

Section 12.4 Phase Changes

Objectives

- **Explain** how the addition and removal of energy can cause a phase change.
- **Interpret** a phase diagram.

Review Vocabulary

phase change: a change from one state of matter to another



Section 12.4 Phase Changes (cont.)

New Vocabulary

melting point

freezing point

vaporization

condensation

evaporation

deposition

vapor pressure

phase diagram

boiling point

triple point

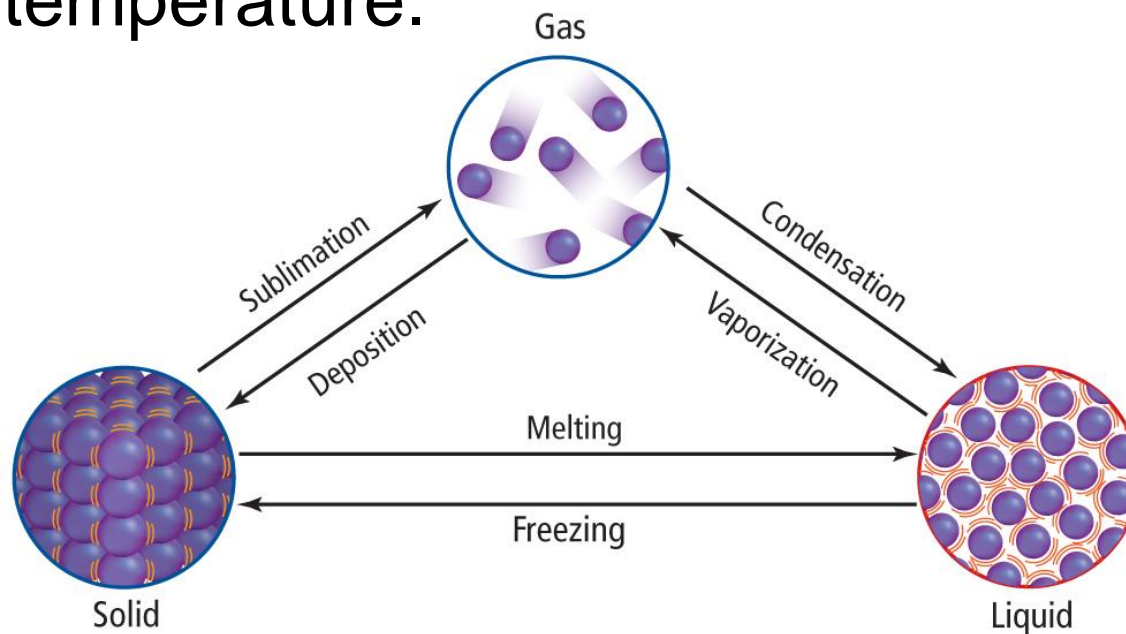
MAIN Idea

Matter changes phase when energy is added or removed.



Phase Changes That Require Energy

- Melting occurs when heat flows into a solid object.
- Heat is the transfer of energy from an object at a higher temperature to an object at a lower temperature.



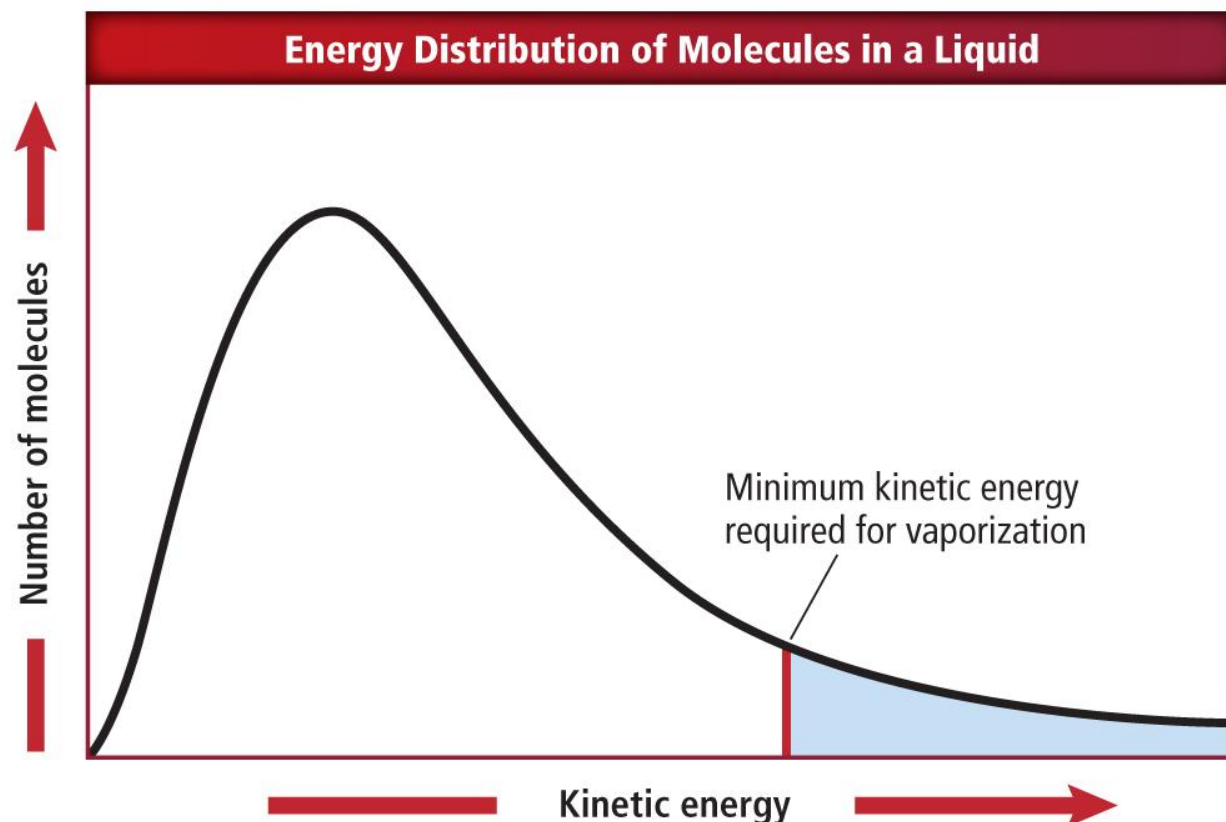
Phase Changes That Require Energy (cont.)

- When ice is heated, the ice eventually absorbs enough energy to break the hydrogen bonds that hold the water molecules together.
- When the bonds break, the particles move apart and ice melts into water.
- The melting point of a crystalline solid is the temperature at which the forces holding the crystal lattice together are broken and it becomes a liquid.



Phase Changes That Require Energy (cont.)

- Particles with enough energy escape from the liquid and enter the gas phase.



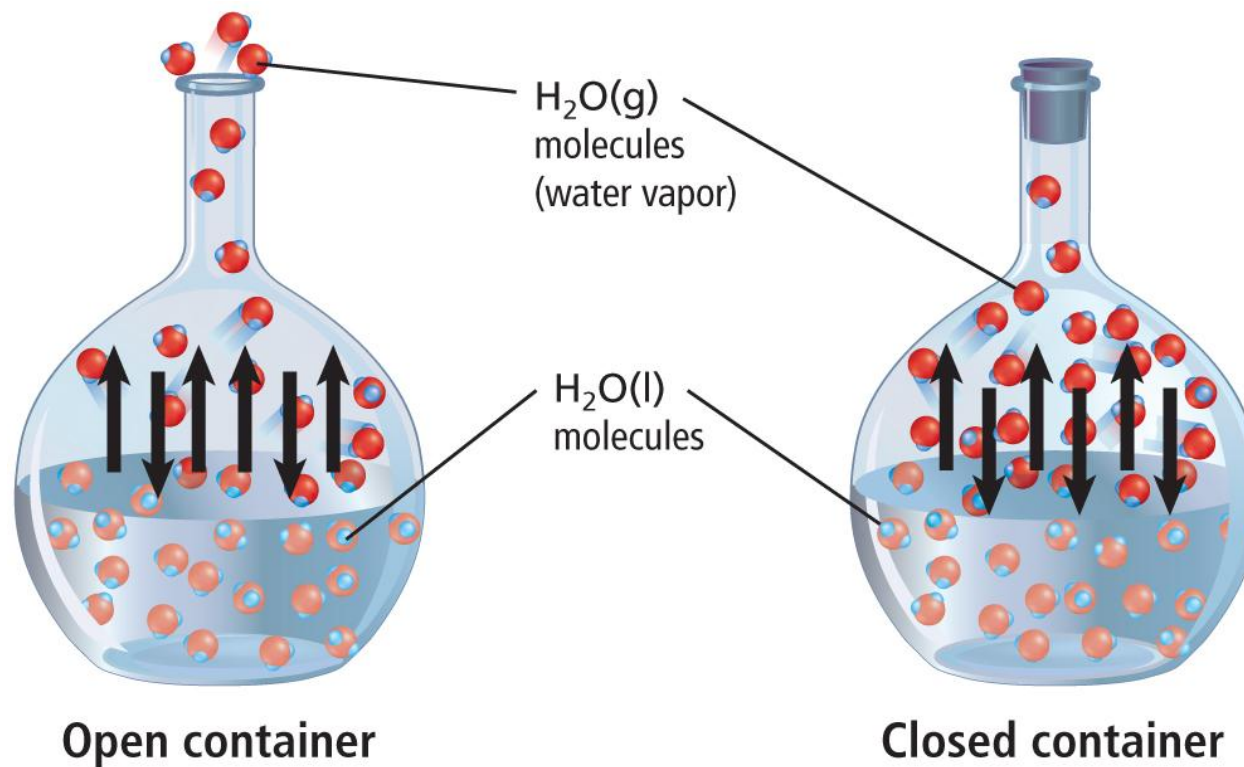
Phase Changes That Require Energy (cont.)

- **Vaporization** is the process by which a liquid changes to a gas or vapor.
- **Evaporation** is vaporization only at the surface of a liquid.



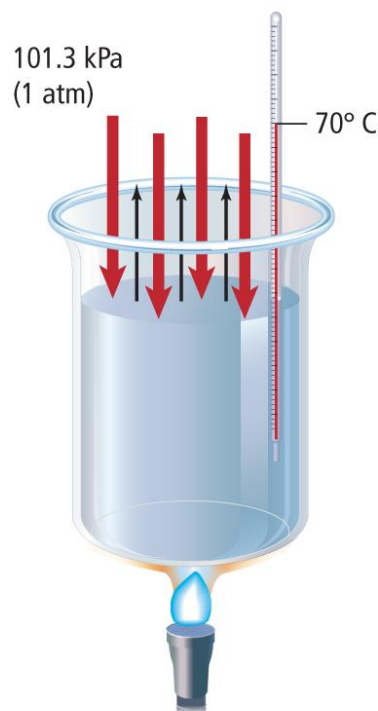
Phase Changes That Require Energy (cont.)

- In a closed container, the pressure exerted by a vapor over a liquid is called vapor pressure.

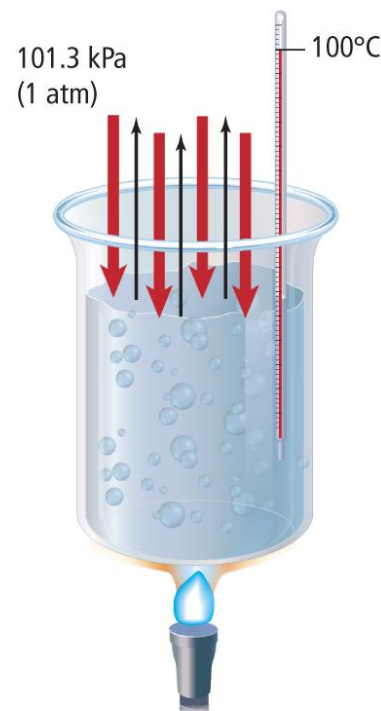


Phase Changes That Require Energy (cont.)

- The **boiling point** is the temperature at which the vapor pressure of a liquid equals the atmospheric pressure.



Below the boiling point



At the boiling point



Phase Changes That Require Energy (cont.)

- Sublimation is the process by which a solid changes into a gas without becoming a liquid.



Phase Changes That Release Energy

- As heat flows from water to the surroundings, the particles lose energy.
- The freezing point is the temperature at which a liquid is converted into a crystalline solid.



Phase Changes That Release Energy (cont.)

- As energy flows from water vapor, the velocity decreases.
- The process by which a gas or vapor becomes a liquid is called condensation.
- Deposition is the process by which a gas or vapor changes directly to a solid, and is the reverse of sublimation.



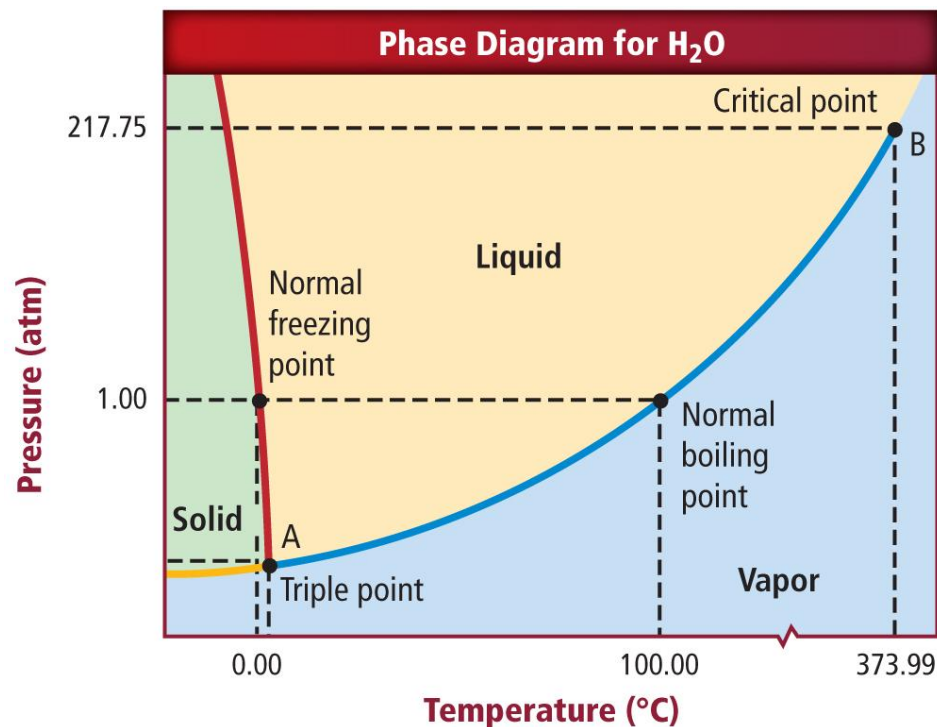
Phase Diagrams

- A [phase diagram](#) is a graph of pressure versus temperature that shows in which phase a substance will exist under different conditions of temperature and pressure.



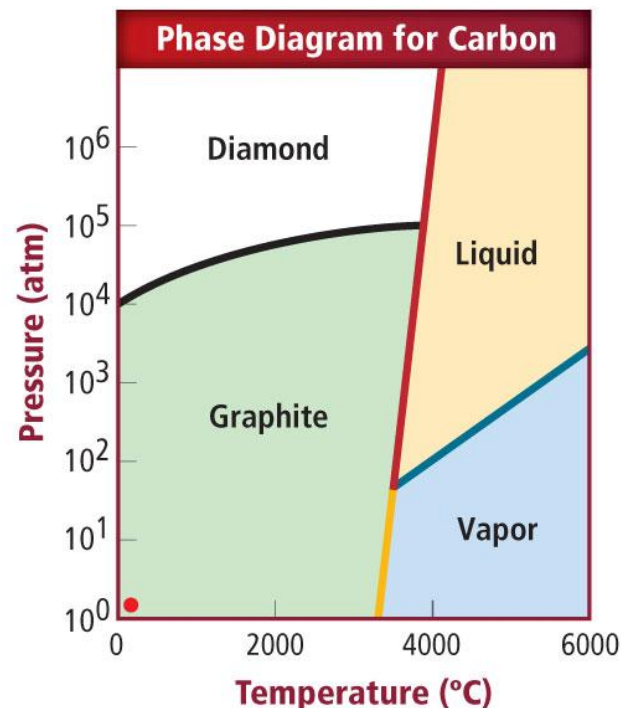
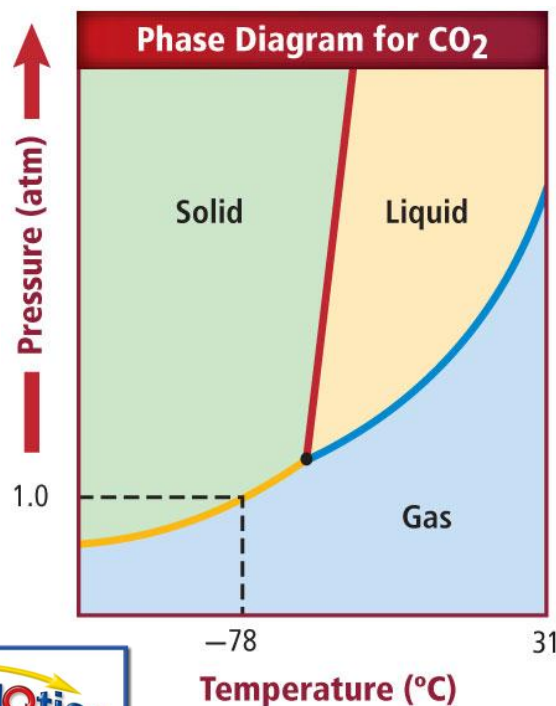
Phase Diagrams (cont.)

- The **triple point** is the point on a phase diagram that represents the temperature and pressure at which all three phases of a substance can coexist.



Phase Diagrams (cont.)

- The phase diagram for different substances are different from water.

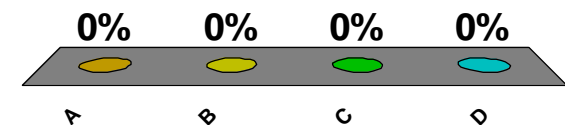


Section 12.4 Assessment



The addition of energy to water molecules will cause them to _____.

- A. freeze
- B. change to water vapor**
- C. form a crystal lattice
- D. move closer together



Section 12.4 Assessment



The transfer of energy from one object to another at a lower temperature is _____.

- A.** heat
- B.** degrees
- C.** conductivity
- D.** electricity

