

QUESTIONS

7.2. How kinetic energy molecular model of matter is helpful in differentiating various states of matter?

Ans: Kinetic Molecular Model of Matter:

- (i) Matter is made up of particles called molecules.
- (ii) The molecules remain in continuous motion.
- (iii) Molecules attract each other.

Characteristics of Molecular Model of Matter:

Kinetic molecular model is used to explain the three states of matter - solid, liquid and gas.

a. Solids:

- (i) Solids such as a stone, metal spoon, pencil, etc. have fixed shapes and volume.
- (ii) Their molecules are held close together by strong forces of attraction.
- (iii) Molecules of solids vibrate about their mean positions but do not move from place to place.

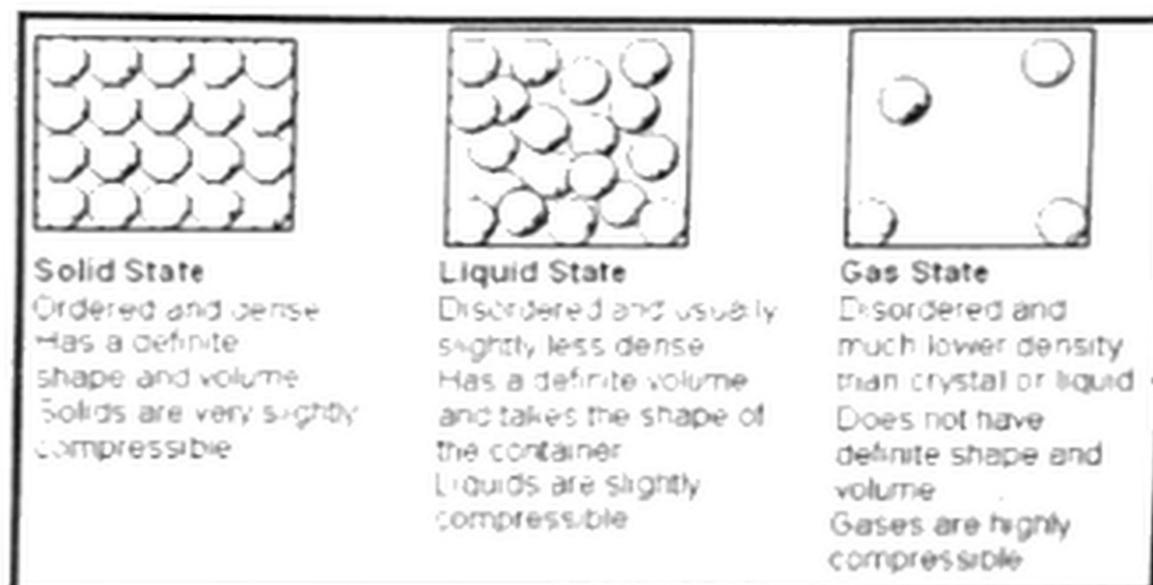
b. Liquids:

- (i) The distances between the molecules of a liquid are more than in solids. Thus, attractive forces between them are weaker.
- (ii) Like solids, molecules of a liquid also vibrate about their mean position but are not rigidly held with each other.
- (iii) Due to the weaker attractive forces, they can slide over one another. Thus, the liquids can flow.

- (iv) The volume of a certain amount of liquid remains the same but because it can flow hence, it attains the shape of a container to which it is put.

c. Gases:

- (i) Gases such as air have no fixed shape or volume. They can be filled in any container of any shape.
- (ii) Their molecules have random motion and move with very high velocities. In gases, molecules are much farther apart than solids or liquids. Thus, gases are much lighter than solids and liquids.
- (iii) They can be squeezed into smaller volumes.
- (iv) The molecules of a gas are constantly striking the walls of a container. Thus, a gas exerts pressure on the walls of the container. ($P \propto K.E$)



d. Plasma – The fourth state of matter:

(i) Production/Formation of Plasma:

The kinetic energy of gas molecules goes on increasing if a gas is heated continuously. This causes the gas molecules to move faster and faster. The collisions between atoms and molecules of the gas become so strong that they tear off the atoms. Atoms lose their electrons and become positive ions.

This ionic state of matter is called plasma. Plasma is also formed in gas discharge tubes when electric current passes through these tubes.

- (ii) Plasma is called the fourth state of matter in which a gas occurs in its ionic state. Positive ions and electrons get separated in the presence of electric or magnetic fields.
- (iii) Plasma also exists in neon and fluorescent tubes when they glow.
- (iv) Most of the matter that fills the universe is in plasma state.
- (v) In stars such as our Sun, gases exist in their ionic state.
- (vi) Plasma is highly conducting state of matter. It allows electric current to pass through it.

| Solid | Liquid | Gas | Plasma |
|---|--|---|---|
| Ice H_2O | Water H_2O | Steam H_2O | Ionized Gas $H_2 \rightarrow H^+ + H^+ + 2e^-$ |
| Cold $T < 0^\circ C$ | Warm $0 < T < 100^\circ C$ | Hot $T > 100^\circ C$ | Hotter $T > 100,000^\circ C$ $T \sim 10^8 \text{ electron volts}$ |
|  |  |  |  |
| Molecules Fixed in Lattice | Molecules Free to Move | Molecules Free to Move, Large Spacing | Ions and Electrons Move Independently, Large Spacing |

7.3 Does there exist a fourth state of matter? What is that?

Ans: Yes, fourth state of matter is called plasma.

Plasma:

