

MATTER IN OUR SURROUNDINGS

➤ What is matter?

- Anything which occupies space and has mass is called matter. For example air, water, books, wood, trees, human, house, car etc.



➤ How matter is classified?

- Matter is classified into two ways on the basis of its physical properties and on the basis of its chemical properties.

➤ How matter is made?

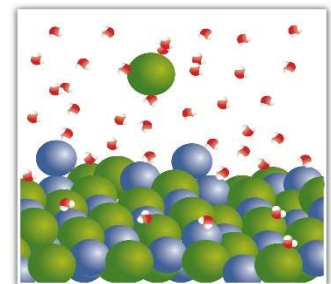
- Matter is made up of small particles called atoms and molecules.

➤ How can you prove that there is existence of particles in matter and they are in motion?

- The existence of particles in matter and their motion comes from the experiments on diffusion (mixing of different substances on their own), and Brownian motion.

Evidence 1 :: Dissolving a Solid in a Liquid.

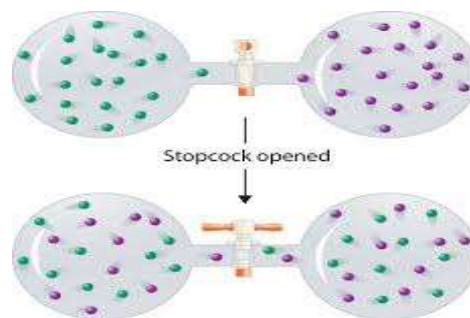
- When we dissolve a solid into a liquid it's break down into small particles and get completely dissolved in the liquid.



Evidence 2 :: Mixing of Two or more than two gases

- Mixing of two or more than two gases is called diffusion. It gives us two conclusions about the nature of matter :

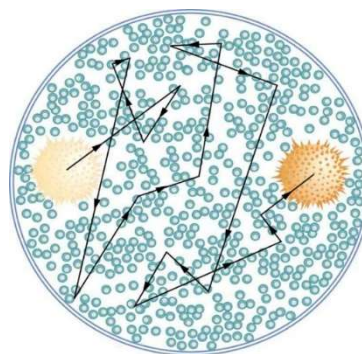
- (i) Matter is made up of tiny particles
- (ii) The particles of matter are constantly moving.



Evidence 3 :: Movement of Pollen Grains in Water

- The existence and movement of particles in liquids was given by Robert Brown in 1827. While doing experiment he found that pollen grains move on the surface of water because they are constantly being hit by the fast moving particles of water.
- The zig-zag movement of the small particles suspended in a liquid (or gas) is called Brownian motion. It can also be observed in gases. The tiny dust particles move here and there because they are constantly hit by the fast moving particles of air.
- The existence of Brownian motion gives us two conclusions about the nature of matter :

- (i) Matter is made up of tiny particles
- (ii) The particles of matter are constantly moving.



➤ What is the Characteristics of Particles of Matter?

- The particles of matter are very, very small.

For example potassium permanganate crystal itself must be made up of millions of small particles which keep on spreading and imparting colour to more and more of water (on dilution).

- The particles of matter have spaces between them.

For Example there is no change in volume on dissolving sugar in water tells us that there are spaces between the particles of water. the particles (or molecules) in water are not tightly packed, they are somewhat loose, having spaces between them.

- The particles of matter are constantly moving.

The best evidence that particles of matter are constantly moving comes from the studies of diffusion and Brownian motion.

For Example when we spray perfumes in one corner of a room, its fragrance (pleasant smell) spreads in the whole room quickly.

Similarly when a few crystals of copper sulphate are placed at the bottom of a beaker (or a gas jar) containing water, then water in the whole beaker turns blue slowly. the spreading of blue colour of copper sulphate crystals in water is due to the movement of both, copper sulphate particles as well as water particles.

- The particles of matter attract each other.

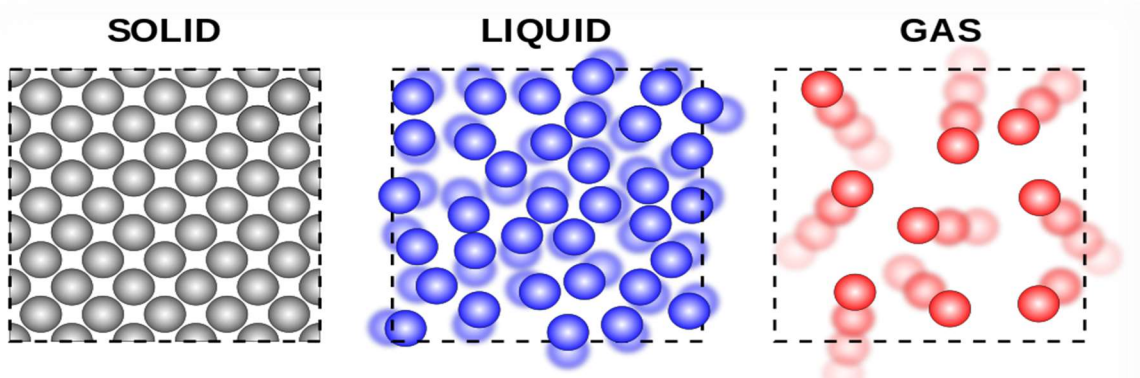
There are some forces of attraction between the particles of matter which bind them together. the force of attraction is maximum in the particles of solid matter and minimum in the particles of gaseous matter.

- **What is Rigid and Fluid?**

- Rigid means 'unbending' or 'inflexible'. A solid is a rigid form of matter.
- Fluid means 'a material which can flow easily' and requires a vessel (or container) to keep it. A gas is a fluid form of matter which fills the whole container in which it is kept.

- **How matter is classified on the basis of Physical State?**

- On the basis of physical states, all the matter can be classified into three groups : Solids, Liquids and Gases.



- **Properties of Solids**

1. Solids have a fixed shape and a fixed volume.
2. Solids cannot be compressed much.
3. Solids have high densities. They are heavy.
4. Solids do not fill their container completely.
5. Solids do not flow.

- **Properties of liquids**

1. Liquids have a fixed volume but they have no fixed shape. Liquids take the shape of the vessel in which they are placed.
2. Like solids, liquids cannot be compressed much.
3. Liquids have moderate to high densities. They are usually less dense than solids.
4. Liquids do not fill their container completely.
5. Liquids generally flow easily.

- **Properties of gases**

1. Gases have neither a fixed shape nor a fixed volume. Gases acquire the shape and volume of the vessel in which they are kept.
2. Gases can be compressed easily (into a small volume).

3. Gases have very low densities. They are very, very light. A gas is much lighter than the same volume of a solid or a liquid.

4. Gases fill their container completely.

5. Gases flow easily.

- **Why Solids, Liquids and Gases Have Different Properties?**

- The solids, Liquids and gases have different Properties because of following reason:

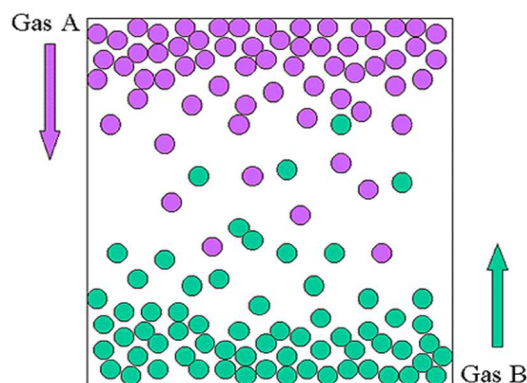
1. The spaces (or distances) between the particles.

2. The force of attraction between particles.

3. The amount of movement of particles (or kinetic energy of particles).

- **What is diffusion and give some example of diffusion in daily life?**

- The spreading out and mixing of a substance with another substance due to the motion of its particles is called diffusion.
- Diffusion is a property of matter which is based on the motion (or movements) of its particles.
- Diffusion is fastest in gases and slowest in solids.
- The rate of diffusion increases on increasing the temperature of the diffusing substance.
- Light gases diffuse faster than heavy gases.
- Some example of diffusion of gases in day to day life :
 - The smell of food being cooked reaches us even from a considerable distance by the process of diffusion.
 - The fragrance of burning incense stick (or *agarbatti*) spreads all around due to the diffusion of its smoke into the air.



- The smell of perfume spreads due to the diffusion of perfume vapours into air.
- Some example of diffusion of liquid in day to day life :
- The spreading of purple colour of potassium permanganate into water, on its own, is due to the diffusion of potassium permanganate particles into water.
- The spreading of blue colour of copper sulphate into water, on its own, is due to the diffusion of copper sulphate particles into water.
- The spreading of ink in water, on its own, is due to the diffusion of ink particles into water.



- Some example of diffusion of Solid in day to day life :
- Chalk on board get diffused if it is rubbed after long time.
- The diffusion of a solid substance into another solid substance is so slow that many people think that diffusion does not take place in solids at all.
- If two metal blocks are bound together tightly and kept undisturbed for a few *years*, then the particles of one metal are found to have diffused into the other metal.



➤ **What is the common unit of temperature and SI unit of temperature ?**

- The common unit to measure the temperature is CELSIUS.
1. The common unit of measuring temperatures (like melting points, boiling points, etc.) is 'degrees Celsius' which is written in short form as $^{\circ}\text{C}$ (read as degrees C).

2. The melting point of ice on Celsius scale of temperature is 0°C

3. The boiling point of water on Celsius scale is 100°C .

- The SI unit to measure the temperature is KELVIN.

1. The SI unit of measuring temperature is Kelvin, which is denoted by the symbol K.

2. The melting point of ice on Kelvin scale is 273 K. And the boiling point of water on Kelvin scale is 373 K.

➤ **How will you convert the temperature from CELSIUS TO KELVIN or KELVIN TO CELSIUS?**

- $0^{\circ}\text{C} = 273 \text{ K}$

Temp. on Kelvin scale = Temp. on Celsius scale + 273

(i) To convert a temperature on Celsius scale to the Kelvin scale, we have to add 273 to the Celsius temperature.

(ii) To convert a temperature on Kelvin scale to the Celsius scale, we have to subtract 273 from the Kelvin temperature.

➤ **How can we change the state of the matter?**

- We can change the physical state of matter in two ways :

1. By changing the temperature
2. By changing the pressure.

➤ **How temperature change the state of the matter?**

1. Solid to Liquid Change : Melting

- ❖ The process in which a solid substance changes into a liquid on heating, is called melting (or fusion).
- ❖ The temperature at which a solid substance melts and changes into a liquid at atmospheric pressure, is called melting point of the substance.



- ❖ The melting point of a solid is a measure of the force of attraction between its particles (atoms or molecules).
- ❖ When a solid is heated sufficiently, it changes its physical state and becomes a liquid.

2. Liquid to Gas Change : Boiling (or Vaporisation)

- ❖ The process in which a liquid substance changes into a gas rapidly on heating, is called boiling.
- ❖ The temperature at which a liquid boils and changes rapidly into a gas at atmospheric pressure, is called boiling point of the liquid.
- ❖ The boiling point of a liquid is a measure of the force of attraction between its particles.
- ❖ When a liquid is heated, it changes its physical state and becomes a gas.



3. Gas to Liquid Change : Condensation

- ❖ The process of changing a gas (or vapour) to a liquid by cooling, is called condensation.
- ❖ Condensation is the reverse of boiling (or vaporisation).



4. Liquid to Solid Change : Freezing

- ❖ The process of changing a liquid into a solid by cooling, is called freezing.
- ❖ Freezing means solidification. freezing is the reverse of melting.
- ❖ The state of matter can be changed by changing the temperature (by heating or cooling).



➤ **What is latent heat and how many types of it?**

- The heat energy which has to be supplied to change the state of a substance is called its latent heat. Latent heat does not cause a rise in temperature of the substance because the latent heat which we supply is used up in overcoming the forces of attraction between the particles of a substance during the change of state.

Latent heat is of two types :

1. Latent heat of fusion,

- The latent heat of fusion (or melting) of a solid is the quantity of heat in joules required to convert 1 kilogram of the solid (at its melting point) to liquid, without any change in temperature. The latent heat of fusion of ice is 3.34×10^5 joules per kilogram.

2. Latent heat of vaporisation.

- The latent heat of vaporisation of a liquid is the quantity of heat in joules required to convert 1 kilogram of the liquid (at its boiling point) to vapour or gas, without any change in temperature. The latent heat of vaporisation of water is 22.5×10^5 joules per kilogram.

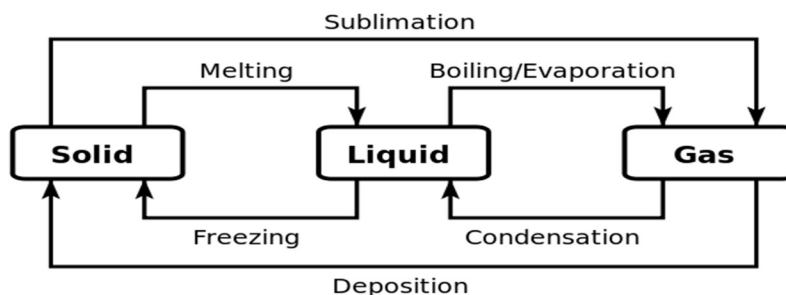
➤ **What is sublimation and give some example of it?**

- The process of changing a solid directly into vapours on heating, and of vapours into solid on cooling, is known as sublimation.

The common examples of substances which undergo sublimation are : Ammonium chloride, Iodine, Camphor, Naphthalene and Anthracene.



➤ **Draw the FLOW CHART OF STATE CHANGE of the Matter**



➤ **How pressure change the state of the Matter or liquifies the gas ?**

- **Gases Can be Liquefied by Applying Pressure and Lowering Temperature.**

1. Ammonia gas can be liquefied by applying high pressure and lowering the temperature.
2. the conversion of solid carbon dioxide into carbon dioxide gas is a change of state (from solid to gas) which is caused by the decrease in pressure and higher atmospheric temperature.



➤ **What is evaporation and on which factors the rate of evaporation depends?**

- The process of a liquid changing into vapour (or gas) even below its boiling point is called evaporation.

Factors Affecting Evaporation

1. Temperature

The rate of evaporation increases on increasing the temperature of the liquid.

2. Surface Area of the Liquid

The rate of evaporation increases on increasing the surface area of the liquid.

3. Humidity of Air

The humidity of air is low, then the rate of evaporation is high, and water evaporates more readily. the humidity of air is high, then the rate of evaporation is low, and water evaporates very slowly.

4. Wind Speed

The rate of evaporation of a liquid increases with increasing wind speed.

➤ **How is Cooling Caused by the Evaporation?**

- The cooling caused by evaporation is based on the fact that when a liquid evaporates, it draws (or takes) the latent heat of vaporisation from 'anything' which it touches.

1. If we put a little of spirit (ether or petrol) at the back of our hand and wave it around, the spirit evaporates rapidly and our hand feels very cold.

2. During hot summer days, water is usually kept in an earthen pot (called pitcher or *matka*) to keep it cool.
3. A fan increases the rate of evaporation of sweat (or moisture) from our skin and makes us feel cool and comfortable.



➤ **How can you prove that there is presence of Water Vapour in the Air?**

- Water vapour comes into the air from the evaporation of water present in ponds, lakes, rivers and oceans. the formation of drops of water on the outside surface of a tumbler containing crushed ice, shows the presence of water vapour in air.

➤ **There is Two More States of Matter : Plasma and Bose-Einstein Condensate**

- **PLASMA**

1. Plasma is a mixture of free electrons and ions.
2. Plasma occurs naturally in the stars (including the sun).
3. The sun and other stars glow because of the presence of plasma in them.
4. Plasma can also be made on the earth by passing electricity through gases at very low pressures taken in a glass tube (called discharge tube).

- **BOSE-EINSTEIN CONDENSATE**

Cooling a gas of extremely low density (about one hundred thousandth the density of normal air) to super low temperatures gives fifth state of matter called Bose-Einstein Condensate.