

LESSON  
**56**  
LAB

# It's Sublime Gas Density

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

## Purpose

To measure density and volume changes associated with phase changes.

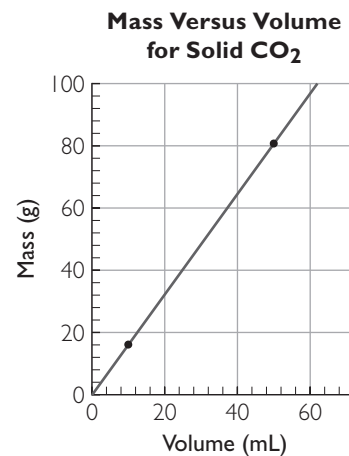
## Part I: Observations and Evidence

1. Provide at least three differences you observed between the dry ice and the water ice.
2. Provide three pieces of evidence that dry ice sublimates.
3. What evidence do you have that the fog is droplets of water and not carbon dioxide?
4. Why does the bag expand?
5. How is the density of the carbon dioxide changing when it sublimates? Explain.

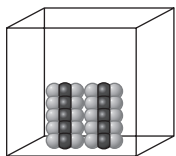
6. The mass and volume of two samples of  $\text{CO}_2(s)$  are measured and graphed. A straight line is drawn through the two data points, beginning at the origin.

a. What is the density of solid  $\text{CO}_2$ ?

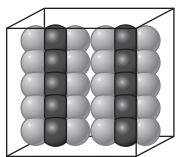
b. Use the graph for solid  $\text{CO}_2$  to show that the value of  $m/V$  is the same for a sample with a volume of 40 mL.



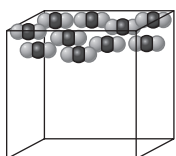
7. Do you predict that the slope of a graph of mass versus volume of gaseous  $\text{CO}_2$  will be steeper or less steep than that of the graph of solid  $\text{CO}_2$ ?



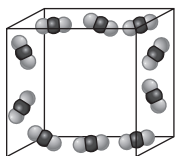
Solid CO<sub>2</sub>



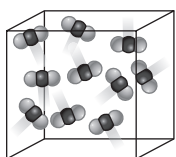
Model A



Model B



Model C



Model D

8. These sketches show a model for dry ice and four possible models for what might be happening in your garbage bag as the dry ice sublimates into a gas.

a. What evidence do you have from your observations of gases that would suggest Models A, B, and C are incorrect?

b. How does Model D explain why the bag inflates?

## Part 2: Finish the Laboratory Experiment

### Procedure

Once the solid is gone, compress the bag into the measurement box to determine its volume. Measure the height, width, and length in centimeters. Multiply the three measurements to obtain the volume in cubic centimeters. Recall that 1 cm<sup>3</sup> is 1 mL. Record the mass and volume of your group's bag in the table. Find the density of your sample of CO<sub>2</sub>.

Mass of CO <sub>2</sub> solid (g)	Volume of CO <sub>2</sub> gas (mL)	Density of CO <sub>2</sub> gas (g/mL)

### Questions

- How close do you think your answer is to the actual density of CO<sub>2</sub>(g)? What factors may have affected the accuracy of your measurements?
- Find the volume occupied by your group's carbon dioxide when it was a solid. Use  $D = 1.56 \text{ g/mL}$  as the density value for solid CO<sub>2</sub>.
- Making Sense** Why is it easy for a solid object to move through a gas?