

Student Investigation Sheet

Charles's Law

Safety Precautions:

- Wear gloves, goggles, and closed-toe shoes, and not to eat or drink anything in the lab (including the experimental materials).
- Report any broken glass. Do not try to clean it up yourself.

Objective(s):

In this activity, you will examine the behavior of a gas qualitatively by witnessing the change in volume of a balloon as the temperature is reduced. You will then plan a procedure to collect the necessary data to examine the behavior quantitatively to see the relationship between the volume of a gas and the absolute temperature of the gas.

Materials:

Per pair or group:

- balloon, round, 20 cm (1)
- string, about 75 cm
- marker
- plastic tub, at least 60 cm high x 60 cm wide x 60 cm long
- ice, about 10 cm deep in the plastic tub
- water, 2-3 L
- meterstick or metric ruler
- thermometer
- goggles
- lab apron
- warm water bath (optional)

Key Question

What is the question you want to answer?	
	<i>Directions:</i> Write the question for the investigation. The question should be specific and investigable.
	<u><i>Key Components</i></u> <ul style="list-style-type: none">• Specific (one general thought, does not combine two or more questions)• Is able to be investigated

Hypothesis

What do you predict will be the result of the investigation?	
	<i>Directions:</i> Develop a claim about what you think is going to happen.
	<u><i>Key Components</i></u> <ul style="list-style-type: none">• Expresses a cause-and-effect relationship• Is testable• Incorporates prior knowledge

Plan

How will you investigate the question?	
	<i>Directions:</i> Describe the plan that you will use to study your question and analyze your hypothesis.
	<u><i>Key Components</i></u> <ul style="list-style-type: none">• Plan is easily repeatable by others• Plan describes the use of materials• Plan is in a logical order

Data

What evidence was gathered during the investigation?	
	<p><i>Directions:</i> Record all of the evidence that has been collected. Use graphic organizers, tables, and graphs when appropriate.</p>
	<p><u><i>Key Components</i></u></p> <ul style="list-style-type: none">• Data (from an investigation and/or other sources, such as observations, reading material, archived data, etc.)• Appropriate (data applies directly to the question)• Sufficient (uses enough data to completely answer the question and determine a finding on the hypothesis)

Conclusion

What did you learn from this investigation?	
	<p><i>Directions:</i> Develop a conclusion for your investigation. The conclusion should contain clear thoughts and proper vocabulary. This section focuses on the answer to your question. It should prove or refute the hypothesis by using logical reasoning to link the hypothesis to the data.</p>
	<p><u><i>Key Components</i></u></p> <ul style="list-style-type: none">• Use precise and accurate language• Use scientific vocabulary• Provide clear logical thoughts• Use evidence and reasoning to support or refute the hypothesis

Analysis and Conclusions

1. Why must the temperature be in kelvins when analyzing the data?

2. Some liquid water may be present in the balloon after it has been cooled. What is the source of this water? What effect, if any, would you predict the water to have on the results?

3. What are some ways in which the procedure could be improved?

4. What would you expect to see using the volumes and temperatures that you collect if these quantities are directly proportional? What would you expect to see if these quantities were inversely proportional? Would you expect these values to match between groups? Explain your reasoning.