

Name _____

Class Period: _____

Be A Scientist Project

The goal of Be A Scientist is for you to investigate a scientific question of interest to you, develop your scientific skills, and build on your curiosity and excitement about science! You will have a scientist mentor from UC Berkeley to guide you through each step of the process. Have fun!

Scientific Method

A way to ask and answer scientific questions by doing experiments and making observations.

- ☐ **Testable Question:** The question you will try to answer by designing and conducting an experiment.
- ☐ **Hypothesis:** An educated guess based on facts.
- ☐ **Experiment Design:** The plan for the experiment.
- ☐ **Materials:** The “stuff” you need to complete your experiment.
- ☐ **Procedure:** The step-by-step instructions you will follow to do your experiment.
- ☐ **Data & Observations:** The information you record during the experiment.
- ☐ **Analysis:** The graphic (picture) representation & interpretation of your results.
- ☐ **Conclusion & Reflection:** The summary of your experiment, what you learned and what you would do next.

Testable Question

A testable question is a question that can be answered by designing and conducting an experiment.

- Results must be measurable. (Examples: length, weight, distance, time, temperature)
- Experiment must be able to be completed in time available: two lab class sessions.
- Experiment must be able to be completed with the tools and materials available. We can buy additional materials, they just have to be reasonably easy to find and relatively inexpensive.
- Experiment should change only one thing, so you can observe the effect of that change on the outcome.
- Must be tested by a hands-on experiment (no surveys).
- Must follow this sentence frame:

“How does _____ (independent variable) affect _____ (dependent variable)?”

*Remember, the **independent** variable is the one that **you** change, and the **dependent** variable is the one that you measure in the experiment.*

Example Testable Question: How does the type of material an ice cube is wrapped in affect the time it takes for it to melt?

My independent variable: _____

My dependent variable: _____

My Testable Question:

Hypothesis

A hypothesis is an educated guess that is developed before an experiment is conducted.

- Written as an “If....., then.....” statement.
- Phrases such as “I think...” or “I believe...” are not used.

Example: If I wrap ice cubes in different materials (cotton, aluminum foil, and wool), then the one wrapped in cotton will take the longest amount of time to melt.

My Hypothesis:

Experiment Design

The experimental design is the plan for the experiment.

- Includes replicates (repeats of each treatment)
- Includes controls so that you can compare different treatments to the same thing, such as a sample that is not treated.

Example: I will wrap 3 ice cubes in cotton, 3 ice cubes in foil, and 3 ice cubes in wool, and then use a stopwatch to measure how long it takes for each ice cube to melt fully. I will also have 3 unwrapped ice cubes as a control.

My experiment design (draw a sketch or describe your experiment here):

Materials & Equipment List

All the tools and materials needed for the experiment.

- Written in list form.
- Each item numbered or bulleted.
- Include the amounts needed for each item.
- Include equipment needed.

Example:

- 1 ice cube tray (needs to have space for 12 ice cubes)
- 500 mL water
- Graduated cylinder
- 3 4cm² cotton squares
- 3 4cm² aluminum foil squares
- 3 4cm² wool fabric squares
- Stopwatch

My Materials List:

[illegible]

Procedure

The procedure is the step-by-step instructions for completing the experiment.

- Written in list form
- Each step numbered to make it easier to follow.
- Include clear, precise, and detailed directions in each step included.
- Include amounts, times, brands, sizes, types, etc.

Example:

1. Gather required materials.
2. In advance, measure 10mL of water into each compartment of ice cube tray
3. Place ice cube tray in freezer at least one day before the experiment is to be performed.
4. ...

My Procedure:

[illegible]

Data

The information you record during the experiment.

A data table is a chart made of rows and columns and is a way to organize, collect, and store the information collected during an experiment. Be sure to label rows & columns and include units.

Example:

Time Minutes	Temperature Degrees Celsius
0 min.	0° C
2 min.	0° C
4 min.	0° C
6 min.	0° C
8 min.	7° C
10 min.	25° C
12 min.	44° C
14 min.	62° C
16 min.	80° C
18 min.	95° C
20 min.	100° C
22 min.	100° C
24 min.	100° C
26 min.	100° C

Draw your data table on the next page

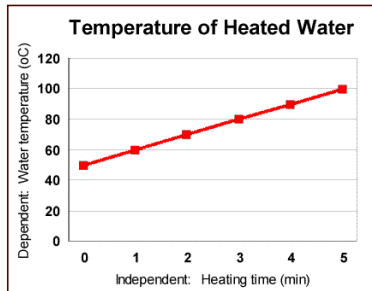
My Data Table:

Other Observations:

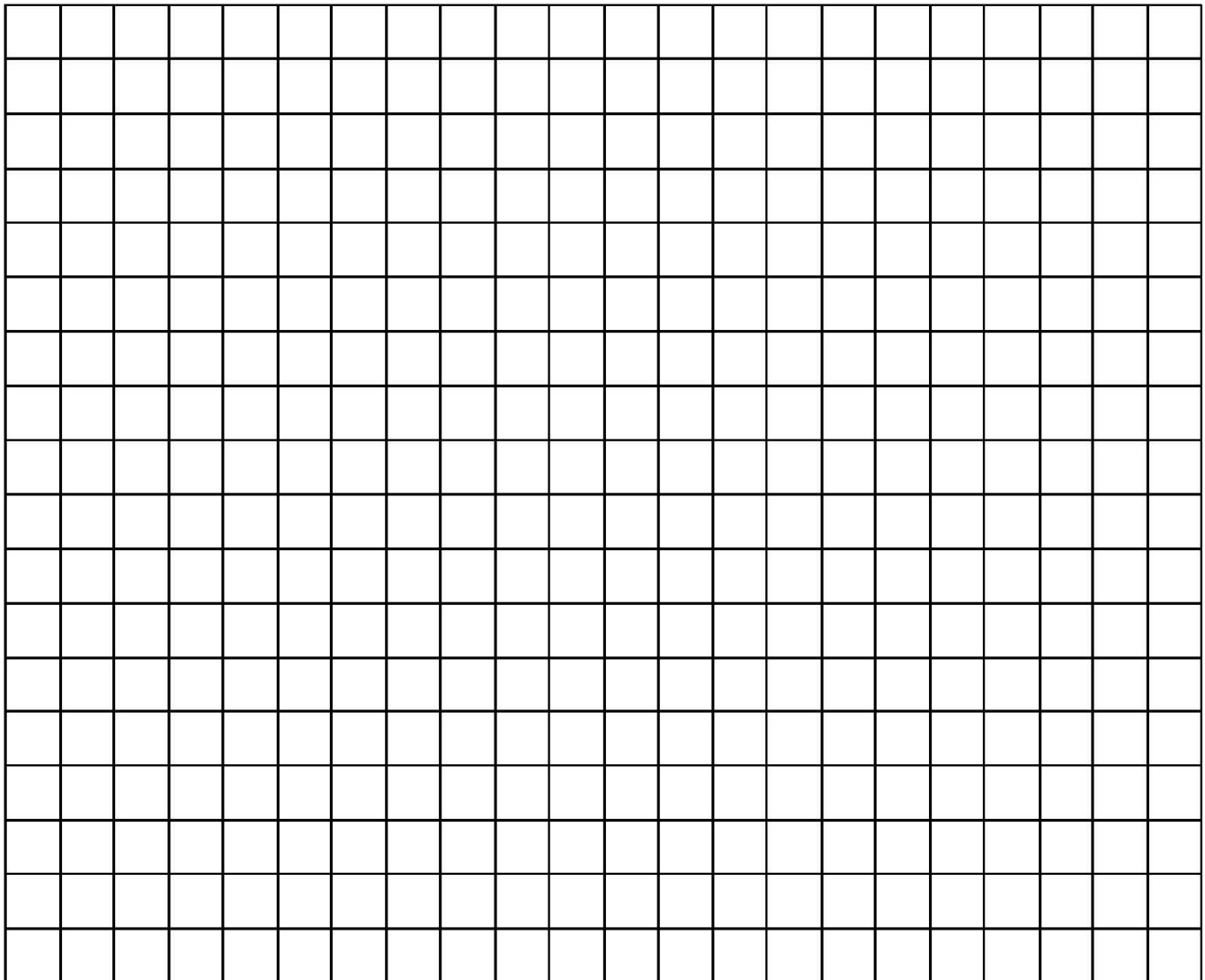
Data Analysis: Graphing data

Although different types of graphs are used for different reasons, they all have the following: a title telling what the graph shows, straight lines, labels on each axis, and units. Most also have color.

Example:



My Graph:



Conclusion & Reflections

In this section you will summarize your experiment and findings, explain your data and what it means, accept or reject your hypothesis and answer your testable question (if you can). You will also reflect on the experimental process and your findings.

Part One: Summary

1. What was the purpose of the experiment- what was the question you set out to answer?
2. What did you do? Summarize the procedure.
3. What were the results? Include your data and give examples.
4. What conclusion did you come to based on your results?

Part Two: Accept or Reject Your Hypothesis

1. Restate your hypothesis.
2. Explain why you accept or reject your hypothesis using data or examples from your experiment.
3. Answer your testable question (if you can!).

Part Three: Reflections

1. Discuss what you learned
2. What you would do next?

My Conclusions & Reflections:

Part One: Summary

Part Two: Accept or Reject Your Hypothesis

Part Three: Reflections

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