Changes of State

Key Concepts

- What happens to a substance during changes between solid and liquid?
- What happens to a substance during changes between liquid and gas?
- What happens to a substance during changes between solid and gas?

The physical state of a substance is related to its thermal energy. Particles of a liquid have more thermal energy than particles of the same substance in solid form. As a gas, the particles have even more thermal energy. A substance changes state when its thermal energy increases or decreases sufficiently.

The change in state from a solid to a liquid is called **melting.** In most pure substances, melting occurs at a specific temperature called the **melting point.** As a solid absorbs thermal energy, its molecules vibrate faster, raising the temperature of the substance. **At its melting point, the particles of a solid substance are vibrating so fast that they break free from their fixed positions.** The temperature of the substance stops increasing. The added energy leads to the change in the arrangement of particles from a solid to a liquid.

Freezing is the change of state from liquid to solid—the reverse of melting. **At its freezing temperature, the particles of a liquid are moving so slowly that they begin to form regular patterns.** The liquid becomes a solid.

The change from a liquid to a gas is called **vaporization. Vaporization takes place when the particles in a liquid gain enough energy to form a gas.** When vaporization takes place only on a liquid's surface, the process is called **evaporation.** When vaporization takes place throughout a liquid, the process is called **boiling.** A pure substance boils at a certain temperature, called its **boiling point.** The boiling point of a liquid also depends on the pressure of the air above the liquid. Lower air pressure decreases the boiling point of a liquid. Higher pressure increases the boiling point.

The opposite of vaporization is called **condensation. Condensation occurs when particles in a gas lose enough thermal energy to form a liquid.** Clouds usually form when water vapor in the atmosphere condenses into liquid droplets. It rains when the droplets get heavy enough.

Sublimation occurs when the surface particles of a solid gain enough energy to become a gas. **During sublimation, particles of a solid do not pass through the liquid state as they form a gas.** Dry ice is solid carbon dioxide that changes directly into a gas. As it changes state, the carbon dioxide absorbs thermal energy. This is why dry ice is used to keep materials cold.

Name _____ Date _____ Class _____

Changes of State (pp. 76–81)

This section explains what happens to substances during changes of state.

Use Target Reading Skills

As you read your textbook, complete the outline about changes in state. Use the red headings for the main ideas and the blue headings for supporting ideas.

Changes in State
I. Changes Between Solid and Liquid A. Melting B. II. Changes Between Liquid and Gas A. B. C. D. III.

Changes Between Solid and Liquid (pp. 77–78)

1. The change in state from a solid to a liquid is called _____.
2. In most pure substances, melting occurs at a specific temperature called the _____.
3. The change of state from liquid to solid is called _____.
4. Is the following sentence true or false? At its freezing point, the particles of a solid are vibrating so fast that they break free from their fixed positions. _____