

Module K: Chapter 2

States of Matter



Section 1: Three States of Matter

Section 2: Behavior of Gases

Section 3: Changes of State

Section 1

Three States of Matter



Particles of Matter

- **Atoms and Molecules** Matter is made up of tiny particles called atoms and molecules. The next slide describes three states of matter—solid, liquid, and gas—in terms of the speed and attraction of the particles.

Section 1

Models of a Solid, Liquid, and Gas



Particles of a solid do not move fast enough to overcome the strong attraction between them. So, they are close together and vibrate in place.



Particles of a liquid move fast enough to overcome some of the attraction between them. The particles are close together but can slide past one another.



Particles of a gas move fast enough to overcome almost all of the attraction between them. The particles are far apart and move independently of one another.

Section 1

Three States of Matter



Solids

- **Solids Have Definite Shape and Volume** A solid is the state of matter that has a definite shape and volume.
- **There Are Two Kinds of Solids** There are two kinds of solids—crystalline and amorphous.

Section 1

Three States of Matter



Liquids

- **Liquids Change Shape but Not Volume** A liquid is the state of matter that has a definite volume but takes the shape of its container.
- **Liquids Have Unique Characteristics** A special property of liquids is surface tension. Surface tension is a force that acts on the particles at the surface of a liquid. Another important property of liquids is viscosity. Viscosity is a liquid's resistance to flow.

Section 1

Three States of Matter



Gases

- **Gases Change in Both Shape and Volume** Gas is the state of matter that has no definite shape or volume.

Section 2

Behavior of Gases



Describing Gas Behavior

- **Temperature** Temperature is a measure of how fast the particles in an object are moving. The faster the particles are moving, the more energy they have.
- **Volume** Volume is the amount of space that an object takes up. Because gas particles spread out, the volume of any gas depends on the container that the gas is in.
- **Pressure** The amount of force exerted on a given area of surface is called pressure. You can think of pressure as the number of times the particles of a gas hit the inside of their container.

Section 2

Behavior of Gases



Gas Behavior Laws

- **Boyle's Law** states that for a fixed amount of gas at a constant temperature, the volume of the gas is inversely related to pressure.

Section 2

Boyle's Law



Lifting the piston lets the particles of gas spread far apart. The volume of the gas increases as the pressure decreases.



Releasing the piston allows the particles of gas to return to their original volume and pressure.



Pushing the piston forces the gas particles close together. The volume of the gas decreases as the pressure increases.

Section 2

Behavior of Gases



Gas Behavior Laws *continued*

- **Charles's Law** states that for a fixed amount of gas at a constant pressure, the volume of the gas changes in the same way that the temperature of the gas changes.

Section 2

Charles's Law



Decreasing the temperature of the gas causes the particles to move more slowly. The gas particles hit the piston less often and with less force. So, the volume of the gas decreases.

Increasing the temperature of the gas causes the particles to move more quickly. The gas particles hit the piston more often and with greater force. So, the volume of the gas increases.

Section 3

Changes of State



Energy and Changes of State

- **From Solid to Liquid to Gas** A change of state is the change of a substance from one physical form to another. All changes of state are physical changes. The particles have different amounts of energy when the substance is in different states.

Section 3

Changes of State



Melting: Solid to Liquid

- **What Is Melting?** Melting is the change of state from a solid to a liquid.
- **Adding Energy** When a solid is at its melting point, any energy added to it is used to overcome the attractions that hold the particles in place.

Section 3

Changes of State



Freezing: Liquid to Solid

- **What Is Freezing?** The change of state from a liquid to a solid is called freezing.
- **Removing Energy** Removing energy will cause the particles in a liquid to begin locking into place.

Section 3

Changes of State



Evaporation: Liquid to Gas

- **Boiling and Evaporation** Evaporation is the change of a substance from a liquid to a gas. Boiling is the change of a liquid to a vapor, or gas, throughout the liquid.
- **Effects of Pressure on Boiling Point** Earlier, you learned that water boils at 100°C . In fact, water boils at 100°C only at sea level, because of atmospheric pressure. Atmospheric pressure is caused by the weight of the gases that make up the atmosphere.

Section 3

Changes of State



Condensation: Gas to Liquid

- **What Is Condensation?** Condensation is the change of state from a gas to a liquid.

Sublimation: Solid to Gas

- **What Is Sublimation?** Sublimation is the change of state in which a solid changes directly into a gas.

Section 3

Changes of State

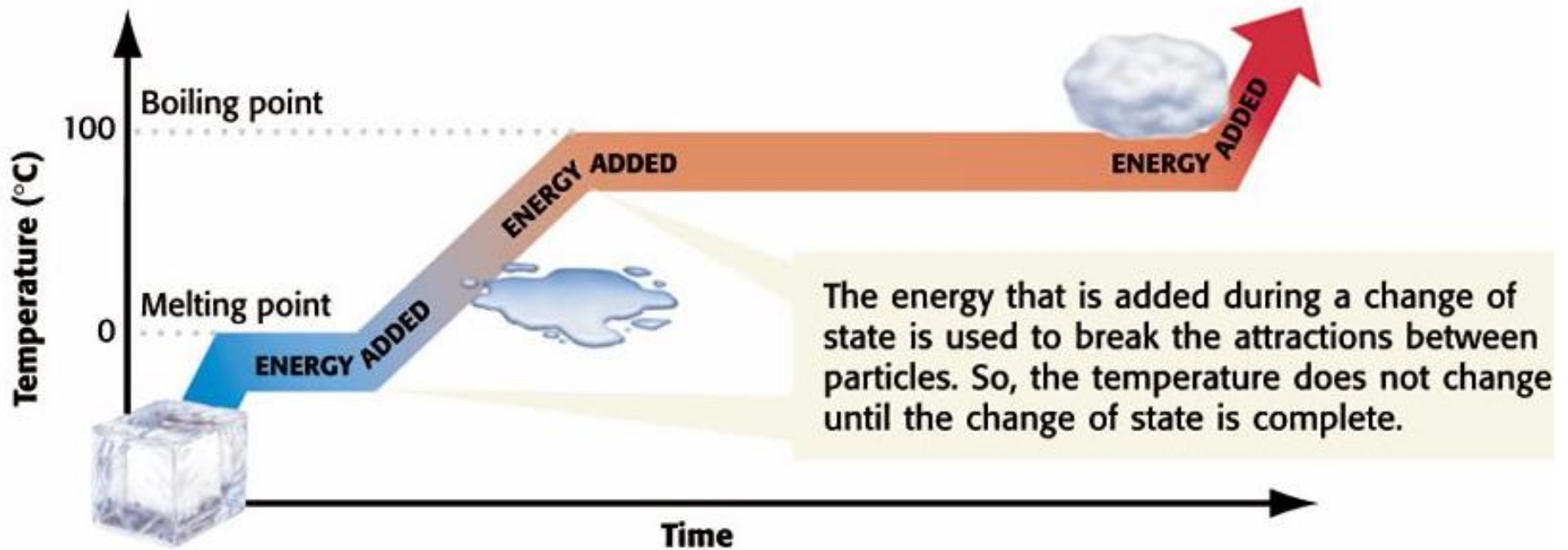


Change of Temperature Vs. Change of State

- **Losing or Gaining Energy** When most substances lose or gain energy, one of two things happens to the substance: its temperature changes or its state changes. The temperature of a substance is related to the speed of the substance's particles. So, when the temperature of a substance changes, the speed of the particles also changes. But the temperature of a substance does not change until the change of state is complete.

Section 3

Changing the State of Water



Chapter 3

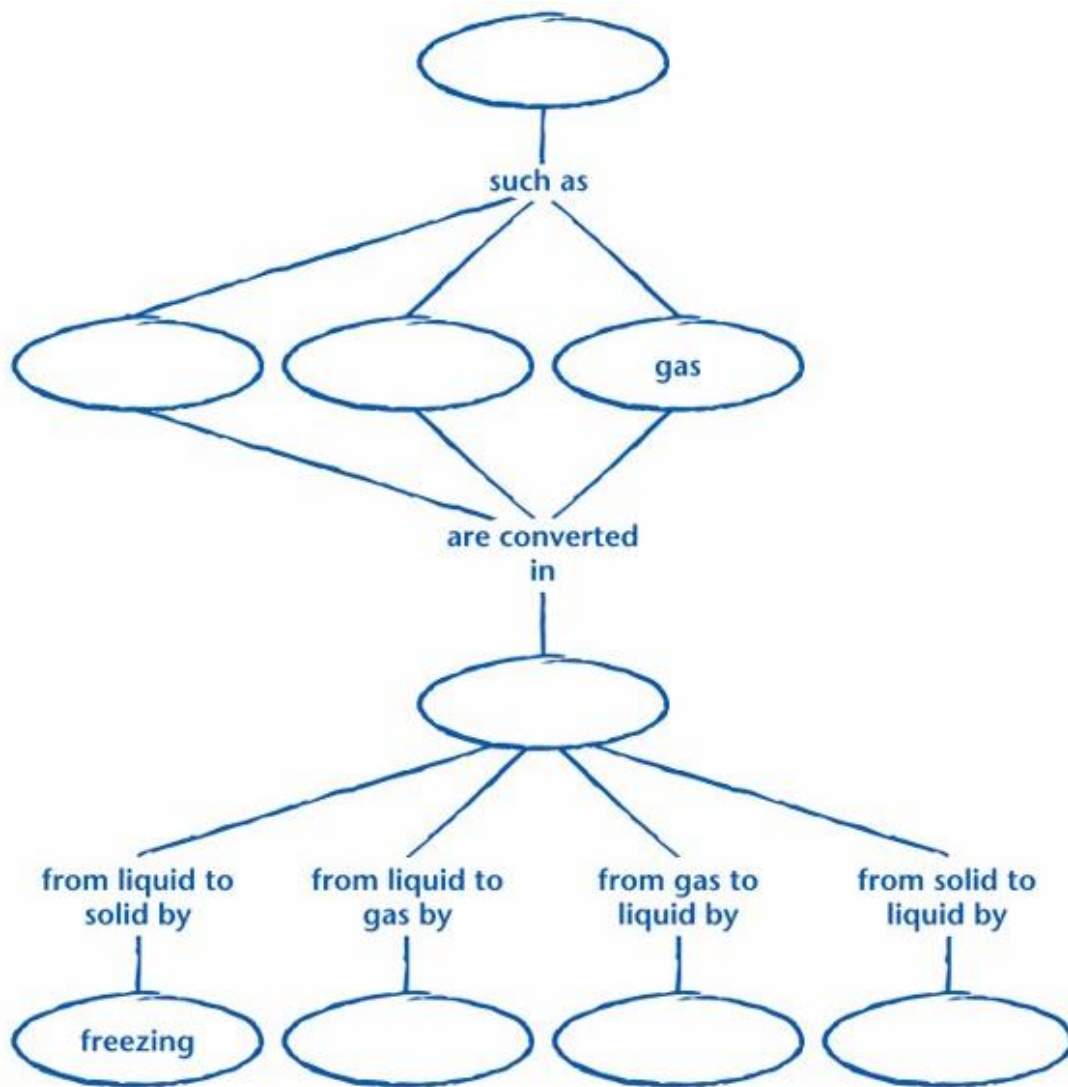
States of Matter



Concept Map

Use the following terms to complete the concept map on the next slide: changes of state, melting, vaporization, liquid, condensation, states of matter, solid.

Chapter 3 Concept Map



Chapter 3 Concept Map

