

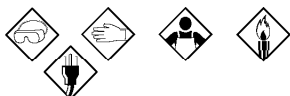


## Full of Hot Air!

Why do hot-air balloons float gracefully above Earth, while balloons you blow up fall to the ground? The answer has to do with the density of the air inside the balloon. Density is mass per unit volume, and volume is affected by changes in temperature. In this experiment, you will investigate the relationship between the temperature of a gas and its volume. Then you will be able to determine how the temperature of a gas affects its density.

### MATERIALS

- 2 aluminum pans
- water
- metric ruler
- hot plate
- ice water
- balloon
- 500 mL beaker
- heat-resistant gloves



### SCIENTIFIC METHOD

#### Form a Hypothesis

1. How does an increase or decrease in temperature affect the volume of a balloon?

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#### Test the Hypothesis

2. Fill an aluminum pan with water about 4 to 5 cm deep. Put the pan on the hot plate and turn the hot plate on.
  3. While the water is heating, fill the other pan 4 to 5 cm deep with ice water.
  4. Blow up a balloon inside the 500 mL beaker, as shown in the figure on page 526 of your textbook. The balloon should fill the beaker but should not extend outside the beaker. Tie the balloon at its opening.
  5. Place the beaker and balloon in the ice water. Observe what happens. Record your observations.
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6. Remove the balloon and beaker from the ice water. Observe the balloon for several minutes. Record any changes.
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7. Put on heat-resistant gloves. When the hot water begins to boil, put the beaker and balloon in the hot water. Observe the balloon for several minutes and record your observations.
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**Full of Hot Air! continued**

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8. Turn off the hot plate. When the water has cooled, carefully pour it into a sink.

**Analyze the Results**

9. Summarize your observations of the balloon. Relate your observations to Charles's law.

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10. Was your hypothesis for step 1 supported? If not, revise your hypothesis.

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**Draw Conclusions**

11. Based on your observations, how is the density of a gas affected by an increase or decrease in temperature?

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12. Explain in terms of density and Charles's law why heating the air allows a hot-air balloon to float.

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