

ELEMENTARY EXPERIMENT LOGBOOK

Name: _____

Grade: _____

Experiment Project Schedule

Week #	Date to be Completed	Assignment
Before you Start	Complete Elementary Science, Technology, Engineering and Math (STEM) Fair Application/Safety Assessment/Media Release Form. Must be signed by teacher, student, and parent.	
1		**Complete Section 1** *Pages 2-5* Purpose & Testable Question Research Hypothesis
2		**Complete Section 2** *Pages 5-8* Variables Control Group Procedure Materials
3-5		**Complete Section 3** *Pages 9-10* Complete Experiment Record Data and Observations
6		**Complete Sections 4** *Pages 11-13* Graphs Evidence
7		**Complete Section 5** *Page 14* Conclusion
8		Complete your STEM Fair presentation and finalize your logbook.

Date: _____

Section 1

Purpose & Testable Question

Brainstorm topics of interest to generate ideas for your experiment.
Example: I am interested in soccer, baking cookies, video games, and the weather.

_____

_____

_____

State the purpose of the project. This is a description of why the experiment was chosen and how it helps society.
Example: The purpose of this experiment is to find out how to better understand how soccer balls bounce. This project will help soccer players have more knowledge of factors that can affect the ball during a game.

_____

_____

_____

Use the purpose to help determine a testable question for the experiment.
While there could be many things to test, it is important to narrow down the focus to ONE testable question. Testable questions must have a variable that is changed and a variable that is measured. A testable question might follow this format: How does changing _____ affect _____? or What happens to _____ if we change _____?
Example: I want to test how air pressure of a soccer ball affects its bounce height. The air pressure will change. The bounce height will be measured. The testable question will be: How does changing the air pressure of a soccer ball affect its bounce height?

Record what you will change (test)?

_____

Record what you will measure to determine the effect of the change? (outcome)

_____

Write your testable question using the information above.

_____

_____

Date: _____

Research

The purpose of research is to find evidence of similar experiments, determine definition of all important words in the experiment, and answer other questions to provide background information on the topic. Research sources can include asking an expert, an article, a book, or online information.

Example:

Source #1 Article: "Measurement in Sport, Pressure" (https://www.nist.gov/system/files/documents/2017/05/09/mis-pressure.pdf)

Summary: The article says that air pressure is, "force per unit area" and that force is the impact of the air molecules inside a ball. The more molecules of air inside a ball, the higher the pressure. Another factor that affects pressure of a ball is the temperature. The article says, "heating a ball makes the molecules move faster and hit harder, so that also increases pressure." Air pressure is measured with a tool called a pressure gauge in units called psi, pound-force per square inch. It is important to measure air pressure, like for Olympic games, to be fair because pressure affects the bounce of the ball.

Use a minimum of 3 research sources and write a summary of what is learned.

Source #1:_____

_____

Summary_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____

Source #2:_____

_____

Summary_____

_____

_____

_____

_____

_____

_____

Source #3:_____

_____

Summary_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____

Hypothesis

A hypothesis is a prediction of what will happen in the experiment. Research helps a scientist make an informed hypothesis. A hypothesis should include information from your testable question and can follow the format, "If (I do this), then (this will happen)."
Example: If the amount of air pressure in a soccer ball increases, then the ball will bounce higher.

Record a hypothesis for the experiment.

_____

_____

_____

Section 2

Variables

A variable is any factor, trait, or condition that can exist in different amounts or types. A scientist must have a clear understanding of all the variables in an experiment to make sure it is a fair test. There are 3 main types of variables in an experiment.

INDEPENDENT VARIABLE (Tested Variable)
Record the independent variable. This describes the one variable that you are changing in the experiment.
Example: The independent variable is the amount of air pressure in the soccer ball. I will test 10 psi and 14 psi.

_____

_____

_____

DEPENDENDENT VARIABLE (Outcome Variable)
Record the dependent variable. This describes the variable you are measuring in the experiment to determine the effect of the independent variable. Always measure in metric units.
Example: The dependent variable is the distance in centimeters the soccer ball bounces.

_____

_____

_____

_____

CONTROLLED VARIABLES (Constants)

Date: _____

Record the controlled variables. This describes ALL the other possible variables that need to stay the same for every trial in the experiment. Think about who, what, where, when, and how to help determine all the controlled variables.

Example: The controlled variables will include the same brand of soccer ball, the same surface to bounce the ball on, the same pressure gauge, the same measuring tape, the same part of the ball to measure the bounce, the same location temperature, same drop height of the ball, and same method to drop the ball.

_____

_____

_____

_____

Control Group

A control group helps a scientist be sure the outcome of an experiment was caused by the tested variable and makes an experiment more valid. Think of a control group as what happens normally, without changing anything. The control group is used to compare to the results of the tested group.

Example: The average psi of a soccer ball is 12 psi. The data collected from dropping the soccer ball with 12 psi will be my control group. I will compare the control group to the tested group, which will have less pressure at 10 psi and more pressure at 14 psi.

Record the control group for the experiment.

_____

_____

Procedure

A procedure is a detailed, step-by-step list of everything done in the experiment. Experiments must be replicable. This means the procedure is clearly written, making sure another scientist can repeat the experiment and get similar results. Be sure to include a minimum of three trials for the control group and for each tested group.

Example:

1. *Gather all materials.*
2. *Place 30cm x30 cm square of artificial turf grass on the floor next to the wall.*
3. *Hang the 150-centimeter measuring tape on the wall with tape, with the 0 cm end in line with the top of the artificial turf.*
4. *Use a Franklin Sports ball pump to inflate the size 4 Wilson ball to 10 psi.*
5. *Hold the bottom of the soccer ball at the 150 mark of the measuring tape directly over the artificial turf. Drop the soccer ball and observe how high the top of the ball bounces on the first bounce. Record in centimeters on data table.*
6. *Repeat step 5 two more times.*
7. *Use a Franklin Sports ball pump to inflate the size 4 Wilson ball to 12 psi.*
8. *Repeat steps 5 and 6.*
9. *Use a Franklin Sports ball pump to inflate the size 4 Wilson ball to 14 psi.*
10. *Repeat steps 5 and 6.*

Date: _____

Record your step-by-step, numbered directions to complete the experiment.

Date: _____

Material List

The materials list is a detailed record of everything you will need to do the experiment. Writing it carefully helps you gather all the supplies, know exactly how much of each to use, and follow the procedure step by step without missing anything. Make sure to use the metric system for all measurements (centimeters (cm), meters (m), milliliters (mL), liters (L), degrees Celsius (℃), etc.)

Example: The materials needed for the investigation include Wilson size 4 soccer ball, Franklin Sports ball pump and pressure gauge, 150 centimeter measuring tape, 30 cm X 30 cm square of artificial turf grass, and tape.

Record a detailed list of all the materials needed to do the experiment. The procedure should mention every material on the list.

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Date: _____

Section 3

Begin Experiment and Collect Data

Scientists record data during an experiment. A data table is used to keep the information organized. The independent variable is listed in the first left column. The dependent variable with different trials is the next columns. The averages are in the last column. Scientists may also keep notes and observations during an experiment.

Design a data table to record your experiment data. Begin the experiment and record data from the test. Data should be measured in metric units.

Example:

	Trial #1	*Trial #2*	*Trial #3*	*Mean*
10 psi	*110 cm*	*108 cm*	*112 cm*	*110 cm*
12 psi (control)	*115 cm*	*118 cm*	*116 cm*	*116.3 cm*
14 psi	*120 cm*	*122 cm*	*121 cm*	*121 cm*

Date: _____

Observation notes can include observations over time or things noticed during the experiment. If an experiment is done over time, observations are helpful to note changes that are observed, but not measured. These observation notes can be helpful when analyzing your data.

Record your observations from your experiment.

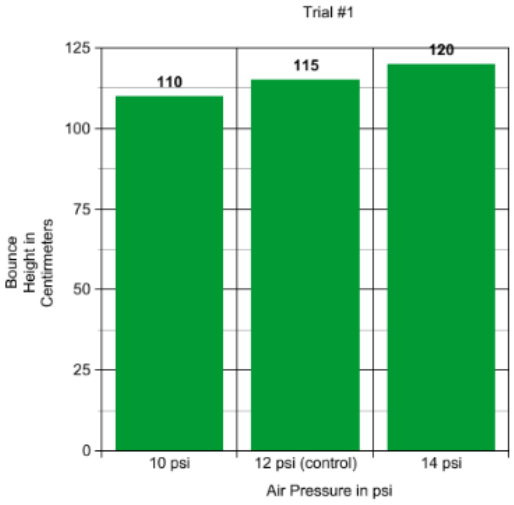
Example: While completing my first trial, I noticed if I held the ball too close to the wall, it could bounce off the wall before hitting the artificial turf. I changed the procedure to hold the ball 4 cm away from the wall before dropping it. I noticed that the ball never bounced higher than the 150-centimeter starting height. It was hard to read how high the ball bounced. I repeated trials if I was unsure of the height.

Date: _____

Section 4
Graphs

Graphs are used to display data because it makes it easier to see patterns in the data.

Create a bar graph to display the data from the experiment. You will need four graphs, one graph for each trial and one graph with the overall average results.



Example

Trial #1 Graph

Title:_____

Label: _____

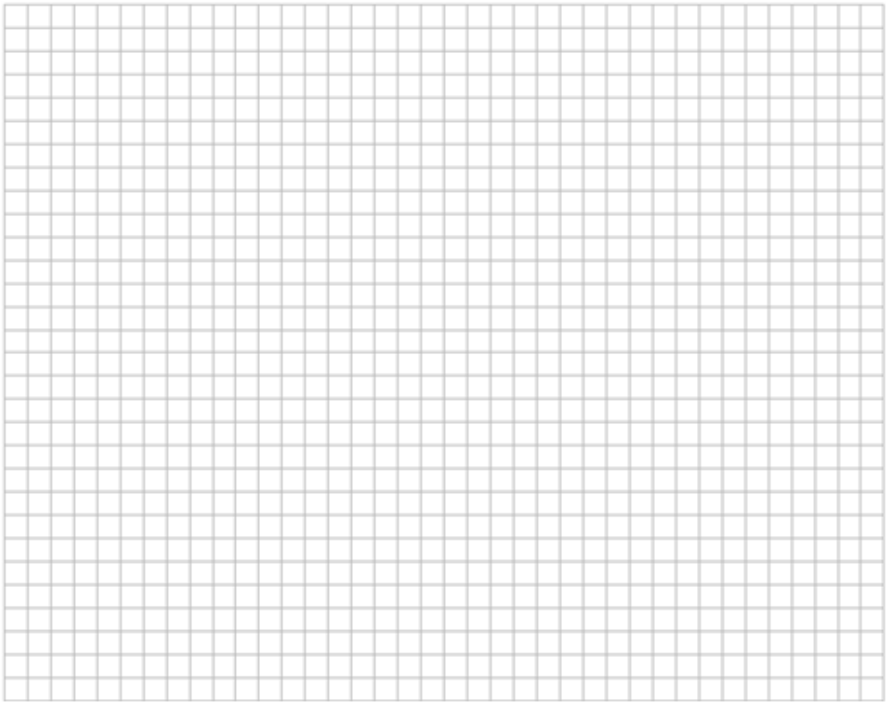
Label: _____

Date: _____

Trial #2 Graph

Title:_____

Label: _____

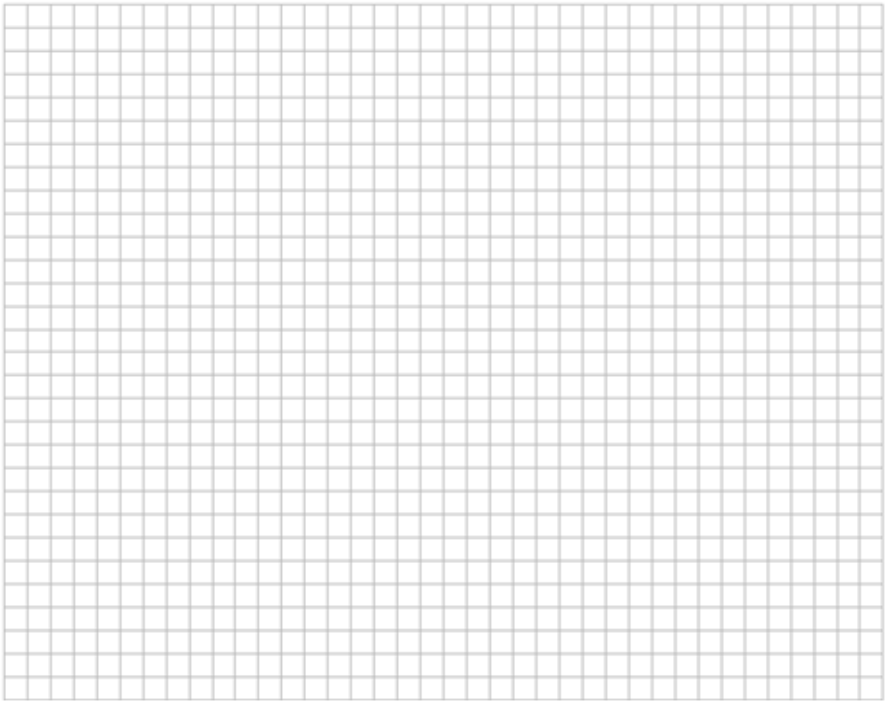


Label: _____

Trial #3 Graph

Title:_____

Label: _____

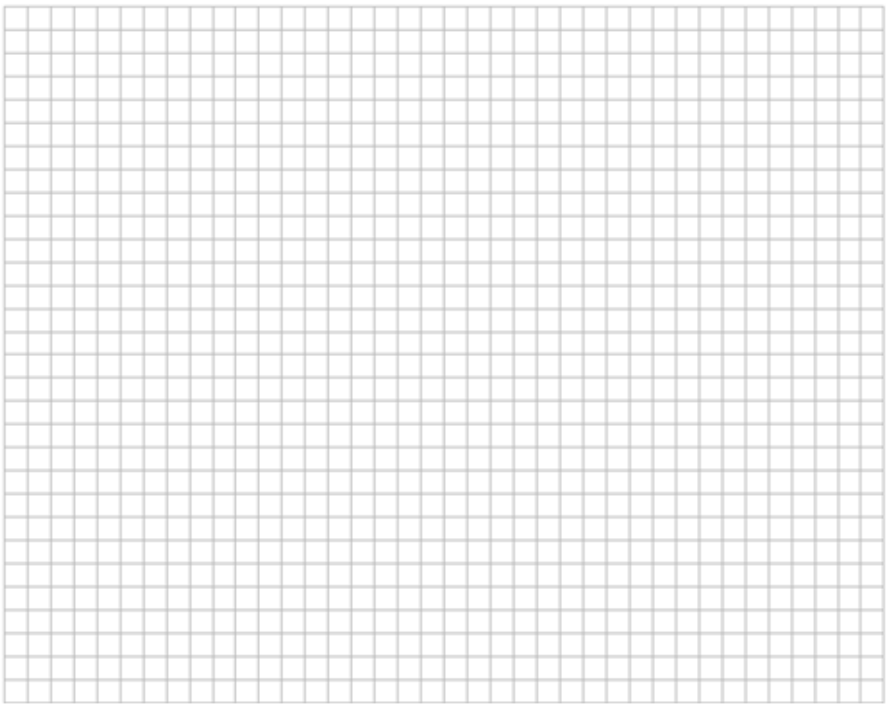


Label: _____

_____

Overall Results Graph

Title:_____



Label: _____

Label: _____

Evidence

Scientists analyze data that is collected in an investigation to determine evidence that will support a conclusion. Use the graphs to record evidence gathered in the investigation that will help answer the testable question.

Example: The control group bounced an average of 116.3 cm. When the ball had less pressure, at 10 psi, the ball bounced lower with an average bounce of 110 cm. This is about 6 cm less than the control group bounce height. When the ball had more pressure, at 14 psi, the ball bounced higher with an average bounce of 120 cm. This is about 4 centimeters more than the control group bounce height.

_____

_____

_____

_____

_____

_____

Date: _____

Section 5
Conclusion

A conclusion statement includes a summary of the experiment results and an answer to the testable question using evidence. It should tell if the hypothesis was supported, unsupported, or if you are still unsure. The conclusions should also comment on the strengths and weaknesses of the design of the experiment. Lastly, this statement should make a connection to how the experiment relates to the real world.

Example:

Based on what we found in the experiment, it seems that when we put more air into a soccer ball, it bounces higher when we drop it from a certain height. My hypothesis was supported by the data. When the air pressure inside the ball is higher, it bounces higher.

We did a good job in the experiment by keeping things fair. We made sure the soccer ball was the same size every time, and we dropped it from the same height onto the same surface. We also did the experiment three times for each amount of air pressure to make sure our results were accurate.

But there are some things we could do better next time. For example, we only tested three different amounts of air pressure. It might be interesting to try more to see if there's a difference. Also, we only dropped the ball from one height. Maybe trying different heights would give us more information.

Overall, we learned that adding more air to a soccer ball makes it bounce higher. This is important because it helps soccer players play better. By knowing this, players and coaches can make sure the balls they use are just right so players can control it better when they kick it and make more accurate passes and shots during games.

Record your conclusion statement.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____