PROPERTIES OF MATTER

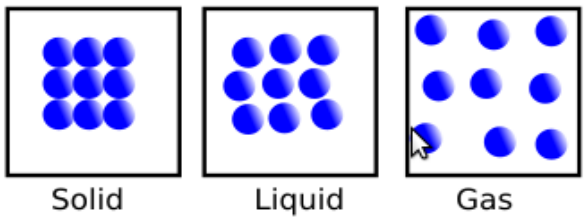
All objects around us are made of different materials. Usually they are seen in solid, liquid or gaseous state.

Matter: Matter is anything that occupies space and has mass.

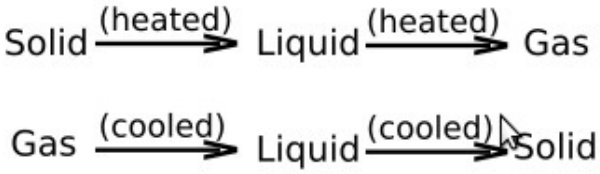
Features of substances in various states			
State	**mass**	**Volume**	**Shape**
Solid	Definite mass	Definite volume	Definite shape
Liquid	Definite mass	Definite volume	No definite shape
Gaseous	Definite mass	No definite volume	No definite shape

All substances are made of minute particles.
Features of this particles: i. This particles bear all the properties of the substance.
ii. They have distance between them.
iii. These particles are in continuous motion.
iv. They attract one another.

The properties of these particles in various states of matter are different. In solids, they are closely packed. In liquid, separation between the particles are greater than that in solid. In gaseous state, the distance between the particles is very large. The packing of particles in solid, liquid and gas are pictured below.



Change of state: The state of a substance can be changed from one state to another by heating or cooling. Heat energy is responsible for the change of state of matter. The flowchart of change of state is given.



When a substance is heated, it absorbs energy. As a result, the following changes occurs to the particles of the substance.
* Increases Energy * Increases the distance between them . * Increases mobility .
* Decreases the attraction between them.

Sublimation: The phenomenon of changing a solid directly into gas without forming liquid is called sublimation.

Example: Camphor,Naphtha-lien ball and Iodine are examples for substances that undergo sublimation.
Solidification: It is the process of changing liquid/gas into solid. Eg:- Freezing of water.
Liquefaction: It is the process of changing solid into liquid. Eg:- Melting of ice.
Condensation: It is the process of changing gas into liquid. Eg:- Formation of dews.
Vapourisation: It is the process of changing liquid into gas. Eg:- Conversion of water into steam.

Changes due to change of state.

Properties	Solid to Liquid	Liquid to Gas	Gas to Liquid	Solid to Gas
Mobility of particles	Increases	Increases	Decreases	Increases
Distance between particles	Increases	Increases	Decreases	Increases
Attraction between particles	Decreases	Decreases	Increases	Decreases
Energy of particles	Increases	Increases	Decreases	Increases

Diffusion: Diffusion is the spontaneous mixing of different particles of gases and liquids. It is due to diffusion the smell of flowers and fruits spread out in the surroundings. Rate of diffusion increases with temperature. As the freedom of movement of the particles in gases is greater than that in liquid, diffusion rate of gas is much greater in gases. Since particles in solid are immobile, there is no diffusion in solids.

Pure substances and mixtures.

Materials made of particles of identical nature are called pure substance.

Examples: Water, sugar, common salt.

If we take some quantity of any of these materials, it contains only particles having unique properties.

Substances which consist particles of different nature are called mixtures.

Example.1: Saline water. It contains particles of water and common salt.

Soda water, ornament gold, lemon juice, tea, air, soil etc are examples for mixtures.

Separation of components from mixture.

In our daily life there are so many occasions when components of mixtures are to be separated.

Example:Separation of chaff from paddy, dredge from tea.

The method of separation is based on the physical properties of the components.

Example.1. We remove dredge from tea by filtering. Here we make use of difference in size of the particles present in the mixture.

2. We can separate aluminium powder and iron powder from their mixture using a magnet. Here we make use of the fact that ion is a magnetic substance and aluminium is non magnetic.

3. Salt can be separated from salt water by distillation. Here volatile nature of water is made use of.

4. Chaff is too lighter than paddy. Hence they can be separated by fanning.

Distillation: This method is employed when one of the components is volatile and the other is non volatile. Water and common salt can be separated from salt water through distillation.

Distillation can also be applied when there is large difference in boiling point of the components. For example the acetone (boiling point 56°C) and water (boiling point 100°C) can be separated from their mixture by distillation.

Distilled water used for injection and in storage battery is produced through this method.

Fractional Distillation: If the difference between the boiling point of the components is small, fractional distillation is used to separate them.

For example: Boiling point of ethanol is 78°C and that of Methanol is 65°C. Since the difference in their boiling point is small, these substances can be separated from their mixture by fractional distillation.

Separation using Separating funnel: The components from the mixture of immiscible liquids having difference in densities can be separated using separating funnel.

Example: Mixture of kerosene and water.

Sublimation.

Components like ammonium chloride, iodine etc having the property of sublimation can be separated by this method.

Centrifugation: This is the method of separation of components from a mixture, based on the difference in the mass of the particles. The mixture is taken in a test tube and is rotated fast. Then the particles with higher mass will be separated from the mixture and move away from centre of rotation.

This method is used in clinical laboratories to separate blood cells from blood. It is also used to separate the precipitate obtained during chemical reaction.

Chromatography: Chromatography is the method used to separate more than one solutes dissolved in the same solvent. Examples:For separating components from dyes, separating poisonous substance mixed with blood.

PRACTICE QUESTIONS & ANSWERS

1. Properties of substance in different states are given . Insert them in the table given below.
a. Has definite volume, but do not have permanent shape. b. Has permanent shape and definite volume.
c. The particles remains far away from one another. d. Attraction between the particles is very high.
e. Highest diffusion rate. f. No diffusion.

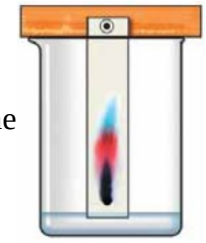
Solid	Liquid	Gas

Ans.

Solid	Liquid	Gas
Has permanent shape and definite volume.	Has definite volume, but no permanent shape.	The particles remains far away from one another.
Attraction between the particles is very high.		Highest diffusion rate.
No diffusion.		

2. Fill in the blanks.
a. When a gas is converted to liquid state, the energy of the particles ..... (increases/decreases)
b. When a substance is cooled down, mobility of the particles ..... (increases/decreases)
c. The form of energy responsible for change of state is .....
d. When a substance absorbs heat, mobility of the particles ..... …… (increases/decreases)
e. The process of changing a substance into solid state is ..... (condensation/ solidification/ sublimation)
f. Conversion of gas into liquid is called ..... (condensation/liquefaction/vapourisation)
g. When substances undergo vapourisation, the energy and mobility of particles ... . (increases/decreases)
h. Due to sublimation, the distance between the particles ..... (increases/decreases)
I. ..... and ..... are examples for substances having the property of sublimation.
Ans.a. When a gas is converted to liquid state, the energy of the particles decreases
b. When a substance is cooled down, mobility of the particles decreases
c. The form of energy responsible for change of state is heat.
d. When a substance absorbs heat, mobility of the particles increases
e. The process of changing a substance into solid state is solidification.
f. Conversion of gas into liquid is called condensation.
g. When substances undergo vapourisation, the energy and mobility of particles increases
h. Due to sublimation, the distance between the particles increases
I. Camphor and Iodine are examples for substances having the property of sublimation.
3. Complete the second pair according to the relation of the first pair.
a. Solid to liquid: liquefaction; gas to liquid : .....
b. Soda water: mixture; water: .....
c. Separate chaff from paddy: difference in weight; Tea dredge from tea: .....
d. Distillation: difference in boiling point; Centrifugation: .....
Ans.a. Solid to liquid: liquefaction; gas to liquid : Condensation
b. Soda water: mixture; water: Pure substance.
c. Separate chaff from paddy: difference in weight; Tea dredge from tea: difference in size.
d. Distillation: difference in boiling point; Centrifugation: difference in weight.
4. Classify the following substances into pure substances and mixtures.
Ornament gold, water, common salt, sugar, soda water, tea, air, soil.
Ans. Pure substances: water, common salt, sugar. Mixtures: Ornament gold,soda water, tea, air, soil.
5. Condenser is one of the parts of distillation system. What happens to the vapour while it passing through condenser.
Ans. It condenses to form liquid.

6. The picture of a device used to separate the components from a mixtures is given.
a. Identify the device.
b. What must be the features of the components which can be separated by this device.
c. Give an example for such a mixture.
Ans.a. Separating funnel.
b. The components must be immiscible and should have difference in density.
c. Mixture of water and kerosene.
7. The method of separation of components from a mixture is selected on the basis of the features of the components.
a. In what kind of mixtures distillation can be adopted?
b. Give an example for a mixture that can be separated through fractional distillation.
c. Name the device that can be used to separate kerosene and water from their mixture.
d. Name the method suitable for the separation of water and acetone from their mixture.
e. Suggest a suitable method for separating ammonium chloride from sand.
Ans.a. Having difference in volatility of the components. Or large difference in boiling point.
b. Mixture of Ethanol and Methanol.
c. Separating funnel.
d. Distillation.
e. Sublimation.
8. It is by centrifugation ghee is separated from curd.
a.What feature of the components is utilised in centrifugation?
b. Give one more example where centrifugation is made in use of.
Ans.a. Difference in weight.
b. For separating blood cells from blood.



9. It is given the picture of an arrangement of separation of various solute present in the same solvent.
a. What is known as this process?
b. Give two situations where this method is used.
Ans.a. Chromatography.
b. i.To separate the poisonous substance mixed with blood. ii. For separating components from dyes.
10. It is given the names of a few mixtures. Suggest suitable methods for separating the components from each one. Also specify the reason for selecting the method.
a. Petrol and diesel b. Iron powder and sand. c. Saline water. d. Camphor and sand.
e. Common salt and ammonium chloride.
Ans.a. Petrol and diesel – Fractional distillation – Small difference in boiling point.
b. Iron powder and sand. - Magnetic separation – Ion is a magnetic substance but sand is non magnetic.
c. Saline water – Distillation – Water is volatile substance but sand is non volatile.
d. Camphor and sand – Sublimation – Camphor has the property of sublimation.
e. Common salt and ammonium chloride – Sublimation – Ammonium chloride has the property of sublimation.
11. Identify the phenomenon in the following situations.
a. When ice pieces are put into a steal glass, water droplets are formed on the outer surface of glass.
b. Petrol is disappeared from an open bottle. c. Water kept in the freezer becomes ice.
Ans.a. Condensation. b. Vapourisation. c. Solidification.
12. Water which is purified by removing minerals from it is used for injection.
a. What is known as this water? b. Identify the method used for this purification?
Ans.a. Distilled water. b. Distillation.
13. Rate of diffusion is different in solids , liquids and gases.
a. Of them which is the state in which diffusion rate is maximum? Why?
b. What is the relation between temperature and diffusion rate?
Ans.a. As the freedom of movement of the particles in gas is very high, rate of diffusion is maximum in gases.
b. When temperature increases, the rate of diffusion also increases.