

10**States of Matter and Phase Changes**

(CHEMACTIVITY: Introduction to Kinetic Theory)

What is the relationship between states of matter, energy, and temperature?

1. **On your own...** Read Sections 15.1-15.2 in Merrill Chemistry.

2. What does the Kinetic Theory attempt to explain?

The effects of temperature and pressure on the matter

3. What are the three basic assumptions of Kinetic Theory?

- 1) All matter is composed of small particles
- 2) These particles are in constant motion
- 3) All collisions are perfectly elastic

4. Define pressure. How can kinetic theory be used to explain the pressure exerted by a gas?

Pressure is the number of gas particles that collide with a container's walls.

5. The following are common pressure equivalents:

$$14.7 \text{ PSI} = 101.325 \text{ kPa} = 760 \text{ mmHg} = 760 \text{ torr} = 101,325 \text{ Pa} = 1.00 \text{ atm} \quad (\text{Memorize These!!})$$

Convert the following using dimensional analysis:

• $478.9 \text{ kPa} = ? \text{ torr}$

$$\frac{478.9 \text{ kPa}}{101.325 \text{ kPa}} \times \frac{760 \text{ torr}}{1} = 3628 \text{ torr}$$

• $9089 \text{ mmHg} = ? \text{ atm}$

$$\frac{9089 \text{ mmHg}}{760 \text{ mmHg}} \times \frac{1 \text{ atm}}{1} = 11.96 \text{ atm}$$

• $345,900 \text{ Pa} = ? \text{ PSI}$

$$\frac{345,900 \text{ Pa}}{101,325 \text{ Pa}} \times \frac{14.7 \text{ PSI}}{1} = 50.18 \text{ psi}$$

• $4.50 \text{ atm} = ? \text{ kPa}$

$$4.50 \text{ atm} \times \frac{101.325 \text{ kPa}}{1 \text{ atm}} = 456 \text{ kPa}$$

6. Describe the three states of matter:

- Solid: fixed shape and volume. particles vibrate around a fixed point. Attraction between particles is strong.

- Liquid: Assume the shape of their container, but not the volume. Particles are closer, but vibrate around moving points.
 - Gas: Take shape and volume of their container - particles are far apart and little to no attraction. Particles move randomly.
7. Of what is temperature a measure? What happens to the particles of a substance as temperature changes?

The average speed of a particle

The motion speed of a particle will increase or decrease with temperature

8. What is the relationship between temperature, KE, and particle mass?

$$KE = \frac{mv^2}{2} \quad v = \text{velocity} \quad m = \text{mass}$$

$$v = f(T) \quad v \propto T \Rightarrow \text{so } KE = \frac{m(T)^2}{2}$$

note: T must be in K

9. Define absolute zero. Why is the Kelvin scale called the "absolute scale"?

Absolute 0 No motion 0 K.F.

Absolute scale - Because No negative!

10. How does the kinetic theory explain the flow of energy between two substances at different temperatures?:

Particle collisions of warmer object will transfer to cooler object the K.E. of moving particles. Eventually, the K.E. of both objects will be the same.

11. How is the state of matter of a substance at room temperature related to temperature, pressure, and intermolecular forces?

+ pressure

State of matter at temperature and pressure is dependant on the bonding. The stronger the bonding the more "solid" a substance will be at room temperature. Ex. ionic compounds are solids, nonpolar covalent molecules are gasses at room temp.

Essential Content and Skills:

How can we explain the relationship between temperature, kinetic energy, pressure, and states of matter?