



## Science 10: The Great Geyser Experiment Your first Design Lab!

You will produce a **GEYSER** by dropping Mentos into a bottle of diet pop. Some questions to think about are:  
*What are you going to test? What are you going to measure? What causes the geyser?*

This experiment aligns with Criterion B: Inquiring and Designing and Criterion C: Processing and Evaluation.

Criterion B: Inquiring and Designing					
	(o)	Beginning (1-2)	Developing (3-4)	Accomplished (5-6)	Exemplary (7-8)
[i]		<i>I am able to:</i> <b>state</b> a problem or question to be tested by a scientific investigation	<i>I am able to:</i> <b>outline</b> a problem or question to be tested by a scientific investigation	<i>I am able to:</i> <b>describe</b> a problem or question to be tested by a scientific investigation	<i>I am able to:</i> <b>explain</b> a problem or question to be tested by a scientific investigation
[ii]	<i>I have not achieved a standard described to the right.</i>	<b>outline</b> a testable hypothesis	<b>formulate</b> a testable hypothesis using <b>scientific reasoning</b>	<b>formulate and explain</b> a testable hypothesis using <b>scientific reasoning</b>	<b>formulate and explain</b> a testable hypothesis using <b>correct scientific reasoning</b>
[iii]		<b>outline</b> the variables	<b>outline</b> how to manipulate the variables, and <b>outline</b> how <b>relevant data</b> will be collected	<b>describe</b> how to manipulate the variables, and <b>describe</b> how <b>sufficient, relevant data</b> will be collected	<b>explain</b> how to manipulate the variables, and <b>explain</b> how <b>sufficient, relevant data</b> will be collected
[iv]		<b>design</b> a method, with <b>limited success</b> .	design a <b>safe method</b> in which he or she <b>selects materials and equipment</b> .	design a <b>complete and safe method</b> in which I select <b>appropriate materials and equipment</b> .	design a <b>logical, complete and safe method</b> in which I select <b>appropriate materials and equipment</b> .

### TEMPLATE:

#### Problem/Question [B-i]

- *This is the question/objective that you are trying to answer by completing your experiment. It should be specific.*

**First question to determine... will you measure the height of the geyser OR the decrease in volume?**

**Choose one of the following questions for your experiment:**

- How many Mentos creates the highest geyser?
  - What type of Mentos creates the highest geyser?
  - What type of pop creates the highest geyser?
  - What volume of pop creates the highest geyser?
  - What temperature of pop creates the highest geyser?
  - Or another one of your choice –please confirm with the teacher before proceeding.
- \_\_\_\_\_

- How many Mentos creates the greatest decrease in volume?
  - What type of Mentos creates the greatest decrease in volume?
  - What type of pop creates the greatest decrease in volume?
  - What volume of pop creates the greatest decrease in volume?
  - What temperature of pop creates the greatest decrease in volume?
  - Or another one of your choice –please confirm with the teacher before proceeding.
- \_\_\_\_\_

#### Hypothesis: [B-ii]

- *This statement reveals the relationship you predict exists between what you're manipulating (independent variable) and what you think will change as a result (dependent variable).*
- *What you predict will happen in your experiment, and why you think it will happen, using scientific reasoning*

**What do you expect will happen?**

If the \_\_\_\_\_ is \_\_\_\_\_  
(independent variable) (changed in what way?)  
 then the \_\_\_\_\_  
(dependent variable)  
 will \_\_\_\_\_ because \_\_\_\_\_  
(be affected in what way?)

\_\_\_\_\_



**Variables**<sup>[B-iii]</sup>

- Identify the Variables:
  - **Independent Variable:** Name the variable that you will change (manipulate) in the experiment and explain how it will be manipulated.
  - **Dependent Variable:** Name the variable that will be MEASURED and how it will be measured.
  - **Controlled Variables:** List all of the variables that you will keep the same throughout the entire experiment and how you will keep them the same. (CONSTANT)
- Explain how sufficient (# of trials & increments) and relevant (types of measurements) data will be collected.

The **independent** variable is \_\_\_\_\_ . It will be manipulated (changed) by \_\_\_\_\_ .

The **dependent** variable is \_\_\_\_\_ . It will be measured by \_\_\_\_\_ .

The **controlled** variables are

- \_\_\_\_\_ . It will be kept constant by \_\_\_\_\_ .
- \_\_\_\_\_ . It will be kept constant by \_\_\_\_\_ .
- \_\_\_\_\_ . It will be kept constant by \_\_\_\_\_ .
- \_\_\_\_\_ . It will be kept constant by \_\_\_\_\_ .
- \_\_\_\_\_ . It will be kept constant by \_\_\_\_\_ .

**Materials**<sup>[B-iv]</sup>

- List all of the specific materials (including sizes/quantities) that you will use in this experiment.

**You will need to provide the diet pop! I will provide the geyser tubes and the Mentos.**

**What materials do you need? How many of each?**

Name: \_\_\_\_\_ Block: \_\_\_\_\_ Date: \_\_\_\_\_



**Method:** [B-iv]

- Steps: Step-by-step instructions that logically and concisely describe how to complete your exact experiment.
  - Includes amounts (e.x. add 20mL of water) and instructions for when/where to make/record observations.
- Diagram: Includes a clearly labeled diagram(s) or image(s) of any apparatuses you will use "in action".
- Safety: Includes important safety information/warnings.
- Ethical Considerations: Includes important ethical concerns of procedure or materials.

**Make a list or draw diagrams to show, in order, the steps that you will take to collect data. Your method should be detailed enough so that someone in a different group could conduct your experiment.**

**How many times will you repeat your experiment?**



Criterion C: Processing and Evaluating				
(o)	Beginning (1-2)	Developing (3-4)	Accomplished (5-6)	Exemplary (7-8)
[i]	<i>I am able to:</i> collect and present data in numerical and/or visual forms	<i>I am able to:</i> correctly collect and present data in numerical and/or visual forms	<i>I am able to:</i> correctly collect, organize and present data in numerical and/or visual forms	<i>I am able to:</i> correctly collect, organize, transform and present data in numerical and/or visual forms
[ii]	interpret data	accurately interpret data and explain results	accurately interpret data and explain results using scientific reasoning	accurately interpret data and explain results using correct scientific reasoning
[iii]	<i>I have not achieved a standard described to the right.</i> state the validity of a hypothesis based on the outcome of a scientific investigation	outline the validity of a hypothesis based on the outcome of a scientific investigation	discuss the validity of a hypothesis based on the outcome of a scientific investigation	evaluate the validity of a hypothesis based on the outcome of a scientific investigation
[iv]	state the validity of the method based on the outcome of a scientific investigation	outline the validity of the method based on the outcome of a scientific investigation	discuss the validity of the method based on the outcome of a scientific investigation	evaluate the validity of the method based on the outcome of a scientific investigation
[v]	state improvements or extensions to the method.	outline improvements or extensions to the method that would benefit the scientific investigation.	describe improvements or extensions to the method that would benefit the scientific investigation.	explain improvements or extensions to the method that would benefit the scientific investigation.

**Results & Observations:** [C-i]

- This is an overview of your **Qualitative** (observations) and **Quantitative** (measurement) results.
- Quantitative data should be well-organized in a data table(s)
  - Columns and rows should have headings and units of measurements, with uncertainty if applicable
  - Individual trials and any columns for statistical analyses should be included
  - Title should be descriptive and underlined (title should describe exactly the data contained in the table)
- Qualitative data can be included in a table, paragraphs, or in the form of images or diagrams.

**Collection of Data:**

Prepare your data table by filling in the following with your independent variable and your dependent variable. Don't forget to include units.

During the experiment, record your values.

Trial	(Independent variable)	(Dependent variable)
1		
2		
3		

- "Transform" raw data by modifying in some way to reveal or emphasize trends:
  - Do calculations (statistical analyses like avg, % change, etc.). Include sample calculations if you do this.
  - Create a graph(s) that shows trends or patterns clearly. Label it clearly and include a descriptive title.
    - Only draw a best fit line if appropriate (to emphasize a mathematical relationship)

**Transformation of Data:**

Show any calculations here. What is the average of your results?



**Analysis & Evaluation** [C-ii, iii, iv, v]

This should be a four to five paragraph write up that addresses the following components:

- **Interpret Results:** [C-ii]
  - What does your data/results mean? What have your findings revealed (refer to specific data to support your inferences), and how are they explained and supported scientifically?
  - Comment on the reliability of the data – were there any unexpected results or outliers?

**Interpretation of Results**

What are your results?

What does your data/results mean?

What have your findings revealed (refer to specific data to support your inferences)?

How are they explained and supported scientifically?

Comment on the reliability of the data – were there any unexpected results or outliers?

- **Assess the validity of the hypothesis:** [C-iii]
  - Was your hypothesis valid (was it validated by your results) or not? What proof (data) supports/rejects it?

**Validity of Hypothesis**

Re-state your hypothesis:

*It was predicted that:*

Name: \_\_\_\_\_ Block: \_\_\_\_\_ Date: \_\_\_\_\_



Did you get the results that you expected?

This hypothesis was **supported / not supported** by the following results:

• **Assess the validity of the method:** <sup>[C-iv]</sup>

- Is your data precise? (Is there enough data? Is your data consistent? Are there any outliers? Why/why not? What sources of error were there in your investigation? Did you control for all extrinsic variables?)
- Is your data accurate? (if applicable) (does it agree with literature values?)
- What were sources of error in your investigation? How did they impact the validity of your test?

**Validity of Method**

Is your data **precise**? Why or why not?

Is your data **accurate**? Why or why not?

What are some sources of error? Why were your results not precise or accurate?



- **Suggest improvements or extensions to the method:** [C-v]
  - How could the method of the experiment be improved? Could you have obtained more accurate results? Fixed some of the invalid components from part C?
  - What would you suggest for students doing this experiment next time; what more could you test?

**Improvements or Extensions to the Method**

If you were to repeat this investigation on another day, how could your method be improved?  
(How could you improve the DESIGN of your lab? Not 'don't make a mistake').

How could you extend this investigation? What else could you test?