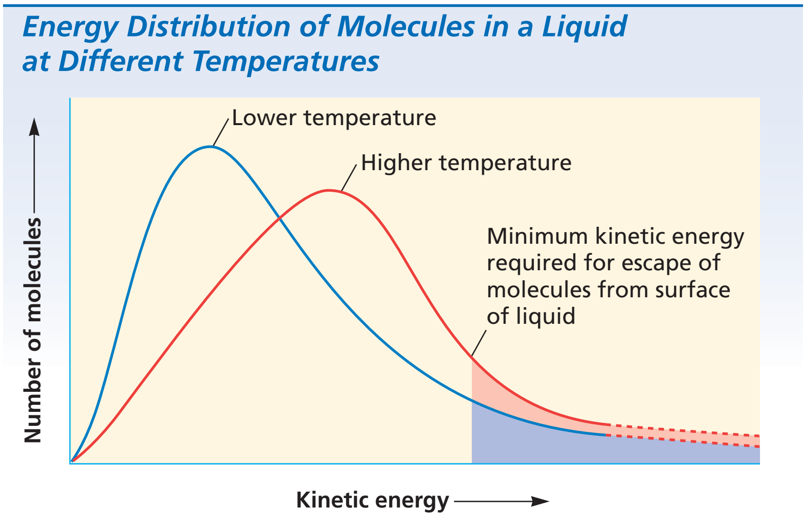

FIGURE 15 The number of molecules in a liquid with various kinetic energies is represented at two different temperatures. Notice the shaded area, which shows the fraction of the molecules that have at least the minimum amount of kinetic energy required for evaporation to take place.

Molar Enthalpy of Vaporization

The amount of energy as heat that is needed to vaporize one mole of liquid at the liquid's boiling point at constant pressure is called the liquid's **molar enthalpy of vaporization,** ΔH_v. The magnitude of the molar enthalpy of vaporization is a measure of the attraction between particles of the liquid. The stronger this attraction is, the more energy that is required to overcome it, which results in a higher molar enthalpy of vaporization. Each liquid has a characteristic molar enthalpy of vaporization. Compared with other liquids, water has an unusually high molar enthalpy of vaporization due to the extensive hydrogen bonding in liquid water. This property makes water a very effective cooling agent. When water evaporates from your skin, the escaping molecules carry a great deal of energy as heat away with them. **Figure 15** shows the distribution of the kinetic energies of molecules in a liquid at two different temperatures. You can see that at the higher temperature, a greater portion of the molecules have the kinetic energy required to escape from the liquid surface and become vapor.

Freezing and Melting

As you learned in Section 2, *the physical change of a liquid to a solid is called* **freezing.** Freezing involves a loss of energy in the form of heat by the liquid and can be represented by the following reaction.

$$\text{liquid} \longrightarrow \text{solid} + \text{energy}$$

In the case of a pure crystalline substance, this change occurs at constant temperature. *The normal* **freezing point** *is the temperature at which the solid and liquid are in equilibrium at 1 atm (760 torr, or 101.3 kPa) pressure.* At the freezing point, particles of the liquid and the solid have the same average kinetic energy. Therefore, the energy loss during freezing