- **The volume of a sample of gas in a flexible container at constant pressure will increase if its temperature is increased and decrease if its temperature is decreased. Charles' law describes this direct relationship.**

12. A 2.50-L balloon at 298 K contains butane gas, a fuel used in some camping stoves. At constant pressure, the temperature of the balloon is then lowered to 280 K. What will be the new volume of the balloon at this temperature?

13. What do you think a marshmallow, composed mainly of gas, would look like at temperatures close to absolute zero? Explain your answer.

- **The pressure exerted by a sample of gas in a rigid container will increase if its temperature is increased and decrease if its temperature is decreased.**

14. Experts recommend measuring automobile tire pressure when the tires are cold. Why is this better than measuring the tire pressure after driving for several hours?

15. Soccer players often notice that kicking the ball feels different on cold days than on warm days. Explain why this might be the case.

16. A steel tank at 300 K contains 0.285 L of gas at 1.92 atm pressure. The tank is capable of withstanding a maximum pressure of 5.76 atm. Assuming that doubling the kelvin temperature causes the internal pressure to double,

    a. at what temperature will the tank burst?
    b. will it burst if placed in a fire burning at 1275 K?

17. A sample of gas in a rigid container is heated from 15 °C to 30 °C. By what proportion would you expect the gas pressure to increase?

- **The kinetic molecular theory states that gases are composed of particles of negligible size that are in constant motion and engage in elastic collisions. The average kinetic energy of a gas sample is directly related to its temperature.**

18. Use the kinetic molecular theory to explain each of the following observations.

    a. Decreasing the volume of a gas sample at constant temperature causes the gas pressure to increase.
    b. At constant volume, the pressure of a gas sample changes when its temperature changes.
    c. Filled balloons eventually become "flat" even when they are tightly tied shut.
    d. Helium-filled balloons go "flat" faster than those inflated with air.

19. Think of a pool table as a model of the behavior of gases.

    a. How would you use pool balls to demonstrate the effect of an increase in the temperature of a gas sample?
    b. How would you use this model to demonstrate the effect of an increase in the total number of gas molecules?