonably comfortable under the conditions of use
- Fit securely without interfering with vision or movement
- Be durable
- Be kept clean and in good repair
- Goggles must be sanitized and cleaned before each use. Goggles may be sanitized by using a UV sanitizing cabinet or by dunking them into a bucket of disinfectant solution (20 mL of disinfectant/L of deionized water) and allowing them to air-dry.

Due to the nature of the lab or activity, different types of face protection should be used. Options include:

- Chemical splash **goggles** utilize indirect vents to protect against splashes of hazardous chemicals or potentially infectious materials. Strong polycarbonate lenses provide durability, clarity of vision, and UV protection.
- Protective impact **glasses/goggles** provide protection against projectiles such as might occur in a physics classroom.
- Dust masks protect again airborne dust, pollen and particulates, but are not effective against harmful vapors.
- Some goggles straps are made of Latex and may cause allergic reactions.

Hearing protection

Hearing protection should be worn during experiments in which the sound safety threshold may be exceeded. Exposure limits depends on both loudness and duration. Detailed information about sound exposure limits is available at OHSA.gov

Safe Laboratory Attire

To promote safety in the school laboratory, students, teachers, and visitors should dress in a manner that will reduce the likelihood of an accident or injury.

Shoes

Shoes that cover the entire foot must be worn to provide a protective barrier against broken glassware and chemical spills.

Clothing

Loose fitting clothing, floppy sleeves and accessories such as ties and scarves should not be worn to prevent contact with chemicals, machinery and flames.

Contact lenses

Students should be made aware of the possible hazards associated with wearing contact lenses. Soft contact lenses have a potential of reacting with vapors produced during a lab. Both soft and hard contacts have a tendency to absorb and concentrate liquids and vapors behind the lens. Contacts also impair the cleansing of the eyes in case of a chemical splash. For these reasons, contact lenses should not be worn when working with chemicals.

Long hair

Long hair should be tied back or put into a bun so that it will not come in contact with chemicals, machinery and flames.

Jewelry

Jewelry on the hands or wrists and all dangling jewelry should be removed.

Emergencies in Science Laboratories

The most important functions of a teacher in preventing accidents are the effective management of instructional activities and the proper supervision of all students. Even under the best conditions, accidents and emergencies may occur. Prompt, calm, and professional handling of emergencies is imperative. The safety of students and teachers is the primary concern.

- The teacher should be familiar with district and building emergency procedures.
- Teachers are to follow district and school policies concerning completing incident reports.
- Always notify an administrator when a laboratory accident occurs.
- **Whenever there is a life-threatening emergency, dial 9-1-1.**
- **All students requiring first aid should be sent to the clinic.**
- **For specific information, refer to your school's hazard control document**

Chemical Spills

At no time should a teacher attempt to fight a chemical fire or deal with a chemical spill that presents any significant threat to health or safety. A small spill or fire is defined as one that poses no significant health or safety hazard tofaculty or students.

In the event of a small chemical spill:

- Remove students from the immediate area.
- If available, activate emergency exhaust fan.
- Follow the specific cleanup procedures on the chemical's MSDS.

In the event of a large or hazardous chemical spill:

- Evacuate the area
- All gas outlets should be turned off at the master gas shutoff button.
- Electricity to the classroom lab tables should be turned off at the master electrical shutoff button.
- Notify the principal immediately and give:
  a. The location of the spill.
  b. The name of the substance spilled.
  c. Other pertinent information regarding the spill.
- Put on appropriate personal protective equipment before entering the contaminated area.
- Absorb liquids with an appropriate absorbing material.
- Pick up materials with a non-sparking tool.
- Place materials in a suitable storage container and label.
- Clean or neutralize affected area appropriately.
- Consult the Approved Chemical List for proper disposal and coordinate the disposal with the appropriate administrator.

Chemical Fires

A small chemical fire can be quickly extinguished with a hand held fire extinguisher. In the event of a small chemical fire, turn off the gas and electrical supply to the lab area, evacuate all students from the area and extinguish the fire. Once the fire has been extinguished, follow the small spill cleanup procedure. After a chemical incident, all emergency equipment must be restored to full working order before a lab class is allowed to continue.

In the event that a chemical fire or spill threatens health or safety, immediately:

- Evacuate all persons from the affected areas.
- All gas outlets should be turned off by using the master gas shutoff button.
- Electricity to the classroom lab tables should be turned off at the master electrical shutoff button.
- Secure the affected areas from accidental entry.
- Alert administration to disconnect ignition sources at the main power panel.
- Begin decontamination procedures for affected individuals.
- Notify the principal immediately. Provide the following information:
  a. Your name and the location of the emergency.
  b. The trade and chemical name of the substance.
  c. Volume of spill or release.
  d. Known hazards of the substance (flammable, corrosive, toxic)
  e. Identify other chemicals in spill and affected areas.
  f. Report injuries, fire and damage.
- Assist your supervisor and authorities if your help is requested.
- Do not enter evacuated areas until they are declared safe.

Clothing/Body Fire

- Use fire blanket (drop and roll)
- Evacuate students, if necessary
- Pull nearest fire alarm station
- Flush burns with cool water
- Call 911, if needed
- Call nurse's office

Chemical Splash to Eye

- If chemicals are splashed in the eye, the eye should be flushed with running water for at least 15 minutes.
- Contamination should be washed from eyes and from under the eyelids.
- The eye should not be rubbed if a foreign object is present in the eye.
- Contact the school nurse or an administrator.
- Consult MSDS for first aid procedures.

Chemical Spill on Body

- Wash for at least 15 minutes with water.
- Remove clothing that might interfere with the complete removal of chemical.
- Additional medical treatment may be necessary.
- Consult MSDS for first aid procedures.

Poisoning

Contact the school nurse and an administrator. If life threatening, call 911. Help is also available from the **Florida Poison Information Center (1-800-282-3171).** Be prepared to identify the toxic chemical, the amount, and the concentration.

Safety Concerns

Biotechnology and Microorganisms

Safety in a laboratory is important in the prevention of infection that might be caused by the microorganisms being studied. Many types of microorganisms are *potentially* pathogenic. This means that, although they would not cause disease in a normal healthy host, they might possibly do so if a large enough quantity of the microbes came into contact with a compromised host, for example, through wounds and cuts. Since local, state and federal regulations and statutes are constantly being updated regarding microbiology protocols, it is recommended that only well-trained educators should engage in microbiological experiments. Deoxyribonucleic acid (DNA) is at the core of many hands–on activities in molecular biology and biotechnology exercises introduced in high school. This study involves isolation, enzymatic digestion, gel electrophoresis, and manipulation of bacterial cells to introduce new genetic information. All research involving recombinant DNA technology must be carried out in accordance with the National Institutes of Health (NIH) (http://www.nih.gov/od/oba/) guidelines for conducting research using recombinant DNA. Essential guidelines for handling any microorganism or DNA in the laboratory are also contained in the *Standards for Microbial Practice* section of the manual, *Biosafety in Microbiological and Biomedical Laboratories*, (http://www.nih.gov/od/ors/ds/pubs/bmbl).

Guidelines

The guidelines below summarize the procedures for working with biotechnology and microorganisms to ensure that the activities will be performed safely. The following are precautions that should be taken:

1. Known pathogens must never be used for class study, and special care must be taken to avoid contamination of laboratory and stock cultures.

2. There must be no eating or drinking in the microbiology laboratory. Food or drink should never be stored in refrigerators containing laboratory materials. All potential infectious vectors, such as fingers and writing instruments, must be kept away from the body's entry points including such as eyes, nose, and mouth.

3. Students and teachers must wear protective eyewear, gloves and laboratory apron/coat. These should be decontaminated after each use.

4. When working with microorganisms and recombinant DNA, keep hands must be kept away from the mouth, nose and eyes, as well as any other entry point such as wounds. Washing the hands thoroughly with soap and water before and at the end of every laboratory period is mandatory.

5. All microorganisms and DNA samples must be treated as if they are potential pathogens, and thus handled accordingly.

6. Use either a 10% bleach solution or a 70% alcohol solution to wipe down benches and work areas both before and after working with cultures and after a spill.

7. If bacterial cultures are accidentally spilled, the area should be disinfected with a 10% bleach solution or a 70% alcohol solution.

8. Decontaminating solutions should be readily available and contained in well-labeled laboratory squeeze bottles.

9. Solutions should never be pipetted by mouth. Use only mechanical pipetting devices for transferring any material.

10. Perform procedures carefully to minimize the formation of aerosols. Inhalation of infectious aerosols is by far the most frequent mode of laboratory infection. Any actions that might result in the generation of an aerosol must be avoided. (e.g., shaking an inoculating loop or agitating media).

11. Sterilize:
    a. all exposed materials such as media, tubes, plates, loops, needles, pipettes, and other glassware used for culturing microorganisms or isolating DNA and restriction enzymes by **autoclaving.**
    b. all cultures and their containers via autoclaving before disposal. Plastic petri dishes should be autoclaved for 20 minutes at 121^0C and disposed without opening or submerged and opened in a 10% bleach solution and left for 30 minutes.
    c. wire inoculating loops and needles must using a flame until the wire glows red-hot, both before and after use.

12. All cultures and media should be clearly and securely labeled with names and dates. Culture dishes, once inoculated, should be sealed with tape and not reopened.

13. There is always a chance that microorganisms obtained from the environment may be pathogenic, so the culture dishes should be sealed with tape and not reopened. No transfers are to be made to other culture dishes.

14. Liquid and solid wastes that have been in contact with experimental organisms must be decontaminated. Experimental organisms must be destroyed before disposal.

The National Institutes of Health - Biosafety in Microbiological and Biomedical Laboratories- (http://www.nih.gov/od/ors/ds/pubs/bmbl*)* has recommendations for BSL 1 organisms that may be suitable for use. Check with Science Resource Teacher for approval. (*Escherichia coli K-12* is on the approved list)

Conducting Gel Electrophoresis –

Electrophoresis experiments are potentially very hazardous because of the presence of ionic solutions in proximity to high voltage and currents. Students must be warned about placing fingers or electricity conducting materials into the electrophoresis buffer solution while the gel box is in operation. The leads from the electrophoresis box must never be disconnected with the power supply turned on.

Staining DNA

Methylene blue (or a commercial derivative) or **Carolina BLU** is the recommended staining agent for viewing DNA after electrophoresis. Students should wear gloves in handling this stain because it is moderately toxic and will stain. Check with MSDS/SDS reports for disposal protocol.

Chemicals

Acetone

Acetone is used as a general laboratory solvent and in experiments involving paper chromatography. It is highly flammable and produces explosive vapor. Inhalation may produce narcosis. Contact with the skin or eyes or by ingestion is toxic. It should be handled cautiously and only under well-ventilated conditions. When practical, dispense acetone in small containers under a fume hood. Proper gloves should be worn when using this chemical.

Acids and Bases

The hazards associated with this class of experiments are related to diluting concentrated acids, to pipetting procedures, and to the filling of glassware such as burets. The teacher should dilute the acids or bases in advance of the lab. If the student must dilute the reagents, care must be taken since the dilution of acid with water is highly exothermic. *Acid* should always be added to *water.*

Antibiotics

Students who are allergic to an antibiotic such as penicillin must not handle antibiotic discs or antibiotic solutions used to test the resistance of bacteria.

Benedict's Qualitative Solution

Benedict's solution is used in the identification of reducing sugars. It contains copper II sulfate and is toxic and caustic, especially when hot. Handel accordingly.

Biuret Reagent

Biuret reagent is used in protein identification. The solution contains sodium hydroxide, is caustic, and requires caution, especially when hot. Proper eye protection is required when working with this solution.

Bleach

Bleach is used as a disinfectant in seed germination experiments and in skeletal preparations in the biology lab. Bleach contains sodium hypochlorite and is irritating to the skin and eyes. It will react violently with acids and will form toxic chlorine fumes in the presence of ammonia. A 10% solution of bleach in water is commonly used as a disinfectant.

Buffer Solutions

Buffer solutions that stabilize solutions at high and low pH are strongly alkaline and acidic. They should be treated as strong acids or bases.

Dry Ice and Liquid Nitrogen

The sublimation point of dry ice (solid carbon dioxide) is -78.5° C (-178° F) and the boiling point of liquid nitrogen is -195.5° C (-3 84° F). Proper insulating gloves, eye

protection, and protective clothing must be worn when handling these substances. Never handle extremely low-temperature substances with bare hands. Always store (only temporary storage is possible in school laboratories) dry ice and liquid nitrogen in well-insulated, vented containers such as Dewar Flasks. Never place dry ice or liquid nitrogen in a sealed container since the resulting increase in gas pressure may cause an explosion. Always transport dry ice and liquid nitrogen in well ventilated vehicles. There is a potential danger of asphyxiation due to the displacement of oxygen by nitrogen and carbon dioxide in an enclosed area.

Fehling's Solutions A and B

Fehling's solutions are used in the identification of reducing sugars. The solutions are caustic and toxic, and require caution, especially when hot.

Hydrogen Peroxide

3% Hydrogen Peroxide is commonly used. Even though this is a relatively weak solution, it should still be considered a skin and eye irritant.

Iodine Solutions

Iodine is toxic and corrosive whether in it elemental form, or in solution, as in Gram's Iodine, Lugol's Iodine, or iodine-potassium-iodide solutions. Iodine solutions greater that 6% are prohibited. Contact with the skin, and especially the eyes, should be avoided. Sublimation of iodine should be carried out in a fume hood.

Limewater

Limewater is used as a common laboratory test for carbon dioxide. It contains calcium hydroxide and is a mild skin irritant. Contact with the skin and eyes must be avoided.

Magnesium

When burning magnesium, caution student to not look directly at the flame because intense ultraviolet light is produced.

Nitric Acid

All reactions involving nitric acid are required to be carried out in a fume hood. Avoid skin contact with nitric acid fumes.

Petroleum Ether

Petroleum ether contains low molecular weight alkanes, and is often used as a solvent in plant pigment chromatography experiments. It is highly flammable and causes narcosis, and thus should be used only in a fume hood.

Plant Growth Hormones

Indole-3-acetic Acid (IAA), 3-indolebutyric acid (IBA), and gibberellic acid are possible mutagens and must be handled cautiously. Both IAA and IBA are contained in commercially available rooting powders. Inhalation of the dust or contact with the skin should be avoided.

Potassium Hydroxide

Potassium hydroxide is used to absorb carbon dioxide in cellular respiration experiments and to clear tissues for subsequent staining. Like sodium hydroxide, it is highly toxic and extremely caustic. Contact with the skin and especially the eyes may cause severe damage.

Radioactive Materials

Without special approval radioactive materials are not allowed.

Sodium Hydroxide

Sodium hydroxide is highly toxic and extremely caustic. Contact with the skin and especially the eyes may cause severe damage.

Solar Studies

Students should never look directly at the sun during a solar eclipse or when doing astronomical or spectrographic studies. When making observations through a spectroscope, telescopes or pinhole camera, students should use indirect viewing or projection methods.

Solvents

Special precaution should be taken when working with solvents. Make sure to close solvent containers after use. Dispose of all solvents properly.

Stains

Many staining solutions contain staining agents dissolved in acetone or alcohol. Use appropriate cautions.

Triethylamine (requires approval)

This is the active ingredient in insect anesthetics such as Fly-Nap and Lull-A-Fly. It is flammable and is an irritant to the eyes, skin, and respiratory tract. It is recommended that CO_2 be used instead. Fly-Nap use will require prior approval for use on a limited basis.

Dissections

Philosophy

These studies are intended to foster an appreciation for the animal's intrinsic value, its place in the ecosystem and its intricate complexity of form and function. The use of animals in the classroom is sanctioned if the teacher has addressed the following four criteria. The criteria can be remembered as the four R's. Alternative instructional activities will be provided at all levels for those students who refuse or are unable to participate in dissection labs, as per Florida Statue 233.0674.

Respect

Teachers should model respect for animals. Discussions on the rationale for animal use and sources of dissection specimens help the student make an informed decision about participation in activities. Taking time to address the proper treatment and careful handling of both live and preserved animals demonstrates respect for the animal.

Teachers must also respect the diversity of opinions and feelings about the use of animals. Students who object to the dissection of animals should be treated with dignity and given meaningful alternative assignments to accomplish the objectives of the lesson. See Student Dissection Form at the end of this section.

Refine

Refine teaching strategies to ensure that the instruction has a relevant, clearly defined intended outcome.

Reduce
The number of animals should be reduced to eliminate unnecessary waste. One significant way to reduce waste is to eliminate the duplication of dissections at different grade levels. In addition, students may be able to work in groups or examine fewer species. A list of recommended specimens has been developed and is available at the end of this section.

Replace
Traditional dissections may sometimes be replaced by alternative effective activities such as on-line simulated dissections.

Safety Guidelines for Dissection

- Rules for safe lab procedures and appropriate laboratory student behavior should be posted, and specific precautions should be brought to each student's attention.
- During dissection activities, rinse dissection equipment in a disinfectant at least once a day.
- Gloves, goggles/safety glasses, and aprons should be worn at all times.
- Purchase preserved specimens from a biological supply house. Use only specimens in good condition. Road kills or fresh specimens of questionable origin are inappropriate.
- It is recommended that dissection materials be preserved specimens obtained from an approved commercial vender. Recommended preservation methods are limited to: dry packed, glycerin, alcohol packed and formaldehyde alternative. Purchasing animals (chicken, fish, squid, etc.) or animal parts (hearts, eyeballs, etc.) from a grocery creates special concerns. Special care should be taken to prevent bacterial contamination from unpreserved specimens purchased at a grocery store. Unpreserved specimens should be refrigerated and used within 24 hours. All equipment and lab surfaces must be disinfected, and students should be cautioned against touching their faces with contaminated gloves. Do not use specimens packed in formalin or formaldehyde.
- Rinsing specimens is recommended before distributing them to the students.
- Dissections should be done in well-ventilated rooms.
- As internal organs are exposed, they should also be rinsed.
- The most dangerous dissecting tools are those that are dull and therefore require the most force. Only sharp cutting tools should be used.
- When using scissors, instruct students to cut away from the body whenever possible. Scalpels should be used for incision only; scissors are the tool of choice. If razor blades are used, only the single-edged type with a rigid, reinforced back should be used.
- At the end of the laboratory period, hands should be washed thoroughly with soap and water, especially under the fingernails.
- Remains of unpreserved food item specimens such as chicken wings and beef heart should be wrapped in paper and placed in plastic bags, then discarded in garbage containers.

Specimen-Animal Waste Disposal Process Checklist

Dissection studies are intended to foster an appreciation for the animal's intrinsic value, its place in the ecosystem and its intricate complexity of form and function. The use of animal dissection in the classroom is sanctioned if the teacher follows the suggested recommendations. Follow the checklist below for disposal. In addition, please refer to **Regulated Hazardous Waste Profile/Removal Request Form** located in the appendix.

Disposal Procedure:

_____ 1. Human and primate tissue waste is not permitted in the dumpster/landfill and must be handled as biomedical waste. (Red bag/box in the school clinic). **Do not** place specimen* or animal waste in the school's biomedical waste containers (red bags) for disposal.

_____ 2. Drip dry the specimens prior to placing the items into a disposal container (i.e. plastic pail, double-lined garbage bag). Separate the liquids from the solids, and place in separate containers. Make sure the containers are sealed tight.

_____ 3. BPS is permitted to place non-liquid, bagged animal dissection waste, in the school's solid waste containers (dumpsters) for municipal landfill disposal. The animal waste must be placed in a sealed, double-bagged black garbage bag, and must not be placed in a red biomedical bag.

_____ 4. Specimen packing liquids, which contain small amounts of alcohol and/or glycol preservatives, may be diluted and poured down the sink. If the liquid is formaldehyde based (formalin), label the liquids container as '**Animal Dissection Liquid preservative'** and store in the same location for pick-up service. ***Teachers should not dispose of on site***.

_____ 5. For hazardous waste disposal, process a work order request to the District's Plant Operations and Maintenance Department requesting hazardous waste disposal. Identify the hazardous waste in the work order request.

Information:

- *Specimens also include grocery store items such as chicken parts, squid, fish, etc.
- Check with your school administration (i.e. Principal, Assistant Principal, Secretary, Head Custodian), to assist in processing a Plant Operations & Maintenance Department work order request.
- Expect 5-10 days for pick-up. Based on the work order request, staff from the District Office of EH&S will pick up and transport the specimen waste to a designated landfill which is permitted to handle dead animals.
- Teachers should purchase specimen/animals that are shipped in vacuum packaging or alcohol/glycol preservatives. Avoid ordering any products using formalin based preservatives.

- These recommendations were provided by the Brevard Public Schools Environmental Health & Safety Office of Plant Operation & Code Compliance/Facilities Services Division, http://plant-ops.brevard.k12.fl.us/ .

Brevard Public Schools
Specimen Recommendations

Grades 6 – 8

Recommended Specimens	Recommended Sources*
Chicken Wing	Grocer or a biological supply company
Fish	Fish market, grocer or a biological supply company
Organs (bones, kidney, heart, etc.)	Grocer or a biological supply company

Grades 9 - 12

Recommended Specimens	Recommended Sources*
Cat	A biological supply company
Clam	Fish market, grocer, harvest in approved areas or a biological supply
Crayfish	Fish market, grocer or a biological supply company
Fetal Pig	Biological Supply Company
Fish	Fish market, grocer, harvest or a biological supply
Grasshopper	Field collection in approved areas or a biological supply
Mink	A biological supply company
Organs (bones, kidney, heart, etc.)	Grocer or a biological supply company
Rat	A biological supply company
Shark	harvest in approved areas or a biological Supply company.
Squid	Fish market, grocer or a biological supply company
Starfish	A biological supply company
Worms	Pet store, bait shop or a biological supply company

NOTE: The use of FROGS is discouraged. Although the decrease in the population of frogs is primarily due to habitat destruction, it seems prudent to reduce the impact of collection for the purposes of dissection.

***Sources should be reputable and conform to licensing/inspection requirements.**

Field Studies/Trips

Careful planning is required before a field trip in order to maximize the use of time and to assure the safety of the students. Be aware of school and district policies governing means of transportation, parental permission forms, licensing of drivers, chaperones, collection of student money and accident reporting procedures. These procedures and forms are available at each school and must be followed.

Field trips to natural bodies of water present specific safety concerns and require special review and permission. When seeking approval for this type field experience, the following conditions must be met:

- list the instructional purpose and the specific standards addressed by the activity.
- identify potential safety concerns and explain the procedures established to assure student safety.
- address all water safety requirements specified by district risk management.
- follow all applicable Coast Guard regulations.

Field trips may involve taking students to natural areas. The following actions are suggested:

- Notify the school administration of the nature of the trip in advance. Complete a field trip approval form provided by administration. This process should be initiated at least a month ahead of time.
- Follow school policy for submitting field trip approval forms, student/parent agreement forms, and/or bus requisition.
- The use of swimming pools while on overnight field trips is prohibited.
- The teacher should visit the area prior to taking the entire class. Obvious hazards should be noted, such as poisonous plants, dangerous organisms, water hazards, electrical hazards and unsafe areas for walking.
- The teacher should inform the students of any special hazards present at the field trip site and establish required rules for safe conduct.
- Students should be advised of the appropriate clothing to be worn.
- The limits of the study area must be clearly defined by the teacher. Students should be informed of a prearranged signal, such as a blast on a whistle that will indicate that they are to return to a certain location.
- Follow school and district guidelines for student chaperone ratios. The buddy system should be used to enhance student safety. Students must never be allowed to wander off alone.
- The trip leader must follow school policy regarding first aid. The teacher must check the parental permission forms to assure that any unusual health problems, such as allergies, have been noted and that any required emergency procedures have been anticipated. Students should be instructed to report any injury, no matter how slight, to the teacher at once.
- A first aid kit is a necessity when visiting a natural area. The kit should be checked and restocked prior to the trip.
- Cloth, plastic bags or plastic jars should be used for collecting plant and animal specimens. Breakable containers should not be used because of hazards associated with breakage.

- Students should be taught to recognize and avoid poisonous plants and animals in the field trip area. They should not touch any specimen that they cannot positively identify as being safe.
- Students with cuts, scratches or open sores should be cautioned about increased risk of infection from water or soil.
- Most accidents occur as the result of student horseplay and/or carelessness, rather than willful disregard for safety procedures. By being observant, attentive, and alert to what the students are doing, and by dealing with misbehavior as soon as it occurs, the teacher will minimize many of the potential risks involved with field trips.

Laboratory Equipment

Microwave Ovens
The use of a microwave oven in a science lab presents specific safety concerns including the possibility of fire and explosion. Overheating a closed container can result in an explosion. Heating items that contain metal can result in a fire.

There have been accidents resulting from students deliberately heating objects containing metal or flammable liquids.

- Student access to a microwave oven located in a lab or classroom should be limited.
- If a microwave oven is used it is recommended that the teacher operate the microwave or directly supervise student operation of the microwave oven.

Centrifuges

- Centrifuging should be done in a location where vibrations will not cause bottles or equipment to fall off shelves.
- Suction cups must be in good condition and capable of firmly gripping the laboratory bench.
- Students must be taught to correctly balance the rotor before starting the motor to minimize vibration.
- The rotor must be completely stopped before removing the tubes.
- Centrifuge tubes should match the contour of their metal sleeves.

Compressed Gas Cylinders
Compressed gas cylinders must be handled and stored in accordance with the following guidelines:

- Cylinders permitted inside buildings must be stored at least twenty feet from highly combustible materials and must be placed in a secure, temperature-controlled environment.
- Empty cylinders must have valves closed while in storage or shipment.
- Valve caps shall be in place except when cylinders are in service.
- Oxygen cylinders in storage must be separated from fuel gas cylinders by at least twenty feet or by a noncombustible barrier at least five feet high having a thirty-minute fire resistance.

- Compressed gas cylinders must be secured with a chain or base to prevent accidental overturning.
- Gas cylinders must be operated, handled and stored according to NFPA 51, Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes (2013).

Electrical Equipment/Electricity

Electricity is a potential hazard in the laboratory because of the possibility of shock or fire. Low voltage direct current (0-12 volt) sources are most frequently used in the science laboratory. Although this voltage range is the least hazardous, it must be pointed out that there is an inherent hazard associated with any electrical device. Most science laboratories are equipped with electrical outlets of 120 and 240 Volts AC. Extreme care should be used around any electrical outlet. Students must have dry hands and skin as well as a dry area on which to stand.

Common sense in using any electrical equipment in the science laboratory is essential. Some of the basic conditions for safe use of electricity are listed below:

- A master cut-off switch for the electrical supply or the posted location of the nearest master cut-off switch.
- Insulated material on the floor when using equipment that generates electricity.
- Three-prong service outlets with proper grounding for the electrical equipment.
- All circuits in the proximity of water splash areas equipped with a ground fault interrupt (GFI) device.
- Two-prong electrical equipment may be used if UL approved.
- Caution students about the dangers of grasping electrical wires improperly. Students should be cautioned that electrical shock remains a possibility even when voltage is low, particularly if the skin is broken or the connecting wire creates a puncture wound.
- Check insulation of all equipment, wires, plugs and outlets before any connection is made, to prevent any shock or fire.
- Do not use switches or equipment that may produce sparks near any volatile, flammable substances.
- Properly discharge a capacitor or Leyden jar before handling.
- Be aware that experiments with resistive heating may produce high temperatures.

Glassware

Glassware should never be used for any purpose other than that for which it is specifically designed. Due to the varying qualities of laboratory glassware, care should be taken in selecting glassware appropriate for laboratory activities.

- Proper eye protection such as goggles or a face shield is required when working with glassware.
- Borosilicate glassware (Pyrex or Kimax) should be used for all laboratory experiments unless otherwise indicated.
- All glassware should be inspected for nicks, cracks and jagged edges. Broken glassware should be disposed of carefully in a specially marked container. Small pieces and shards of glass should be swept up or picked up with dampened paper towels, never fingers.

- When heated over a flame, glass apparatus should be placed on wire gauze.
- A Pyrex or Kimax glass test tube can be heated directly as long as it is heated at approximately a 45-degree angle with its mouth pointed away from people.
- Never heat a closed system such as a stoppered flask or stoppered test tube.
- Students should be reminded that glass retains heat. Any glass that has been heated should never be placed in direct contact with a tabletop, but rather on a ceramic wire gauze screen. Extra care should be taken when fire polishing and bending glass tubing.
- Students must never eat or drink from laboratory glassware.
- Graduated cylinders should have plastic bumpers near the top lip. The bumpers are not to be used as quantity indicators but are to prevent breakage if the cylinder is accidentally knocked over.
- Frozen glass-to-glass surfaces and glass tubing adhered to rubber present a particular hazard unless extreme care and patience are exercised.

Glass Tubing/Rods

Whenever glass tubing must be prepared by the student for use in the laboratory, the following safety procedures should be observed to reduce the risk of laboratory accidents.

Cutting soft glass tubing

- Place the length of glass tubing flat on the laboratory table. Make a deep scratch across the tubing, using the cutting edge of a sharp triangular file.
- Wrap the scratched glass with either a cloth or damp paper towel as well as wearing an apron, gloves and goggles or a face shield. Align both thumbs directly over the scratch and "snap" the tubing by pushing thumbs outward. Glass must be pointed away from any other persons as it is broken.
- Do not use force if the glass does not break easily. Deepen the scratch with another stroke of the file and the glass should break easily.

Fire polishing the cut ends glass tubing

- Light the burner and adjust the air supply so that two blue cones are visible in the flame. This is considered to be a hot flame.
- Holding the glass tubing horizontally, place the cut end at the tip of the inner blue cone and rotate constantly. An orange colored flame indicates that the glass is melting.
- Constant rotation will assure that the melted glass evenly coats the edge being fire polished.
- Cool 5-10 minutes on a ceramic mat before polishing the other end of the tubing.

Inserting glass tubing/thermometers into holed stoppers

- Use a slit stopper or thermometer clips.
- Never attempt to force tubing through a hole that is too small for the tubing.
- Glass tubing or thermometers must be inserted into stoppers and hoses by using a drop of glycerin or water on both the tubing and stopper.

- Wrap the tubing and the stopper in layers of cloth or paper towel to protect the hands if the glass shatters in spite of precautions.
- Slowly and gently work the tube into the stopper with a twisting motion. Do not hurry.

Removing glass tubing/thermometers from holed stoppers

- Remove stopper as soon as possible to avoid "freezing" the tubing in the stopper.
- If freezing occurs, soak tubing and stopper overnight in soapy water before attempting to remove tubing.
- If a tube or thermometer cannot be removed, it may be necessary to cut the stopper.

Heating Equipment

Whenever a heating agent is used in the laboratory, students and teachers should be properly attired for safety.

- The location of fire safety equipment and techniques for their use must be clearly communicated.
- Whenever possible use hot plates in place of open flame burners.
- Laboratories should be properly vented.
- Volatile or pulverized materials are easily ignited by open flames and intense heat can burn hair, clothing or skin.
- When flammable liquids are being used, all flames in the laboratory should be extinguished.
- An operating heating source should never be left unattended.

Alcohol Burners

• The use of alcohol burners is not allowed

Candles

- Candles should be placed on a stable, non-flammable surface, such as a metal jar lid, a small metal tray or in a pan of sand.
- Students should be cautioned to avoid contact with hot wax.

Canned Heat

Not recommended as a heat source for use by students.

- Canned heat sources (such as Sterno) may be used by the teacher to demonstrate heat energy from a fuel. Make sure arrangement is stable and extinguish it when not in use.

Electric Coffee Pot or Tea Kettle

• A safe alternative for heating water.

Gas Burners/Bunsen Burners

- It is important that students understand how to operate gas burners before using them. The location and function of the gas supply inlet, air adjustment vent/valve, and gas adjustment valve should be clearly communicated.
- Rubber tubing should be inspected periodically for cracks and hardening.

- Portable propane burners produce a much hotter flame than Bunsen burners and should be used with extreme caution.

Hot Plates

- Only hot plates designed for laboratory applications should be purchased for student use. The heating element should be fully enclosed. There should be an indicator light showing when the hot plate is on and the power cord should be grounded.
- Hot plates should be plugged into GFI protected circuit. Be careful to keep the cord away from water sources or the hot surface.
- When using the hot plate check for properly working thermostats to prevent dangerous overheating. Use only heat-resistant gloves and/or tongs when placing or removing samples from heating apparatus.
- When laboratory exercise is completed, allow sufficient time for the device to cool; warn students to be wary of the residual heat. When the hot plate is cool, clean the surface with steel wool or a damp cloth, making sure the power source is disconnected from the wall outlet.

Immersion Heaters

- Immersion heaters other than aquarium heaters are not permitted in the lab.

Spectrum Tubes

Spectrum Tubes are cold cathode tubes and have a limited life span. Gas will accumulate at the ends of the tube and deposit on the glass during use. This diminishes the glow and eventually the tube will not work. Most of the gasses have differing life spans and it cannot be predicted exactly how long they will work under different usage conditions. It is recommended that these tubes are used intermittently and not be used as a lamp source. To maximize the life span it is recommended to operate the tubes for no more than 30 seconds and then let cool for 30 seconds. Mercury vapor tubes need to be disposed of as hazardous waste. Please contact the Brevard Public Schools Office of Environmental Health and Safety for disposal procedures, 633-3496.

Steam Generating Equipment

There are some particular hazards that are associated with steam heating apparatus not encountered with open flames. The extreme pressures and temperatures are hazardous if not properly controlled.

- Steam generators must be inspected periodically to ensure that openings and vents are clear. If the container openings are blocked, the container may explode.
- Pressure cookers, steam generators, distillers, autoclaves, sterilizers and other such devices usually have accompanying instruction manuals. Anyone using such equipment should be familiar with its operation and the specific precautions listed by the manufacturer.
- Pressure relief valves should be tested before each use to ensure smooth operation. Final pressure should never exceed 184kPa (20 psi). The pressure in an autoclave must be allowed to gradually return to normal atmospheric pressure on its own.

- Even when pressure gauges read zero, the pressure relief valve should be opened prior to opening the door or lid. Caution should be exercised when opening to avoid escaping steam.

Light Sources/Lenses/Mirrors

- Lenses and mirrors must be inspected for chips and cracks.
- Lasers used in the classroom must be of low power (Class II or IIIa). Prolonged exposure to reflections from door knobs, glass plates, diamonds or other polished surfaces can cause retinal damage.
- When UV light is used, appropriate UV protective safety goggles must be worn if there is any possibility of direct exposure to the ultraviolet rays.
- Strobe lights can trigger seizures in susceptible people. Caution students not to look directly at the strobe.

Microscopes and Telescopes

- A microscope's mirror should never be aimed directly at the sun. If an electric illuminator is used, it should be grounded or UL approved and plugged into a GFI protected circuit.
- Telescopes without proper filters should not be used to examine bright objects such as the sun.
- Lenses may be disinfected with an alcohol-based lens cleaner.

Neodymium magnets

- Neodymium or Rare-Earth magnetic products should be handled with care.
- These magnets are very powerful and can accelerate at great speeds toward each other and toward ferrous material.
- When strong magnets come together quickly, they can shatter and break sending particles at high speed.
- Neodymium magnets can pinch strongly if allowed to come together against the skin.
- Gloves and eye protection should be worn when handling strong rare-earth magnets.

Refrigerators

- Foods for human consumption should never be kept in laboratory refrigerators.
- Flammable solvents should not be kept in a refrigerator unless it is specifically designed to be "explosion-proof".

Ring Stand

- When attaching equipment to a ring stand, position it so that the center of gravity of the system is over the base.

Thermometers

- Mercury thermometers are not permitted.
- Anti-roll devices should be placed on thermometers so that they do not roll off a counter.

- Use a rubber safety grip when inserting a thermometer into a stopper and lubricate the end of the thermometer before insertion. The teacher, not the student, should remove a thermometer stuck in a stopper. This can be done by slitting the stopper

Vacuum Pumps

- Improper design or operation of a vacuum system can result in implosion of the chambers producing flying glass.
- Use special glassware designed for evacuation such as a bell jar or a filtering flask.
- The vacuum pump, glassware and other part of the system should be firmly mounted.
- The walls of the vacuum chamber may be taped to reduce flying glass in the event of an accident.

Lab Procedures

Flame Tests

NSTA recommends use of chlorides for flame tests rather than nitrates due to respiratory health concerns.

Gas Generator Reactions

Whenever gas generators are used, they must be properly vented to avoid increased internal pressure that can cause explosions. Never leave gas generator experiments unattended. If the solutions for these labs are prepared in advance, the potential dangers are reduced.

Hydrogen Production

Hydrogen reaction generators can be dangerous. Hydrogen/air mixture is explosive, be sure that there is no open flame near the generator. Never ignite a hydrogen jet.

Melting Point Experiments

Since several of the low melting point substances used in these experiments are flammable, toxic, or suspected carcinogens, use only chemicals on the Approved Chemicals list as substitutes. Water baths should be used in place of open flames whenever possible.

Organic Chemistry

Organic chemistry experiments are generally greater health and safety hazards than high school inorganic experiments. Increased hazards result from the higher volatility and flammability of organic compounds. These experiments require proper ventilation such as exhaust systems and fume hoods. Potential fire risk may be lessened by using hot plates for heating.

Oxidation and Reduction

There are several sources of possible hazard in this class of experiments. Most can be reduced to a minimum. Cobalt compounds may be used in redox reactions in place of

chromium compounds. Most other compounds used in these experiments are safe in dilute solutions. If gases will be generated during the reactions, the fume hood should be used. In any procedure that calls for the use of concentrated acid, extreme care must be used. Special precautions must be taken when disposing of redox chemicals. Follow the recommended disposal procedures described by the Material Safety Data Sheet for that substance.

Radiation Chemistry

Experiments in this class are usually not performed in a school setting. If experiments with radiation are included, care should be exercised with pipetting, chemical handling, and equipment use (e.g., radiation detectors).

Smelling Chemicals

Students should never handle, taste, or smell a chemical unless directed to do so by the teacher. To smell the contents of a test tube or other container, students should be instructed to waft some of the escaping vapors towards themselves. The container should never be brought close to the nose.

Live Organisms

Animals

Experiences with live animals in the classroom can provide excellent learning opportunities and encourage respect for life. Student's interest in science is sparked when they can observe animal behavior first hand and reinforces the Life Science benchmarks of the Next Generation Sunshine State Standards. To have animals in the classroom, teachers must adhere to the following requirements:

- have clear educational goals
- obtain permission from the principal, complete a "Request for Use of Live Animals on School Property" Link page 29
- notify parents and staff members in writing that animals will be kept in the classroom and adjustments will be made to accommodate health-related concerns
- educate themselves about the safe and responsible use of animals in the classroom or on school property
- ensure the safe care of animals housed in the classroom to include: monitoring conditions of cages and tanks, supervising students, staff and visitors when interacting with animals, and establishing classroom procedures for humane animal treatment
- never allow highly dangerous animals on school property

Additionally, teachers should be aware of student allergies and not keep animals that cause problems for sensitive students. Animals will not be allowed if a student's documented health concern cannot be accommodated.

The decision to keep live animals in the classroom requires compliance with Florida laws, Florida Game and Fresh Water Fish Commission rules available at http://myfwc.com/ and

Brevard County School District policies. Some of the regulations from these agencies are summarized below.

Animals that may be kept without a permit:

- Reptiles (except venomous/poisonous, protected species, endangered, threatened, conditional or otherwise regulated) Conditional species now includes pythons http://myfwc.com/wildlifehabitats/nonnatives/conditional-prohibited-species/conditional/
- Amphibians (except poisonous, protected species, endangered, threatened, conditional, or otherwise regulated)
- Chinchillas, ferrets, hedgehogs, honey possums, sugar gliders, moles, shrews, prairie dogs, squirrels, chipmunks, gerbils, rats, mice, rabbits, guinea pigs, and hamsters
- Parakeets, canaries, love birds, cockatiels, finches, myna birds, doves (ringed, ruddy & diamond), button quail, parrots, shell parakeets, toucans
- See Florida Fish and Wildlife for list: http://myfwc.com/license/captive-wildlife/

Animals that may *not* be kept:

- Venomous or poisonous (amphibians, etc.) animals may **not** be kept
- Protected animals (such as indigo snakes, gopher tortoises, alligators and American crocodiles) may **not** be kept
- No more than two box turtles and/or one Florida pine snake may be kept
- See Florida Fish and Wildlife for list: http://myfwc.com/license/captive-wildlife/

Animal care:

- All aspects of animal care and treatment shall be supervised by a qualified adult who is knowledgeable about research methods, biology, care and husbandry of the species being studied
- The feeding of live vertebrate animals to reptiles should *not* be viewed by students
- Glass aquaria can present unique safety hazards and require awareness and caution. Safety should be a consideration in selection and placement of tanks. Teachers may wish to consider acrylic or tempered glass when feasible.
- Animals must be housed in clean, ventilated, comfortable environments appropriate for the species and have adequate lighting, humidity and controlled temperature (See Housing Requirements for Common Classroom Animals available at the end of this section).
- Proper care for the animals must be provided at all times. Due to energy conservation practices, animals should not be kept as year round pets. Before acquiring classroom pets, long term arrangements, such as weekends, holidays, and vacation periods must be considered.
- Emergency plans for animal care should be ready in the event of a natural disaster such as tropical storms and hurricanes
- Vertebrate behavior studies should use only reward (such as providing food) and not punishment in training programs. When food is used as a reward, it should not be withheld for more than 12 hours. Normal feeding of animal should be researched through a reputable animal care guide. See the ISEF guidelines for more detail available at http://www.societyforscience.org/page.aspx?pid=318

- Appropriate plans should be made for future care of animals at the conclusion of the study or the end of the school year. Laboratory-bred animals should not be released into the wild as they may disturb the natural ecology of the environment **National Invasive Species Information Center:** http://www.invasivespeciesinfo.gov\

Handling animals

- After handling any animal, hands should be thoroughly washed with soap and water
- Adequate plans should be made to control unwanted breeding of classroom animals
- Pregnant or nursing animals should not be handled or disturbed. Even the tamest laboratory animal may inflict a painful bite
- The wearing of heavy gloves is recommended when handling animals that may become excited, such as untamed rodents or new additions to a cage
- If animals of suspect origin are handled, protective gloves must be worn
- Children under 5 should not handle animals that are high-risk for *Salmonella*. It is important to know that an animal can carry *Salmonella* and appear healthy and clean. **Extra care** should be exercised with younger children who handle high-risk animals in classrooms. These include reptiles (turtles, snakes, and lizards), amphibians (frogs and toads), and poultry (chicks, chickens, ducks ducklings, geese, turkeys), rodents (guinea pigs and hamsters), dogs, cats, birds (including pet and wild birds), horses, and farm animals (goats, calves, sheep). See the Centers for Disease Control and Prevention for more information available at http://www.cdc.gov/healthypets/

Injuries and Allergies

- Housing animals in a classroom can increase the risk of allergic reactions in susceptible students. Allergies are a leading cause of chronic disease in children under age 17. Pre-existing allergic disease can lead to the development of sensitivity to animal allergens. Any animal species can be the source of allergic reactions. Allergic reactions can include skin welts and hives, itchy eyes, nasal congestion, sneezing, wheezing, and more serious attacks of asthma.
- A student bitten by an animal is required to go to the clinic. The animal must not be destroyed, but should be kept isolated until any required examination is performed.
- Dried wing scales and exoskeletons from insect collections, mammalian hair and dander and toxic secretions of many animals have all been implicated as allergens.
- See Caring for Animals: A Guide to Animals in the Classroom http://www.aalas.org/resources/classroom_animals.aspx

Purchasing and acquiring animals

- Animals should be ordered from reputable suppliers when they are to be housed in classrooms or used in class experiments to minimize the risk of parasites and diseases. Only those animals that appear to be healthy should be kept in the classroom. Animals that show any sign of illness should be kept isolated.
- If animals are removed from the environment, teachers are required to have proper

permits if applicable. For the Florida Marine Science Educators Assoc. website see http://fmsea.org\events\ascw\

- Invasive animal species should be avoided. If used, strict guidelines need to be adhered to avoid introduction into the wild. http://www.invasivespeciesinfo.gov/

Injured Animals and the Science Teacher

Wildlife, whether healthy or injured, brought in by students should not be accepted by the teacher for classroom housing. However, students continue to bring sick or injured animals to the science teacher with the expectation of humane and knowledgeable help. Educators may encourage respect and concern for the well-being of animals by offering assistance, but must protect students from potential hazards such as disease transmission or infections from bites. The injured animal should be isolated until it can be transferred to a licensed rehabilitator.

The Florida Game and Fresh Water Fish Commission regulate licensed rehabilitators for the care and rehabilitation of injured animals and prohibit the possession of sick or injured wildlife by unlicensed persons. Contact Animal Control for assistance in locating a licensed rehabilitator.

Brevard County Animal Services	**(321) 633-2024**
Florida Wildlife Hospital, Melbourne, Florida	**(321) 254-8843**

Housing Requirements for Common Classroom Animals

Animal	Minimum Cage Size and Physical Requirement
Rabbits	
1 adult or 2 juveniles (smaller breed)	2’ x 3’ floor space and 1 gnawing log
1 adult or 2 juveniles (larger breed)	2’ x 4’ floor space and 1 gnawing log
Guinea Pigs	
1 adult	1.5’ x 2’ floor space and 1 gnawing log
2 or more adults	2’ x 2’ floor space and 1 gnawing log
Hamsters, Mice & Gerbils	
1-2 animals	10” x 10” floor space and 1 gnawing log
Rats	
1-2 animals	18” x 18” floor space and 1 gnawing log
Snakes	
1-4 snakes	a perimeter 1.5 times the length of the longest snake, a resting limb, a large rock and a soaking area
Each additional snake	increase cage size 25% of floor area.
Lizards, Anoles & Skinks	
1-2 lizards (2 – 6” long)	12” x 8” x 10” high with branches and access to ultraviolet light
Each 2 additional lizards	increase cage size by 2” in length & width
1-2 lizards (7-12” long)	20” x 10” x 15” high, with branches and access to ultraviolet light
Each additional lizard	increase cage size by 4” in length & width
1-2 lizards (13 – 24” long)	30” x 15” x 12” high, with branches and access to ultraviolet light
Each additional lizard	increase cage size by 6” in length & width
1-2 lizards (2-4’ long)	36” x 15” x 18” high, with branches and access to ultraviolet light increase cage size
Each additional lizard	by 10” in length & width
Turtles & Terrapins	
1 turtle	an area 5 times body size, with 50% of the area having a pool, sun and shade
Each additional turtle	increase cage area by 5 times body size
Soft shelled turtles	a non-abrasive pool bottom is required and must allow for complete submersion of the largest turtle
Tortoises	
1 tortoise	a land area 10 times body size, with sun and shade and a sloped pool for immersion
Each additional tortoise	increase cage area by 7 times body size
Birds	
1-2 birds	1’ x 1’ x 10” high minimum, depending on species community cages must provide
Each additional bird	flight space.

Brevard Public Schools

Request for Use of Live Animals on School Property

Teacher: _____ School: _____

Animal Species: _____ # of Animals: _____

Benchmarks Addressed: _____

Please attach additional pages as needed to fully answer each question.

1. Please describe why the above animal is needed to support the curriculum, how the animal will be used, and how the activity will enhance student learning.

2. Where will the animal(s) be housed?

3. Please describe plans for assuring the humane treatment and health of the requested animal(s), including nutrition, sanitation, housing, and safety needs. Be sure to include plans for weekend, vacation, end of year and emergency (hurricane) care.

4. What date(s) will the animal(s) be on school property?

5. Where will the animal(s) be placed after the above date(s)?

6. Please describe your experience, training, or background knowledge related to safely and effectively using the animal listed above in a school setting.

7. Please describe the precautions you will take to assure the health and safety of students and staff?

8. How did you verify that the presence of the above animal will not adversely affect students or staff?

I request permission to use the animal listed above to support student learning, and acknowledge my responsibilities as outlined above.

_____ _____

Signature of Requester Date

I have reviewed and **APPROVED** the above request. _____ Signature of Administrator Date	I have reviewed and **DENIED** the above request. _____ Signature of Administrator Date

Live Organisms Resources

The following resources are recommended sources of information about the suitability, maintenance and care of various animals. Care booklets accompanying live animals ordered from major suppliers may also be good sources of information.

American Association for Laboratory Animal Science. (n.d.). *American Association for Laboratory Animal Science*. Retrieved July 23, 2013, from https://www.aalas.org/public-outreach/resources#.U8_Br_lkRyw

Brevard Zoo Education Staff (321) 254-9453

Captive Wildlife Licenses & Permits. (n.d.). *Captive Wildlife Licenses & Permits*. Retrieved from http://myfwc.com/license/captive-wildlife/

Centers for Disease Control and Prevention. (2012, August 07). Retrieved from http://www.cdc.gov/healthypets/

CSI: BREVARD - Elementary Science Implementation and Resource Guide (2006 green cover document) Available at https://docs.google.com/a/share.brevardschools.org/file/d/0B5--VfTZqLfuVWJJN0FxM29ON3M/edit?pli

Expert Report. (n.d.). *Guide for the Care and Use of Laboratory Animals (2010) : Division on Earth and Life Studies*. Retrieved from http://dels.nas.edu/Report/Guide-Care/12910?bname=ilar

Invasive Species: Aquatic Species - Purple Loosestrife (Lythrum salicaria). (n.d.). *Invasive Species: Aquatic Species - Purple Loosestrife (Lythrum Salicaria)*. Retrieved July 23, 2013, from http://www.invasivespeciesinfo.gov/aquatics/loosestrife.shtml

Federal Animal Welfare Act (AWA) 7 U.S.C. 2131-2157 Subchapter A - Animal Welfare (Parts I, II, III) http://awic.nal.usda.gov/government-and-professional-resources/federal-laws/animal-welfare-act; USDA/APHIS/AC http://awic.nal.usda.gov

Florida's Poisonous Plants http://www.floridagardener.com/pplants/ppindex.htm

Florida Poison Information Center – Tampa Website: www.fpicn.org
EMERGENCY NUMBER: (800) 222-1222

Guide for the Care and Use of Laboratory Animals (2010)
http://dels.nas.edu/global/ilar/links-care

John's Hopkins Center for Alternatives to Animal Testing http://caat.jhsph.edu/

Laboratory Animals, Institute of Laboratory Animal Research (ILAR), Commission on Life Sciences, National Research http://dels.nas.edu/ilar

National Institute of Health. (1998). *Guide for the Care and Use of Laboratory Animals*. Retrieved from http://oacu.od.nih.gov/regs/guide/guide.pdf

Potentially Hazardous Biological Agents. (n.d.). *Intel ISEF*. Retrieved from http://www.societyforscience.org/page.aspx?pid=319

Vertebrate Animals. (n.d.). *Intel ISEF*. Retrieved from http://www.societyforscience.org/page.aspx?pid=318

Human Studies

Experiments on the human organism can be among the most motivating and satisfying of laboratory activities for students. They can also be the most dangerous. It is impossible to be too cautious when planning activities that directly affect the health of the students. Students should have a parental permission form before beginning these activities. An alternative activity addressing the same standard should be available for students who elect not to participate.

Cardiovascular/Respiratory

- **Exercise**
  Experiments involving changes in respiratory rate, blood pressure and pulse rate (e.g. running in place, climbing stairs, stepping up on chairs, or other strenuous activities) should be monitored closely by the teacher. Teacher should have a plan of response ready to react to students who might become ill. No student should be forced to take part in such activities during science class. An alternative activity should be available if necessary.
- **Spirometers**
  Disposable spirometer mouthpieces should be used and replaced prior to each use. Students should be cautioned to exhale only (NEVER INHALE) when using a spirometer.
- **Cheek cells**
  Use of human samples like cheek cells raises concerns about transmitting a human pathogen. Review *Safe Science* section on Biotechnology and Microorganisms, page 8. Link
  It is recommended the science teacher review the National Association of Biology Teachers Position and Recommendations for "*The Use of Human Body Fluids and Tissue Products in Biology Teaching". A set of safety protocols for implementing these kinds of activities are documented at this site.*
  http://www.nabt.org/websites/institution/index.php?p=98
- **Genetics**
  In any work involving human genetics, the student's right to privacy must be respected. It is advisable for teachers to have an alternative activity available for students who may be reluctant to divulge family history.

Please note the following human studies are not allowed.

- **Ingestion of Dyes**
  Activities that involve the ingestion of dyes intended to appear later in the student's saliva or in the urine are **not acceptable**.

- **Tissues and Fluids**
  Laboratory activities involving human blood, fluids, or tissues (except for cheek cells) are **not acceptable**.

- **PTC Paper**
  Activities involving PTC paper are **not acceptable.** Chemical found in PTC paper is a respiratory tract irritant.

Plants

Plants provide us with food, furnish us with oxygen, beautify our surroundings, and produce some of the most deadly substances to which humans can be exposed. Over 700 poisonous species and thousands of toxic plant principles have been identified. Since it is not possible to list each one, and since all plants have not been researched for their toxicity, the following general rules should be followed:

- Never eat unknown berries, seeds, fruits, or any other plant part
- Never expose students to any unknown plant species without identification of possible toxic impact to health
- Never rub any sap or plant juice into the skin, eyes, or open wound
- Never inhale or expose the skin or eyes to the smoke of any burning plant or plant parts
- Never eat food after handling plants without first washing the hands

Any part of an unknown plant may be toxic. Conversely, simply because a plant is known does not mean that it is safe. Many of Florida's commonly grown ornamental plants are highly dangerous when ingested. Seeds of common garden fruits and vegetables purchased for planting are generally not fit for human consumption. Often they have been treated with hormones, fungicides, and insecticides and their ingestion may produce allergic reactions, digestive upset, or death.
The list of dangerous plants that follows is far from complete. All of the plants named below are found growing in Florida, and all are toxic to some degree. Teachers should familiarize themselves with the many pamphlets published by the Florida Division of Forestry, the University of Florida, and county agricultural services for more extensive surveys. Be aware that some plants that are recommended for butterfly gardens, such as lantana, are toxic. Take all precautions to protect students from harm.

- **Allamanda:** Ingestion of any part may be hazardous. The sap may cause a rash.
- **Azalea:** Ingestion of any part may produce digestive upset, difficulty in breathing and eventual coma.
- **Balsam Pear:** Ingestion of seeds causes vomiting and diarrhea.
- **Brazilian Pepper:** Allergic reactions may occur after contact with any part of the plant.

- **Castor Bean:** One or two seeds may approach the lethal dose for an adult.
- **Cherry Trees:** Ingestion of bark, or chewing on twigs or leaves, may result in difficulty in breathing, coma and death.
- **China berry:** All parts of the plant are toxic and can cause paralysis.
- **Dieffenbachia:** (Also called Dumb Cane) Is an intense irritant of the mouth. Ingestion of any part of the plant may be fatal.
- **Elderberry:** Ingestion of the shoots, leaves, or bark may lead to nausea and digestive upset.
- **Holly:** Ingestion of the berries may lead to nausea, vomiting, diarrhea and stupor.
- **Iris:** Ingestion of the underground stem causes severe, but rarely fatal digestive upset.
- **Jimson Weed:** (Also called Thornapple) all parts are toxic, and ingestion of any part can be fatal.
- **Lantana:** Ingestion of the berries can be fatal.
- **Melaleuca:** Allergic reactions may occur after contact with any part of the plant.
- **Milkweed:** Contact with the sap may cause skin irritation. Ingestion of any plant part can be fatal.
- **Mistletoe:** Ingestion of the berries can be fatal.
- **Mushrooms:** All mushrooms should be considered poisonous in the absence of a positive identification. The differences between edible and poisonous mushrooms should only be learned directly from an expert. Although mushrooms are not plants, they are included here because of their potential toxicity.
- **Nightshade:** Ingestion of the leaves or berries can lead to severe digestive upset, nervous system failure and death.
- **Oak:** Ingestion of leaves or acorns can have an effect on kidney function.
- **Oleander:** Ingestion of leaves and branches may lead to severe digestive upset, circulatory collapse and death. Avoid smoke from burning plants.
- **Poinsettia: T**he sap may cause skin irritation. Ingestion of leaves may cause serious digestive upset.
- **Poison Berry:** The green fruit and leaves are toxic causing headache, vomiting, diarrhea, stomach pains, and convulsions.
- **Poison Ivy:** Poison ivy (poison oak, poison vine, three-leafed vine) and poison sumac all contain toxic chemicals. Severe allergic reactions may occur after contact with any part of the plant.
- **Pokeberry, Pokeweed:** Most parts are toxic and cause severe nausea, vomiting, convulsions.
- **Rhubarb:** Ingestion of the leaf blades may lead to convulsions and death.
- **Rosary Pea:** Ingestion of a single seed has caused death.
- **Spanish Moss:** While the plant itself poses no threat, it may harbor ticks and mites.
- **Stinging Nettle:** Not a true nettle but in the poinsettia family. Contact with any part of the plant may produce a severe rash with blistering.
- **Trumpet Vine:** The sap is toxic and possibly fatal if ingested.
- **Water Hemlock:** Ingestion of any part of the plant may be fatal.

Students with known allergies to pollen or spores should not be required to participate in plant-related activities. The teacher should always be alert for any signs of serious illness: constriction of the pupils, increase in nasal and salivary secretions, sweating, gastrointestinal distress, tightness in the chest with difficulty in breathing, muscle tremors, itching and

swelling of the skin, redness of the eyes and bluish discoloration of the lips and nails. In the case of contact, the area should be washed, and if skin or eye irritation persists, a physician should be contacted.

Dangerous Plants Resources:

Brevard County Extension Office – Solutions for Your Life - UF Institute of Food and Agricultural Sciences. (n.d.). *Brevard County Extension Office – Solutions for Your Life - UF Institute of Food and Agricultural Sciences*. Retrieved from http://brevard.ifas.ufl.edu/

Invasive Species: Aquatic Species - Purple Loosestrife (Lythrum salicaria). (n.d.). *Invasive Species: Aquatic Species - Purple Loosestrife (Lythrum Salicaria)*. Retrieved July 23, 2013, from http://www.invasivespeciesinfo.gov/aquatics/loosestrife.shtml

Lockey, R. F. (1992). *Florida's Poisonous Plants, Snakes, Insects: This book might save the life of one you love*. Tampa, FL: Lewis S. Maxwell.

Plants & Grasses. (n.d.). Retrieved from http://solutionsforyourlife.ufl.edu/lawn_and_garden/plants_and_grasses/

Poison Information Center - Tampa. (n.d.). *Poisonous Plants*. Retrieved from http://www.poisoncentertampa.org/poisonous-plants.aspx

University of Florida Herbarium (FLAS). (n.d.). *University of Florida Herbarium (FLAS)*. Retrieved from http://www.flmnh.ufl.edu/herbarium/

Rocketry

The use of model rockets requires a consideration of safety in several areas: construction, engines, flying conditions, launch, and recovery.

- All rocket launches should be supervised by a Brevard Public School teacher.
- Contact all airports within five miles of the launch site of upcoming rocketry activity.
- All participants and spectators must wear appropriate personal protective equipment including eye protection.
- An ABC fire extinguisher must be available at launch site.
- Participants and spectators should be at a safe distance from the rocket launcher during a launch. Factors such as type of rocket and type of launch system affect the minimum safe distance. See guidelines for each type of rocket regarding minimum safe distance recommendation.

Compressed Air Rockets

Rocket launch systems using compressed air pose a danger from over pressurization that can result in a explosion. If using compressed air launch systems be certain that there is no risk of over pressurization. Possible alternatives are systems with an over pressurization release valve or burst disk.

NASA RECOMMENDS DISCONTINUATION OF STUDENT ROCKET ACTIVITY

Recently, an air pressurized paper rocket launcher being used by an educator failed. This launcher is described in NASA's Rockets Educator Guide, publications EG-2011-11-223-KSC, pp. 86-90 and EG-2008-05-060-KSC, pp. 86-90. NASA completed an engineering investigation into the failure and determined that the launcher, or design equivalents, should not be used. NASA has removed the launcher design from its website and its education curriculum. Individuals and organizations should immediately discontinue use of the launcher published in the referenced NASA publications. The point of contact for additional information is James Stofan, Deputy Associate Administrator for Education Integration at nasaedpartners@nasa.gov. We request that your organization assist NASA in disseminating this information as widely as possible throughout the education community.

Water Rockets

NASA Water Rocket Safety Guide

Safety is very important with any rocket. Rockets are safe when everyone understands and abides by safe behavior. Only plastic drink bottles should be used, and new bottles should be used whenever possible. Bottles should be retired from use after 10-15 launches.

CAUTION: Children should be closely supervised when they are using rockets. Even if they understand and agree to the safety rules, there will be lapses in concentration or judgment. Children cannot be made responsible for the safety of others.

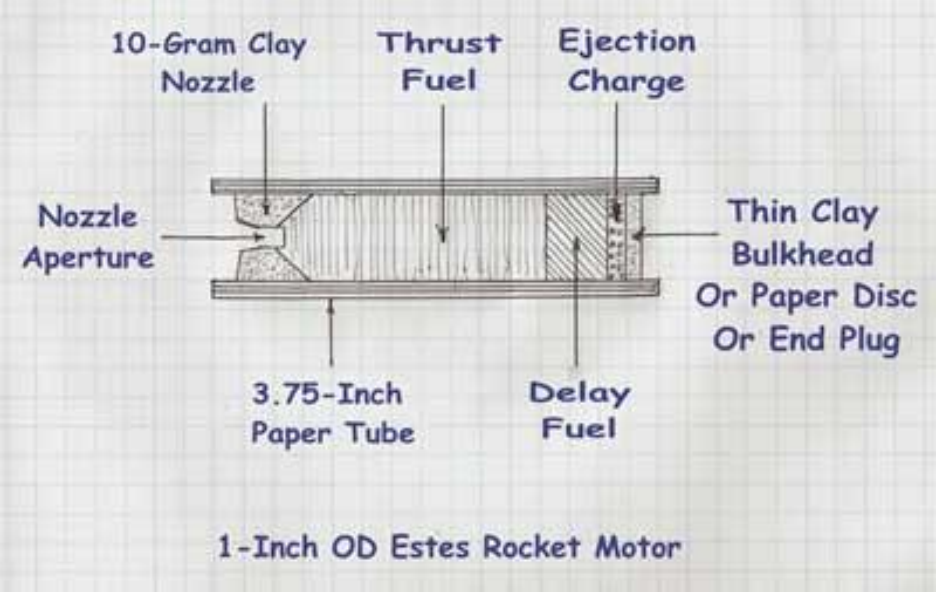
Launch Safety Instructions:

- Select a grassy field or athletic practice field that measures at least 30 meters in width. Place the launcher in the center of the field and anchor it in place. (If it is a windy day, place the launcher closer to the side of the field from which the wind is blowing so that the rocket will drift onto the field as it descends.)

- As you set up your rocket on the launch pad, observers should stand back several meters. It is recommended that you rope off the launch site.
- Do not point your water rocket at another person, animal, or object. Water rockets take off with a good deal of force from the air pressure and weight from the water.
- The team member responsible for pumping air into the rocket should wear eye protection. The bottle rocket should be pumped no higher than about 50 pounds of pressure per square inch, but never above 90 psi. Before launching, consult the following table provided for coaches in the Science Olympiad:

Table of Distances for a Given Pressure	
Pressure	**Typical Classroom Maximums**
20 psi	26 meters
40 psi	51 meters
60 psi	77 meters
80 psi	102 meters

- When pressurization is complete, everyone should stand in back of the roped off area for the countdown. Two-liter bottles can weaken and will explode. Bottles should be retired from use after 10-15 launches.
- Continue to countdown and launch the rocket only when the recovery range is clear.
- If you do not experience successful liftoff, remember that the bottle is pressurized and may blast off when you touch it. Be careful; do not let it hit you. **Never** stand over the rocket.
- A team member should retrieve the rocket.



Model Rockets Using Solid Propellant Engines

National Association of Rocketry • Model Rocket Safety Code Effective August 2012

- **Materials -** Use only lightweight, non-metal parts for the nose, body, and fins of the rocket.
- **Motors -** Use only certified, commercially-made model rocket motors, and do not tamper with these motors or use them for any purposes except those recommended by the manufacturer.
- **Ignition System –** Launch rockets with an electrical launch system and electrical motor igniters. The launch system will have a safety interlock in series with the launch switch and a launch switch that returns to the "off" position when released.
- **Misfires -** If a rocket does not launch when the button of the electrical launch system is pressed, remove the launcher's safety interlock or disconnect its battery. Then wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.
- **Launch Safety -** Use a countdown before launch and ensure that everyone is paying attention and is at a safe distance of at least 15 feet away when rockets with D motors or smaller are launched. When launching rockets with larger engines, the minimum safe distance is 30 feet. Check the stability of all rockets before flight. Launch rockets only after warning spectators and ensuring that everyone is at a safe distance. When conducting a simultaneous launch of more than ten rockets observe a safe distance of 1.5 times the maximum expected altitude of any launched rocket.
- **Launcher -** Launch the rocket from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up. Use a blast deflector to prevent the motor's exhaust from hitting the ground. To prevent accidental eye injury, place launchers so that the end of the launch rod is above eye level or cap the end of the rod when it is not in use.
- **Size –** Do not use rockets that weigh more than 1,500 grams (53 ounces) at liftoff and contain more than 125 grams (4.4 ounces) of propellant or 320 N-sec (71.9 pound-seconds) of total impulse.
- **Flight Safety –** Do not launch rockets at targets, into clouds, or near airplanes. Do not put flammable or explosive payload in a rocket. No animals are to be placed in a rocket.
- **Launch Site -** Launch rockets outdoors in an open area at least as large as shown in the accompanying table. Only launch in safe weather conditions with wind speeds no greater than 20 miles per hour. Ensure that there is no dry grass close to the launch pad and that the launch site does not present risk of grass fires.
- **Recovery System -** Use a recovery system such as a streamer or parachute in the rocket so that it returns safely and undamaged and can be flown again. Use only flame-resistant or fireproof recovery system wadding.
- **Recovery Safety -** Do not attempt to recover any rocket from power lines, tall trees, or other dangerous places.

Launch Site Dimensions

Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site Dimensions (ft.)
0.00--1.25	1/4A, 1/2A	50
1.26--2.50	A	100
2.51--5.00	B	200
5.01--10.00	C	400
10.01--20.00	D	500
20.01--40.00	E	1,000

Rocks and Minerals

There are several safety guidelines that are related to geology and the earth sciences.

- **Carbonate tests** Use a maximum 2% hydrochloric acid solution.
- **Cleavage tests** Eye protection should be used when performing cleavage or fracture tests on rock or mineral samples. Small fragments can cause eye injury.
- **Crystal-Growing kits** Be sure that all chemicals in the kits are on the District Approved Chemicals List. Most crystal growing kits contain highly toxic and corrosive chemicals. Water-based crystal growing kits using salts or sugar are recommended for elementary school students.
- **Fossil molds** Use caution with Plaster of Paris when making casts and molds. Students should wear dust masks to avoid inhaling the powder.
- **Hardness tests/scratch tests** Be sure that the glass slides are on a hard flat surface, and that only minimal pressure is applied when conducting the tests. Have students exercise caution when using nails to conduct scratch tests.
- **Peels of plant fossils** Use caution with acetone.
- **Rock and mineral sample kits** Many older kits contain samples that have asbestos. Those rocks and minerals should be removed from kits. Talc, mica and soapstone are hazardous in powdered form, but are permitted in kits if they are in solid, non-powdered form. Serpentine and hematite samples should not be present in the classroom.
- **Streak tests** Avoid testing talc and soapstone. Hazardous powder is produced when testing these substance.

Grocery and Household Items Needed for Science Instruction

***Bold items must be stored in stockroom only**

To include but not be limited to:

***Alcohol**	
Aluminum pans/foil	
Animal feed	All, such as mouse ration, fish food
Animal parts/meat (raw)	All, such as liver, heart
***Antacid**	All, such as Alka-Seltzer
Aquarium supplies	
Artificial sweetener	All
Bags	All, such as trash, plastic storage bags
Baking powder	
Baking soda	
Baskets	
Batteries	
Beans	All
Bread	All
Butter	
Candy	All, such as small, hard, asst colors, licorice, and gum drops
Carbonated beverages	All, such as ginger ale, cola (artificial and natural sweetener)
Cereal	All, such as oatmeal, wheat germ, corn flakes
Cheese	All
Clay	
Cleaning supplies	All, such as soap, detergent, ammonia, bleach
Cornstarch	
Crackers/Chips	All, such as Chex Mix
Disinfectant/Sanitizer	All
Eggs	
***Epsom salt**	
Fish	Raw, whole or part; clams, oysters, squid, etc.
Flour	
Flowers	Fresh, including leaves and stems
Food coloring	
Fruit	All, fresh or dried, such as raisins, apples, lemons, oranges, etc.
Fruit juices	All, such as lemon, grape, orange, etc.
Gelatin	Plain or flavored
Glue/Paste	All
***Glycerin**	
Honey	
Hydrogen peroxide	
Ice/dry ice	
Ink/markers	All, such as pens, paint, highlighters
***Iodine**	3% solutions small bottles only
Marbles	
Marshmallows	

Grocery and Household Items Needed for Science Instruction *continued*

***Bold items must be stored in stockroom only**

Milk	All, such as whole, skim, cream
***Milk of Magnesia**	
Mineral oil	All, such as baby oil
Mints	All, such as Mentos
Nuts/Seeds/Legumes	All, excluding peanuts
Oil	All, such as olive, corn, vegetable, etc
Paper goods	All, such as plates, towels, cups, tissue, wax paper
Pickles	
Plants	All
Plastic storage containers	All
Plastic wrap	All
Play-Doh	
Potting soil	All such as fertilizer, pots, stakes
Rice	
Shampoo	
Spices	All, such as salt, pepper, nutmeg
Starch	
Sugar	
Syrup	All, such as corn, maple, molasses
Tea	All
Toothpicks	
Trays	
Utensils	disposable
Vegetables	All, such as cabbage, onions, peas, parsnips, potatoes, yams
Vinegar	
***Vitamins**	All, including food supplements, etc
Water	
Wire	
Yeast	
Yogurt	

Chemical Storage and Handling

The science teacher is responsible for making sure that all chemicals are stored, labeled, handled (by both teacher and student), and disposed of appropriately. Use this section and the Approved Chemical List (next section) to determine appropriate use.

Chemical Labels

The label on a stock chemical is one of the most valuable sources of information. The United Nations has instituted a new system of classification and labeling of chemicals called the Globally Harmonized System (GHS). This universal system combines signal words, hazard statements, and pictograms to offer a more comprehensive look at safe chemical handling. A stock chemical label may supply the following information:

- Name of the chemical
- Chemical formula
- Degree of hazard
- Health and physical hazards
- Precautionary measure to prevent misuse
- First aid information
- NFPA hazard symbol
- Suggested storage on the label.
- Pictogram representing the degree of hazard

The degree of hazard is indicated by the use of appropriate signal words and pictograms, which call attention to the severity of the potential hazard of the chemical. The GHS signal words are:

Danger - high degree of hazard
Warning - intermediate degree of hazard

There are eight pictograms in GHS. The link below will take you to a Flinn Facts that shows an example of each pictogram with an example of a chemical that would be represented by the symbol.
Flinn Scientific http://www.flinnsci.com/media/914778/2013-3_chemistry.pdf

Exposure to chemical substances can be hazardous to your health. The Occupational Safety and Health Administration (OSHA) has defined classes of health hazards. The definitions are at: https://www.osha.gov/dsg/hazcom/ghd053107.html

Unknowns

Occasionally, the science teacher may come across a chemical substance in a container that has a deteriorated label, is unclearly labeled or is even missing a label. For example, in the course of its normal use, a label on a dropper bottle solution may have deteriorated. In such a case, the following protocols are recommended:
First and foremost, DO NOT use the chemical until it has been positively identified.
If needed, communicate with other teachers in the department to find out if anyone has knowledge of that particular container. This may help to immediately resolve the issue.
The teacher may attempt to deduce the chemical's identity, without the need of direct testing, based on any or all of the following:

- The nature of recent experiments and demonstrations performed.
- Review of inventory data.
- Physical characteristics of the unknown, including color, crystal texture, and density.
- Type of container (For example, stock bottle type.).
- If the label is fragmented, enough information may be sufficient to identify the chemical.
- Where the chemical was stored.

Once the substance is positively identified, it should be immediately and properly labeled.
If the identity of the chemical substance is still not positively identified a few simple tests can be performed on micro-quantities of the unknown substance. For example, a simple pH test using pH testing paper can reveal enough additional information to identity the chemical.
Such tests can be found at: www.cameochemicals.noaa.gov
Further information can be located at:
www.dep.state.fl.us/waste/categories/hazardous/pages/schoolchemicals.htm

If the unknown chemical still defies identification, then contact the District to receive further instructions to determine final disposition of the unknown.

OSHA Classes of Health Hazards

Systemic Effects

Carcinogen: Substances that are suspected or proven to produce cancer in humans or laboratory animals. (a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or
(b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or,
(c) It is regulated by OSHA as a carcinogen.

Toxic agent: is a chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause

harmful effects to living organisms.
The International Science and Engineering Fair rules recommend that in work with vertebrates, **'no deaths due to experimental procedures are permitted'**.
(www.societyforscience.org)

Corrosive: A chemical that causes visible destruction of, or **irreversible alterations in, living tissue by chemical action at the site of contact**. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in appendix A to 49 CFR part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

Irritant: A chemical, which is not corrosive, but which causes a **reversible inflammatory effect** on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

Sensitizer: A chemical that causes a substantial proportion of exposed people or animals to **develop an allergic reaction in normal tissue after repeated exposure** to the chemical.

Target Organ Effects

Hepatotoxin: chemicals which produce **liver damage**
Nephrotoxin: chemicals which produce **kidney damage**
Neurotoxin: chemicals which produce their primary **toxic effects on the nervous system**
Blood/hematopoietic toxin: Agents which **act on the blood or hematopoietic system**: Decrease hemoglobin function; deprive the body tissues of oxygen.
Respiratory toxin: chemicals which **irritate or damage pulmonary tissue**
Reproductive toxin: chemicals which **affect the reproductive capabilities** including chromosomal damage (mutations) and effects on fetuses (teratogenesis).
Cutaneous hazard: chemicals which affect the dermal layer of the body
Eye hazard: chemicals which affect the eye or visual capacity

OSHA Classes of Physical Hazards

Physical Hazards:
A chemical is a physical hazard if it is likely to burn or support fire; may explode or release high pressures that can inflict bodily injury; or can spontaneously react on its own, or when exposed to water.

- Fire Hazards
  Combustible liquid: A liquid is combustible if the flashpoint is between 100°F - 200°F (37.8°C - 93.3°C).
  Flammable liquid: A liquid is flammable if the flashpoint is below 100°F (38°C).
  Flammable aerosol: an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.
  Flammable gas: A gas that burns in air at a concentration of less than 13%; or has an LFL of 13% or more with a concentration range for burning in air greater than 12%. The range is the difference between the LFL and the UFL.
  Flammable solid: A solid is a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one tenth of an inch per second along its major axis.
  Oxidizer: A chemical that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.
  Pyrophoric: a chemical that will ignite spontaneously in air at a temperature of 130° F (54.4°C) or below.

- **Explosion Hazards:**
  Compressed gas: A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C): or a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or a liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.
  Explosive: A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

- **Reactive Hazards:**
  Organic peroxide: an organic compound that contains the bivalent -O-O structure and which may be considered a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.
  Unstable (reactive): chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature."
  Water-reactive: chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Explosive

Materials that detonate or explode when subjected to heat, sudden shock or friction.

Fire

Materials that will readily burn if subjected to heat, sparks, flame or other sources of ignition.

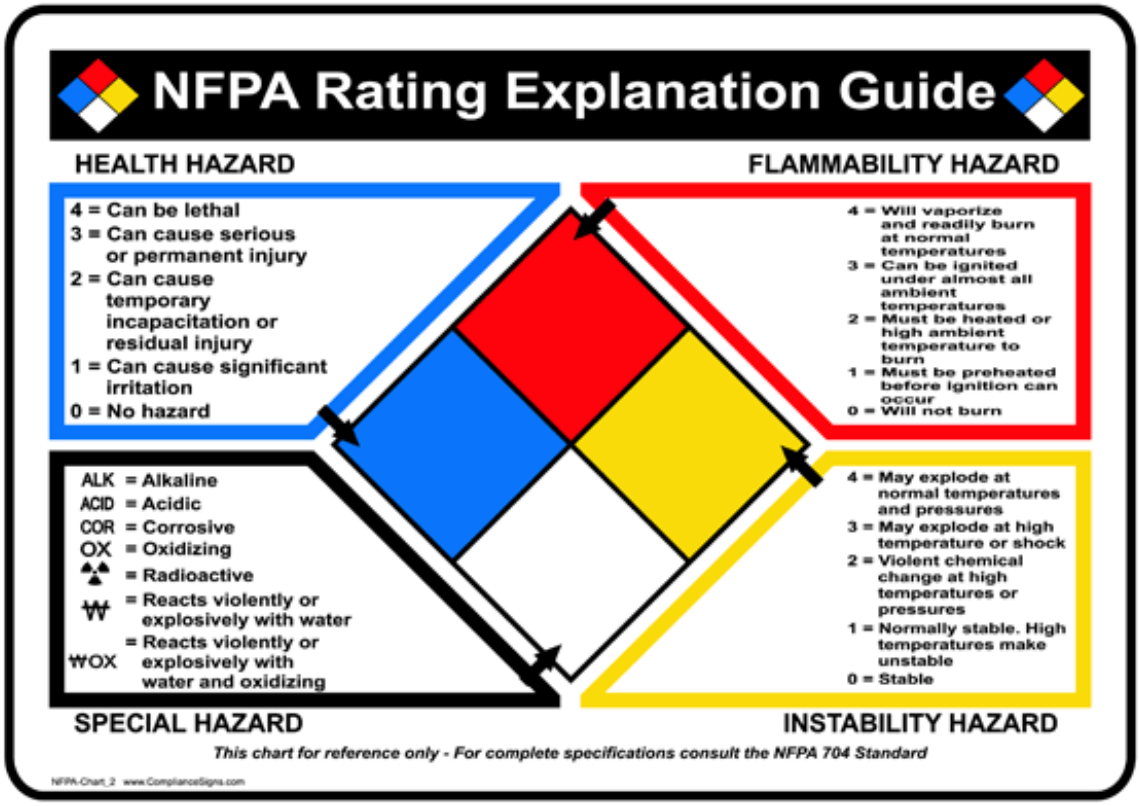
Reactive

Materials that produce a chemical reaction or react violently when exposed to air, water, or other materials. Chemical reactions that are capable of producing heat, fire or explosion.

NFPA Labels

The National Fire Protection Association (NFPA) has established a labeling system that provides a quick and simple method of identifying the type and relative degree of chemical hazard. This system allows individual who are not familiar with the hazardous nature of chemicals a ready method of identification. An example of the NFPA label is located on the next page.

The NFPA label includes a diamond-shaped symbol into four color-coded areas (Health, Fire, Reactivity, and Special) that represent major areas of hazard. The degree of hazard in each area is represented by numbers (0 - none, 1 - minor, 2 - moderate, 3 - severe, 4 - extreme). The Special Hazards area is reserved for symbols that represent special handling and storage precautions that need to be observed.



NFPA Symbol

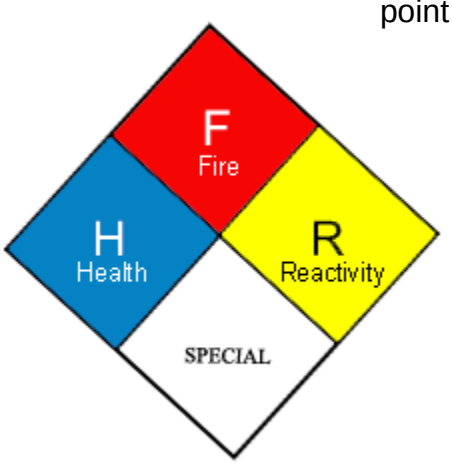
The NFPA label includes a diamond-shaped symbol and must be placed on every stock chemical once it is received by the Science Department.

Health Hazard (blue)

0 None
1 Minor, slightly hazardous
2 Moderate, temporarily incapacitate
3 Severe, short exposure may cause residual damage if prompt medical attention is not obtained
4 Extreme, short exposure may cause death (deadly)

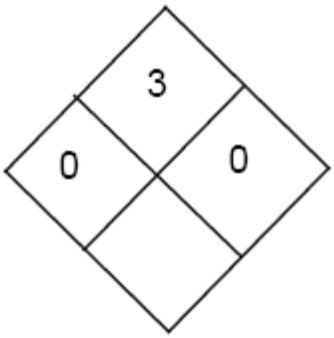
Fire Hazard (red)

0 None, will not burn
1 Minor, must be preheated before ignition
2 Moderate, some heat required for ignition.
3 Severe, Will ignite under normal temperature conditions.
4 Extreme, flammable liquid Flash point below 22.8°C.



Special Hazard (white)

Symbols that represent special storage and storage precautions.
OX – oxidize
COR – corrosive
ALK – alkali or base
ACID – acid



Reactivity (yellow)

0 None, stable
1 Minor, unstable if heated or exposed to water
2 Moderate, unstable but will not deteriorate, can produce violent chemical reaction
3 Severe, explosive if heated or water is added, shock may detonate.
4 Extreme, explosive under normal conditions.

Ethyl Alcohol
(store in flammable cabinet)

Material Safety Data Sheets or Safety Data Sheets

When using any chemicals, teachers should comply with these items and should not use a chemical unless they have reviewed the label and MSDS and therefore:

- know in advance hazards presented by that chemical
- know in advance the precautions you must follow to minimize the probability of harm.
- are able to take those precautions
- have prepared in advance and are able to carry out the necessary first aid and emergency measures in the event something goes wrong.

The MSDS/SDS provides both useful and critical information on a substance which can help to ensure a safe science classroom environment. It is a teacher's professional obligation to become familiar with the MSDS/SDS for every chemical to be used in a lab or research project.

Each chemical storeroom should have a notebook with the MSDS for the chemicals in that storeroom. In addition, the administration is responsible for keeping MSDS for all of the chemicals used in the school.

The Material Safety Data Sheet/Safety Data Sheets (MSDS/SDS) is designed to provide the teacher with guidelines concerning the proper handling and safe use of substances. The format and information provided by a MSDS/SDS may vary depending on the source but familiarity with the following information prior to conducting a lab or approving a research project is critical. The following are some of the many properties that can be found on a MSDS/SDS.

- flash point
- odor
- toxicity
- health
- fire
- reactivity hazards
- proper storage
- spill/leak cleanup
- disposal procedures
- protective equipment

A review of certain key sections on the MSDS/SDS will usually give a teacher a good understanding of the potential danger and risks involved with using the substance in the science classroom. **How to Read an MSDS (Flinn Scientific)**
http://access.ewu.edu/Documents/HRRR/ehs/Flinn-HowtoReadMSDS.pdf

Names and Synonyms
It is important to become familiar with the chemical name and its various synonyms since different sources (vendors, chemical container labels, text and lab books, reference and safety manuals, and emergency personnel) may use different names for the same chemical.

Formula

The chemical may also be referred to by its formula.

Reactivity

This section indicate**s** that methanol is normally stable if stored and handled properly. Substances that are identified as unstable may react when exposed to normal conditions such as air, humidity, low temperatures, and slight to moderate physical shock. Unstable substances are therefore more dangerous to work with and more difficult to store.

Conditions to Avoid

This section can be very helpful to the teacher as a source for planning the safe use of the chemical substance. For example, this section advises that methanol be secured from any ignition source. Thus the teacher now knows that sources of heat and electrical sparks must be either eliminated or controlled before the use of this chemical in the classroom or laboratory.

Health Hazard

This section warns that ingestion of methanol can cause serious injury (blindness) alerting the teacher to consider restricting the use of the substance to more mature experienced students in as small a quantity and concentration as possible. Such control will limit the student's exposure time to an absolute minimum. This section offers critical information including how the chemical can enter your body (inhalation, swallowing, skin absorption), and what health hazards could result from the exposure. Substances which are absorbed through the skin and which may result in acute symptoms are generally more dangerous to use due to the risk of accidental exposure.

Tolerance Limit Value (TLV)

This section describes the maximum chemical concentration allowed for a person who is exposed to a particular chemical on a daily basis. No one should be exposed to a level above the TLV for any amount of time. For particular matter such as dust or fine mist, concentrations are expressed in units of milligrams per cubic meter. For gases and vapors given off by volatile substances such as methanol, concentrations are usually reported as parts per million in air.

Another useful measure of toxicity often reported on the MSDS is the research based **LD_{50}** value. LD means Lethal Dose. The subscript 50 indicates that 50% of the test animals (usually rats) died when administered the lethal dosage. **The lower the TLV or LD_{50}, the more toxic the substance and thus the greater the potential danger in the science classroom environment.**

The International Science and Engineering Fair rules recommend that in work with vertebrates, **'no deaths due to experimental procedures are permitted'**. ***(www.societyforscience.org)***

Fire Hazard

This section describes the flammability of the substance. For methanol the flash point is reported to be 54 degrees Fahrenheit. The flash point is the lowest temperature at which a combustible liquid will generate a flammable vapor. Since the flash point is well below average classroom temperature, the teacher knows that potentially dangerous fumes will be given off when this substance is being used. This section also recommends the type of fire extinguisher to use if the substance ignites.

Spills, Leaks, and Disposal
In case of accidental spills or leaks, this MSDS section recommends specific procedures for the safe cleanup and disposal of the substance.

Special Precautions
This section reinforces the information in the previous sections and advises steps that must be taken to ensure safer use of the substance. It advises the use of proper gloves and goggles to protect the skin and eyes. This section is therefore useful when planning for chemical hygiene practices which may prevent accidental exposure.

Chemical Storage

Chemicals should be stored according to compatibility on stable shelving with proper ventilation. Teachers are responsible for returning chemicals to the proper location after use.

Science departments can reduce potential hazards in storage by maintaining a small dynamic inventory with limited quantities. This assures fresh supplies and helps to alleviate the problem of disposing of old, chemicals. Purchasing disposable and safe laboratory supplies should be a major consideration.

Another consideration in the storage of chemicals is whether the storeroom itself is safe. Fire protection, chemical exposure protection and security are important concerns. The storeroom must have certain safety features easily accessible, including at least one Type ABC dry chemical fire extinguisher, a pail of silica sand (for extinguishing metal fires) and a spill control kit to neutralize and contain liquid chemical spills. A smoke detector is also recommended.

Teachers must also be aware that many chemicals have a limited shelf life. Many chemicals become more or less reactive over time. Teachers should refer to a suitable reference to determine the shelf life of the chemicals in their storeroom.

CHEMICALS MUST NOT BE STORED ALPHABETICALLY. Several storage systems are available**.** The safest and most efficient storage pattern for chemicals is to separate the chemicals into their organic and inorganic families. Each family is then subdivided into compatible sub-families. The storage pattern diagrams on pages 53-55 shows the recommended shelf storage pattern for both the organic and inorganic chemical families using Flinn's sub-family grouping numbers. Chemicals should be stored according to this pattern.

Storage pattern codes:

IN - inorganic chemicals on open shelves.
OR - organic chemicals on open shelves.
AC - acid cabinet
FC - flammable cabinet

Keep a current inventory of all chemicals. The inventory should include the following information:

- Chemical name
- Date purchased
- Storage pattern code (IN, OR, AC, FC)
- Quantity
- Hazard
- Purchase restrictions (if any)

Other storage considerations:

- The chemical storeroom must be locked at all times.
- Students should ***NOT*** have access to the chemical storeroom.
- An **NFPA (or equivalent) label *must*** be placed on all chemicals.
- All flammables (materials with an NFPA Flammability Rating 3 or 4) ***must*** be stored in a dedicated flammables cabinet.
- All inorganic and some organic acids should be stored in a dedicated acid cabinet.
- Isolate concentrated nitric acid from organic acids(such as Acetic Acid) in an isolation cube or in a Styrofoam shipping container. It may be stored on a storeroom shelf near the floor if organic acids are stored in the acid cabinet.
- **Isolate ammonium nitrate in the solid form from all other chemicals.**
- Chemicals must never be stored on the floor, even temporarily.
- Chemicals must never be stored on the top of a storage cabinet.
- Chemicals must never be stored above eye level.
- Shelf assemblies must be firmly attached to the wall.
- All shelving must have anti-roll-off one-half inch lips.
- All shelving units should be made of chemically resistant material.
- All chemicals ordered for AP/IB/AICE/second year courses/Science Research are to be labeled as such.

"When we heal the earth,
we heal ourselves."

David Orr

Suggested Shelf Storage Pattern

A suggested arrangement of compatible chemical families on shelves in a chemical storage room, suggested by the *Flinn Chemical Catalog/Reference Manual*, is depicted on the following page. However, the list of chemicals below does not mean that these chemicals should be used in a high school laboratory.

* First sort chemicals into organic and inorganic classes.
* Next, separate into the following compatible families.

Inorganics	Organics
1. Metals, hydrides	2. Acids, Anhydrides, Peracids
3. Halides, Halogens, Phosphates, Sulfates, Thiosulfates	4. Alcohols, Amides, Amines, Glycols, Imides, Imines
5. Amides, Azides*, Nitrates* (except Ammonium nitrate), Nitrites*, Nitric Acid	6. Ethers*, Ethylene oxide, Halogenated hydrocarbons, Ketenes, Ketones
7. Carbon, Carbonates, Hydroxides, Oxides, Silicates	8. Epoxy compounds, Isocyanates
9. Carbides, Nitrides, Phosphides, Selenides, Sulfides	10. Azides*, Hydroperoxides, Peroxides
11. Chlorates, Chlorites, Hydrogen Peroxide*, Hypochlorites, Perchlorates*, Perchloric acid*, Peroxides	12. Nitriles, Polysulfides, Sulfides, Sulfoxides
13. Arsenates, Cyanates, Cyanides	14. Cresols, Phenols
15. Borates, Chromates, Manganates, Permanganates	
16. Acids (except Nitric Acid)	
17. Arsenic, Phosphorous*, Phosphorous pentoxide*, Sulfur	

* **Chemicals deserving special attention because of their potential instability**
* **Referenced from NIOSH National Institute for Occupational Safety and Health http://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf**
* **Reference Flinn Scientific**

INORGANIC - Suggested Shelf Storage Pattern

<table>
<tr><td rowspan="5">Inorganic # 9

Acid Storage Cabinet
(Store acids in dedicated acid cabinet)

Acids,
EXCEPT Nitric acid
(Store Nitric acid away from other acids unless the cabinet provides a separate compartment for nitric acid storage)</td><td>Inorganic # 10
Arsenic, Phosphorous, Phosphorous pentoxide, Sulfur</td><td>Inorganic # 7
Arsenates, Cyanates, Cyanides
Store Away From Water</td></tr>
<tr><td>Inorganic # 2
Halides, Halogens, Phosphates, Sulfates, Sulfites, Thiosulfates</td><td>Inorganic # 5
Carbides, Nitrides, Phosphides, Selenides, Sulfides</td></tr>
<tr><td>Inorganic # 3
Amides, Azides, Nitrates, Nitrites
EXCEPT Ammonium nitrate
(store ammonium nitrate away from all other substances)</td><td>Inorganic # 8
Borates, Chromates, Manganates, Permanganates</td></tr>
<tr><td>Inorganic # 1
Hydrides, Metals
Store away from water.
Store any flammable solids in dedicated cabinet.</td><td>Inorganic # 6
Chlorates, Chlorites, Hypochlorites, Hydrogen Peroxide, Perchlorates, Perchloric acid, Peroxides</td></tr>
<tr><td>Inorganic # 4
Carbon, Carbonates, Hydroxides, Oxides, Silicates</td><td>Miscellaneous</td></tr>
</table>

Do NOT store chemicals on the floor

ORGANICSS – Suggested Shelf Storage Pattern

<table>
<tr><td>Organic # 2

Alcohols, Amides, Amines, Imides, Imines, Glycols

Store Flammables in Dedicated Cabinet</td><td>Organic # 8

Cresols, Phenol</td><td>Poison Storage Cabinet

Toxic Substances</td></tr>
<tr><td>Organic # 3

Aldehydes, Esters, Hydrocarbons

Store Flammables in Dedicated Cabinet</td><td>Organic # 6

Azides, Hydroperoxides, Peroxides</td><td rowspan="5">Flammable Storage Cabinet

Flammable Organic # 2

Alcohols, Glycols, etc

Flammable Organic # 3

Hydrocarbons, Esters, etc

Flammable Organic # 4</td></tr>
<tr><td>Organic # 4

Ethers, Ethylene oxide, Halogenated Hydrocarbons, Ketenes, Ketones

Store Flammables in Dedicated Cabinet</td><td>Organic # 1

Acids, Anhydrides, Peracids

Store Certain Organic Acids in Acid Cabinet</td></tr>
<tr><td>Organic # 5

Epoxy compounds, Isocyanates</td><td>Miscellaneous</td></tr>
<tr><td>Organic # 7

Nitriles, Polysulfides, Sulfides, Sulfoxides, etc.</td><td>Miscellaneous</td></tr>
</table>

Do NOT store chemicals on the floor

Incompatible Chemicals

A wide variety of chemicals react dangerously when mixed with certain other chemicals. The chemical storage patterns are designed to prevent such occurrences.
Some of the more widely used incompatible chemicals are listed below, but the absence of a chemical from this list should not be taken to indicate that it is safe to mix it with any other chemical.

- *Escherichia coli* (non-enteropathogenic) (gram - rod) K-12

Although many of the chemicals on this list are not on the approved chemical list, they are listed for reference purposes.

Chemical	Incompatibilities
acetic acid	chromic acid, ethylene glycol, nitric acid, hydroxyl compounds, per chloric acid, peroxides, permanganates
acetone	concentrated sulfuric and nitric acid
acetylene	chlorine, bromine, copper, fluorine, silver, mercury
alkali and alkaline earth metals	water, chlorinated hydrocarbons, carbon dioxide, halogens, alcohols, aldehydes, ketones, acids, powdered metals
ammonium nitrate	acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic combustible materials
aniline	nitric acid, hydrogen peroxide
arsenic compounds	reducing agents
azides	acids
bromine	ammonia acetylene, butadiene, hydrocarbons
calcium oxide	water
carbon (activated)	calcium hypochlorite, oxidizing agents
chlorates	ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials

Chemical	Incompatibilities
chromic acid and chromium	acetic acid, naphthalene, camphor, glycerol, flammable liquids in general
chlorine	ammonia acetylene, butadiene, hydrocarbons, hydrogen, sodium carbide, turpentine, benzene, finely divided metals
chlorine dioxide	sulfide ammonia, methane, phosphine, hydrogen
copper	acetylene, hydrogen peroxide, nitric acid
cyanides	acids
flammable liquids	ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
hydrocarbons (butane, benzene, etc.)	fluorine, chlorine, bromine, chromic acid, sodium peroxide
hydrocyanic acid	nitric acid, alkali
hydrofluoric acid	aqueous or anhydrous ammonia
hydrogen peroxide	copper, chromium, iron, most metals or their salts, acetone, organic materials, aniline, nitro methane, flammable alcohols, liquids, oxidizing gases
hydrogen sulfide	fuming nitric acid, oxidizing gases
hypo chlorites	acids, activated carbon
iodine	acetylene, ammonia (aqueous or anhydrous), hydrogen
nitrates	sulfuric acid
nitric acid (conc.)	acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, heavy metals
nitrites	acids

Chemical	Incompatibilities
nitroparaffins	inorganic bases, amines
oxalic acid	silver, mercury
oxygen	oils ,greases, hydrogen, flammables
per chloric acid	acetic anhydride, bismuth and its alloys, ethanol, paper, wood
peroxides (organic)	acids, avoid friction or shock
phosphorus (white)	air, alkalies, reducing agents, oxygen
potassium chlorate	acids
potassium perchlorate	acids, chlorates
potassium permanganate	glycerin, ethylene glycol, benzaldehyde, sulfuric acid
selenides	reducing agents
silver	acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium nitrite	ammonium salts
Sodium peroxide	ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
sulfides	acids
sulfuric acid	potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)
matter	antimatter

Chemical Disposal and Spills

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA) which directed the U.S. Environmental Protection Agency (EPA) to develop and implement a program to protect human health and the environment from improper hazardous waste management practices. The program is designed to manage hazardous waste from its generation to its ultimate disposal.

Disposal Techniques
The Approved Chemical List includes MSDS/SDS URLs that have information on disposal for each of the chemicals approved for use in the District. See page 78, Link. These disposal techniques are to be applied to the reactants and products generated from laboratory experimentation. **All chemicals must be disposed of properly in strict accordance with these protocols as specified by the MSDS/SDS information. Non-approved disposal methods are forbidden.** Expired stock chemicals are to be properly labeled and stored for pickup by a licensed hazardous waste hauler. See page 68, Link, for a copy of the Regulated/Hazardous Waste Profile and Removal Request Form. The quantity of expired stock chemicals can be significantly reduced by careful planning and purchasing practices. Whenever possible, always order chemicals in quantities that will be consumed during the school year that they were purchased.

Small Chemical Spill Materials:

Absorbent material such as kitty litter or chemical absorbent pads
Neutralizers: Acid spills (sodium carbonate), base spills (citric acid)
Plastic scoop (plastic dust pan)
Appropriate gloves / Safety Splash Goggles
Sealable plastic bags

The Purchase and Use of Chemical Kits

It has become increasingly popular to purchase various types of chemical kits and data logging probe ware that use chemicals to perform experiments such as water quality tests. Before considering purchasing these kits, the teacher must first review the chemical contents of each kit including the Material Safety Data Sheets, disposal methods and all pertinent information concerning the safety of using the kit. If the kit contains chemicals *not* on the Approved Chemical List and the teacher wishes to purchase the kit, the appropriate chemical approval request form must be submitted. If approval is granted, then the kit may be purchased as long as all conditions concerning the approval are met.

"I have learned to use the word IMPOSSIBLE with the greatest caution."

Wernher von Braun

Brevard Public Schools Student Science Safety Agreement

Student Name_____ Course/Period _____

For the Student:
A science laboratory is a safe place to work if you are alert and cautious. It is important that you understand and abide by the guidelines below:

- Follow all written or verbal instructions given by the teacher. Ask for clarification if needed. Never work without teacher supervision in the laboratory.
- Follow procedures as explained and do not perform unauthorized experiments. Work at your assigned station unless instructed otherwise.
- Do not handle equipment or chemicals without the teacher's permission. Do not remove any chemical or equipment from the laboratory without teacher permission.
- Use appropriate safety attire (goggles, face shields, aprons, and/or gloves).
- Never taste chemicals. When appropriate, cautiously smell chemicals only using the proper wafting technique. Do not wear contact lenses when working with chemicals.
- Dress appropriately. Tie long hair back. Avoid open shoes, dangling jewelry, and floppy sleeves.
- Use good housekeeping and hygiene practices. Wash hands with soap and water after performing all experiments.
- Report all accidents and possible hazards to the teacher.
- Know the location and the use of classroom safety equipment.
- Know the primary and secondary exit routes from the laboratory.
- Act in a responsible manner at all times in a laboratory situation.
- Do not have food, drink or gum in the lab.

I understand and agree to abide by the safety regulations described above.

Student Signature _____ Date _____

For the Parent:
Laboratory activities are integral to the science curriculum. Student safety is our highest priority, and is enhanced by awareness and caution. Please help us to assure a safe and positive learning experience for your child by completing the items below:

- Does the student have any health problems, physical limitations, or allergies (including food and plant allergies)?_____ If yes, please specify: _____
  _____
- Does the student wear contact lenses?_____

I have reviewed the above student guidelines for laboratory safety with my child. I will direct any questions I may have concerning laboratory activities to the science teacher.

Parent/Guardian Signature _____Date_____

Brevard Public Schools Safety

Non-laboratory Science Classrooms Checklist

The teacher should check the operation and/or condition of the following at the beginning of each semester and the end of the school year for the purpose of initiating corrective actions or repairs. Science teachers should regularly check their instructional areas to assure that they are safe.

Concerns about safety conditions related to the facilities, equipment, supplies, curriculum, and classroom occupancy load should be communicated in writing immediately to the science department chairperson and/or site administrator for assistance in correcting the condition.

Recommended in all Science Classrooms

Room Number		School Year			
		Date	Date	Date	Date
Fire Extinguisher: ABC Type					
Eye Wash					
Ground-fault circuit interrupters (GFI)					
Broom and dust pan					
Designated waste container for glass					
Exits marked and readily accessible					
Equipment properly stored					
Chemicals properly labeled and stored					
Goggles	(record number)				
Sanitizing equipment for goggles	(record location)				
Lab Aprons	(record number)				

Y =Yes, working condition NP =Not Present NW =Not Working AV =Available, when needed

Safety check completed by _____ ___

Please return form to Science Department Chairperson or Facilities Site Administrator each time checklist is completed.

Brevard Public Schools Student Dissection Agreement

Student Name_____ Course/Period _____

Instructions:

- Sign either the top section **OR** the bottom section, but not both.
- If you wish to participate in dissections, read and sign the top section.
- If you do **NOT** wish to participate in dissections, read and sign the bottom section.

RESPONSIBLE USE OF ANIMAL SPECIMENS AGREEMENT FORM

- I am aware that the purpose of any dissection is to advance my knowledge and appreciation of the structure of living organisms. If I do not learn from the experience, the use of the organisms or tissues is not justified. I also understand that it is my responsibility to complete the activity as directed and to follow all safety rules and procedures.
- I understand that careless work on the specimen; improper handling of the specimen or deliberate mutilation of the specimen is **UNACCEPTABLE.**
- I understand that I have the right to change my decision, and I accept responsibility for obtaining and submitting another signed "Student Dissection Agreement".

Student Signature _____ Date _____

Parent/Guardian _____ Date _____

REQUEST FOR ALTERNATE ASSIGNMENT IN LIEU OF DISSECTION

- In accordance with Florida Statue 233.0674, "students may be excused from dissection upon written request of a parent or guardian." My parent/guardian and I request that I be given relevant alternative learning activities in lieu of dissection activities.
- I understand that I have the right to change my decision, and I accept responsibility for obtaining and submitting another signed "Student Dissection Agreement".

Please check one of the following:

- ☐ I prefer to work on my alternate assignment in the classroom during animal dissections.
- ☐ I prefer to work on my alternative assignment in another area during animal dissection

Student Signature _____ Date _____

Parent/Guardian _____ Date _____

Brevard Public Schools

Safety Checklist for Secondary Science Laboratories

The teacher should check the operation and/or condition of the following at the beginning of each semester and the end of the school year for the purpose of initiating corrective actions or repairs. Science teachers should regularly check their instructional areas to assure that they are safe.

Concerns about safety conditions related to the facilities, equipment, supplies, curriculum, and classroom occupancy load should be communicated in writing immediately to the science department chairperson and/or site administrator for assistance in correcting the condition.

Recommended in all Secondary Science Laboratories

Room Number	School Year		
	Date	Date	Date
Fire Extinguisher: ABC Type			
Fire Blanket			
Shower with drain			
Eye Wash			
Chemical Spill Materials			
Ventilation exhaust fan			
Fume hood			
Gas master cut-off			
Electrical Master cut-off or posted location of master cut-off			
Ground-fault circuit interrupters (GFI)			
Broom and dust pan			
Designated waste container for glass			
Exits marked and readily accessible			
Equipment properly stored			
Chemicals properly labeled and stored			
Goggles (record number)			
Sanitizing equipment for goggles (record location)			
Face Shields (record number)			
Lab Aprons (record number)			
Chemically inert gloves (record number)			
Heat resistant gloves (record number)			
Adequate # of lab stations to accommodate class load			

Y =Yes, working condition NP =Not Present NW =Not Working AV =Available, when needed

Safety check completed by_____

Please return form to Science Department Chairperson or Facilities Site Administrator each time checklist is completed.

Brevard Public Schools

Safety Checklist for Chemical Storerooms

The science chairperson or designee should check the operation and/or condition of the following at the **beginning of each semester** and the **end of the school year** for the purpose of initiating corrective actions or repairs.

Room Number	School Year		
	Date	Date	Date
Storage areas are securable			
Storage area well lighted			
Storage area has separate constant ventilation			
Storage area has temperature and humidity control			
Storage area is free of floor clutter			
Acid Storage Cabinet - labeled			
Flammable Storage Cabinet – labeled and ventilated			
Chemicals properly labeled			
Chemical properly arranged by compatibles			
No unapproved chemicals stored in storeroom			
Shelving with 1/2" lip			
Gas cylinders secured			
Emergency lighting			
Emergency alarm & communication device			
Chemical Inventory			
Hazardous waste stored at floor level			

Y =Yes, working condition NP =Not Present NW =Not Working AV =Available, when needed

- Chemical storage must be in an area that is locked and not accessible to students
- Forced air ventilation to outside is required
- Chemical storage areas must be maintained at a moderate temperature on a year round basis
- Chemical storage areas must have adequate lighting
- Chemical storage areas must be clear of items that prevent ease of access
- All chemicals must be stored in compatible groups according to recognized shelf storage pattern and NOT alphabetical order
- Metal storage cabinets used for flammable materials must be approved and labeled "FLAMMABLE"
- All stored chemicals must contain the following: Chemical Name, Suppliers Name, date of purchase, concentration, and known hazards
- Each school must keep an inventory of all chemicals that are on site for science instruction purposes. This inventory must be updated on a yearly basis and should contain the following information: Chemical Name, Supplier's Name, Date Received, Concentration, and Amount on hand.
- Certain explosive chemicals and human carcinogens are not allowed for use or storage in chemical storerooms.

_____ _____

Safety check completed by Administrator signature

Brevard Pubic Schools
Chemical and Biological Agent Use Approval Form

Form must be completed for any chemical or biological agent, brought on campus, not included in approved chemistry list. Use a separate form for each requested chemical or biological agent. Approval is only valid for a **one time order** of the requested item. **Attach** the appropriate Material Safety Data Sheets.

Teacher:	School:	
Teacher email:	Teacher Telephone:	School Fax:
Type of Class: ☐ Research ☐ Regular/Honors AP/IB/AICE ☐ Science		Use: ☐ Teacher ☐ Demonstration
Chemical or Organism Name and Source:	Quantity:	Hazards:
Method of Disposal of Excess:		NFPA Code or BSL:
Purpose of Experiment / Activity :		
Description of Experiment (attach copy of lab procedure or research protocol and safety precautions):		

_____
Teacher Signature / Date

_____
Science Chairperson Signature / Date

_____
Principal Signature / Date

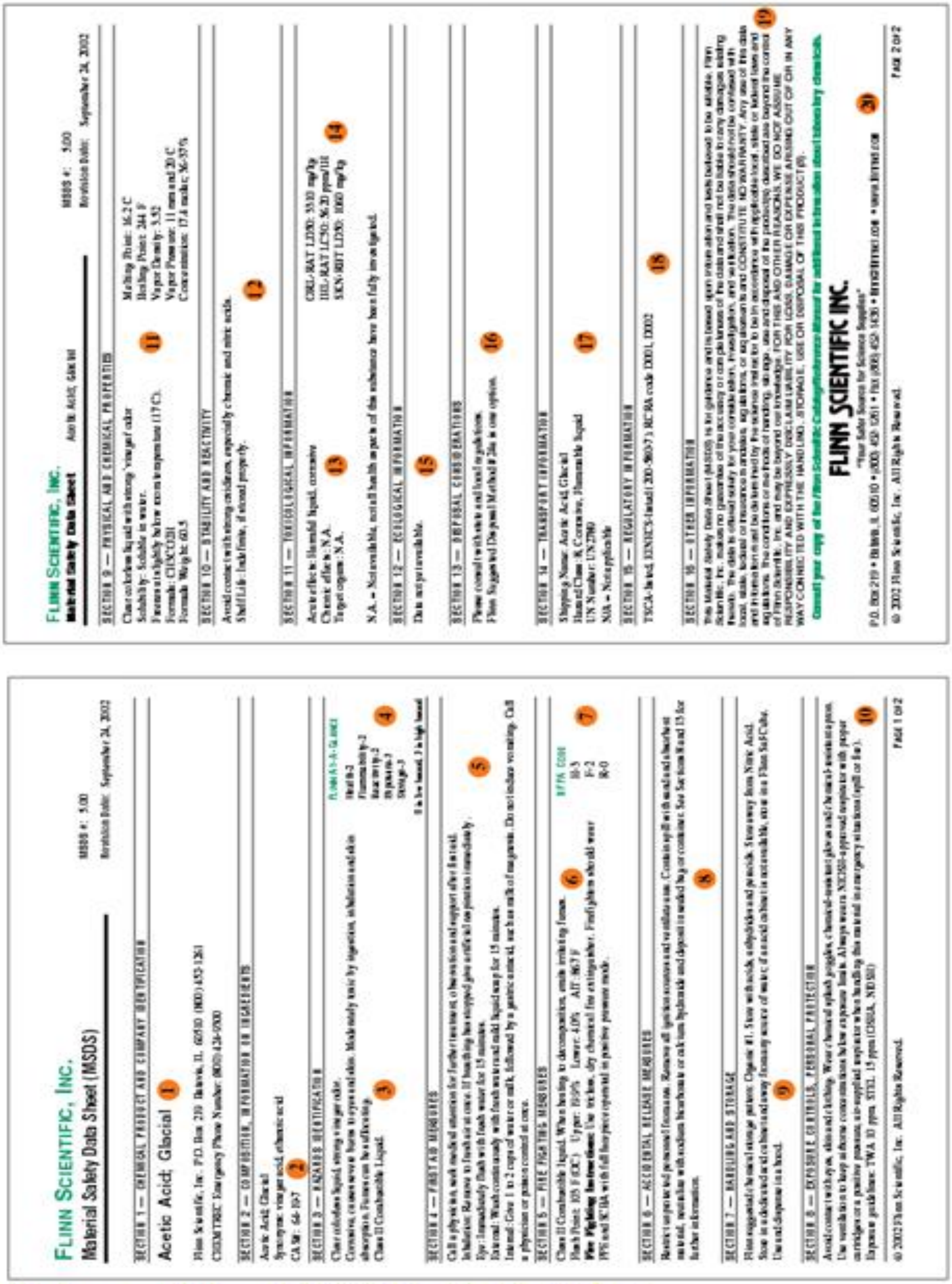
Teacher should forward copy of completed approval to Science Chairperson.

Send completed form and MSDS/SDS or Organism Product Sheet to:

High School Science Resource Teacher
Office of Secondary Programs
Educational Service Facility
Brevard Public Schools

_____
Approval Signature / Date

Sample MSDS



http://access.ewu.edu/Documents/HRRR/ehs/Flinn-HowtoReadMSDS.pdf

Regulated Hazardous Waste Profile/Removal Request Form

Brevard County School District **Regulated / Hazardous Waste Profile and Removal Request Form**

Site/Facility Name: _____ Request Date: _____

Requesters Name: _____ Pick-up Contact Person: _____

Substance	Approximate Amount in Container	Size of Container	Container Type	Container Condition	Location/Room Number

Notes _____

_____

_____

_____

The school assistant principal for facilities should send all completed forms to the BPS Office of Environmental Health and Safety as a scanned electronic copy or by courier. Call 321-633-3496 ext 4, with any questions.

Page ____ of ____

Call 633-2042 at least 24 hours in advance to arrange disposal
Complete this form, three (3) copies of this form must accompany each load

Non-hazardous waste manifest

Bill of Lading

Generator's Name: Brevard Public Schools

Address: 2700 Judge Fran Jamieson Way, Viera Florida 32940

Telephone #: 321-633-1000

Transporter's Name:

Address: 1254 S. Florida Ave Rockledge FL 32955

Landfill

Telephone #: 321-633-3496 **Account #:**

Description of Waste: (type and process generating waste)

Quantity (yd³/tons)

Delivery Date:
Transporter's Signature:

Deliver to:

Central Disposal Facility
2250 Adamson Road
Cocoa, FL 32926

CDF Supervisor/Lead Worker Date

Discrepancy:

NSTA Position Statement-Laboratory Safety

Liability of Science Educators for Laboratory Safety

Introduction

Laboratory investigations are essential for the effective teaching and learning of science. A school laboratory investigation "lab" is an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC 2006, p. 3). Inherent in laboratory-based activities is the potential for injury. Studies show that safety in K–12 school science instruction needs immediate and significant attention. (Gerlovich et al. 2005)

As professionals, teachers of science have a duty of care to ensure the safety of students, teachers, and staff. Duty of care is defined as an obligation, recognized by law, requiring conformance to a certain standard of conduct to protect others against unreasonable risk (Prosser et al. 1984). "The breach of a particular duty owed to a student or others may lead to liability for both the teacher and the school district that employs that teacher." (Ryan 2001). As such, science educators must act as a reasonably prudent person would in providing and maintaining a safe learning environment for their students. Educators' duty to maintain a safe learning environment while providing science instruction also must be shared by school leaders, district administrators, school boards, parents, and students. It is vital that teachers and administrators communicate regularly and fully on the essentials of safe instruction for students.

Declarations

To ensure a safe and effective learning environment for students, teachers of science should:

- Integrate laboratory investigations into science instruction so that all students—including students with academic, remedial, or physical needs; gifted and talented students; and English language learners—have the opportunity to participate in laboratory investigations in a safe environment (NSTA 2007).

- Be proactive in seeking professional development opportunities to learn and implement practices and procedures necessary to conduct safe laboratory science investigations, including storage, use, and disposal of materials and chemicals; use of personal protective equipment; engineering controls; and proper administrative procedures (Roy 2006).

- Request and encourage school and district leadership to provide necessary professional development opportunities for staff and take personal professional responsibility to learn and implement these safe practices and procedures into teaching.

- Exercise reasonable judgment when conducting laboratory investigations.

- Accept the duty of care to provide all students and staff with a safe environment while performing hands-on science investigations or demonstrations in the laboratory, classroom, or field setting; using, storing, disposing/recycling, or transporting chemicals; or engaging in other related activities.
- Modify or alter activities in a safe manner, or select alternative activities to perform, when in the exercise of their duty, they determine that the proposed activities cannot be performed safely or a safe environment cannot be maintained.

- Identify, document, and notify school and district officials about existing or potential safety issues that impact the learning environment, including hazards such as class-size overcrowding in violation of occupancy load codes (BOCA 1996, ICC 2003, NFPA 2006) or contrary to safety research (West et al. 2005), inadequate or defective equipment, inadequate number or size of labs, or improper facility design (Motz et al. 2007), and give necessary recommendations to correct the issue or rectify a particular situation. Overcrowding has two research-based safety concerns: sufficient supervision and adequate individual workspace. Classes containing more than 24 students engaged in science activities cannot safely be supervised by one teacher. Additionally, research data show that accidents rise dramatically as class enrollments exceed 24 students or when inadequate individual workspace is provided (West et al. 2005).

- Communicate fully and regularly (at least once quarterly) with administrators regarding issues impacting the provision of safe science instruction.

- Share the responsibility with school district officials in establishing and implementing written safety standards, policies, and procedures, and ensure their compliance.

- Understand the scope of the duty of care in acting as a reasonably prudent person in providing science instruction, and acknowledge the limitations of insurance in denying coverage for reckless and intentional acts, as well as the potential for individual liability for acts outside the course and scope of employment. [*See generally*, Restatement (Second) of Torts §202. 1965; Anderson et al. 1999, p. 398.]

To ensure a safe learning environment, school district officials—such as administrators, principals, assistant principals, science supervisors, and superintendents—should:

- Understand that for science to be taught properly and effectively, lab activities—conducted in the laboratory, classroom, or field setting—must be integrated fully and safely into the science curriculum (NSTA 2007).

- Develop and implement comprehensive safety policies with clear procedures for engaging in lab activities. These safety policies should comply with all applicable local and state health and safety codes, regulations, ordinances, and other rules established by the applicable oversight organization, including the Occupational Safety & Health Administration (OSHA), International Code Council (ICC), Building Officials and Code Administrators (BOCA), and National Fire Protection Association (NFPA).

- Ensure that all safety policies, including those related to safety training, are reviewed and updated annually in consultation with school or district science educators.

- Support and encourage the use of laboratory investigations in science instruction, and share the responsibility with teachers to develop and fully integrate these activities into the science curriculum.

- Become knowledgeable of and enforce all local, state, and federal codes and regulations to ensure a safe learning environment for students and educators. Particular attention should be given to means of hazard prevention, including reasonable class sizes to prevent overcrowding in violation of occupancy load codes (BOCA 1996, ICC 2003, NFPA 2006) or contrary to safety research (West et al. 2005); replacement or repair of inadequate or defective equipment; adequate number or size of labs (Motz et al. 2007), or proper facility design; and the proper use, storage, disposal, or recycling of chemicals.

- Understand that the number of occupants allowed in the laboratory must be set at a safe level based on building and fire safety codes, size and design of the laboratory teaching facility, chemical/physical/biological hazards, and students' needs (NSTA 2000; Roy 2006). Science classes should have no more than 24 students to allow for adequate supervision during science activities, even if the occupancy load limit might accommodate more (NSTA 2004). It is equally important to ensure adequate workspace for each student. NSTA recommends 60 sq. ft. for each secondary student and 45 sq. ft. for each elementary student in a laboratory/classroom setting (Motz et al. 2007). Research data show that accidents rise dramatically as class enrollments exceed 24 students or when inadequate individual workspace is provided (West et al. 2005).

- Require teachers to develop, maintain, and implement chemical hygiene plans based on OSHA's Laboratory Standard criteria (OSHA 29 CFR 1910.1450) and Right to Know Standard (OSHA 29 CFR 1910.1200).

- Support teachers of science by obtaining materials and resources from national, state, and local organizations that will inform and educate teachers about safe laboratory activities, safety procedures, and best practices in the teaching of laboratory-based science instruction.

- Review existing insurance policies to ensure adequate liability insurance coverage for laboratory-based science instruction.

- Provide teachers with sustained, comprehensive training in lab logistics—including setup, safety, management of materials and equipment, and assessment of student practices—at the time of initial assignment and before being assigned to a new exposure situation (OSHA 29 CFR 1910.1450[f][2]). This includes storage, use, and disposal of materials and chemicals; use of personal protective equipment; engineering controls; and proper administrative procedures. To ensure ongoing safety, annual training should be provided to keep teachers well informed about changes in safety procedures (NSTA 2000).

- Support the decisions of teachers to modify or alter activities in a safe manner or select safe alternative activities to perform in the science classroom/laboratory.

- Maintain adequately supplied, properly equipped, and safe facilities for performing lab instruction by conducting annual facilities audits (Motz et al. 2007; Ryan 2001).

To ensure a safe learning environment, members of the school board should:

- Recommend and support upgrading and improving school science facilities and science curriculum/instruction. If possible, a district wide review of science facilities and instruction should be conducted at least every 3–5 years.

- Ensure that the district has adequate insurance to cover liability claims arising in the science classroom/laboratory.

- Adopt district wide policies for safety, including guidelines for a safe working environment for all employees.

Adopted by the
NSTA Board of Directors
September 2007

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Prosser, W. L., W. P. Keeton, D. B. Dobbs, R. E. Keeton, and D. G. Owen, eds. 1984. *Prosser and Keeton on torts.* 5th ed. Eagan, MN: West Group.
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Additional Resources

Americans with Disabilities Act of 1990 (ADA). See *www.usdoj.gov/crt/ada/adahom1.htm* and *www.ada.gov/pubs/ada.htm.*
Building Officials and Code Administrators (BOCA). See *www.iccsafe.org/help/redirect-bocai.html.*
Individuals with Disabilities Education Act (IDEA). See *www.ed.gov/offices/OSERS/Policy/IDEA/index.html* and *www4.law.cornell.edu/uscode/20/1400.html.*
International Code Council (ICC). See *www.iccsafe.org.*
National Fire Protection Association (NFPA). See *www.nfpa.org.*
Occupational Safety & Health Administration (OSHA). U.S. Department of Labor. See *www.osha.gov.*

NSTA Position Statement-Laboratory Instruction

The Integral Role of Laboratory Investigations in Science Instruction

Introduction

A hallmark of science is that it generates theories and laws that must be consistent with observations. Much of the evidence from these observations is collected during laboratory investigations. A school laboratory investigation (also referred to as a lab) is defined as an experience in the laboratory, classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (NRC 2006, p. 3). Throughout the process, students should have opportunities to design investigations, engage in scientific reasoning, manipulate equipment, record data, analyze results, and discuss their findings. These skills and knowledge, fostered by laboratory investigations, are an important part of inquiry—the process of asking questions and conducting experiments as a way to understand the natural world (NSTA 2004). While reading about science, using computer simulations, and observing teacher demonstrations may be valuable, they are not a substitute for laboratory investigations by students (NRC 2006, p. 3).

For science to be taught properly and effectively, labs must be an integral part of the science curriculum. The National Science Teachers Association (NSTA) recommends that all preK–16 teachers of science provide instruction with a priority on making observations and gathering evidence, much of which students experience in the lab or the field, to help students develop a deep understanding of the science content, as well as an understanding of the nature of science, the attitudes of science, and the skills of scientific reasoning (NRC 2006, p. 127). Furthermore, NSTA is committed to ensuring that all students—including students with academic, remedial, or physical needs; gifted and talented students; and English language learners—have the opportunity to participate in laboratory investigations in a safe environment.

Declarations

NSTA strongly believes that developmentally appropriate laboratory investigations are essential for students of all ages and ability levels. They should not be a rote exercise in which students are merely following directions, as though they were reading a cookbook, nor should they be a superfluous afterthought that is only tangentially related to the instructional sequence of content. Properly designed laboratory investigations should:

- have a definite purpose that is communicated clearly to students;
- focus on the processes of science as a way to convey content;
- incorporate ongoing student reflection and discussion; and
- enable students to develop safe and conscientious lab habits and procedures (NRC 2006, p. 101–102).
-

Integration of Labs into the Science Program

Inquiry-based laboratory investigations at every level should be at the core of the science program and should be woven into every lesson and concept strand. As students move through the grades, the level of complexity of laboratory investigations should increase. In addition, NSTA

recommends that teachers and administrators follow these guidelines for each grade level:

Preschool and Elementary Level

- With the expectation of science instruction every day, all students at the preschool and elementary level should receive multiple opportunities every week to explore science labs that fit the definition described in the Introduction.
- Laboratory investigations should provide all students with continuous opportunities to explore familiar phenomena and materials. At developmentally appropriate levels, they should investigate appropriate questions, analyze the results of laboratory investigations, debate what the evidence means, construct an understanding of science concepts, and apply these concepts to the world around them.

Middle and High School Levels

- With the expectation of science instruction every day, all middle level students should have multiple opportunities every week to explore science labs as defined in the Introduction. At the high school level, all students should be in the science lab or field, collecting data every week while exploring science labs.
- Laboratory investigations in the middle and high school classroom should help all students develop a growing understanding of the complexity and ambiguity of empirical work, as well as the skills to calibrate and troubleshoot equipment used to make observations. Learners should understand measurement error; and have the skills to aggregate, interpret, and present the resulting data (NRC 2006, p. 77).
- As students progress through middle and high school, they should improve their ability to collaborate effectively with others in carrying out complex tasks, share the work of the task, assume different roles at different times, and contribute and respond to ideas.

College Level

At the college level, all students should have opportunities to experience inquiry-based science laboratory investigations as defined in the Introduction. All introductory courses should include labs as an integral part of the science curriculum. Laboratory experiences should help students learn to work independently and collaboratively, incorporate and critique the published work of others in their communications, use scientific reasoning and appropriate laboratory techniques to define and solve problems, and draw and evaluate conclusions based on quantitative evidence. Labs should correlate closely with lectures and not be separate activities. Exposure to rigorous, inquiry-based labs at the college level also is important because most teachers develop their laboratory teaching techniques based on their own college coursework laboratory experiences.

Support for Teachers of Science

To give teachers at all levels the support they need to guide laboratory investigations as an integral part of the total curriculum, NSTA recommends:

- Ongoing professional development opportunities to ensure that teachers of science have practical experiences that familiarize them with the pedagogical techniques needed to facilitate inquiry-based labs matched to appropriate science content (NSTA 2006, NRC 2006, p. 150–151).

- Yearly evaluation of the laboratory investigations to determine if they continue to be an integral and effective part of the whole program and the delivery of all content.
- Periodic training in lab logistics, including setup, safety, management of materials and equipment, and assessment of student practices. Safety equipment and annual safety training should be provided so that science educators are well informed about yearly changes in safety procedures to ensure that students and educators are protected (NSTA 2000).
- Training to work with students with academic or remedial needs, physical needs, and gifted and talented students so that teachers can differentiate instruction appropriately. Assistive equipment, additional personnel, and facilities, modified as needed, also should be provided to ensure appropriate instruction of all students.
- Effective preservice programs that prepare teachers to carry out science labs as a central part of every science curriculum.

Support for Science Labs

To ensure that laboratory investigations are implemented in schools, administrative support is crucial. NSTA recommends that the school administration recognize the instructional importance, overarching goals, and essential activities of laboratory investigations and provide the following:

- An adequate facility where labs can be conducted. At the preschool and elementary levels, this means a classroom with sufficient work space, including flat moveable desks or tables and chairs, equipment, and access to water and electricity. At the middle and high school levels, a safe, well-equipped lab space should be available, with necessary equipment and access to water and electricity. In addition, appropriate facilities to work with students with special needs should be provided. (Beihle 1999)
- Adequate storage space for all materials, including devices and materials in common use that are considered hazardous. (Beihle 1999)
- Funding for yearly educator training on how to manage materials and guide inquiry-based learning during labs.
- A budget for regular maintenance of facilities and equipment, as well as annual costs for new or replacement equipment, supplies, and proper waste management.
- A budget that recognizes additional costs required for field experiences.
- **Laboratory occupancy load limits (number of occupants allowed in the laboratory) set at a safe level based on building and fire safety codes, size and design of the laboratory teaching facility, chemical/physical/biological hazards, and the needs of the students (Roy 2006; NSTA 2000). Science classes should have no more than 24 students even if the occupancy load limit might accommodate more. (NSTA 2004) Research data shows that accidents rise dramatically as class enrollments exceed this level. (West 2001) Teachers should not be faced with a Hobson's choice—teach in an unsafe environment or sacrifice the quality of teaching by not doing labs.**

Assessment

Assessment, a powerful tool in science education, serves both formative and summative purposes. Not only does it help show what students have learned and the nature of their reasoning, it also indicates what gaps remain in learning and what concepts must be reviewed (NSTA 2001). NSTA recommends the following steps to ensure that laboratory investigations are part of the assessment process:

- Teachers of science, supported by the administration, be given the time and training to develop assessments that reveal and measure inquiry skills—the ability to design, conduct, analyze, and complete an investigation, reason scientifically, and communicate through science notebooks and lab reports.
- Instruction and assessment be aligned so that formative and summative assessments are meaningful and can be used to improve the science curriculum as well as determine what students have learned.

—Adopted by the NSTA Board of Directors
February 2007

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Additional Resources

Clough, M.P. 2002. National Science Teachers Association. *Using the Laboratory to Enhance Student Learning. Learning Science and the Science of Learning*, ed. R. W. Bybee, 85–96. Arlington, VA: NSTA Press.

MSDS / SDS Search Engines

A material safety data sheet (MSDS) or safety data sheet (SDS), is an important component of science safety in the classroom. It is intended to provide teachers and administrators with procedures for handling or working with selected substances in a safe manner. Information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures are included on these documents. MSDS and SDS formats can vary from source to source.
Use one or more of the following MSDS/SDS Search Engines to gather safety information of chemicals used in the classroom.

MSDS/SDS Search Engine LINKS

http://sdssearchengine.com/sds/search.php?query=acs&start=7&search=1&results=10&domain=

http://www.sciencelab.com/msdsList.php

http://hazard.com/msds/

http://www.flinnsci.com/msds-search.aspx

http://www.fishersci.com/ecomm/servlet/msdssearchhome?showMSDSSearch=Y&storeId=10652

http://www.sigmaaldrich.com/safety-center.html?gclid=CJvQluKq478CFaTm7AodcG8AoQ

http://www.msds.com/ (Requires free registration)

http://www.ehso.com/msds.php

http://www.ilpi.com/msds/#Internet

Approved Chemicals List

Maximum volume when ordering chemicals is 500 mL. Please note some quantities are less and noted in the maximum storage column. Larger orders must be approved by Brevard Public Schools Science Resource Teacher, High School Programs.

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
1 ,1 0-Phenanthroline [AP/IB/AICE]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
1 ,2-Propanediol (Propylene Glycol)	MSDS / SDS Search Engine Links page 78	✓	Or-2	
1 -He2713adeconol (Cetyl Alcohol) [AP/IB/AICE]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
1 -Octanol	MSDS / SDS Search Engine Links page 78		Or-2	
1-Butanol (Butyl Alcohol)	MSDS / SDS Search Engine Links page 78		FC	100mL
2,3,5-Triphenyl-2H-tetrazolium (Tetrazolium Chloride)	MSDS / SDS Search Engine Links page 78		Or-9	
2,6-Dichlorophenolindolphenol (DPIP)	MSDS / SDS Search Engine Links page 78		Or-8	
2-Aminobenzoic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
2-Etho*yethanol (Cellosolve)	MSDS / SDS Search Engine Links page 78		Or-2	
2-Propanol (Isopropyl alcohol)	MSDS / SDS Search Engine Links page 78		FC	1L
3,5,3-Triiodo-L-thyronine	MSDS / SDS Search Engine Links page 78		Or-1	
3-Aminophthalhydrazide (Luminol)	MSDS / SDS Search Engine Links page 78		Or-2	
3-Indoleacetic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
3-Pentanol (Amyl Alcohol)	MSDS / SDS Search Engine Links page 78		Or-2	1L
Acacia (Arabic Gum)	MSDS / SDS Search Engine Links page 78		Or-1	
Acetamide	MSDS / SDS Search Engine Links page 78			
Acetic Acid (1.0 M)	MSDS / SDS Search Engine Links page 78		Acid	250 mL
Aceto-CarmIne	MSDS / SDS Search Engine Links page 78		Or-4	
Acetone (Dimethyl Ketone)	MSDS / SDS Search Engine Links page 78		FC	4L
Aceto-OrceIn Solution	MSDS / SDS Search Engine Links page 78		Or-9	
AcetylcholIne Bromide Solution	MSDS / SDS Search Engine Links page 78		Or-2	
AcetylcholIne Chloride	MSDS / SDS Search Engine Links page 78		Or-2	
Acetylsalicylic Acid (AspirIn)	MSDS / SDS Search Engine Links page 78		Or-1	
AdenosIne Triphosphate	MSDS / SDS Search Engine Links page 78		Or-2	
Adipic Acid (He*anedioic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Adrenaline (epenephrine)	MSDS / SDS Search Engine Links page 78		Or -2	
Agar Agar (Culture Media)	MSDS / SDS Search Engine Links page 78		Or-M	
Agarose	MSDS / SDS Search Engine Links page 78		Or-M	
Alanine	MSDS / SDS Search Engine Links page 78		Or-1	
AlbumIn	MSDS / SDS Search Engine Links page 78		Or-2	
Alcojet	MSDS / SDS Search Engine Links page 78		Wash area	
Alcono*	MSDS / SDS Search Engine Links page 78		Wash area	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
AlizarIn Red S	MSDS / SDS Search Engine Links page 78		Or-9	
AlizarIn Yellow R	MSDS / SDS Search Engine Links page 78		Or-9	
Alum, Ammonia	MSDS / SDS Search Engine Links page 78		In-2	
Alum, Ferric	MSDS / SDS Search Engine Links page 78		In-2	
Alum, Potassium, Aluminum Potassium Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Alum, Sodium; Aluminum Sodium Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Alumina (Aluminum O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Aluminon (AurIn Tricarbo*ylic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Aluminum (No powder)	MSDS / SDS Search Engine Links page 78		In-1	
Aluminum Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Aluminum Ammonium Sulfate (Ammonia Alum)	MSDS / SDS Search Engine Links page 78		In-2	
Aluminum Chloride (Hydrated only)	MSDS / SDS Search Engine Links page 78		In-2	
Aluminum Hydrate (Aluminum Hydro*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Aluminum Hydro*ide (Aluminum Hydrate)	MSDS / SDS Search Engine Links page 78		In-4	
Aluminum Nitrate	MSDS / SDS Search Engine Links page 78		In-3	
Aluminum O*ide (Alumina) (Carborundum)	MSDS / SDS Search Engine Links page 78		In-4	
Aluminum Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Aluminum Sulfide	MSDS / SDS Search Engine Links page 78		In-5	
Aminoacetic Acid (Glycine)	MSDS / SDS Search Engine Links page 78		Or-1	
Aminomethane Trishydro*ymethyl (TRJS) [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
Ammonia, Household (Solution) (Ammonium Hydro*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Ammonium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Bicarbonate	MSDS / SDS Search Engine Links page 78		In-4	
Ammonium Biphosphate	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Bisulfite	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Bromide	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Carbonate	MSDS / SDS Search Engine Links page 78		In-4	
Ammonium Chloride (ammonium salt)	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Citrate	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Formate	MSDS / SDS Search Engine Links page 78		Or-M	
Ammonium Iodide	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Metavanadate	MSDS / SDS Search Engine Links page 78		In-8	
Ammonium Molybdate	MSDS / SDS Search Engine Links page 78		In-8	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Ammonium Pero*ydisulfate (Ammonium Persulfate)	MSDS / SDS Search Engine Links page 78			
Ammonium Phosphate (Monobasic)	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Sulfite	MSDS / SDS Search Engine Links page 78		In-2	
Ammonium Tartrate	MSDS / SDS Search Engine Links page 78		In-2	
Amyl Acetate (Banana Oil)	MSDS / SDS Search Engine Links page 78		FC	
Amyl Alcohol (3-Pentanol)	MSDS / SDS Search Engine Links page 78		FC	1L
Amylase	MSDS / SDS Search Engine Links page 78		Or-2	
Anesthetic MS-222 (Ethyl m-Aminobenzoate Methanesulfonate)	MSDS / SDS Search Engine Links page 78		Or-M	
Aniline Blue	MSDS / SDS Search Engine Links page 78		Or-9	
Antimony solid (No dust or powder)	MSDS / SDS Search Engine Links page 78		In-1	
Arabic Gum (Acacia)	MSDS / SDS Search Engine Links page 78		Or-1	
Arabinose, DL	MSDS / SDS Search Engine Links page 78		Or-2	
Arginine (L)	MSDS / SDS Search Engine Links page 78		Or-1	
Argon	MSDS / SDS Search Engine Links page 78		Secure	
Ascorbic Acid (Vitamin C)	MSDS / SDS Search Engine Links page 78		Or-1	
Asparagine (L-monohydrate)	MSDS / SDS Search Engine Links page 78		Or-1	
Aspartic Acid (L)	MSDS / SDS Search Engine Links page 78		Or-1	
Azolitmin Solution (Litmus Solution)	MSDS / SDS Search Engine Links page 78		Or-9	
Baking Powder	MSDS / SDS Search Engine Links page 78		In-2	
Baking Soda (Sodium Bicarbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Balsam Canada	MSDS / SDS Search Engine Links page 78		FC	
Banana Oil (Amyl Acetate)	MSDS / SDS Search Engine Links page 78		FC	
Barium Chloride (0.1 M)	MSDS / SDS Search Engine Links page 78		In-2	
Barium Nitrate (0.1 M)	MSDS / SDS Search Engine Links page 78		In-3	
Basic Fuchsin	MSDS / SDS Search Engine Links page 78		Or-9	
Beef E*tract	MSDS / SDS Search Engine Links page 78		Or-M	
Beeswa*	MSDS / SDS Search Engine Links page 78		Or-3	
Benedict's Qualitative Solution	MSDS / SDS Search Engine Links page 78		In-2	
Benedict's Reagent Powder	MSDS / SDS Search Engine Links page 78		In-2	
Bial Reagent	MSDS / SDS Search Engine Links page 78		FC	1L
Bile Salts	MSDS / SDS Search Engine Links page 78		Or-1	
Biotin (Vitamin H)	MSDS / SDS Search Engine Links page 78		Or-1	
Bismuth (no powder)	MSDS / SDS Search Engine Links page 78		In-1	
Bismuth Chloride (Bismuth Trichloride) (0.2M) *[AP/IB/AICE]*	MSDS / SDS Search Engine Links page 78	✓	In-2	
Bismuth Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Biuret Reagent Solution	MSDS / SDS Search Engine Links page 78		Or-2	
Bleach (15% solution) (Sodium Hypochlorite)	MSDS / SDS Search Engine Links page 78		In-6	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Blood Typing Serum (only synthetic/simulated blood typing kits)	MSDS / SDS Search Engine Links page 78		Or-M	
Boiling Granules (Tamer-Tabs)	MSDS / SDS Search Engine Links page 78		In-M	
Boiling Stones/Chips	MSDS / SDS Search Engine Links page 78		In-M	
Bone Black (Charcoal)	MSDS / SDS Search Engine Links page 78		In-4	
Bora* (Sodium Tetraborate)	MSDS / SDS Search Engine Links page 78		In-8	
Boric Acid	MSDS / SDS Search Engine Links page 78		In-9	
Boron (No Powder)	MSDS / SDS Search Engine Links page 78		In-1	
Brilliant Green Bile Broth	MSDS / SDS Search Engine Links page 78		Or-M	
Brom Cresol Green (Bromcresol Green)	MSDS / SDS Search Engine Links page 78		Or-9	
Brom Cresol Purple (Bromcresol Purple)	MSDS / SDS Search Engine Links page 78		Or-9	
Brom Phenol Blue (Bromphenol Blue)	MSDS / SDS Search Engine Links page 78		Or-9	
Brom Thymol Blue (Bromothymol Blue)	MSDS / SDS Search Engine Links page 78		Or-9	
Bromine Water (5% solution)	MSDS / SDS Search Engine Links page 78		In-2	
Butyl Alcohol (1-Butanol)	MSDS / SDS Search Engine Links page 78		FC	100mL
Butyric Acid	MSDS / SDS Search Engine Links page 78		Or-1can	
Calcium (No powder)	MSDS / SDS Search Engine Links page 78		In-1can	
Calcium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Bromide	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Carbonate (Marble Chips-Chalk)	MSDS / SDS Search Engine Links page 78		In-4	
Calcium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Hydro*ide (Slaked Lime)	MSDS / SDS Search Engine Links page 78		In-4	
Calcium Hypochlorite (15% solution)	MSDS / SDS Search Engine Links page 78		In-6	
Calcium Lactate	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Calcium Phosphate (dibasic)	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Phosphate (monobasic)	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Sulfate (Plaster of Paris) (Drierite)	MSDS / SDS Search Engine Links page 78		In-2	
Calcium Sulfide	MSDS / SDS Search Engine Links page 78		In-5	
Camphor	MSDS / SDS Search Engine Links page 78		Or-4	
Carbamide (Urea)	MSDS / SDS Search Engine Links page 78		Or-2	
Carbon	MSDS / SDS Search Engine Links page 78		In-4	
Carbon Dio*ide (Dry ice)	MSDS / SDS Search Engine Links page 78			
Carbon Dio*ide (Gas)	MSDS / SDS Search Engine Links page 78		Secure	
Carborundum (Aluminum O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Carmine	MSDS / SDS Search Engine Links page 78		Or-9	
Carmine Alum Lake	MSDS / SDS Search Engine Links page 78		Or-9	
Carmine-aceto Solution	MSDS / SDS Search Engine Links page 78		Or-9	
CarolinaBlu	MSDS / SDS Search Engine Links page 78			

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Casein	MSDS / SDS Search Engine Links page 78		Or-2	
Casitone (Bacto)	MSDS / SDS Search Engine Links page 78		Or-2	
Castor Oil	MSDS / SDS Search Engine Links page 78		Or-4	
Catalase	MSDS / SDS Search Engine Links page 78		Or-1	
Cedarwood Oil	MSDS / SDS Search Engine Links page 78		Or-3	
Cellosolve (2-Etho*yethanol)	MSDS / SDS Search Engine Links page 78		Or-2	
Cellulase	MSDS / SDS Search Engine Links page 78		Or-1	
Cellulose	MSDS / SDS Search Engine Links page 78		Or-2	
Cetyl Alcohol (1 -He*adeconol) [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
Chalk (Calcium Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Charcoal (Bone Black) (Wood)	MSDS / SDS Search Engine Links page 78		In-4	
China Clay (Kaolin)	MSDS / SDS Search Engine Links page 78		In-4	
Chlorine Water*	MSDS / SDS Search Engine Links page 78		In-2	
Chloroplatinic Acid (Platinum Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Cholesterol	MSDS / SDS Search Engine Links page 78		Or-2	
Chorionic Gonadotropin	MSDS / SDS Search Engine Links page 78		Or-2	
Chromium(III) Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Citric Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Clayton Yellow (Thiazol Yellow G)	MSDS / SDS Search Engine Links page 78		Or-9	
Clove Oil	MSDS / SDS Search Engine Links page 78		Or-8	
Cobalt Nitrate (100 g)	MSDS / SDS Search Engine Links page 78		In-3	
Cobalt O*ide	MSDS / SDS Search Engine Links page 78		In-4	
Cobalt Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Coconut Oil	MSDS / SDS Search Engine Links page 78		Or-4	
Congo Red	MSDS / SDS Search Engine Links page 78		Or-9	
Copper (I) Chloride (Cuprous Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Copper (I) O*ide (Cuprous O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Copper (II) Acetate (Cupric Acetate) anhydrous	MSDS / SDS Search Engine Links page 78		In-2	
Copper (II) Bromide (Cupric Bromide)	MSDS / SDS Search Engine Links page 78		In-2	
Copper (II) Carbonate (Cupric Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Copper (II) Chloride (Cupric Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Copper (II) Nitrate (1.0 M) (Cupric Nitrate)	MSDS / SDS Search Engine Links page 78		In-3	
Copper (II) O*ide (Cupric O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Copper (II) Sulfate (Cupric Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Copper (No Powder)	MSDS / SDS Search Engine Links page 78		In-1	
Cottonseed Oil	MSDS / SDS Search Engine Links page 78		Or-3	
Cream of Tartar (Potassium Bitartrate)	MSDS / SDS Search Engine Links page 78		In-2	
Creatine anhydrous	MSDS / SDS Search Engine Links page 78		Or-1	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Cresol Red	MSDS / SDS Search Engine Links page 78		Or-9	
Crystal Violet (Gentian Violet)	MSDS / SDS Search Engine Links page 78		Or-9	
Crystal Violet Solution	MSDS / SDS Search Engine Links page 78		Or-9	
Culture Media	MSDS / SDS Search Engine Links page 78		Or-M	
Cupric Acetate (Copper (II) Acetate) anhydrous	MSDS / SDS Search Engine Links page 78		In-2	
Cupric Bromide (Copper (II) Bromide)	MSDS / SDS Search Engine Links page 78		In-2	
Cupric Carbonate (Copper (II) Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Cupric Chloride (Copper (II) Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Cupric Nitrate (1.0 M) (Copper (II) Nitrate)	MSDS / SDS Search Engine Links page 78		In-3	
Cupric O*ide (Copper (II) O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Cupric Sulfate (Copper (II) Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Cysteine	MSDS / SDS Search Engine Links page 78		Or-1	
D-alpha-Tocopherol (Vitamin E)	MSDS / SDS Search Engine Links page 78		Or-1	
DCIP (2-6-Dichlorophenolindolphenol) (Sodium Salt)	MSDS / SDS Search Engine Links page 78		Or-8	
De*trin	MSDS / SDS Search Engine Links page 78		Or-2	
De*trose	MSDS / SDS Search Engine Links page 78		Or-2	
Diastase of Malt	MSDS / SDS Search Engine Links page 78		Or-M	
Diatomaceous Earth	MSDS / SDS Search Engine Links page 78		In-4	
Dimethyl Ketone (Acetone)	MSDS / SDS Search Engine Links page 78		FC	4L
Dimethylglyo*ime	MSDS / SDS Search Engine Links page 78		Or-2	
Dipotassium Hydrogen Phosphate	MSDS / SDS Search Engine Links page 78		In-2	
Disodium Hydrogen Phosphate (Sodium	MSDS / SDS Search Engine Links page 78		In-2	
Dodecyl Alcohol (lauryl alcohol)	MSDS / SDS Search Engine Links page 78		Or-2	
Drierite (Calcium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Dry ice (Carbon Dio*ide)	MSDS / SDS Search Engine Links page 78			
Dulbecco's Modified Eagle's Medium	MSDS / SDS Search Engine Links page 78			
Eagle's Minimum Essential Medium	MSDS / SDS Search Engine Links page 78			
Escherichia coli K-12	MSDS / SDS Search Engine Links page 78		Or-M	
EDTA (Ethylene Diamine Tetraacetic Acid) (Ethylenedinitrilo Tetraacetic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Eosin Methylene Blue Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Eosin B	MSDS / SDS Search Engine Links page 78		Or-9	
Eosin Red	MSDS / SDS Search Engine Links page 78		Or-9	
Eosin Y (Eosin Yellowish)	MSDS / SDS Search Engine Links page 78		Or-9	
Epsom Salt (Magnesium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Eriochrome Black T	MSDS / SDS Search Engine Links page 78		Or-9	
Erythrosin B	MSDS / SDS Search Engine Links page 78		Or-9	
Ethanol (Ethyl Alcohol)	MSDS / SDS Search Engine Links page 78		FC	4L

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Ethyl m-Aminobenzoate Methanesulfonate	MSDS / SDS Search Engine Links page 78		Or-M	
Ethyl Benzoate	MSDS / SDS Search Engine Links page 78		Or-2	
Fehlings Solution B	MSDS / SDS Search Engine Links page 78		In-4	
Ferric Ammonium Citrate (iron (III) Ammonium Citrate)	MSDS / SDS Search Engine Links page 78		In-2	
Ferric Ammonium Sulfate (iron (III) Ammonium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Ferric Chloride (iron (III) Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Ferric Nitrate (1.0 M) (iron (III) Nitrate)	MSDS / SDS Search Engine Links page 78		In-3	
Ferric Phosphate (iron (III) Phosphate)	MSDS / SDS Search Engine Links page 78		In-2	
Ferric Sulfate (iron (III) Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Ferric Tartrate (iron (III) Tartrate	MSDS / SDS Search Engine Links page 78		In-2	
Ferrous Ammonium Sulfate (iron (II) Ammonium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Ferrous Chloride (iron (II) Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Ferrous O*ide (iron (II) O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Ferrous Sulfate (iron (II) Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Fetal Bovine serum	MSDS / SDS Search Engine Links page 78			
Fibrin	MSDS / SDS Search Engine Links page 78		Or-2	
Fluorescein	MSDS / SDS Search Engine Links page 78		Or-9	
Fluorescein Sodium	MSDS / SDS Search Engine Links page 78		Or-8	
Food Coloring	MSDS / SDS Search Engine Links page 78		Or-M	
Formalternate	MSDS / SDS Search Engine Links page 78		Or-2	
Fructose (Levulose)	MSDS / SDS Search Engine Links page 78		Or-2	
Fuchsin- Basic	MSDS / SDS Search Engine Links page 78		Or-9	
Fuchsin-carbol	MSDS / SDS Search Engine Links page 78		Or-8	
Fuller's Earth	MSDS / SDS Search Engine Links page 78		In-4	
Fumaric Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Galactose	MSDS / SDS Search Engine Links page 78		Or-2	
Gallic Acid	MSDS / SDS Search Engine Links page 78		Or-9	
Gastric Juice	MSDS / SDS Search Engine Links page 78		In-9	
Gelatin	MSDS / SDS Search Engine Links page 78		Or-2	
Gentian Violet (Crystal Violet)	MSDS / SDS Search Engine Links page 78		Or-9	
Germanium (no powder)	MSDS / SDS Search Engine Links page 78		In-1	
Gibberellic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Giemsa Staining Solution	MSDS / SDS Search Engine Links page 78		FC	500mL
Glucose	MSDS / SDS Search Engine Links page 78		Or-2	
Glucose 1-Phosphate Disodium Salt	MSDS / SDS Search Engine Links page 78		Or-2	
L-glutamine	MSDS / SDS Search Engine Links page 78			
Glutathione	MSDS / SDS Search Engine Links page 78		Or-1	
Glycerol (Glycerin)	MSDS / SDS Search Engine Links page 78		Or-2	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Glycine (Aminoacetic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Glycogen	MSDS / SDS Search Engine Links page 78		Or-2	
Gram's iodine Solution	MSDS / SDS Search Engine Links page 78		In-2	
Graphite Powder	MSDS / SDS Search Engine Links page 78		In-4 can	
Guaiacol (Metho*yphenol)	MSDS / SDS Search Engine Links page 78		Or-8	
Guar Gum	MSDS / SDS Search Engine Links page 78		Or-2	
Helium	MSDS / SDS Search Engine Links page 78		Secure	
Hemoglobin	MSDS / SDS Search Engine Links page 78		Or-2	
He*anedioic Acid (Adipic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Histamine Acid Phosphate Solution	MSDS / SDS Search Engine Links page 78		Or-2	
Histidine	MSDS / SDS Search Engine Links page 78		Or-2	
Holtfreter's Solution	MSDS / SDS Search Engine Links page 78		In-M	
Horse serum	MSDS / SDS Search Engine Links page 78			
Hydrochloric Acid	MSDS / SDS Search Engine Links page 78		AC	12L
Hydrogen Pero*ide (6% Ma*.) [*AP/IB/AICE]*	MSDS / SDS Search Engine Links page 78	✓	In-6	
Hydrogen Sulfide [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	In-5	
Hydro*ylamine hydrochloride [AP/IB/AICE]]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
Immersion Oil (post 1979 mfg only)	MSDS / SDS Search Engine Links page 78		Or-3	
Indole Nitrate Broth	MSDS / SDS Search Engine Links page 78		Or-M	
Indophenol Sodium Salt (2-6-Dichloroindophenol Sodium Salt)	MSDS / SDS Search Engine Links page 78		Or-8	
Insulin (*AP/IB/AICE*)	MSDS / SDS Search Engine Links page 78	✓		
Invertase	MSDS / SDS Search Engine Links page 78		Or-2	
Iodic Acid	MSDS / SDS Search Engine Links page 78		AC	
Iodine 6%	MSDS / SDS Search Engine Links page 78		In-2	
Iodine- tincture	MSDS / SDS Search Engine Links page 78		In-2	
Ion E*change Resin	MSDS / SDS Search Engine Links page 78		Or-M	
Iron (II) Ammonium Sulfate (Ferrous Ammonium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (II) Chloride (Ferrous Chloride)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (II) O*ide (Ferrous O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Iron (II) Sulfate (Ferrous Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (III) Ammonium Citrate (Ferric Ammonium Citrate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (III) Nitrate (1.0 M) (Ferric Nitrate)	MSDS / SDS Search Engine Links page 78		In-3	
Iron (III) Phosphate (Ferric Phosphate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (III) Sulfate (Ferric Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (III) Tartrate (Ferric Tartrate)	MSDS / SDS Search Engine Links page 78		In-2	
Iron (No Powder)	MSDS / SDS Search Engine Links page 78		In-1	
Iron Pyrites	MSDS / SDS Search Engine Links page 78		In-1	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Isoleucine	MSDS / SDS Search Engine Links page 78		Or-2	
Isopropyl Alcohol	MSDS / SDS Search Engine Links page 78		FC	1L
Kaolin (China Clay)	MSDS / SDS Search Engine Links page 78		In-4	
Kerosene	MSDS / SDS Search Engine Links page 78		FC	1L
Kligler Iron Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Knop's Solution	MSDS / SDS Search Engine Links page 78		In-2	
Lactic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Lactose	MSDS / SDS Search Engine Links page 78		Or-M	
Lampblack	MSDS / SDS Search Engine Links page 78		In-4	
Lanolin	MSDS / SDS Search Engine Links page 78		Or-3	
Late*	MSDS / SDS Search Engine Links page 78		Or-3	
Lauric Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Lauryl Alcohol (Dodecyl Alcohol)	MSDS / SDS Search Engine Links page 78		Or-2	
Lead solid (no dust- no powder)	MSDS / SDS Search Engine Links page 78		In-1	
Lead(II)Chloride (1.0 M)	MSDS / SDS Search Engine Links page 78		In-2	
Lead(II)Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Leucine	MSDS / SDS Search Engine Links page 78		Or-2	
Levulose (Fructose)	MSDS / SDS Search Engine Links page 78		Or-2	
Limewater	MSDS / SDS Search Engine Links page 78		In-4	
Linseed Oil	MSDS / SDS Search Engine Links page 78		Or-3	
Lipase	MSDS / SDS Search Engine Links page 78		Or-2	
Liquino*	MSDS / SDS Search Engine Links page 78		In-M	
Lithium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Lithium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Litmus	MSDS / SDS Search Engine Links page 78		Or-2	
Litmus Solution (Azolitmin Solution)	MSDS / SDS Search Engine Links page 78		Or-2	
Lugol's Iodine Solution	MSDS / SDS Search Engine Links page 78		Or-2	
Luminol (3-Aminophthalhydrazide)	MSDS / SDS Search Engine Links page 78		Or-	
Lycopodium	MSDS / SDS Search Engine Links page 78		Or-2	
Lysine Monohydrochloride	MSDS / SDS Search Engine Links page 78		Or-1	
Lysol	MSDS / SDS Search Engine Links page 78		Or-8	
Magnesium (no dust or powder)	MSDS / SDS Search Engine Links page 78		In-1	
Magnesium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Magnesium Carbonate	MSDS / SDS Search Engine Links page 78		In-4	
Magnesium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Magnesium Hydro*ide	MSDS / SDS Search Engine Links page 78		In-4	
Magnesium Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Magnesium O*ide	MSDS / SDS Search Engine Links page 78		In-4	
Magnesium Sulfate (Epsom Salts)	MSDS / SDS Search Engine Links page 78		In-2	
Malachite Green (waterbase)	MSDS / SDS Search Engine Links page 78		Or-9	
Maleic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Malonic Acid [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-1	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Maltose	MSDS / SDS Search Engine Links page 78		Or-2	
Manganese (no dust or powder)	MSDS / SDS Search Engine Links page 78		In-1	
Manganese Chloride tetrahydrate	MSDS / SDS Search Engine Links page 78		In-2	
Manganese Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Manganese Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Mannitol Salt Agar	MSDS / SDS Search Engine Links page 78		Or-2	
Mannose (D)	MSDS / SDS Search Engine Links page 78		Or-2	
Marble Chip (Chalk) (Calcium Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
m-Cresol Purple	MSDS / SDS Search Engine Links page 78		Or-9	
M-endo Broth	MSDS / SDS Search Engine Links page 78		Or-M	
Menthol	MSDS / SDS Search Engine Links page 78		Or-2	
Methanol (Methyl Alcohol)	MSDS / SDS Search Engine Links page 78		FC	4L
Methionine	MSDS / SDS Search Engine Links page 78		Or-1	
Metho*yphenol (Guaiacol)	MSDS / SDS Search Engine Links page 78		Or-8	
Methyl Green	MSDS / SDS Search Engine Links page 78		Or-9	
Methyl Violet	MSDS / SDS Search Engine Links page 78		Or-9	
Methylcellulose	MSDS / SDS Search Engine Links page 78		Or-2	
Methylene Blue	MSDS / SDS Search Engine Links page 78		Or-9	
MFC Medium	MSDS / SDS Search Engine Links page 78		Or-M	
Microcosmic Salt	MSDS / SDS Search Engine Links page 78		In-2	
Mineral oil culture grade	MSDS / SDS Search Engine Links page 78			
Mineral Spirits	MSDS / SDS Search Engine Links page 78		Or-2	
Mueller Hinton Agar	MSDS / SDS Search Engine Links page 78		Or-M	
n-Amyl Alcohol (Pentanol-1)	MSDS / SDS Search Engine Links page 78		FC	1L
n-Butyl Alcohol (Butyl Alcohol)	MSDS / SDS Search Engine Links page 78		FC	100mL
Neon	MSDS / SDS Search Engine Links page 78		Secure	
Neutral red (Toluylene Red)	MSDS / SDS Search Engine Links page 78		Or-9	
Niacin (Nicotinic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Nickel(II)Chloride (1.0 M)	MSDS / SDS Search Engine Links page 78		In-2	
Nickel(II)Nitrate (.1 M)	MSDS / SDS Search Engine Links page 78		In-3	
Nigrosine	MSDS / SDS Search Engine Links page 78		Or-2	
Nitric Acid- Concentrated	MSDS / SDS Search Engine Links page 78		In-M	100mL
Nitrogen	MSDS / SDS Search Engine Links page 78		Secure	
Nitrogen (Liquid)	MSDS / SDS Search Engine Links page 78		N/A	1L
n-Propyl Alcohol (1-Propanol)	MSDS / SDS Search Engine Links page 78		FC	1L
Nutrient Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Nutrient Broth	MSDS / SDS Search Engine Links page 78		Or-M	
Oleic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Onion's Fusible Alloy	MSDS / SDS Search Engine Links page 78		In-1	
Opti-Mem serum	MSDS / SDS Search Engine Links page 78			
Orange IV (Tropaeolin OO)	MSDS / SDS Search Engine Links page 78		Or-M	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
O*alic Acid [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-1	
O*ygen	MSDS / SDS Search Engine Links page 78		Secure	
Palmitic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Pancreatin	MSDS / SDS Search Engine Links page 78		Or-2	
Paraffin	MSDS / SDS Search Engine Links page 78		Or-2	
Paraffin Oil	MSDS / SDS Search Engine Links page 78		Or-2	
Pentose Sugar (L +,- Arabinose)	MSDS / SDS Search Engine Links page 78		Or-2	
Peppermint Oil	MSDS / SDS Search Engine Links page 78		Or-2	
Pepsin	MSDS / SDS Search Engine Links page 78		Or-2	
Peptone	MSDS / SDS Search Engine Links page 78		Or-2	
Permount	MSDS / SDS Search Engine Links page 78		Or-M	
Petroleum Ether	MSDS / SDS Search Engine Links page 78		Or-4	1 00mL
Petroleum Jelly (Petrolatum)	MSDS / SDS Search Engine Links page 78		Or-2	
Phenol Red	MSDS / SDS Search Engine Links page 78		Or-9	
Phenolphthalein Powder	MSDS / SDS Search Engine Links page 78		Or-2	
Phenylpthalein	MSDS / SDS Search Engine Links page 78			
Phenyl Salicylate	MSDS / SDS Search Engine Links page 78		Or-3	
Phenylalanine (DL)	MSDS / SDS Search Engine Links page 78		Or-2	
Phloroglucinol	MSDS / SDS Search Engine Links page 78		Or-3	
Phosphate Buffered solution	MSDS / SDS Search Engine Links page 78			
Phosphate Standard Solution	MSDS / SDS Search Engine Links page 78		In-2	
Phosphoric Acid	MSDS / SDS Search Engine Links page 78		In-9	100mL
Photobacterium Medium	MSDS / SDS Search Engine Links page 78		Or-M	
Plaster of Paris (Calcium Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Platinum (II) Chloride (Chloroplatinic Acid)	MSDS / SDS Search Engine Links page 78		In-2	
Polyvinyl Acetate	MSDS / SDS Search Engine Links page 78		Or-2	
Polyvinyl Alcohol	MSDS / SDS Search Engine Links page 78		Or-2	
Potash (Potassium Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Potassium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Acid Phthalate (Potassium Hydrogen Phthalate)	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Bicarbonate	MSDS / SDS Search Engine Links page 78		In-4	
Potassium Bisulfate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Bitartrate (Cream of Tartar)	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Bromide	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Carbonate	MSDS / SDS Search Engine Links page 78		In-4	
Potassium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Citrate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Dichromate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-8	Safe-bag
Potassium Hydrogen Phthalate (Potassium Acid Phthalate)	MSDS / SDS Search Engine Links page 78		In-2	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Potassium Hydro*ide (pellet only)	MSDS / SDS Search Engine Links page 78		In-4	
Potassium Iodate	MSDS / SDS Search Engine Links page 78		In-6	
Potassium Iodide	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Phosphate ((Diabasic))	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Potassium Persulfate	MSDS / SDS Search Engine Links page 78		In-6	
Potassium Phosphate (Diabasic) (Potassium	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Phosphate (Monobasic) Potassium Dihydrogen Phosphate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Phosphate (Tribasic) (Tripotassium Phosphate)	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Pyrosulfate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Sodium Tartrate (Rochelle Salts)	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Sulfide (1.0 M)	MSDS / SDS Search Engine Links page 78		In-5	
Potassium Sulfite	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Tartrate	MSDS / SDS Search Engine Links page 78		In-2	
Potassium Thiocyanate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-7	
Potato De*trose Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Primuline Yellow (Thiazol Yellow G) (Titan Yellow) (Clayton Yellow)	MSDS / SDS Search Engine Links page 78		Or-9	
Proline	MSDS / SDS Search Engine Links page 78		Or-2	
Proprionic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Propylene Glycol (1 ,2-Propanediol)	MSDS / SDS Search Engine Links page 78		Or-2	
Ptyalin (Amylase)	MSDS / SDS Search Engine Links page 78		Or-2	
Pumice	MSDS / SDS Search Engine Links page 78		In-4	
Quinine Sulfate	MSDS / SDS Search Engine Links page 78		Or-2	
Rennin	MSDS / SDS Search Engine Links page 78		Or-M	
Rhodamine 6G	MSDS / SDS Search Engine Links page 78		Or-9	
Rhodamine B	MSDS / SDS Search Engine Links page 78		Or-9	
Riboflavin (Vitamin B2)	MSDS / SDS Search Engine Links page 78		Or-2	
Ringer's Solution	MSDS / SDS Search Engine Links page 78		In-2	
Rochelle Salts	MSDS / SDS Search Engine Links page 78		In-2	
Rose Water	MSDS / SDS Search Engine Links page 78		Or-2	
Safranin O	MSDS / SDS Search Engine Links page 78		Or-9	
Salicylic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Saline Solution	MSDS / SDS Search Engine Links page 78		In-1	
Sand	MSDS / SDS Search Engine Links page 78		In-M	
s-Diphenylcarbazone (Dithizone)	MSDS / SDS Search Engine Links page 78		Or-2	
Serine (L)	MSDS / SDS Search Engine Links page 78		Or-1	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Shellac Gum	MSDS / SDS Search Engine Links page 78		Or-M	
Silica	MSDS / SDS Search Engine Links page 78		In-4	
Silica Gel (Sodium Metasilicate)	MSDS / SDS Search Engine Links page 78		In-4	
Silicon (no powder)	MSDS / SDS Search Engine Links page 78		In-1	
Silver	MSDS / SDS Search Engine Links page 78		In-1	
Silver Acetate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-2	
Silver Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Silver Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
SJM Medium	MSDS / SDS Search Engine Links page 78		Or-M	
Slaked Lime (Calcium Hydro*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Snyder's Test Medium	MSDS / SDS Search Engine Links page 78		Or-M	
Soap (Tincture Green)	MSDS / SDS Search Engine Links page 78		Or-M	
Soda Ash (Sodium Carbonate)	MSDS / SDS Search Engine Links page 78		In-4	
Soda Lime (Sodium Calcium Hydrate)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Ammonium Phosphate (Microcosmic Salt)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Benzenoneindophenol (Indophenol Sodium Salt)	MSDS / SDS Search Engine Links page 78		Or-8	
Sodium Benzoate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Bicarbonate (Baking Soda)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Bismuthate	MSDS / SDS Search Engine Links page 78		In-7	
Sodium Bisulfate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Bitartrate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Bromide	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Calcium Hydrate (Soda Lime)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Carbonate (Soda Ash)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Citrate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Cobaltinitrite	MSDS / SDS Search Engine Links page 78		In-3	
Sodium Dihydrogen Phosphate (Sodium Phosphate (Monobasic))	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Fluoride (1.0 M)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Hydro*ide (pellets)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Hypochlorite (Bleach 15% solution)	MSDS / SDS Search Engine Links page 78		In-6	
Sodium Hypochlorite (Bleach) (15% solution)	MSDS / SDS Search Engine Links page 78		In-6	
Sodium Iodate	MSDS / SDS Search Engine Links page 78		In-6	
Sodium Iodide	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Lactate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Lauryl Sulfate	MSDS / SDS Search Engine Links page 78		In-2	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Sodium Meta-Bisulfite	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Metasilicate (Silica Gel)	MSDS / SDS Search Engine Links page 78		In-4	
Sodium Molybdate	MSDS / SDS Search Engine Links page 78		In-8	
Sodium Monohydrogen Phosphate (Sodium Phosphate (Diabasic)) (Disodium Hydrogen Phosphate)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium O*alate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Monohydrogen Phosphate (Sodium Phosphate (Diabasic)) (Disodium Hydrogen Phosphate)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Polyacrylate	MSDS / SDS Search Engine Links page 78		Or-3	
Sodium Pyrophosphate (TSPP)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Salicylate	MSDS / SDS Search Engine Links page 78		Or-1	
Sodium Silicate Solution (Water Glass)	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Sulfite	MSDS / SDS Search Engine Links page 78		In-2	
Sodium Tetraborate (Bora*)	MSDS / SDS Search Engine Links page 78		In-8	
Sodium Thiosulfate	MSDS / SDS Search Engine Links page 78		In-2	
Standard Methods Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Stannic O*ide (Tin (IV) O*ide)	MSDS / SDS Search Engine Links page 78		In-2	
Stannous Chloride	MSDS / SDS Search Engine Links page 78		In-2	25g
Stannous O*ide (Tin (II) O*ide)	MSDS / SDS Search Engine Links page 78		In-2	
Starch (liquid)	MSDS / SDS Search Engine Links page 78		Or-2	
Starch Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Steel	MSDS / SDS Search Engine Links page 78		In-1	
Steel Wool	MSDS / SDS Search Engine Links page 78		In-1	
Strontium Carbonate	MSDS / SDS Search Engine Links page 78		In-4	
Strontium Chloride	MSDS / SDS Search Engine Links page 78		In-2	
Strontium Hydro*ide Solution	MSDS / SDS Search Engine Links page 78		In-4	
Strontium Nitrate (1.0 M)	MSDS / SDS Search Engine Links page 78		In-3	
Succinic Acid	MSDS / SDS Search Engine Links page 78		Or-1	
Sucrose	MSDS / SDS Search Engine Links page 78		Or-2	
Sudan III	MSDS / SDS Search Engine Links page 78		Or-9	
Sulfamic Acid	MSDS / SDS Search Engine Links page 78		Or-9	
Sulfanilamide	MSDS / SDS Search Engine Links page 78		In-3	
Sulfanilic Acid	MSDS / SDS Search Engine Links page 78		AC	
Sulfur	MSDS / SDS Search Engine Links page 78		In-10	
Sulfuric Acid (18M)	MSDS / SDS Search Engine Links page 78		AC	2.5L
Sulfurous Acid	MSDS / SDS Search Engine Links page 78		AC	1 00mL
Tamer-Tabs (Boiling Granules)	MSDS / SDS Search Engine Links page 78		In-M	
Tartar Emetic (Antimony Potassium Tartrate)	MSDS / SDS Search Engine Links page 78		In-7	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Tartaric Acid (2 % solution)	MSDS / SDS Search Engine Links page 78		Or-1	
Tes-tape	MSDS / SDS Search Engine Links page 78		Or-M	
Tetrazolium Chloride (2,3,5-	MSDS / SDS Search Engine Links page 78		Or-9	
Thiamine Hydrochloride(Vitamin B 1)	MSDS / SDS Search Engine Links page 78		Or-2	
Thiazol (Yellow G)(Titan Yellow) (Clayton Yellow)	MSDS / SDS Search Engine Links page 78		Or-9	
Thymol Blue (Thymolsulfonephthalein)	MSDS / SDS Search Engine Links page 78		Or-8	
Thyro*ine (Sodium) Pentahydrate	MSDS / SDS Search Engine Links page 78		Or-2	
Tin (II) Chloride	MSDS / SDS Search Engine Links page 78		In-2	25g
Tin (II) O*ide (Stannous O*ide)	MSDS / SDS Search Engine Links page 78		In-4	
Tin (IV) O*ide (Stannic O*ide)	MSDS / SDS Search Engine Links page 78		In-2	
Tin (No dust)	MSDS / SDS Search Engine Links page 78		In-1	
Tincture Iodine	MSDS / SDS Search Engine Links page 78		In-2	
Titan Yellow (Primuline Yellow) (Thiazol Yellow G)	MSDS / SDS Search Engine Links page 78		In-2	
Titanium (no dust)	MSDS / SDS Search Engine Links page 78		In-1	
Toluidine Blue [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-9	
Toluylene Red (Neutral Red)	MSDS / SDS Search Engine Links page 78		Or-9	
Tragacanth Gum	MSDS / SDS Search Engine Links page 78		Or-M	
Trichlorotrifluoroethane (TTE)	MSDS / SDS Search Engine Links page 78		Or-4	2L
Triethanolamine	MSDS / SDS Search Engine Links page 78		Or-2	
Triple Sugar Iron Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Tripotassium Phosphate (Potassium Phosphate (Tribasic)	MSDS / SDS Search Engine Links page 78		In-2	
Tris-borate-EDTA	MSDS / SDS Search Engine Links page 78			
TRIS (Hydro*ymethyl) Aminomethane [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	Or-2	
Trisodium Phosphate	MSDS / SDS Search Engine Links page 78		In-2	
Tropaeolin OO (Orange JV)	MSDS / SDS Search Engine Links page 78		Or-M	
Trypan Blue	MSDS / SDS Search Engine Links page 78		Or-8	
TryPLE	MSDS / SDS Search Engine Links page 78			
Trypsin	MSDS / SDS Search Engine Links page 78		Or-2	
Tryptic Nitrate Agar	MSDS / SDS Search Engine Links page 78		Or-M	
Tryptic Soy Broth	MSDS / SDS Search Engine Links page 78		Or-M	
Tryptic soy agar	MSDS / SDS Search Engine Links page 78			
Tryptone	MSDS / SDS Search Engine Links page 78		Or-M	
Tryptophan	MSDS / SDS Search Engine Links page 78		Or-1	
TTE (Trichlorotrifluoroethane)	MSDS / SDS Search Engine Links page 78		Or-4	2L
Tungsten (no powder)	MSDS / SDS Search Engine Links page 78		In-1	
Turpentine	MSDS / SDS Search Engine Links page 78		FC	
Tyrosine	MSDS / SDS Search Engine Links page 78		Or-1	
Universal Indicator Solution	MSDS / SDS Search Engine Links page 78		Or-9	

Brevard Public Schools, Approved Chemical List, Safe Science 2015				
Name (Alternate Name)	**MSDS or SDS Search Engine**	***AP/IB AICE Research (only)***	**Flinn Storage**	**Max. Storage 500 mL quantity**
Urea (Carbamide)	MSDS / SDS Search Engine Links page 78		Or-2	
Vanillin	MSDS / SDS Search Engine Links page 78		Or-2	
Vaseline	MSDS / SDS Search Engine Links page 78		Or-M	
Vegetable Dyes	MSDS / SDS Search Engine Links page 78		Or-M	
Vinegar	MSDS / SDS Search Engine Links page 78		Or-1	
Vitamin B 1 (Thiamine Hydrochloride)	MSDS / SDS Search Engine Links page 78		Or-2	
Vitamin B2 (Riboflavin)	MSDS / SDS Search Engine Links page 78		Or-2	
Vitamin C (Ascorbic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Vitamin C (Ascorbic Acid)	MSDS / SDS Search Engine Links page 78		Or-1	
Vitamin H (Biotin)	MSDS / SDS Search Engine Links page 78		Or-1	
Vitamin H (D-Biotin)	MSDS / SDS Search Engine Links page 78		Or-1	
Vitamine E (d-alpha-Tocopherol)	MSDS / SDS Search Engine Links page 78		Or-1	
Water Glass (Sodium Silicate Solution)	MSDS / SDS Search Engine Links page 78		In-2	
White Vitriol (Zinc Sulfate)	MSDS / SDS Search Engine Links page 78		In-2	
Winkler's Solution #1 (Manganous Sulfate) [*AP/IB/AICE]*	MSDS / SDS Search Engine Links page 78	✓	In-2	
Winkler's Solution #2 (Alkaline-Iodide Solution) [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	In-4	
Wright's Stain	MSDS / SDS Search Engine Links page 78		Or-9	
*ylose	MSDS / SDS Search Engine Links page 78		Or-2	
Yeast	MSDS / SDS Search Engine Links page 78		Or-M	
Zeolite	MSDS / SDS Search Engine Links page 78		In-4	
Zinc (not dust)	MSDS / SDS Search Engine Links page 78		In-1	
Zinc Acetate	MSDS / SDS Search Engine Links page 78		In-2	
Zinc Carbonate	MSDS / SDS Search Engine Links page 78		In-4	
Zinc Chloride Solution (1M) [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	In-2	
Zinc Nitrate	MSDS / SDS Search Engine Links page 78		In-3	
Zinc O*ide [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	In-4	100 g
Zinc Stearate	MSDS / SDS Search Engine Links page 78		In-2	
Zinc Sulfate	MSDS / SDS Search Engine Links page 78		In-2	
Zinc Sulfide [*AP/IB/AICE*]	MSDS / SDS Search Engine Links page 78	✓	In-5	

SCHOOL BOARD OF BREVARD COUNTY
Educational Services Facility
2700 Judge Fran Jamieson Way
Viera, Florida 32940-6699

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Superintendent
Brevard Public Schools

Ms. Cyndi Van Meter
Associate Superintendent
Division of Curriculum and Instruction
Equity Coordinator

Mr. Robin Novelli, Director
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2700 Judge Fran Jamieson Way
Viera, Florida 32940-6699
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It is the policy of the School Board of Brevard County not to discriminate against **employees** or **applicants** for employment on the basis of race, color, religion, sex, national origin, participation and membership in professional or political organizations, marital status, age, or disability. Sexual harassment is a form of employee misconduct which undermines the integrity of the employment relationship, and is prohibited. This policy shall apply to recruitment, employment, transfers, compensation, and other terms and conditions of employment.

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Mr. Jim Hickey, Director
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