

**FOCUS POINTS**  
**CHAPTER – 1**  
**Matter in our Surroundings**

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- Anything that occupies space and has mass and is felt by senses is called matter.
- According to Indian ancient philosophy, matter is the form of five basic elements (the Panchtatva) – air, earth, fire, sky and water.

### **Characteristics of particles of matter**

- Made of tiny particles.
- Vacant spaces exist between particles.
- Particles are in continuous motion.
- Particles are held together by forces of attraction.

### **States of Matter**

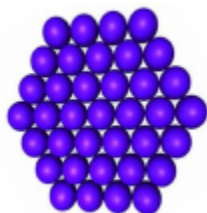
#### **Basis of Classification of Types**

- Based upon particle arrangement
- Based upon energy of particles
- Based upon distance between particles

### **Five states of matter**

1. Solid
2. Liquid
3. Gas
4. Plasma
5. Bose-Einstein condensate

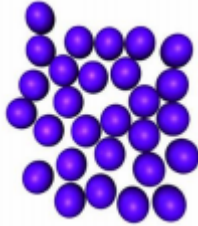
#### **(I) SOLID**



- Fixed mass, volume and shape
- Inter-particle distances are least.
- Incompressible.
- High density and do not diffuse
- Inter particle forces of attraction are strongest.

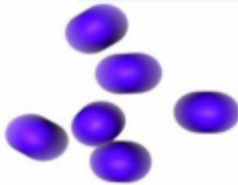
- Constituent particles are very closely packed.

## (II) LIQUID



- Not fixed shape but fixed volume and mass.
- Inter particle distances are larger than solid.
- Almost incompressible.
- Density is lower than solids and can diffuse.
- Inter particle forces of attraction are weaker than solids .
- Constituent particles are less closely packed.

## (III) GAS



- Neither fixed shape nor fixed volume.
- Inter particle distances are largest.
- Highly compressible.
- Density is least and diffuse.
- Inter particle forces of attraction are weakest.
- Constituent particles are free to move about.

## (IV) PLASMA (NON-EVALUATIVE)

- A plasma is an ionized gas.
- A plasma is a very good conductor of electricity and is affected by magnetic fields.
- Plasma, like gases have an indefinite shape and an indefinite volume. Ex. Ionized gas

## (v) BOSE-EINSTEIN CONDENSATE (non –evaluative)

- A **BEC** is a state of matter that can arise at very low temperatures.
- The scientists who worked with the Bose-Einstein condensate received a Nobel Prize for their work in 1995.

- The BEC is all about molecules that are really close to each other (even closer than atoms in a solid).

### **Microscopic Explanation for Properties of Solids**

- Solids have a definite shape and a definite volume because the particles are locked into place
- Solids do not flow easily because the particles cannot move/slide past one another
- Solids are not easily compressible because there is little free space between particles

### **Microscopic Explanation for Properties of Liquids**

- Liquids are not easily compressible and have a definite volume because there is little free space between particles.
- Liquids flow easily because the particles can move/slide past one another.
- Liquids flow easily because the particles can move/slide past one another.

### **Microscopic Explanation for Properties of Gases**

- Gases are easily compressible because there is a great deal of free space between particles
- Gases flow very easily because the particles randomly move past one another.
- Gases have an indefinite shape and an indefinite volume because the particles can move past one another (non –evaluative)

### **Microscopic Explanation for Properties of Plasmas**

- Plasmas have an indefinite shape and an indefinite volume because the particles can move past one another.
- Plasmas are easily compressible because there is a great deal of free space between particles.
- Plasmas are good conductors of electricity & are affected by magnetic fields because they are composed of ions.

### **Microscopic Explanation for Properties of BEC**

- Particles are less energetic than solids because they exist at very low temperature.
- Particles are literally indistinguishable because they are locked into same space .

- BEC shows super fluidity because Particles can flow without friction.

## 1. Interchange in states of matter

Water can exist in three states of matter –

- Solid, as ice,
- Liquid, as the familiar water, and
- Gas, as water vapour.

**Sublimation** : The changing of solid directly into vapours on heating & vapours into solid on cooling. Ex. Ammonium chloride, camphor & iodine.

### (a) Effect of change in temperature

The temperature effect on heating a solid varies depending on the nature of the solid & the conditions required in bringing the change.

- On increasing the temperature of solids, the kinetic energy of the particles increases which overcomes the forces of attraction between the particles thereby solid melts and is converted to a liquid.
- The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.
- The melting point of ice is 273.16 K.
- The process of melting, that is, change of solid state into liquid state is also known as fusion.

### (b) Effect of Change of Pressure

- Increasing or decreasing the pressure can change the state of matter. Applying pressure and reducing temperature can liquefy gases.
- Solid carbon dioxide ( $\text{CO}_2$ ) is stored under high pressure. Solid  $\text{CO}_2$  gets converted directly to gaseous state on decrease of pressure to 1 atmosphere without coming into liquid state. This is the reason that solid carbon dioxide is also known as dry ice.

### Latent Heat :

The hidden heat which breaks the force of attraction between the **molecules during** change of state.

**Fusion** Heat energy required to change 1kg of solid into liquid.

**Vaporisation** Heat energy required to change 1kg of liquid to gas at atmospheric pressure at its boiling point

Thus, we can say that pressure and temperature determine the state of a substance, whether it will be solid, liquid or gas.

#### 4. Evaporation & Boiling

- Particles of matter are always moving and are never at rest.
- At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy.
- In the case of liquids, a small fraction of particles at the surface, having higher kinetic energy, is able to break away from the forces of attraction of other particles and gets converted into vapour .
- This phenomenon of change of a liquid into vapours at any temperature below its boiling point is called evaporation.

#### Factors Affecting Evaporation

- The rate of evaporation increases with an increase of surface area.
- With the increase of temperature, more number of particles get enough kinetic energy to go into the vapour state.
- Humidity is the amount of water vapour present in air. The air around us cannot hold more than a definite amount of water vapour at a given temperature. If the amount of water in air is already high, the rate of evaporation decreases.
- Wind speed : the higher the wind speed , the more evaporation.

#### Evaporation cause cooling.

- The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation,

#### Evaporation Vs Boiling

- Boiling is a bulk phenomenon. Particles from the bulk (whole) of the liquid change into vapour state.
- Evaporation is a surface phenomenon. Particles from the surface gain enough energy to overcome the forces of attraction present in the liquid and change into the vapour state.

#### 5. Kelvin & Celsius Scale

- Kelvin is the SI unit of temperature,  $0^{\circ}\text{C} = 273.15\text{ K}$  we take  $0^{\circ}\text{C} = 273\text{ K}$ .
- SI unit of temperature is Kelvin.  $T(\text{K}) = T(^{\circ}\text{C}) + 273$
- Kelvin scale of temperature has always positive sign , hence regarded as better scale than Celsius.

- Atmosphere (atm) is a unit of measuring pressure exerted by a gas. The SI unit of pressure is Pascal (Pa):
- 1 atmosphere =  $1.01 \times (10 \text{ to the power } 5) \text{ Pa}$ . The pressure of air in atmosphere is called atmospheric pressure. The atmospheric pressure at sea level is 1 atmosphere, and is taken as the normal atmospheric pressure.

### **You are expected to know**

- Particle nature of matter.
- All five states of matter & their behaviour
- enter conversion of states of matter
- Latent heat
- Conversion between Kelvin scale & Celsius scale