

States of Matter, Kinetic Molecular Theory

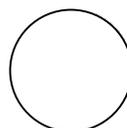
Read 9.1 (pages 418 – 420)

- Are there larger attractive forces between molecules of gases, liquids, or solids? Explain.
- Which state(s) of matter have these properties: a) definite shape, b) definite volume, c) takes the shape its container, d) incompressible.
- Explain the properties of the three states of matter by referring to the forces that exist in each (e.g. "solids have intermolecular forces that are so strong that molecules are fixed in place. This gives solids a definite shape and volume. Solids are incompressible because their strong forces hold molecules tightly together, eliminating space between molecules." Repeat for liquids & gases.)

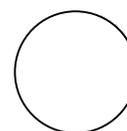
States of Matter, Kinetic Molecular Theory

- What factor, in addition to strength of intermolecular forces, affects the state of a substance?
- Which theory deals with molecular motion?
- What 3 types of motion can a molecule exhibit? Simply stated, what do these words mean? Which types exist in solids, liquids, & gases?
- What term means "the energy of motion"? What is an average measure of this?
- A flask of $O_2(g)$ is heated from $10^\circ C$ to $90^\circ C$. Are all O_2 molecules moving faster at $90^\circ C$? Explain.
- Why does evaporation cause the temperature of a liquid to decrease?
- Would a gas diffuse faster or slower in a vacuum? Explain your reasoning.

Demo 1: Diffusion of $KMnO_4$



Cold water

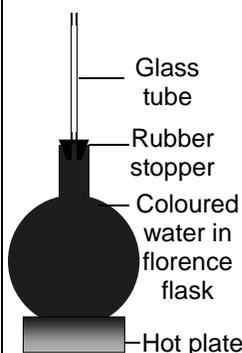


Hot water

Observations: $KMnO_4$ (potassium permanganate) diffuses faster in hot water.

Explanation: $KMnO_4$ dissolves in water. As the $KMnO_4$ dissolves, it collides with H_2O molecules and spreads out. Because molecules in hot water are moving faster, the solid dissolves faster and diffuses faster.

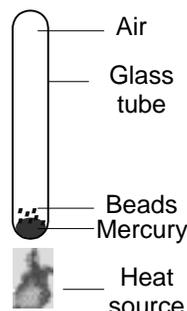
Demo 2: thermal expansion of a liquid



Observations: coloured water moves slowly up the tube

Explanation: heat increases the kinetic energy of liquid particles. The particles move faster (greater vibrational, rotational, and translational energy). This greater movement increases the distance between molecules. Thus, the volume expands.

Demo 3: Heating Mercury



Observations: beads are propelled upwards when mercury is heated.

Explanation: heat increases the kinetic energy, so that the particles move faster. The fastest moving mercury molecules (that boil off) transfer their energy to the beads, causing them to jump. Would this work with water?

Pressure and Volume

Read 9.2 (pages 423 – 425)

- Define pressure. What is the SI unit for pressure?
- How does a gas exert pressure on the side of a container? What would happen to the pressure if a container of gas was heated? Explain with reference to the kinetic molecular theory).
- Define and give the conditions of STP and SATP.
- How was atmospheric pressure first determined?
- Copy figure 1 into your notes. What would happen to the the level of mercury if a) the barometer were at a high elevation (where atmospheric pressure is lower), b) the tube length was doubled, c) the air pressure was increased?
- Solve for question 2 on page 425.

Demo 4: Kill da wabbit

Question: what will happen when the air pressure surrounding a balloon is decreased? Why?

