Boyle's Law A gas sealed in a container has a certain pressure. Recall that pressure is the force created by particles striking the walls of a container. You have seen the effect of pressure on the rubber walls of balloons like those in Figure 6.7. The walls of the balloons are pushed out by the constant bumping of the gas particles trapped inside.

What happens to the pressure exerted by a gas when the volume of its container is changed? If you squeeze a gas into a smaller space, its particles will strike the walls of the container more often. The pressure on the walls will increase. If you increase the space, the gas particles strike the container's walls less often and the pressure will decrease. This relationship between pressure and volume is called *Boyle's Law.* It was discovered by Robert Boyle, a British scientist who lived in the 1600s.

Boyle's Law states that if a sample of gas is kept at a constant temperature, decreasing its volume will increase the pressure the gas exerts. Boyle's Law can be tested using a cylinder with a movable piston like the one shown in Figure 6.8. Data on pressure and volume can be used to construct a graph similar to the one you see below. What inferences can you make from the shape of the curve?

Life Science
L I N K

Blow up a balloon. What happened to your lungs while you were blowing up the balloon? Write about how your lungs work in terms of Boyle's Law.

A C T I V I T Y

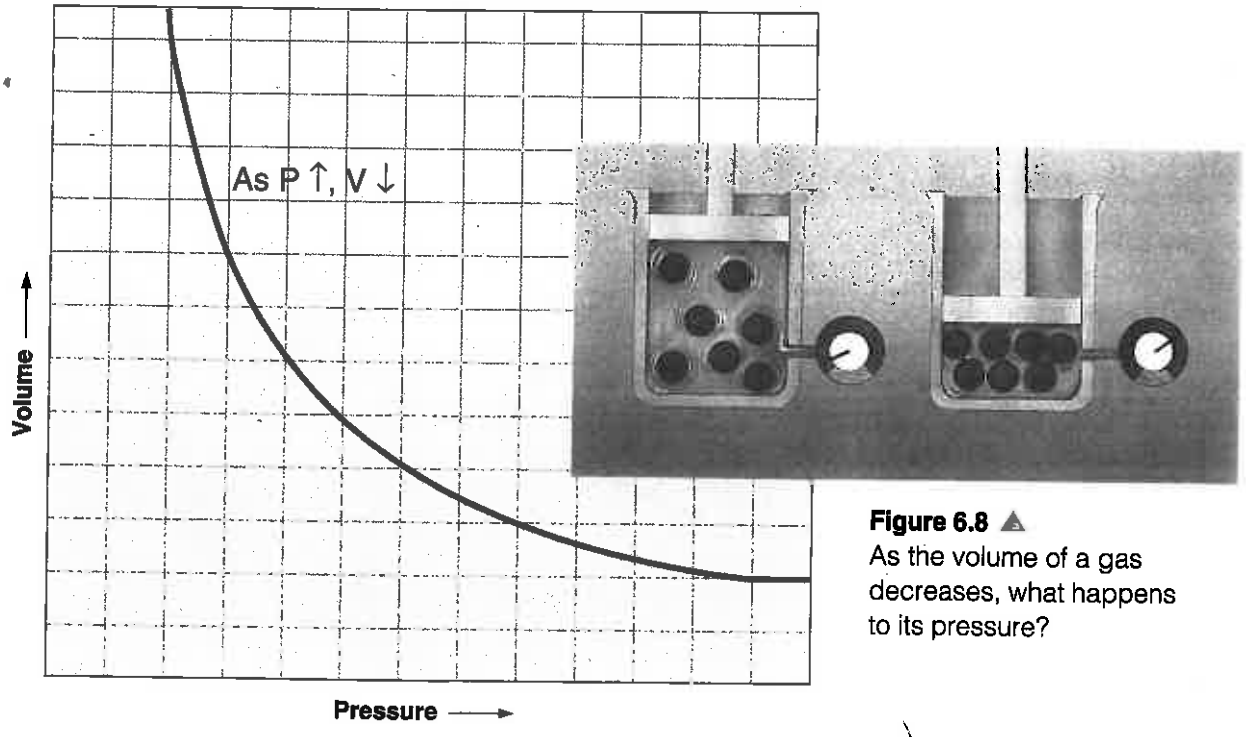
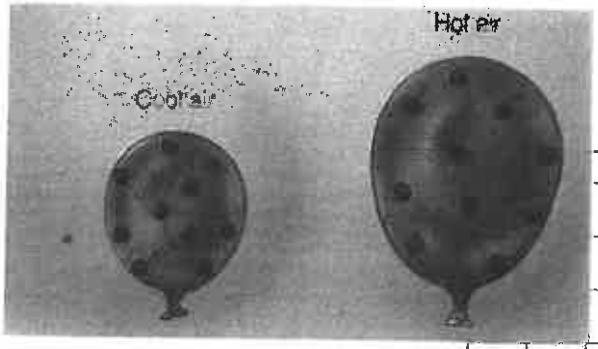


Figure 6.8 ▲
As the volume of a gas decreases, what happens to its pressure?

Charles' Law The relationship between the temperature of a gas and its volume was first described in the late 1700s by a French scientist named Jacques Charles. According to *Charles' Law*, if a sample of gas is kept at constant pressure, its volume increases as the temperature increases. The graph in Figure 6.9 shows this relationship. Many products in spray cans, such as whipped cream and paint, contain gas at a fairly high pressure. Their labels warn you to keep them away from heat or fire. Why?

Adding heat energy to a gas causes the gas particles to move faster. When the particles move faster, they strike the walls of their container harder and more often. If the container walls aren't flexible, as in a can of whipped cream, the pressure of the gas will increase. Since the can will withstand only so much pressure, the result could be explosive and dangerous!

However, if a gas in a container with flexible walls is heated, the volume of the gas will increase. You can see the volume increase in the balloons in Figure 6.9. Cooling a gas causes the reverse to happen. The volume of the gas decreases. Have you noticed what happens to the air in sealed bags of food you put in the refrigerator?



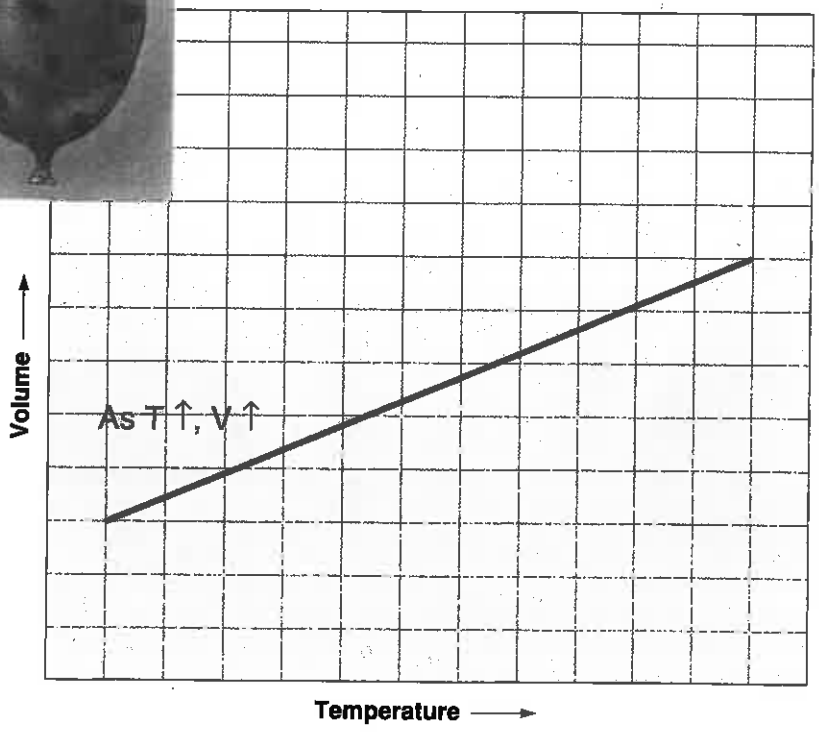


Figure 6.9 ▲
What happens to the volume of a gas as its temperature increases?