Chapter - 2

Is Matter Around Us Pure ?

CONCEPT MAPPING

Matter

Pure Substances

Elements
- Represented by Symbols
- Cannot be broken into Simpler Substances.
- eg. Copper, Sodium, Silver, Oxygen, Hydrogen etc.

Compounds
- Have fixed Composition.
- Can be broken down into its constituents by chemical reactions or electrochemical reactions
- eg: Water, Salt, Sugar etc.

Impure Substances (Mixtures)

Homogeneous
- True Solutions
- Uniform Composition
- eg. Suger & water, & alcohol

Heterogeneous
- Colloidal Solution & Suspension
- Non-uniform Composition
- eg. Sand & Sugar, water & oil, milk.

Solution

(Solute + solvent)
- Unsaturated
- Saturated
- Super Saturated

Methods of Separation
- Evaporation
- Centrifugation
- By Separating funnel
- Sublimation
- Chromatography
- Distillation
- Crystallisation
- Filtration
- Magnetic Separation
- Winnowing
- Threshing

RECALL

Elements

Metals
- Malleable
- Ductile
- Good Conductor of Heat & Electricity
- eg. Copper, Silver, Gold, Sodium

Metalloid's
- Show some of The properties of metals and some of non-metals.
- eg. Silicon, Germanium

Non-metals
- Non-malleable
- Non-ductile
- Bad conductor of Heat & Electricity
- eg. Oxygen, Hydrogen, Nitrogen, Sulphur etc.

Dt.:
Pg.:
Delta

IS MATTER AROUND US PURE?

'Pure' word means that there is no mixing in a substance. But according to scientific language all things are mixture of so many substances, not of single one. That is why they are not Pure.

- Pure substances means that all elements have same chemical Properties.
- A pure substance is made up of same Kind of elements.

■ **Substance:** A substance is a Kind of matter that cannot be separated into other Kind of matter by any Physical Properties.

■ **What is a mixture?**

It is a substance in which two or more substances are simply mixed together in any Proportion.

Example: Air is a mixture of oxygen, nitrogen, CO_2 and water vapour.

■ **Types of Mixture**
- (i) Homogenous mixture
- (ii) Heterogenous Mixture

Dt:
Pg:

- **Homogenous Mixture:** A mixture in which the composition is uniform is called homogeneous mixture.
  { Simple words में ऐसा Mixture जो पूरी तरह से dissolved घुल चुका है }

Example: Sugar in water. It has uniform composition.

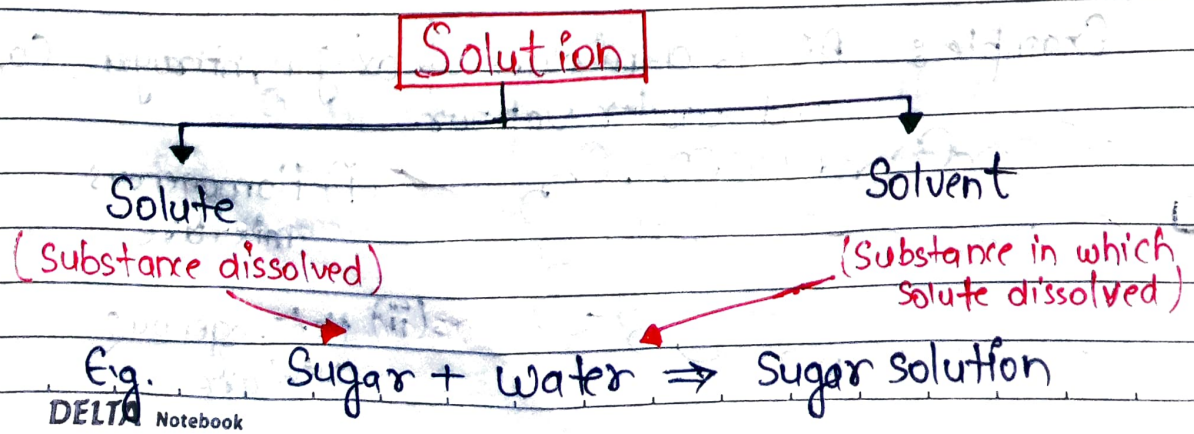
- **Heterogenous mixture:** A heterogeneous mixture is a mixture in which the composition is not uniform throughout the mixture. It consist of two phases.

Example: Mixture of oil & water, they do not mix thoroughly, but instead form two separate layers.

What is Solution?

A solution is a homogeneous mixture of two or more substances.

E.g. Nimbu pani, soda water etc.



Types of Mixtures

True	Colloidal	Suspension
1. Size of solute particles smallest. $< 10^{-9}$m.	1. Size of solute particles bigger than true but smaller than suspension. In between 10^{-9} to 10^{-6} m.	1. Size of particles biggest. $> 10^{-6}$ m.
2. Solute particles can't be seen with naked eye.	2. Solute particles can't be seen with Naked eye.	2. Can be seen with naked eye.
3. Homogenous mixture.	3. Seems homogenous but actually heterogenous mixture.	3. Heterogenous mixture.
4. Particles can't be separated by filteration.	4. Particles can't be separated by filteratoin.	4. Can be Separated by filteration.
5. Transparent	5. Translucent	5. Opaque
6. Stable solutoins - i.e., solute particles do not settle on keeping.	6. Stable solutions.	6. Unstable solution – solute particles settle upon keeping.
7. Do not show tyndall effect.	7. Show tyndall effect.	7. May or may not show tyndall effect.
8. Solution diffuse rapidly through filter paper as well as parchment paper.	8. Colloid particles pass through filter paper but not through parchment paper.	8. Suspension particles do not pass through filter paper as well as parchment paper.
9. e.g., Sugar in water.	9. e.g., Milk, blood.	9. e.g., Sand/mud in water.

Common examples of colloids :

	Dispersal Phase (Solute)	Dispersion Medium (Solvent)	Type	Example
1.	Liquid	Gas	Aerosol	Fog, cloud
2.	Solid	Gas	Aerosol	Smoke

3	Gas	Liquid	Foam	Shaving Cream
4.	Liquid	Liquid	Emulsion	Milk, face cream, emulsion paint
5.	Solid	Liquid	Sol	Mud, digene
6.	Gas	Solid	Foam	Foam, rubber sponge
7.	Liquid	Solid	Gel	Jelly, cheese
8.	Solid	Solid	Solid sol	Coloured gemstones, glass (milky, coloured)

- *Gas in gas is not a colloidal solution – it is called a mixture.*

- **Concentration of Solution**

(1.) Mass by Mass percentage = $\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$

(2.) Mass by Volume percentage = $\frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$

METHOD OF SEPARATION

(1) **Evaporation**: Out of the two components of a mixture one can evaporate [i.e. has less boiling point] and other has higher boiling point.

Example: Mixture of dye and water. out of water and dye, water evaporates but dye is left behind as dye has higher boiling point.

(2.) **Centrifugation**: Separation of particles/substance on the basis of their density when mixture is rotated very fast, then denser particles are forced at the bottom and lighter particles stay above.

Example: Separating cream from milk

■ Applications :

(a) used in diagnostic labs for blood and urine tests.
(b) used in dairies and home to separate butter from cream.
(c) used in washing machines dryers to squeeze out water from clothes.

(3) Separating funnel : Two immiscible liquids (which do not dissolve in each other) can be easily separated by putting in a separating funnel.

■ Applications :
(a) Seperation of oil from water.
(b) Extraction of iron from its ore. Lighter slag is removed from above the molten iron.

(4) Sublimation :

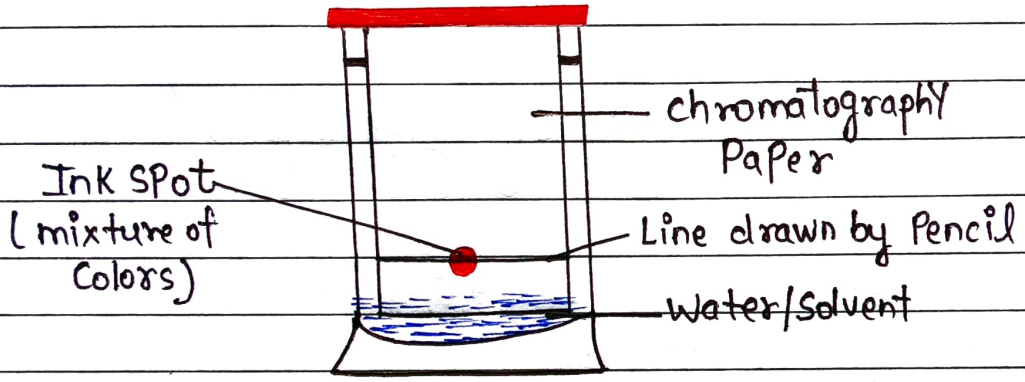
Out of the two Components, one will sublime (directly converts to gas from solid) and other will not.

Example : NH_4Cl (ammonium chloride) and NaCl (salt) mixture can be easily separated by heating so that NH_4Cl sublimes but Common salt remains behind.

■ APPlications :
(a) Camphor, napthalene, anthracene can sublime.

(5) Chromatography :

→ Basic Principle : Coloured components of a mixture can be separated by using an Adsorbent on which they are adsorbed at different areas.



When water/any suitable solvent moves up, the chromato-graphy paper ink with two different colours separates because both colours are absorbed at different speeds.

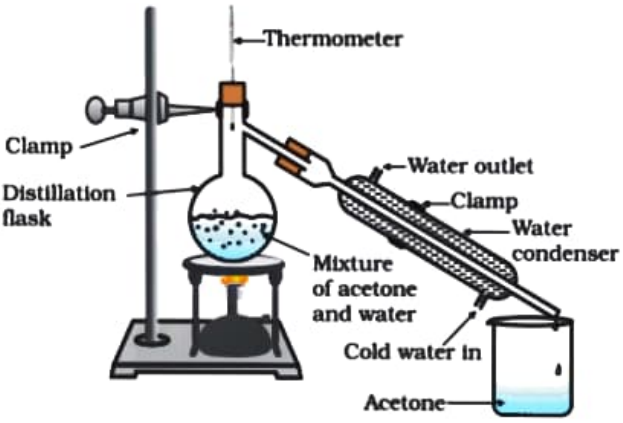
■ Applications :

(a) To separate colours of a dye.
(b) To separate pigments from natural colours like chlorophyll.
(c) To separate drugs from blood.

(Can you guess what is done when athletes undergo a doping test for their blood?)

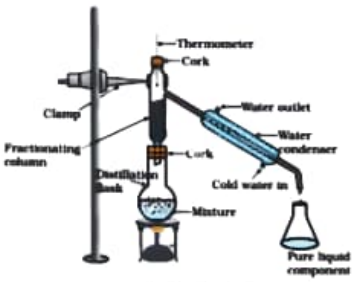
(6) Distillation :

Basic principle : Based on Separating mixture of miscible liquids have different boiling points, followed by condensation. Out of the two components one has a lower boiling point and other has higher boiling point. This is used to separate two or more miscible liquids.



Example : When mixture of acetone and water is heated, acetone having lesser boiling point, boils and moves to delivery tube, within which it condenses back to liquid with the help of a condenser clamped to it. Thus, acetone is separated out in a beaker and water is left in the distillation flask.

Note : If there are more than two components (liquids) mixed (with different boiling points) then we use a fractionating column to separate all the components from each other. This process is done for air, petroleum etc.



Petroleum is separated into paraffin wax, lubricating oil, diesel, kerosene, petrol and petrol gas by this method.

Fractional Distillation of Air :

Air is also separated by this method.

Air —(*compressed and cooled*)→ Liquid air → Allowed to warm up slowly in a fractionating column → Gases separated at different heights

Some of the applications of fractional distillation :

(a) In petroleum refineries, petrochemical and chemical plants, natural gas processing and cryogenic air separation plants.

(b) In oil refineries to separate crude oil into useful substances (or fractions).

(c) In the process of organic juice.

(d) In the separation of oxygen, liquid nitrogen and argon from air.

(d) In the separation of oxygen, liquid nitrogen and argon from air.

(7) Crystallisation :

Basic principle : To remove impurities from a mixture by first dissolving in a suitable solvent and then crystallising out one component.

For example : Copper sulphate crystals (impure) are first dissolved in sulphuric acid and then heated to saturated solution. Now, this solution is left overnight. So, only pure copper sulphate crystals on filter paper.

Why is crystallisation better than evaporation ?

(i) Some solids decompose or get charred upon heating to dryness during evaporation. E.g., sugar.

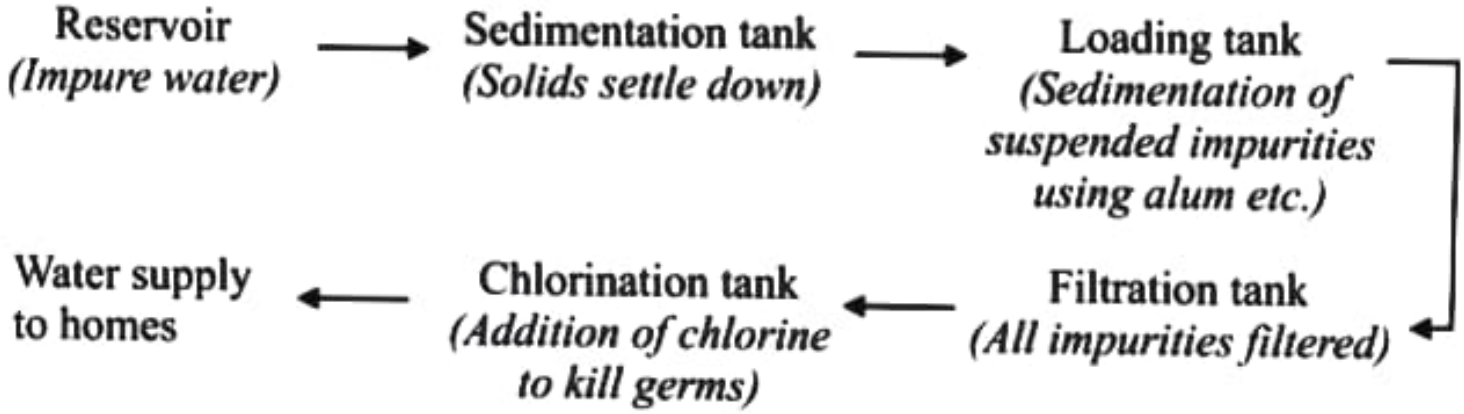
(ii) Some impurities remain dissolved in solution after filteration. On evaporation, these impurities do not evaporate and remain with the mixture.

Applications :

(a) Purification of salt from sea water.

(b) Separation of crystals [e.g., alum (phitkari), copper sulphate] from their impure crystals.

Water purification in water treatment plants



Physical Vs Chemical Changes

Chemical	Physical
• Not easily revered • New Product(s) formed • Reactants used up • Often heat/light/sound/ fizzing occurs • Electricity may be produced • A precipitate may form • E.g., Wood burning	• Easily reversible • No new products • Often just a state change • E.g., ice melting

Elements

Made of same type of atoms

S.No.	Metals	Non-metals	Metalloids
1.	Lustrous	Non-lustrous	Metallaoids have intermediate properties between metals and non-metals.
2.	Malleable, ductile	Non-malleable, non-ductile	E.g., Boron, Germanium, Silicon
3.	Sonorous	Non-sonorous	
4.	Good conductors of heat & electricity	Bad conductors	
5.	E.g., Gold, iron etc.	E.g., Oxygen, Phosphorus	

Mixture	Compound
1. Elements or compounds are simply mixed so no new substance is formed.	1. Substances are reacted together with each other to make a new substance.
2. Elements do not combine in a fixed ratio.	2. Composition of the components is fixed i.e., they combine together in a fixed radio according to their masses.
3. A mixture shows the properties of its components.	3. Compound doesn't show the properties of component elements.
4. Components can be easily separated by any mechanical method which is suitable.	4. Components can't be separated from each other by simple mechanical methods.
5. E.g., Mixture of iron and sulphur.	5. E.g., Iron and sulphur react to from iron sulphide.

QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. Classify the following into homogenous and heterogenous mixtures :
   (a) Ice (b) Soil
   (c) Wood (d) Air
2. Name the type of mixture formed by mixing sulphur and carbon disulphide.
3. Justify the statement that: 'Rusting of iron is corrosion and it is a chemical change".
4. Name the processes used for separatoin :
   (a) Miscible liquids
   (b) Immiscible liquids
   (c) Butter from milk
   (d) Sand from water-sand mix
   (e) Separation of colours in dyes.
   (f) Camphor from camphor, sand and salt
   (g) Alcohol from aqueous alcohol.
5. Name the apparatus by which mixture of oil and water can be separated.
6. A hard substance produces a tinkling sound when beaten. Is it metal or a non metal?
7. What type of solution is an alloy?
8. Classify the following as physical change or chemical change.
   (a) Burning of magnesium ribbon in air
   (b) Burning of sulphur in air
   (c) Electrolysis of water.
9. Which component of the mixture (Iron & sulphur) reacts with dil Hcl and gives Hydrogen gas?
10. Crystallization is a better technique than simple evaporation. Give one reason to justify the statement.

SHORT ANSWER TYPE QUESTIONS

1. What is meant by concentration of a solution?
2. List the two conditions essential for using distillation as a method for separation of the components from a mixture.
3. Smoke and fog both are aerosols. In what ways are they different?
4. Salt can be recovered from its solution by evaporation can you suggest any other method also?
5. Can we separate alcohol dissolved in water by using a separating funnel?

   If yes, then describe the procedure. If not, explain.
6. Crystallization is a better method or technique than separation for separating substances from a mixture. Give one reason to justify the statement.
7. A solution is prepared by adding 40 gm of sugar in 100 gm of water. Calculate the concentration is terms of mass by mass percentage of solution.
8. What is chromatography? Mention its two applications.
9. Write down the processes in sequential order involved in to get the supply of drinking water to your home form the water works (Flow-chart).
10. How many litres of 15% (m/v) sugar solution would it take to get 75 gm of sugar ?

    [Hint : 15% of (75+x) = 75]

LONG ANSWER TYPE QUESTIONS

1. Why the interconversion of states of matter in considered as a physical change? Give three reasons to justify your answer.
2. During an experiment the students were asked to prepare a 20% (mass/mass) solution of sugar in water. Ram dissolved 20 gm of sugar in 100 gm of water while Sohan prepared it by dissolving 20 gm of sugar in water to make 100 gm of solution.

   (a) Are the two solutions of the same concentration.

   (b) Compare the mass% of the two solutions.

   (c) Whose solution contain less amount of solute.
3. When a fine beam of light enters a room through a small hole, Tyndall effect is observed, Explain, why does this happen ? Give one more example where this effect can be observed.

4. With the help of flow diagram, sow te process of obtaining or separating different gases from air. If the boiling points of Oxygen, argon and nitrogen are –183°C, –186°C and –196°C respectively which gas gets liquified first as the air is cooled?

5. You are provided with a mixture containing sand, iron fillings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents form the mixture.

6. Sometimes the solid particles in a liquid are so small and pass through filter paper : Suggest a technique which is used to separate solid from liquid. What is the principal of this method? Explain the process with an example.

OBJECTIVE TYPE QUESTIONS :

1. Complete the sentence by choosing the correct words given in the bracket:

   a. Pure substances are ..... and have the same ..... throughout.

   b. Mixture of sulphur and carbon disulphide is. ..... and does not show ..... (homogenous, heterogeneous, Tyndall effect.

   c. Tincture of iodine has antiseptic properties. This solution is mad by dissolving ..... in ..... (potassium iodide, iodine, water, alcohol)

2. Which of the following are homogeneous in nature ?

   (i) ice. (ii) wood. (iii) soil (iv) air

   (a). (i) and (iii) (b). (ii) and (iv)

   (c). (i) and (iv) (d) (iii) and iv)

3. Which of the following are physical changes ?

   (i) Melting of iron metal. (ii) Rusting of iron

   (iii) Bending of an iron rod. (iv) Drawing a wire of iron metal

   a. (i), (ii) and (iii),

   b. (i), (ii) and (iv)

   c. (i), (ii) and (iv)

   d. (ii), (iii) and (iv)

4. Which of the following are chemical changes ?

   (i) Decaying of wood. (ii) Burning of wood

   (iii) Sawing of wood. (iv) Hammering of a nail into a piece of wood

6. Name the process associated with the following:

   a. Dry ice is kept at room temperature and at one atmospheric pressure.

   b. A drop of ink placed on the surface of water contained in a glass spreads throughout the water.

   c. A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring.

   d. A acetone bottle is left open and the bottle becomes empty.

   e. Settling of sand when a mixture of sand and water is left undisturbed for some time.

   f. Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths.

7. Give an example each for the mixture having the following characterstics. Suggest a suitable method to separate the components of these mixtures

   a. A volatile and a non-volatile component .....

   b. Two volatile components with appreciable difference in boiling points.....

   c. Two immiscible liquids .....

   d. One of the components changes directly from solid to gaseous state .....

   e. Two or more coloured constituents soluble in some solvent .....

8. Which of the following are not compounds ?

   a. Chlorine gas

   b. Potassium chloride

   c. Iron.

   d. Iron sulphide

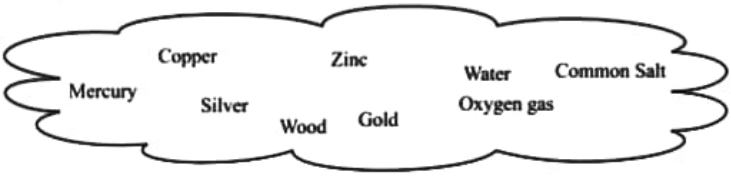
   e. Aluminum

   f. Iodine

   g. Carbon

   h. Carbon monoxide

9. Classify the substances given in the cloud into elements and compounds :



   Elements :

   Compounds :

10. Sugar crystals obtained from sugarcane and beetroot are mixed together. Will it be pure substance or a mixture ? Yes or No