



FIGURE 1 Gas particles travel in a straight-line motion until they collide with each other or the walls of their container.

3. Gas particles are in continuous, rapid, random motion. They therefore possess kinetic energy, which is energy of motion. Gas particles move in all directions, as shown in **Figure 1**. The kinetic energy of the particles overcomes the attractive forces between them, except near the temperature at which the gas condenses and becomes a liquid.
4. There are no forces of attraction between gas particles. You can think of ideal gas molecules as behaving like small billiard balls. When they collide, they do not stick together but immediately bounce apart.
5. The temperature of a gas depends on the average kinetic energy of the particles of the gas. The kinetic energy of any moving object, including a particle, is given by the following equation:

$$KE = \frac{1}{2}mv^2$$

In the equation, m is the mass of the particle and v is its speed. Because all the particles of a specific gas have the same mass, their kinetic energies depend only on their speeds. The average speeds and kinetic energies of gas particles increase with an increase in temperature and decrease with a decrease in temperature.

All gases at the same temperature have the same average kinetic energy. Therefore, at the same temperature, lighter gas particles, such as hydrogen molecules, have higher average speeds than do heavier gas particles, such as oxygen molecules.

The Kinetic-Molecular Theory and the Nature of Gases

The kinetic-molecular theory applies only to ideal gases. Although ideal gases do not actually exist, many gases behave nearly ideally if pressure is not very high and temperature is not very low. In the following sections, you will see how the kinetic-molecular theory accounts for the physical properties of gases.

Expansion

Gases do not have a definite shape or a definite volume. They completely fill any container in which they are enclosed, and they take its shape. A gas transferred from a one-liter vessel to a two-liter vessel will quickly expand to fill the entire two-liter volume. The kinetic-molecular theory explains these facts. According to the theory, gas particles move rapidly in all directions (assumption 3) without significant attraction between them (assumption 4).

Fluidity

Because the attractive forces between gas particles are insignificant (assumption 4), gas particles glide easily past one another. This ability to

extension

Chemical Content

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