Lesson 1 : Kinetics Theory and Physical State of Matter.

What is Matter ?



Dear students ,

Lesson Objective

At the end of The lesson, you will be able to :

- understand the kinetic molecular theory and properties of the three physical states of matter.
- Know the behavior of gases by using the variables volume, temperature, pressure and number of moles.
- know terms like ideal gas, diffusion, evaporation, boiling, condensation, vapor, pressure, boiling point, molar heat of vaporization.
- understand gas laws; develop skills in solving problems to which the gas laws apply; perform activities to illustrate gas laws; carry out experiments to determine the boiling points of liquids and the melting point of solid.

Brainstorming Question

- 1. During rainy season sometimes we observe ice rain. What is the sourc of this ice rain (precipitation)? What makes it different from water?
- 2. If you put some water in an evaporating dish and gently heat for sometime, what kind of change do you observe
- 3. give examples for each of the three physical states of matter?

Key terms/ Concepts

• Kinetics theory

• Matter

- Kinetic energy
 - Plasma

Kinetic theory refers to a set of

principles that explain the behavior of gases in terms of the motion of their particles. Key postulates of the kinetic theory include:

- 1. **Gas consists of particles**: Gas is composed of a large number of particles (atoms or molecules) that are in constant, random motion.
- 2. **Negligible volume of particles**: Compared to the volume of the container, the volume occupied by individual gas particles is negligible.
- 3. **Collisions are elastic**: Collisions between gas particles and between particles and the walls of the container are perfectly elastic, meaning there is no net loss of kinetic energy.
- 4. Average kinetic energy relates to temperature: The temperature of a gas is directly proportional to the average kinetic energy of its particles. Higher temperature corresponds to higher average kinetic energy.
- 5. **Pressure arises from collisions**: Gas pressure arises from the collisions of gas particles with the walls of the container. The force exerted by each collision contributes to the total pressure exerted by the gas.

Kinetic theory provides a microscopic explanation for many macroscopic properties of gases, such as pressure, temperature, volume, and diffusion. It forms the basis for understanding the behavior of gases under different conditions and has applications in various fields of science and engineering.

3.1 Introduction

add heat

- You recall that matter is defined as anything that occupies space and has mass.
- In general, matter is known to exist in one of the three states called solid, liquid or gas.
- Matter is defined as anything that occupies space and has mass. It can exist in the form ofgas, liquid and solid. The simplest example is the water we use in our daily life. The threephysicalstates of water are:
- Steam, water in the form of gas.
- Water, in the form of liquid.
- Ice,water in the form of solids.

ice



add heat

- The physical state of a given sample of matter depends on the temperature and pressure. Changing these conditions or variables may change the behaviour of the substances as solids, liquids, gases or plasma.
- A solid is rigid and possesses a definite shape.

- A liquid flows and takes the shape of its container, except that it forms a flat or slightly curved upper surface when acted upon by gravity.Both liquid and solid samples have volumes that are very nearly independent of pressure.
- A gas takes both the shape and volume of its container.
- A fourth state of matter, plasma occurs naturally in the interiors of stars.
- Plasma is a gaseous state of matter that contains appreciable numbers of electrically charged particles. Example of plasma state: Lightning, Comet tail,Solar Wind,Stars (Including The Sun),Interstellar Gas Clouds,Welding arcs,fluorescent lights, Static electricity, Rocket Exhaust etc.

3.2 The Kinetic Theory of matter

- The States of matter in which substances are Chemically the same but Physically differently are explained by the kinetic theory of matter
- gives an explanation of the nature of the motion and the heat energy
- according to the theory, every substance consists of avery large number of very small particles called ions, atoms and molecules

• The motion of the particles increases with arise in temperature kinetic theory of matter is based on:

- All matter is composed of particles which are inconstant motion.
- The particles possess kinetic energy and potential energy.
- The difference between The three States of matter is due to their energy contents and the motion of the particles.

3.3 Properties of Matter

Brainstorming Question

what are the state of matter ?

properties of gases can be summarized.



- Gases have no definite shape and definite volume.
- Gases can be easily compressed.
- Gases have low densities compared with liquids and solids.
- Gases exert pressure in all directions.

• Gases easily flow and diffuse through one another.

Properties of Liquids

- Have a definite volume, but havenodefinite shape.
- Have higher densities than gases.
- Are slightly compressible.
- Are fluids.

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Liquid

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p").hide();
.aagb_button_toggle").click(function(e) {
    e.preventDefault();
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(".expand

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.aagb__accordion_component p:hidden").length === 0)
{
    (".aagb_overlay").fadeOut("slow"); } });
});
Properties of Solids
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- Solids have a definite shape and a definite volume.
- Solids generally have higher densities than gases and liquids.
- Solids are extremely difficult to compress.
- Solids are not fluids.



Water States of matter Phase. Change of State for Water Diagram. Changing the state of matter from solid, liquid and gas due to temperature

Lesson 1: Summary

The kinetic theory of matter explains the behavior of matter, particularly gases, based on the movement of its constituent particles.

Kinetic Theory of Matter:

- 1. **Particle Motion**: Matter is composed of tiny particles (atoms or molecules) that are in constant, random motion.
- 2. **Particle Size**: The size of these particles is much smaller compared to the distance between them, and they are separated by empty space.

- 3. **Elastic Collisions**: Collisions between particles and between particles and the walls of a container are perfectly elastic, meaning there is no net loss of kinetic energy.
- 4. **Temperature and Kinetic Energy**: The temperature of a substance is a measure of the average kinetic energy of its particles. Higher temperature means higher average kinetic energy.
- 5. States of Matter: The kinetic theory helps explain the different states of matter:
- **Solids**: Particles are closely packed together and vibrate in fixed positions.
- Liquids: Particles are close together but can move past one another.
- **Gases**: Particles are far apart and move freely. **Pressure and Volume**:
- Gas pressure arises from the collisions of gas particles with the walls of the container. The volume occupied by gas particles is negligible compared to the volume of the container.

Properties of Matter:

Properties of matter can be classified into two main categories:

Solids

- Shape: Definite shape, maintains its own shape and volume.
- Volume: Definite volume, does not change.Particle Arrangement: Particles are closely packed in a regular arrangement.Particle Movement: Vibrates in fixed positions, minimal movement.
- Density: Generally high density due to close packing of particles.
- Compressibility: Virtually incompressible. Melting Point: Melts at a specific temperature to become a liquid.
 - Liquids
- Shape: Takes the shape of its container.
- Volume: Definite volume, does not change.
- Particle Arrangement: Particles are close together but can move past each other.
- Particle Movement: Moves with moderate freedom.
- Density: Density is lower than solids but higher than gases.
- Compressibility: Slightly compressible.
- Boiling Point: Boils at a specific temperature to become a gas.
 Gas:
- Shape: Expands to fill its container.
- Volume: No definite volume, takes the volume of its container.
- Particle Arrangement: Particles are far apart and move freely.
- Particle Movement: Moves rapidly and randomly.
- Density: Low density due to large spaces between particles.
- Compressibility: Highly compressible.Boiling Point: No distinct boiling point, transitions to liquid under appropriate conditions.