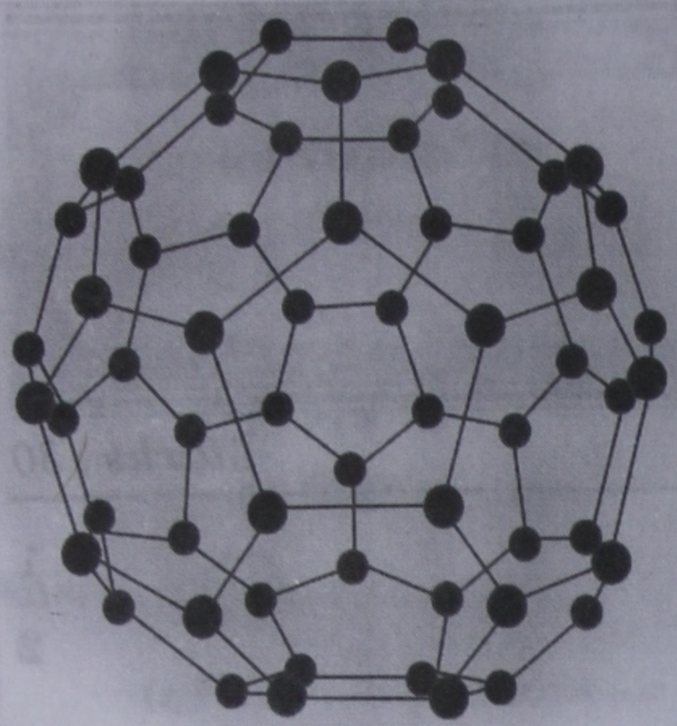


3 ELEMENTS, COMPOUNDS AND MIXTURES

SCOPE OF SYLLABUS

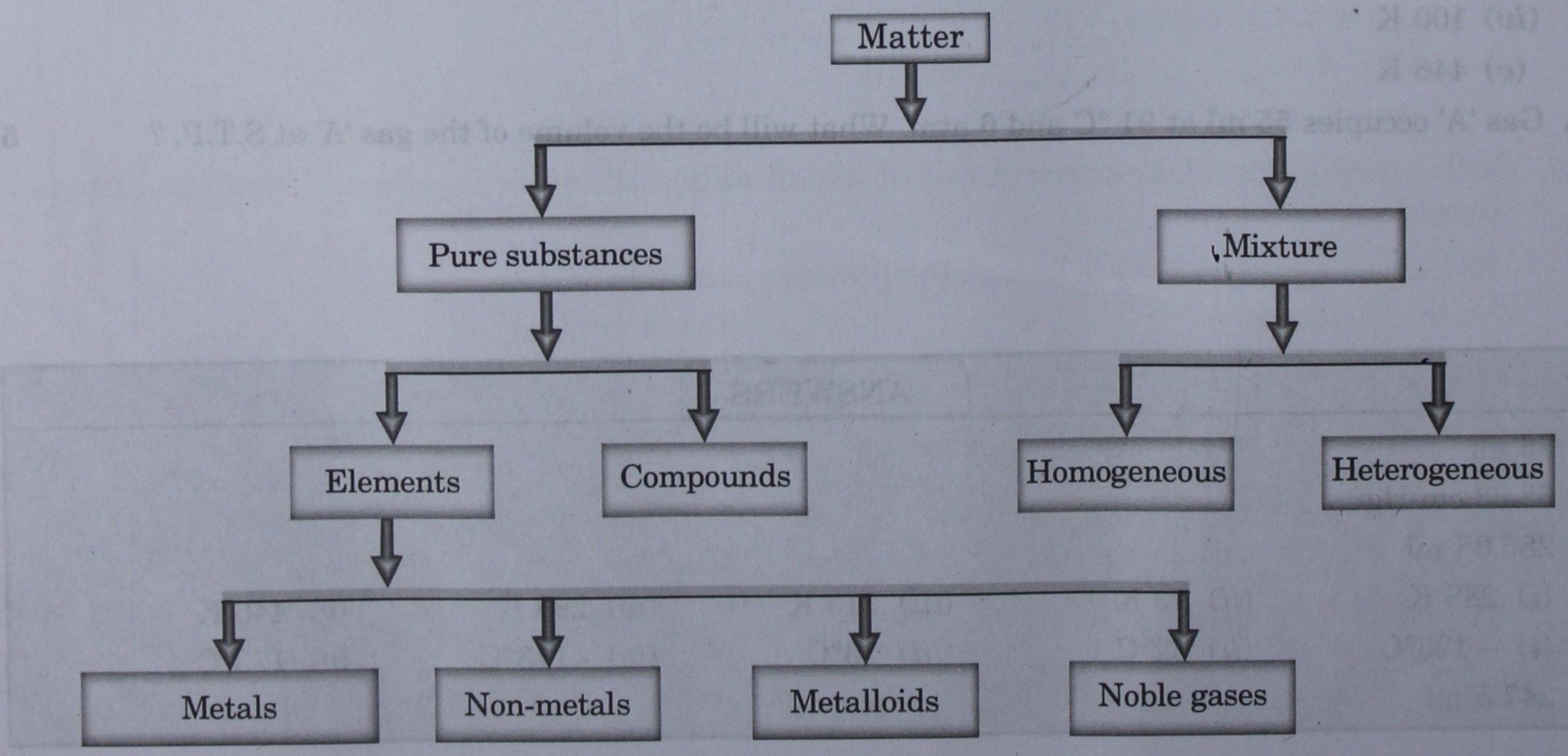
(*i*) ***General characteristics and differences between elements, compounds and mixtures.***
Reasons for considering a substance as an element, compound or mixture may be given to make the concepts clear.

(*ii*) ***Types of mixtures : of two solids, a solid and a liquid, two liquids, liquid and gas, two gases.***
Definition of mixture; each type of mixture should be shown to the students (including both homogeneous and heterogeneous types) – true solution, suspension and colloidal solution to make the concepts clear.

(*iii*) ***Separation of mixtures involving - use of a solvent, filtration, evaporation and distillation, fractional distillation, simple paper chromatography, centrifugation, immiscible liquid.***
The following examples should be used to illustrate the principles of separation of mixtures by using following methods.
(*a*) Use of solvent and filtration (*e.g.*, sodium chloride + sand (water as solvent), carbon and sulphur (carbon tetrachloride as solvent).
(*b*) Evaporation *e.g.*, sodium chloride from its aqueous solution.
(*c*) Distillation *e.g.*, purification of water containing dissolved solids.
(*d*) Fractional distillation involves the difference in boiling points of liquids *e.g.*, benzene + toluene.
(*e*) Simple paper chromatography (limited to separation of colouring matter in ink).
(*f*) Centrifugation (involving separation of cream from milk).
(*g*) Immiscible liquids (separating funnel *e.g.*, water + carbon tetrachloride).

IMPORTANT POINTS TO REMEMBER

1. **Matter** can be easily **classified** as



2. **Pure substances** are one which contains **particles of only one kind**. **Pure substances** have a **definite set of properties**.
3. **Pure substances** which are made up of **particles or atoms of only one kind** are called **elements**. The elements **cannot be made** or **broken down** into **simpler substances** by any **physical** or **chemical** means.
4. These **elements** are **placed** in the **increasing order** of their **atomic number** in **periodic table**. There are **116** elements **discovered**.
5. **Elements** are **classified** as
   (*i*) Metals (*ii*) Non-metals
   (*iii*) Metalloids (*iv*) Inert gases or Noble gases.
6. The **differences** between **metals** and **non-metals** are :

Metals	*Non-metals*
(*i*) Metals are solids except **Mercury** which exists in **liquid state** at room temperature. **Gallium** and **Caesium** exist in **liquid state** at 30° C.	(*i*) Non-metals are usually gases sometimes solids like **Carbon**, **Sulphur** and **Phosphorus**. **Bromine** is a **liquid** non-metal.
(*ii*) Metals are **sonorous**.	(*ii*) Non-metals are **non-sonorous**.
(*iii*) Metals are **lustrous**.	(*iii*) Non-metals are **non-lustrous**. Except **Carbon (Graphite)** and **Iodine**.
(*iv*) Metals are **ductile**. The property of metals by which they can be drawn into wires is called **ductility**.	(*iv*) Non-metals are **non-ductile**.
(*v*) Metals are **malleable**. The property of metals by which they can be beaten into sheets is called **malleability**.	(*v*) Non-metals are **non-malleable**.
(*vi*) Metals have **high density**.	(*vi*) Non-metals have **low density**.
(*vii*) Metals have **high** melting point and boiling point.	(*vii*) Non-metals have **low** melting point and boiling point.
(*viii*) Metals are **monoatomic**. The number of atoms present per molecule of an element is called as **atomicity**.	(*viii*) Non-metals are **diatomic** (H_2, N_2, O_2). They may be **polyatomic** like Ozone — O_3, Phosphorus — P_4, Sulphur — S_8
(*ix*) Metals are **good conductors** of heat and electricity.	(*ix*) Non-metals are **poor conductors** of heat and electricity except **Carbon (Graphite)** and **Carbon (Gas carbon)**.
(*x*) Metals form **basic oxides** and few **amphoteric oxides**.	(*x*) Non-metals form **acidic oxides** and few **neutral oxides**.

7. The elements having certain properties of **metals** and **non-metals** are called **metalloids**. For example, **Arsenic**, **Germanium**, **Antimony**, **Bismuth**.
8. The elements having **eight electrons** in their outermost shell or valence shell are called **inert gases** or **noble gases**. **Except helium**, all the inert gases have eight electrons in their valence shell.
   He — Helium complete duplet *i.e.*, two electrons in valence shell.
   Ne — Neon
   Ar — Argon
   Kr — Krypton
   Xe — Xenon
   Rn — Radon.
9. **Compounds** are the pure substances in which **two** or **more elements** combined **chemically** in **fixed proportion** by weight.

10. Characteristics of Compounds are :

(*i*) Compounds are **homogeneous**.

(*ii*) In compounds, two or more elements **combined chemically** in **fixed proportion** by weight.

(*iii*) The **different constituents** of **compounds cannot** be separated by **simple physical means**. They **can** only be **separated** by **chemical means**, for example electrolysis of water.

$$2H_2O \xrightarrow{\text{electrolysis}} 2H_2 + O_2$$

Water breaks down to give **hydrogen** and **oxygen** on passing **electric current** whereas **water cannot** be separated into **hydrogen** and **oxygen** by simple **physical means** like **filtration, distillation**, etc.

(*iv*) The **constituents** of **compounds loose** their **identical properties**. For example, **water** is a compound of **hydrogen** and **oxygen**. **Hydrogen** is a **combustible gas** whereas **oxygen** is a **supporter of combustion** whereas **water** is a **colourless liquid** which is **neither combustible nor** it is a **supporter of combustion**.

(*v*) Formation of compounds involves **energy changes**, *i.e.*, the **energy** is either **released** or **absorbed**, *i.e.*, either the reaction is **exothermic** or **endothermic** in nature.

11. When **two** or **more elements** or **compounds** combine **physically** in **any proportion** by weight **mixtures are formed**.

12. Mixture may be **homogeneous** or **heterogeneous** in nature.

13. The **mixture** having the **same composition** and **same property** in **its every part** is called **homogeneous mixture**.

14. The **mixture** having **different properties** and **different compositions** in **different parts** is called **heterogeneous mixture**.

15. Characteristics of Mixtures are :

(*i*) In **mixture** the **different constituents** combine **physically** in **any proportion** by weight.

(*ii*) During the **formation** of **mixture no energy changes** take place.

(*iii*) The **constituents** of **mixture do not loose their identical property**. For example, in a **mixture** of **iron** and **sulphur**, **iron** gets **attracted** by the **magnet** and **sulphur dissolves** in **carbon disulphide**.

(*iv*) The **different constituents** of mixture **can be easily separated** by **simple physical means** like **distillation, filtration**, etc.

(*v*) **Mixture** may be **homogeneous** or **heterogeneous** in nature.

16. The **comparative study** of **compounds** and **mixtures** are as follows by taking the **example** of **mixture of iron and sulphur** and the **compound of iron and sulphur, *i.e.*, iron (II) sulphide.**

Mixture of Iron and Sulphur	*Iron (II) sulphide*
(*i*) The mixture is **heterogeneous** in nature and the **two constituents** are **easily visible** in the form of **yellow** and **grey particles**.	(*i*) The compound is **homogeneous** in nature and the **two elements cannot be differentiated.**
(*ii*) When a **magnet** is rolled over the mixture the **grey coloured iron particles cling to the magnet**. This shows that the constituents of mixture **can be easily separated by simple physical means** and the constituents of mixture **retain their identical properties.**	(*ii*) When a **magnet** is brought near the compound of iron and sulphur, **none of the iron filings stick to the magnet**. This shows that the constituents of compounds **cannot be separated by simple physical means** and the constituents in compounds **loose their identical properties.**
(*iii*) When **carbon disulphide** is added to mixture, **yellow sulphur particles dissolve leaving behind grey coloured iron particles.**	(*iii*) When **carbon disulphide** is added to the compound, **the greyish black solid remains unaffected**.

(*iv*) On adding **dilute hydrochloric acid** to the mixture of iron and sulphur **a colourless** and **odourless gas** evolves which **burns** with **popping sound** as **iron** reacts with **dilute hydrochloric acid** to liberate **hydrogen.** $Fe + [S] + 2HCl \xrightarrow[\text{dil.}]{} FeCl_2 + H_2\uparrow + \underset{\text{unreacted}}{[S]}$ This shows that **all the constituents of mixture do not take part in a single chemical reaction.**	(*iv*) On adding **dilute hydrochloric acid** to the compound of iron and sulphur, *i.e.*, iron (II) sulphide, **a colourless gas** having **rotten egg smell** evolves which turns **lead acetate solution black.** $FeS + 2HCl \xrightarrow[\text{dil.}]{} FeCl_2 + H_2S\uparrow$ $(CH_3COO)_2Pb + H_2S \longrightarrow \underset{\text{black ppt.}}{PbS\downarrow} + 2CH_3COOH$ **This shows that all the constituents of compound undergo chemical reaction.**

17. The **differences** between **compound** and **mixture** can be summarized as :

Compound	*Mixture*
(*i*) When **two** or **more elements** combine **chemically** in **fixed proportion** by weight, compound is formed. (*ii*) **Compounds** are always **homogeneous.** (*iii*) The **constituents** of **compound loose** their **identical properties.** (*iv*) The **constituents** of **compounds cannot be separated** by simple **physical means.** (*v*) **Energy changes take place** during the formation of a compound.	(*i*) When **two** or **more elements** or **compounds** combine **physically** in **any proportion** by weight, mixture is formed. (*ii*) **Mixture** may be **homogeneous** or **heterogeneous.** (*iii*) The **constituents** of **mixture retain** their **identical properties.** (*iv*) The **constituents** of the **mixtures can be** easily **separated** by simple **physical means.** (*v*) **No energy changes take place** during the formation of mixture.

18. The **homogeneous mixture** of **solute** and **solvent** is called as **solution.**

19. **Solids, liquids** and **gases** can be **mixed together** in **different proportions** to get the **mixtures.** The mixtures formed may be either **homogeneous** or **heterogeneous.** Depending upon the **physical property of mixture**, they can be **classified** as follows :

Constituents of mixture	*Nature of mixture*	*Examples*
(*i*) Solid-Solid	Homogeneous	Alloys
(*ii*) Solid-Solid	Heterogeneous	Iron and Sulphur Sand and Sugar.
(*iii*) Solid-Liquid	Homogeneous	Sugar in Water Salt in Water.
(*iv*) Solid-Liquid	Heterogeneous	Sand in Water Sulphur in Water.
(*v*) Liquid-Liquid	Homogeneous	Ethyl alcohol and Water Milk in Water.
(*vi*) Liquid-Liquid	Heterogeneous	Oil in Water Benzene in Water.
(*vii*) Liquid-Gas	Homogeneous	Hydrogen chloride gas in Water Ammonia in Water
(*viii*) Gas-Gas	Homogeneous	Air
(*ix*) Gas-Solid	Heterogeneous	Smoke.

20. A **system** consisting of **a substance** distributed as **very small particles** of **solid**, **droplets** of **liquid** or **tiny bubbles** of **gas** in a **suitable medium** is called **dispersion system**.

21. The **distributed substance** is called **dispersed phase**.

22. The **medium** in which the **dispersed phase** is **distributed** is called **dispersion medium**.

23. On the **basis** of the **size of particles**, the **dispersion system** can be **classified as**

(*i*) True solution

(*ii*) Colloidal solution

(*iii*) Suspension.

24. **True solution** is **homogeneous system** and the **particle size** is **less than 1 nm** *i.e.*, **10^{-9} m**. These particles are **invisible** and **cannot** be **seen even with the microscope**. Due to their **very small size** of the **dispersed phase**, true solutions **can pass** through **ordinary filter paper** as well as through the **animal** membrane. The particles **do not settle down** under the influence of gravity.

For example : Common salt, sugar, urea form true solution in water.

25. **Colloidal solution** is **heterogeneous system** and the **particle size** is lying **between 1 nm – 100 nm (10^{-9} m – 10^{-7} m)**. Although the **particles** of **colloidal solution** are **larger than** that of **true solution**, yet they are **not large enough** to be seen with the **naked eye**. However, they **can be seen** with the help of **ultramicroscope**. Colloidal solutions **can easily pass** through **ordinary filter paper** but **not** through the **animal membrane**. The particles **do not settle** but **settle** by **centrifugation**.

26. **Suspension** is also **heterogeneous system** and the **particle size** is **more than 100 nm ($>10^{-7}$ m)**. These particles are **visible** to the **naked eyes**. The particles of suspension **neither pass** through **ordinary filter paper nor to animal membrane**. The particles **easily settle down**.

Important Characteristics of True solutions, Colloidal solutions and Suspension

Property	*True solutions*	*Colloidal solutions*	*Suspension*
(*i*) Particle size	Less than 1nm (10^{-9} m)	Between 1 nm – 100 nm (10^{-9} m – 10^{-7} m)	Greater than 100 nm ($>10^{-7}$ m)
(*ii*) Nature	Homogeneous.	Heterogeneous.	Heterogeneous.
(*iii*) Visibility of particles	Invisible.	Visible under ultramicroscope.	Visible through naked eyes.
(*iv*) Filtrability	Can easily pass through ordinary filter paper and animal membrane.	Can easily pass through ordinary filter paper but not through animal membrane.	Cannot pass through ordinary filter paper as well as animal membrane.
(*v*) Settling of particles under the influence of gravity	Do not settle.	Do not settle but they can be made to settle under high speed by centrifugation.	Settle down.
(*vi*) Scattering of light	Do not scatter.	Scatter light (shows Tyndall effect).	Do not scatter.

27. **Separation of solid-solid mixtures by the following named techniques :**

(*i*) **Mechanical separation or handpicking.** This method is used to separate those mixtures which have difference in (*a*) size of the particles (*b*) colour of the particles. So, they can be easily distinguished and picked by hand. For example, stones mixed with rice.

(*ii*) **Magnetic separation.** This method is employed for the separation of mixtures where one of the components is magnetic in nature, *i.e.*, it gets attracted by the magnet like iron, cobalt, steel, etc.

For example, mixture of iron and sulphur.

(*iii*) **Using a suitable solvent.** This method is used for those mixtures in which one of the components is soluble in a particular solvent.

For example,

(*a*) In a mixture of iron and sulphur, sulphur can be separated by dissolving it in carbon disulphide.

(*b*) In a mixture of nitre and charcoal, nitre dissolves in water leaving behind charcoal.

(*c*) The components of gun powder, *i.e.*, nitre, charcoal and sulphur can be easily separated by first adding carbon disulphide which dissolves sulphur and then adding water which dissolves nitre.

(*d*) In a mixture of sodium chloride and sand, water is added. Sodium chloride dissolves in water leaving behind sand.

(*e*) In a mixture of carbon and sulphur, carbon tetrachloride is added. Sulphur dissolves in carbon tetrachloride leaving behind carbon.

The different compounds are recorded, as the insoluble component is left as a residue on the filter paper and the soluble component passes through the funnel as the filtrate. The insoluble component is dried between the folds of filter paper. The filtrate is evaporated slowly by mild heating or when exposed to sunlight. The solvent evaporates leaving behind the soluble compound.

List of Substances and Important Solvents in which they dissolve

Substance	*Solvent*
(*i*) Sulphur	Carbon disulphide
(*ii*) Phosphorus	Carbon disulphide
(*iii*) Grease	Petrol
(*iv*) Paint	Turpentine oil
(*v*) Rust	Oxalic acid
(*vi*) Nail polish	Acetone
(*vii*) Chlorophyll	Methylated spirit
(*viii*) Nitre	Water
(*ix*) Oil	Petrol
(*x*) Iodine	Ethyl alcohol.

(*iv*) **Fractional crystallization.** If both the solids of a mixture are soluble in a common solvent but have different solubilities at a given temperature. This process of separation of two different soluble salts in their solution forms by crystallization is called as fractional crystallization.

For example, mixture of nitre and sodium chloride.

(*v*) **Sublimation.** This method is used for the separation of mixtures, where one component of the mixture sublimes, *i.e.*, it directly gets converted into vapour state without passing through the liquid state. The substances that sublime are ammonium chloride, iodine, dry ice, naphthalene, camphor, benzoic acid, etc.

For example,

(*a*) Mixture of sand and iodine. Iodine sublimes leaving behind sand.

(*b*) Mixture of ammonium chloride and sodium sulphate. Ammonium chloride sublimes leaving behind sodium sulphate.

(*c*) Mixture of benzoic acid and iron filings. Benzoic acid sublimes leaving behind iron filings.

28. Separation of solid-liquid mixtures (Heterogeneous mixtures).

The following techniques are employed for separating solid-liquid heterogeneous mixtures.

(*i*) **Sedimentation and Decantation.** The solid is heavier than liquid and is insoluble in liquid. The settling down of the heavier insoluble particles under the influence of gravity is called as sedimentation. The insoluble solid which settles down under the influence of gravity is called sediment. The clear liquid above the sediment is called the supernatant liquid.

The process of pouring off the clear liquid above the sediment is called decantation.

For example,

(*a*) Mixture of sand and water

(*b*) Mixture of mud and water.

(*ii*) **Filtration.** The solid is lighter and insoluble in liquid. The process of separation of insoluble, lighter solid component of a mixture from its liquid by passing it through the filter paper is called the process of filtration. The insoluble solid component left on the filter paper after the process of filtration is called residue. The clear liquid obtained after the process of filtration is called filtrate.

For example,

Mixture	*Residue*	*Filtrate*
(*i*) Sawdust and water	Sawdust	Water
(*ii*) Lead sulphate and water	Lead sulphate	Water
(*iii*) Barium sulphate and hydrochloric acid	Barium sulphate	Hydrochloric acid

29. Separation of solid-liquid mixtures (Homogeneous mixtures).

The following techniques are employed for separating solid-liquid homogeneous mixtures.

(*i*) **Evaporation.** Evaporation is the process of conversion of liquid into its vapour state at any temperature (below its boiling point) by supplying heat.

By evaporation those mixtures are separated where solid is soluble in liquid and is non-volatile in nature. During evaporation only solute particles are recovered whereas the liquid portion gets escaped. In salt solution, water gets evaporated leaving behind salt.

For example,

Mixture	*Solute*	*Liquid (solvent)*
(*i*) Salt and water	Salt	Water
(*ii*) Sugar and water	Sugar	Water

(*ii*) **Distillation.** The process of simultaneous evaporation and condensation is called distillation. In this process both the solid (solute) as well as the liquid (solvent) components are recovered.

For example,

(*a*) Mixture of salt and water

(*b*) Mixture of sugar and water

(*c*) Distilled water from water.

30. Separation of liquid-liquid mixtures :

The liquid-liquid mixtures are of two types :

(*i*) Miscible liquids : Homogeneous

(*ii*) Immiscible liquids : Heterogeneous.

Miscible liquids are separated by the process of **fractional distillation** on the basis of difference in their boiling points. The liquid having lower boiling point will distil first while with higher boiling point will distil out at last.

For example,

(*i*) Petroleum is a mixture of several hydrocarbons separated by fractional distillation.

(*ii*) Mixture of ethyl alcohol and water.

(*iii*) Mixture of benzene and toluene.

Organic compound	*Boiling Point*	*Fraction to be distiled*
Benzene	80.1°C	first distil
Toluene	110.6°C	left behind

Immiscible liquids are separated by using separating funnel on the basis of the difference in their densities. The heavier liquid settles down whereas the lighter liquid floats.

For example,

(*i*) Mixture of carbon tetrachloride and water.

(*ii*) Mixture of carbon disulphide and water.

Immiscible liquids	*Heavier*	*Lighter*
Carbon tetrachloride + Water	Carbon tetrachloride	Water
Carbon disulphide + Water	Carbon disulphide	Water

31. Separation of liquid-gas mixtures.

The principle behind the separation of liquid-gas mixture is that the solubility of a gas in a liquid decreases with the rise in temperature.

For example,

(*i*) Mixture of carbon dioxide in water.

(*ii*) Mixture of sulphur dioxide in water.

(*iii*) Mixture of dissolved gases in water.

32. Separation of gas-gas mixtures.

The gas-gas mixtures are easily separated by the following methods :

(*i*) Diffusion. The rate of diffusion of the gases is inversely proportional to the square roots of their densities according to the Graham's law of diffusion. The lighter gases undergo fast diffusion as compared to heavier gases. The care should be taken that during diffusion, the gases should not undergo chemical reaction.

For example,

(*a*) Mixture of nitrogen and carbon dioxide.

(*b*) Mixture of hydrogen and carbon dioxide.

(*ii*) Dissolution in a suitable solvent. The gas-gas mixtures can be separated by passing it through suitable solvent in which one of the components dissolves.

For example,

(*a*) Mixture of carbon dioxide and nitrogen. If the mixture is passed through caustic potash solution, carbon dioxide gets absorbed leaving behind nitrogen.

(*b*) Mixture of hydrogen chloride gas and nitrogen. If this mixture is passed through water, hydrogen chloride gas gets dissolved in water leaving behind nitrogen.

(*iii*) By preferential liquefaction. It is the process in which the homogeneous mixture of gases is suddenly allowed to expand, then one of the components gets liquified under high pressure.

For example,

Mixture of ammonia and carbon monoxide. Ammonia liquifies leaving behind carbon monoxide.

33. Chromatography. The process of separation of the different dissolved components of a mixture present in a small quantity by absorbing them on the surface of suitable adsorbent is called chromatography. **Paper chromatography** can be used for the separation of various pigments (colouring matter) of the ink on the basis of process of adsorption.

For example,

(*i*) Separation of colouring matter in ink.

(*ii*) Pigments of flower.

34. Centrifugation. The process of separation of solid from a solid-liquid mixture, where the mixture is homogeneous is called centrifugation.

For example, milk, blood (colloidal solutions), precipitates of salts.

To separate cream from milk :

The liquid is taken in a centrifuge tube, balance this tube by placing the tube of equal weight in a centrifuge machine on its opposite side and the tubes are rotated at a very high speed. As a result, the solid cream settles down leaving behind the milk.

IMPORTANT QUESTIONS

Q1. How will you separate following mixtures ? (Name technique only).

(*i*) Iron and sulphur
(*ii*) Salt and water
(*iii*) Nitre, charcoal and sulphur
(*iv*) Methyl alcohol and ethyl alcohol
(*v*) Benzene and water
(*vi*) Carbon dioxide and hydrogen
(*vii*) Ammonium chloride and sand
(*viii*) Benzoic acid and iron filings
(*ix*) Kerosene oil and water
(*x*) Ammonia and nitrogen
(*xi*) Pigments of leaf
(*xii*) Iodine and common salt
(*xiii*) Iodine and chloroform
(*xiv*) Nitrogen from liquid air
(*xv*) Nitrogen and hydrogen chloride gas.

Ans. (*i*) By using magnet.
(*ii*) By evaporation or distillation.
(*iii*) First dissolving the mixture in water, nitre will dissolve and insoluble charcoal and sulphur are separated by filtration. Nitre can be obtained by the process of crystallization. Charcoal and sulphur are treated with carbon disulphide. Sulphur dissolves and charcoal is separated by filtration. Sulphur is obtained by the evaporation of carbon disulphide.
(*iv*) By fractional distillation.
(*v*) By separating funnel.
(*vi*) By dissolving in suitable solvent.
(*vii*) By sublimation.
(*viii*) By sublimation/magnetic separation.
(*ix*) By separating funnel.
(*x*) By using suitable solvent.
(*xi*) By chromatography.
(*xii*) By sublimation.
(*xiii*) By distillation.
(*xiv*) By fractional distillation.
(*xv*) By dissolving in water.

Q2. Name the following :

(*i*) Metal which exists in liquid state at room temperature.
(*ii*) A non-metal having metallic lustre.
(*iii*) A liquid non-metal.
(*iv*) A non-metal which is good conductor of electricity.
(*v*) The property of metals by which they can be drawn into wires.
(*vi*) The property of metals by which they can be beaten into sheets.
(*vii*) The number of atoms present per molecule of an element.
(*viii*) A diatomic element.
(*ix*) A triatomic element.
(*x*) A tetraatomic element.

Ans. (*i*) Mercury
(*ii*) Carbon (Graphite)
(*iii*) Bromine
(*iv*) Carbon (Graphite, Gas carbon)
(*v*) Ductility
(*vi*) Malleability
(*vii*) Atomicity
(*viii*) Chlorine, hydrogen, oxygen, nitrogen
(*ix*) Ozone
(*x*) Phosphorus.

Q3. Define the following :

(*i*) Element **(*ii*) Pure substance**
(*iii*) Compound **(*iv*) Residue**
(*v*) Filtrate **(*vi*) Distillate**
(*vii*) Sublimation **(*viii*) Distillation**
(*ix*) Adsorption **(*x*) Sedimentation.**

Ans. (*i*) **Element.** It is the pure substance which is made up of atoms of only one kind.
(*ii*) **Pure substance.** A homogeneous material which is made up of particles of only one kind is called pure substance.
(*iii*) **Compound.** Compounds are the pure substances in which two or more elements combine chemically in fixed proportion by weight.
(*iv*) **Residue.** An insoluble component left behind after the process of filtration is called residue.
(*v*) **Filtrate.** The clear liquid obtained after the process of filtration is called filtrate.
(*vi*) **Distillate.** The liquid component recovered after the process of distillation is called distillate.

(*vii*) **Sublimation.** The process in which solids on heating or without heating directly get converted into their vapour state without passing through the liquid state is called sublimation.

(*viii*) **Distillation.** The process of simultaneous evaporation and condensation is called distillation.

(*ix*) **Adsorption.** It is a surface phenomenon in which the absorption takes place only on the surface.

(*x*) **Sedimentation.** The process of settling down of heavy insoluble particles under the influence of gravity is called sedimentation.

Q4. What do you observe when

(*i*) Iodine crystals are heated ?

(*ii*) Ammonium chloride is heated ?

(*iii*) Zinc and sulphur are heated and the product thus formed is heated with dilute hydrochloric acid ?

(*iv*) A magnet is brought over the mixture of iron filings and sulphur ?

Ans. (*i*) Grey coloured crystals on heating get converted into violet coloured vapours which condense on the cooler portions of test-tube to give shining grey crystals back.

(*ii*) White powder on heating directly gets converted into their vapour state which condense on the cooler portions of the test–tube in the form of white solid back.

(*iii*) A greyish black powder is formed which on heating with dilute hydrochloric acid gives a colourless gas having rotten egg smell which turns lead acetate solution black.

(*iv*) Iron filings cling to the magnet.

Q5. Differentiate between

(*a*) Metals and non-metals

(*b*) Compound and mixture.

Ans. Differences :

(*a*)

Metals	*Non-metals*
(*i*) Metals are solids except mercury which exists in liquid state at room temperature. Gallium and Caesium exist in liquid state at 30° C.	(*i*) Non-metals are usually gases, some are solids like carbon, sulphur and phosphorus. Bromine is a liquid non-metal.
(*ii*) Metals are lustrous (shining surface).	(*ii*) Non-metals are non-lustrous.
(*iii*) Metals are sonorous.	(*iii*) Non-metals are non-sonorous.
(*iv*) Metals are ductile.	(*iv*) Non-metals are non-ductile.
(*v*) Metals are malleable.	(*v*) Non-metals are non-malleable.
(*vi*) Metals are good conductors of heat and electricity.	(*vi*) Non-metals are poor conductors of heat and electricity.
(*vii*) Metals have high density.	(*vii*) Non-metals have low density.
(*viii*) Metals have high melting point and boiling point.	(*viii*) Non-metals have low melting point and boiling point.

(*b*)

Compound	*Mixture*
(*i*) In compound, two or more elements combine chemically in fixed proportion by weight.	(*i*) In mixture, two or more elements or compounds combine physically in any proportion by weight.
(*ii*) Formation of compound involves energy change.	(*ii*) Formation of mixture does not involve any energy change.
(*iii*) The constituents of compounds loose their identical properties during its formation.	(*iii*) The constituents of mixture do not loose their identical properties during its formation.
(*iv*) The constituents of compounds cannot be separated by simple physical means.	(*iv*) The constituents of mixtures can be separated by simple physical means.
(*v*) Compounds are homogeneous in nature.	(*v*) Mixtures may be homogeneous or heterogeneous in nature.

Q6. Name the solvent for the following precipitates.

(*i*) Silver chloride **(*ii*) Lead sulphate** **(*iii*) Lead chloride**

(*iv*) Copper hydroxide **(*v*) Zinc hydroxide**

Ans. (*i*) Ammonium hydroxide (*ii*) Ammonium acetate (*iii*) Soluble in hot water

(*iv*) Dilute acid (*v*) Alkali or dilute acid.

Q7. State whether the following statements are True or False.

(*i*) The solubility of a gas in a liquid decreases with the rise in temperature.

(*ii*) The solubility of a gas in a liquid increases with decrease in pressure.

(*iii*) Diffusion is the inter-mixing of gases.

(*iv*) Kerosene oil and water form a clear solution.

(*v*) Hydrogen chloride gas is highly soluble in water.

Ans. (*i*) True (*ii*) False (*iii*) True

(*iv*) False (*v*) True.

Q8. Name the type of solution

(*i*) Which cannot pass through both, the ordinary filter paper and animal membrane.

(*ii*) Which can pass through both, the ordinary filter paper and animal membrane.

(*iii*) Which can pass through the filter paper but not through the animal membrane.

Ans. (*i*) Suspension

(*ii*) True solution

(*iii*) Colloidal solution

Q9. Classify the following as true solution, suspension and colloidal solution.

Tincture of iodine, Milk, Jellies, Chalk water, Soap lather, Sugar solution.

Ans.

True solution	Colloidal solution	Suspension
Tincture of Iodine Sugar solution	Milk Jellies, Soap lather	Chalk water

Q10. The following questions are related to the separation of the liquids.

(*i*) Name the process employed for the separation of two miscible liquids.

(*ii*) Name the apparatus employed for the separation of two immiscible liquids.

(*iii*) On which property the separation of two immiscible liquids depend.

Ans. (*i*) Fractional distillation

(*ii*) Separating funnel

(*iii*) The difference in the densities of the liquids.

LET'S RECALL

Fill Your Answer in the Space Given for Each Question.

Q1. Match the following :

A.

Column I	**Column II**
(*i*) Ozone	(*a*) Tetraatomic
(*ii*) Phosphorus	(*b*) Octaatomic
(*iii*) Sulphur	(*c*) Triatomic
(*iv*) Oxygen	(*d*) Monoatomic
(*v*) Helium	(*e*) Diatomic

Ans. (*i*) ☐ (*ii*) ☐ (*iii*) ☐ (*iv*) ☐ (*v*) ☐

B.

Column I (Mixture)	**Column II (Separation technique)**
(*i*) Sand and iodine	(*a*) Evaporation/Distillation
(*ii*) Salt and water	(*b*) By using magnet
(*iii*) Nitrogen and ammonia	(*c*) Filteration
(*iv*) Iron and sulphur	(*d*) Sublimation
(*v*) Sand and sawdust	(*e*) By using suitable solvent

Ans. (*i*) ☐ (*ii*) ☐ (*iii*) ☐ (*iv*) ☐ (*v*) ☐

Q2. Fill in the blanks.

(*i*) Metals usually form _____ oxides but sometimes _____ oxides.

(*ii*) Solvent for sulphur is _____ .

(*iii*) _____ changes take place during the formation of compound.

(*iv*) Immiscible liquids are separated by using _____.

(*v*) Benzoic acid _____ on heating.

(*vi*) Constituents of the mixture _____ their identical properties.

(*vii*) Water is a _____. Its constituents cannot be separated by _____ means.

(*viii*) Gun powder is a mixture of _____, _____ and _____.

(*ix*) Mixture of ethanol and water is separated by _____ as it is a mixture of _____liquids.

(*x*) Distillation is a process of simultaneous _____ and _____.

Q3. State whether the following statements are True or False.

(*i*) Solvent for paint is turpentine oil. ☐

(*ii*) Iodine sublimes on heating. ☐

(*iii*) If dilute hydrochloric acid is added to the mixture of iron and sulphur, hydrogen sulphide is obtained. ☐

(*iv*) Diamond is a non-metal having metallic lustre. ☐

(*v*) Pigments of leaf are separated by chromatography. ☐

Q4. Each question has four options, out of which only one option is correct. Dark the bubble for correct answer.

(*i*) Metal which exists in liquid state at room temperature is

(*a*) Sodium (*b*) Potassium (*c*) Calcium (*d*) Mercury

Ans. (a) (b) (c) (d)

(*ii*) The atomicity of metals is

(*a*) two (*b*) one (*c*) three (*d*) four

Ans. (a) (b) (c) (d)

(*iii*) Sedimentation and decantation are the techniques used for separating solid-liquid mixtures in which solid is

(*a*) soluble in liquid (*b*) insoluble in liquid

(*c*) Both of these (*d*) None of these

Ans. (a) (b) (c) (d)

(*iv*) The solvent for nail polish is

(*a*) water (*b*) hot water (*c*) detergent (*d*) acetone

Ans. (a) (b) (c) (d)

(*v*) Which of the following solutions shows Tyndall effect ?

(*a*) Suspension (*b*) True solution (*c*) Colloidal solution (*d*) All of the above

Ans. (a) (b) (c) (d)

(*vi*) Which is not the property of colloidal solution ?

(*a*) Visible under microscope (*b*) Do not scatter light

(*c*) Heterogeneous (*d*) None of these

Ans. (a) (b) (c) (d)

Answers

1. A.	(*i*) *c*	(*ii*) *a*	(*iii*) *b*	(*iv*) *e*	(*v*) *d*
B.	(*i*) *d*	(*ii*) *a*	(*iii*) *e*	(*iv*) *b*	(*v*) *c*
2.	(*i*) basic, amphoteric	(*ii*) carbon disulphide	(*iii*) energy	(*iv*) separating funnel	
	(*v*) sublimes	(*vi*) retain	(*vii*) compound, physical		
	(*viii*) nitre, charcoal, sulphur	(*ix*) fractional distillation, miscible			
	(*x*) evaporation, condensation				
3.	(*i*) True	(*ii*) True	(*iii*) False	(*iv*) False	(*v*) True
4.	(*i*) *d*	(*ii*) *b*	(*iii*) *b*	(*iv*) *d*	(*v*) *c* (*vi*) *b*

SELF EVALUATION TEST

Time : *30 minutes* ***Marks :*** *30*

Q1. Name the following. **2**

(*i*) A non-metal having metallic lustre.

(*ii*) A non-metal which is good conductor of electricity.

Q2. How is the solubility of a gas in a liquid is affected by **4**

(*a*) increase in temperature ?

(*b*) decrease in temperature ?

(*c*) increase in pressure ?

(*d*) decrease in pressure ?

Q3. State the effect of **4**

(*i*) adding dilute hydrochloric acid to the mixture of iron and sulphur and the compound of iron and sulphur.

(*ii*) bringing strong bar magnet near the mixture of iron and sulphur and the compound of iron and sulphur.

Q4. In which of the following would you expect change in energy ? **4**

(*i*) Iron rod dipping in copper sulphate solution.

(*ii*) Dissolution of glucose in water.

(*iii*) Mixing of sugar in water.

(*iv*) Mixing of nitrogen in methane.

Q5. State which of the following mixtures is homogeneous or heterogeneous. **5**

(*a*) Oil and water

(*b*) Salt and water

(*c*) Brass

(*d*) Alloy of metal with mercury

(*e*) Iron and sulphur

Q6. Air is a mixture.Give five points to support your answer. **5**

Q7. How are the following mixtures separated ? Name the technique only. **6**

(*a*) Copper hydroxide and zinc hydroxide

(*b*) Carbon tetrachloride and water

(*c*) Oxygen and hydrogen

(*d*) Mud and water

(*e*) Lead sulphate and water

(*f*) Pigments of ink