

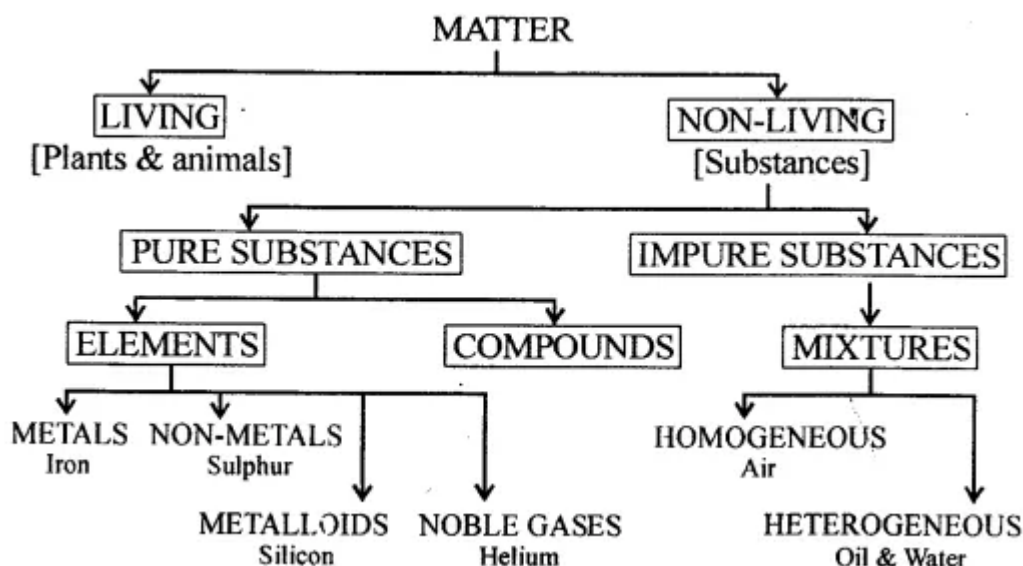
Elements, Compounds & Mixtures

EXERCISE

Question 1.

Represent with the help of a simple chart how matter is classified into pure or impure substances & further into elements, compounds & mixtures, with elements further segmented.

Answer:



Question 2.

Define the terms elements, compounds & mixtures with a view to show their basic difference.

Answer:

Element is a pure substance.

1. It is the basic unit of matter and cannot be broken down into two or more simpler substances by any means.
2. It is mainly classified into metals, non-metals, metalloids and noble gases.

Compound is a pure substance.

1. It is formed by combination of two or more elements.
2. The elements are combined together in a fixed ratio.
3. It can be broken down into its elements by chemical means.

Mixture is an impure substance.

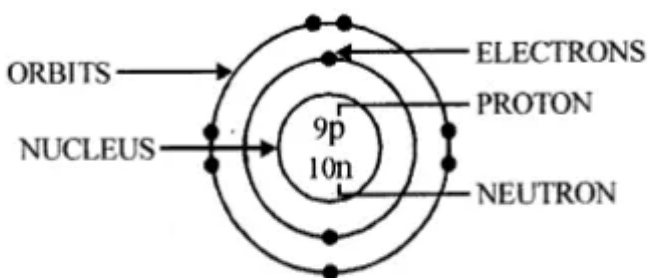
1. It is formed by combination of two or more elements, compounds or both.
2. The substances are mechanically mixed together in any ratio.

Question 3.

'An atom is the basic unit of an element'. Draw a diagram of an atom – divisible as seen today.

Answer:

'An atom is the basic unit of an element'.



An atom – of fluorine [At. No. 9]

$$Z = p = e$$

[atomic no.] [no. of protons] [no. of electrons]

Question 4.

'The modern periodic table consists of elements arranged according to their increasing atomic numbers'. With reference to elements with atomic numbers 1 to 20 only in the periodic table – differentiate them into – metallic elements, metalloids, non-metals & noble gases.

Answer:

Names and symbols of metal, non-metals, metalloids and noble – gases out of 1st 20 elements.

Metal	Symbol	Non-metal	Symbol
• Lithium	Li	• Hydrogen	H
• Beryllium	Be	• Carbon	C
• Sodium	Na	• Nitrogen	N
• Magnesium	Mg	• Oxygen	O
• Aluminium	Al		
• Potassium	K	• Fluorine	F
• Calcium	Ca	• Phosphorus	P
		• Sulphur	S
		• Chlorine	Cl
Metalloids	Symbol	Noble gas	Symbol
• Boron	B	• Helium	He
• Silicon	Si	• Neon	Ne
		• Argon	Ar

Question 5.

Elements are broadly classified into metals & non-metals. State six general differences in physical properties of metals & non-metals. State two metals & two non-metals which contradict with the general physical properties – giving reasons. State one difference in property between metalloids & noble gases.

Answer:

Metallic elements :

- (a) Have lustre – i.e. shine.
- (b) Are malleable – i.e. can be beaten into sheets.
- (c) Are ductile – i.e. can be drawn into wires.
- (d) Are good conductors – of heat and electricity.
- (e) have high – melting and boiling points.
- (f) Have high – density.
- (g) Contain – one type of atoms – monoatomic

Non-metallic Elements :

- (a) Do not have lustre.
- (b) Are non-malleable – i.e. cannot be beaten into sheets.
- (c) Are non-ductile – i.e. cannot be drawn into wires.
- (d) Are poor conductors – of heat and electricity.
- (e) Have low – melting and boiling points.
- (f) Have low – density.
- (g) Contain – monoatomic or diatomic atoms.

Two metals which contradict properties :

1. **Mercury** — is liquid at room temperature whereas metals are mostly solid.
2. **Zinc** — is NON-MALLEABLE and NON-DUCTILE contradicts metal which are MALLEABLE and DUCTILE.

Two Non-metals are :

1. **Iodine** — is lustrous contradicts non-metals have no lustre.
2. **Graphite** — is good conductor of electricity where as non – metals are poor conductor of electricity.

Question 6.

With reference to elements – define the term 'molecule'. Give two examples each of a monoatomic, diatomic & polyatomic molecule.

Answer:

Molecule : Atoms of the same element or different elements combine to form a molecule. It is the smallest particle of a substance – which can normally exist independently and can retain, the physical and chemical properties of the substance.

Examples

Monoatomic molecule : Metals – Na, Mg etc.

Diatomic molecule : H_2 , O_2 , N_2 .

Polyatomic molecule : O_3 , P_4 .

Question 7.

Define the term 'compound'. In the compound carbon dioxide – the elements carbon & oxygen are combined in a fixed ratio. Explain.

Answer:

A compound is a pure substance made up of two or more different elements [atoms] combined chemically in a fixed proportion.

(a) Contains – two or more kinds of atoms, e.g. compound – carbon dioxide [CO_2].

(b) Can be broken down – into two or more simpler substances – by chemical means.

(c) Properties of compounds – differ from those of their elements, e.g. CO_2 contains elements – Carbon [C] is combustible and Oxygen [O] is supporter of combustion – but carbon dioxide is non-combustible and non-supporter of combustion.

Question 8.

State five different characteristics of compounds. Give three differences between elements & compounds with relevant examples.

Answer:

Five characteristics of a compound :

(a) Components in a compound are in a definite proportion.

(b) Compound is always homogenous [i.e. identical composition].

(c) Particles in a compound are of one kind.

- (d) Compounds have a definite set of properties.
(e) Elements in the compound do not retain their original properties.
(f) Components in a compound can be separated by chemical means only.

Three differences between elements and compounds :

Element :

1. They contain one kind of atoms only e.g. element (Na) Sodium and [Cl] chlorine.
2. They have their own set of properties e.g. [H] Hydrogen is combustible.
3. They cannot be broken down into two or more simpler substances by physical or chemical means.

Compound :

1. They contain two or more kinds of atoms, e.g. compound — water [H₂O].
2. Their properties of compounds are entirely new i.e. water [H₂O] is a liquid and can extinguish fire.
3. They cannot be broken down into two or more simpler substances by chemical means.

Question 9.

Explain the term 'mixture'. Differentiate between homogenous & heterogeneous mixtures. State why brass is considered as a homogenous mixture while a mixture of iron & sulphur – heterogeneous. Give an example of two liquids which form (a) homogenous (b) heterogeneous – mixtures.

Answer:

Mixture : A mixture is made up of two or more substances elements or compounds or both mechanically mixed together in any proportion.

A mixture retains the properties of its constituent elements or compounds.

Difference between homogenous & heterogeneous mixtures :

Homogenous mixture :

- Their constituents are uniformly mixed.
- Their properties and composition are the same throughout the mixture
- Two solids are Brass [Cu + Zn]

Heterogeneous mixture :

- Their constituents are not uniformly mixed.
- Their properties and composition vary throughout the mixture.
- Two solids are Iron + sulphur

BRASS is HOMOGENOUS because mixture is just the same throughout and its constituents cannot be distinguished from each other i.e. composition is the same throughout.

Whereas in Heterogeneous mixture of iron and sulphur, the constituents can be separated easily by a magnet, the particles can be distinguished from each other and composition is not uniform.

(a) Two liquids which form Homogenous mixture are Alcohol and water.

(b) Two liquids which form Heterogenous mixture are oil and water.

Question 10.

Compare the properties of iron [II] sulphide with iron – sulphur mixture, considering iron [II] sulphide as a compound & particles of iron & sulphur mixed together as an example of a mixture.

Answer:

Iron and sulphur mixture :

1. The constituents i.e. iron and sulphur are seen separately.
2. Iron attracts and clings to magnet.
3. On adding dil. HCl to the mixture H_2 gas evolves.

Iron [II] sulphide is a compound

1. It is black solid.
2. On bringing a magnet near it we cannot separate iron.
3. On adding dil. HCl to it H_2S gas evolves.

Question 11.

State any one method – to separate the following mixtures –

- (a) Two solid mixtures one of which – directly changes into vapour on heating.
- (b) Two solid mixtures one of which – dissolves in a – particular solvent and other does not
- (c) A solid-liquid mixture containing – an insoluble solid in the liquid component
- (d) A solid-liquid mixture containing – a soluble solid in the liquid component
- (e) A liquid-liquid mixture containing – two immiscible " " liquids having different densities
- (f) A liquid-liquid mixture containing – two miscible liquids having different boiling points.
- (g) A liquid-gas mixture containing – a gas dissolved in a liquid component.
- (h) A gas-gas mixture containing – two gases with different densities.
- (i) A mixture of different solid constituents – in a liquid constituent.

Answer:

(a) **The method used is sublimation :** Sublimable solid sublimes on heating i.e. changes into vapours and condenses on cooling is separated leaving behind non – sublimable solid.

(b) **The method is solvent extraction :** Soluble solid dissolves in solvent leaving behind the other insoluble solid. The dissolved solid is recovered by evaporation.

(c) **The method is filtration :** The insoluble solid is obtained on the filter paper as residue.

(d) **The method is evaporation or distillation :** Liquid evaporates leaving behind solid.

(e) **The method is separating funnel :** Heavier liquid collects in the flask below an opening tap, while lighter layer remains in the separating funnel.

(f) **Method is fractional distillation :** The liquid with lower boiling point collects in the receiver while the liquid with higher B.P. remains in distillation flask.

(g) **The method used is boiling the mixture :** Solubility of gas decreases with increase in temperature, so gas escapes when mixture is boiled and collected separately.

(h) **The method is diffusion :** The lighter gas diffuses more rapidly on passing through porous

partition where as heavier gas diffuses less rapidly on passing through porous partition.

(i) The method used is chromatography.

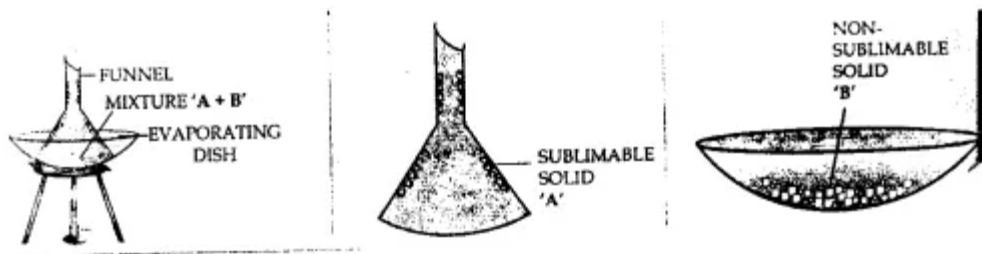
Question 12.

Explain with diagrams the process used to – separate the following substances from the given mixtures.

- (a) Ammonium chloride from a mixture of – ammonium chloride & potassium chloride.
- (b) Iron from a mixture of – iron & copper
- (c) Sulphur from a mixture of – sulphur & copper.
- (d) Potassium nitrate from a mixture of – potassium nitrate & potassium chlorate.
- (e) Lead carbonate [insoluble] from a mixture of – lead carbonate & water.
- (f) Lead nitrate [soluble] from a mixture of – lead nitrate & water Le. lead nitrate solution.
- (g) Carbon tetrachloride from a mixture of – carbon tetrachloride [heavier component] & water.
- (h) Benzene from a mixture of – benzene [b.p. 80°C] & toluene [b.p. 110°C].
- (i) Different dyes – in their liquid constituent ink.

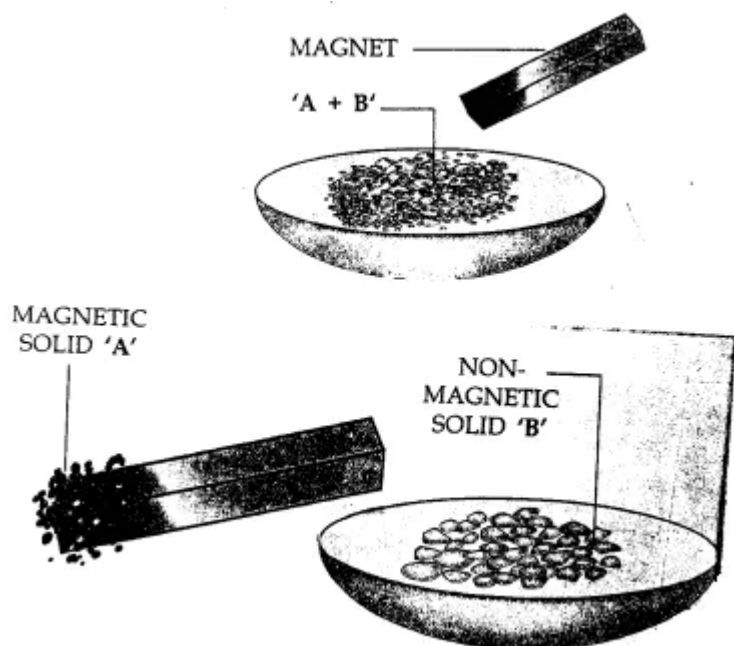
Answer:

(a) By sublimation : On heating the mixture in evaporating dish, ammonium chloride sublimes on the walls of funnel and potassium chloride remains in evaporating dish.



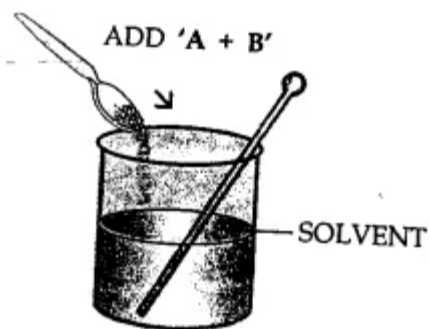
Here A is Ammonium Chloride and B is Potassium Chloride.

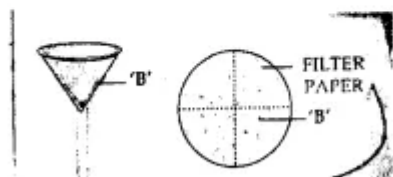
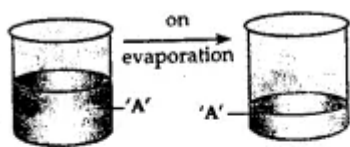
(b) By magnetic separation : By bringing a magnet near the mixture iron pieces can be separated which will cling to the magnet.



Here A is Iron and B is Copper.

(c) By solvent extraction : Mixture of copper and sulphur is added to the beaker containing solvent carbon disulphide and stirred well. Sulphur dissolves. Put this mixture on filter paper in the funnel. Copper remains on filter paper and sulphur passes into the beaker as filtrate. Sulphur separates as carbon disulphide evaporates.

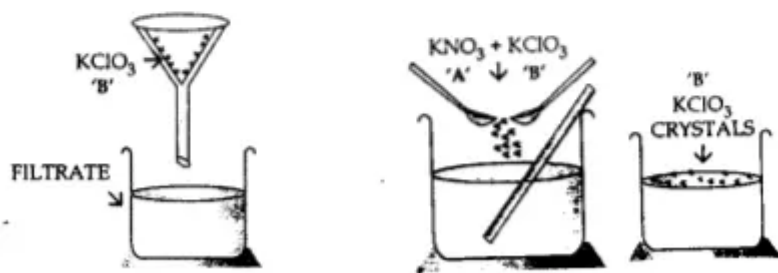
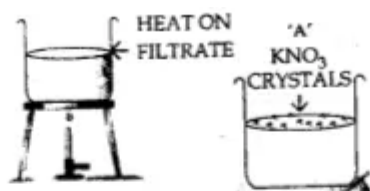




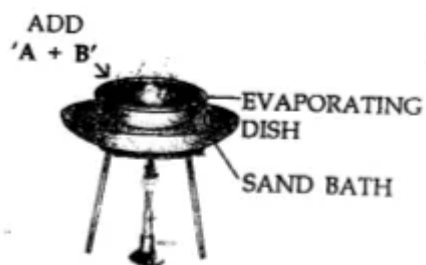
Here A is for Copper and B is Sulphur.

(d) Potassium nitrate KNO_3 is more-soluble than potassium chlorate KClO_3 .

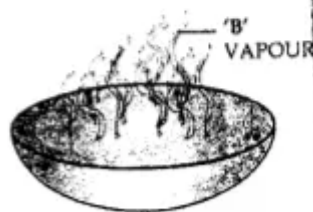
On heating to get saturated solution and on cooling the saturated solution less soluble (KClO_3) crystallise out. More soluble KNO_3 is filtered out from hot saturated solution and is recrystallised from hot water and dried.



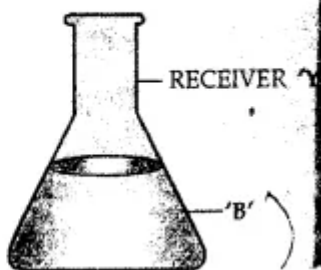
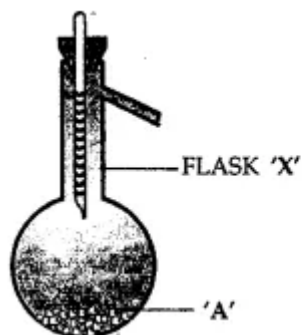
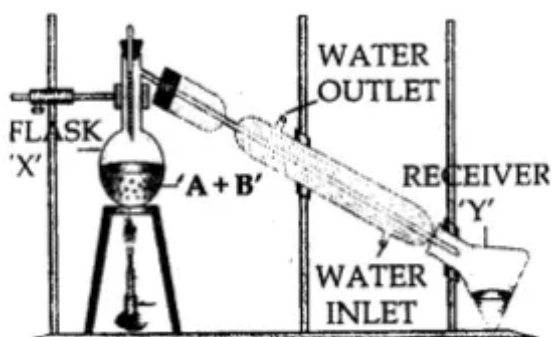
(e) Evaporation : Lead carbonate can be separated by evaporation. On evaporation, water evaporates leaving behind solid lead carbonate which has higher M.P.



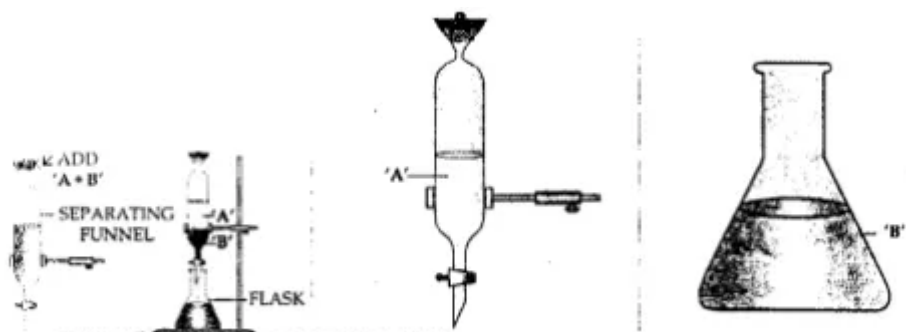
ON
EVAPORATION



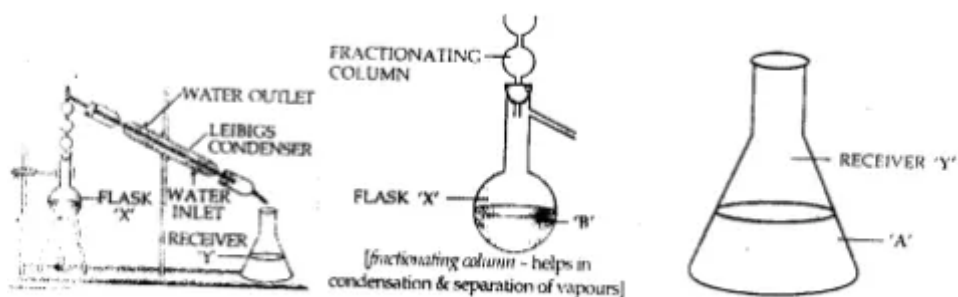
(f) Lead nitrate is separated from soluble lead nitrate solution by crystallisation.



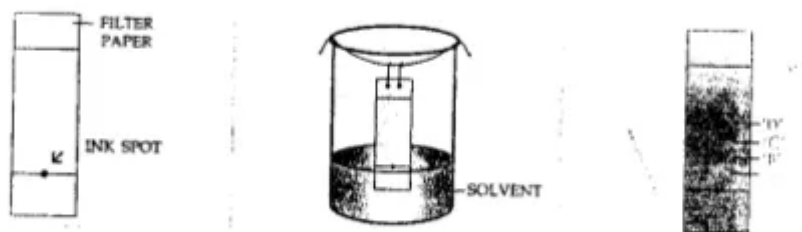
(g) By separating funnel, heavier CCl_4 carbon tetrachloride from the lower layer is separated when tap is opened and is collected in the flask. Water the lighter top layer remains in the funnel.



(h) By fractional distillation, miscible low boiling point benzene (B.P. 80°C) evaporates on heating the mixture and condenses in and collects in flask 'Y' whereas higher boiling pt. Toluene (B.P. 110°C) remains in flask 'X' after condensation.



(i) By chromatography : Different dyes [solid constituents i.e. A, B, C, D] in ink which is the liquid constituent. By placing the ink spot containing different solid constituents [dyes] on the filter paper. Filter paper is hung with its lower end completely dipped in the solvent.



The solvent flows over the ink spot and the solid constituents [dyes 'A', 'B', 'C', 'D'] separate out.

OBJECTIVE TYPE QUESTIONS

Q.1. Select the correct answer from A, B, C, D & E for each statement given below :

A: Gunpowder

B: Iodine

C: Boron

D: Helium

E: Bromine

Question 1.

A diatomic molecule.

Answer:

E: Bromine

Question 2.

A metalloid.

Answer:

C: Boron

Question 3.

A non-metal which is lustrous.

Answer:

B: Iodine

Question 4.

A mixture consisting of elements & a compound.

Answer:

A: Gunpowder

Question 5.

A noble gas.

Answer:

D: Helium

Q.2. Match the separation of components in List I with the most appropriate process in List II.

List I**List II**

- | | |
|---|----------------------|
| 1. Naphthalene from naphthalene & sodium chloride. | A: Separating funnel |
| 2. Cream from milk. | B: Sublimation |
| 3. Kerosene oil from kerosene oil & water. | C: Boiling |
| 4. Lead nitrate from an aqueous solution of lead nitrate. | D: Centrifugation |
| 5. Ammonia from an aqueous solution of ammonia. | E: Distillation |

Answer:

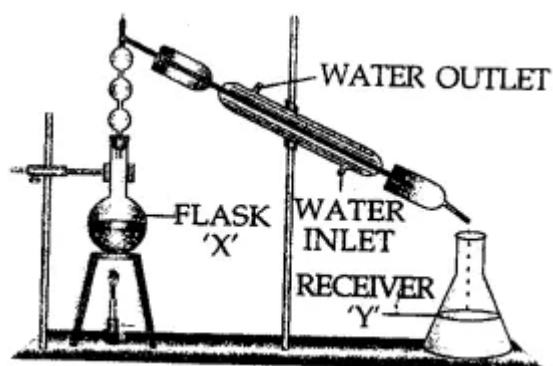
List I

1. Naphthalene from naphthalene & sodium chloride.
2. Cream from milk.
3. Kerosene oil from kerosene oil & water.
4. Lead nitrate from an aqueous solution of lead nitrate.
5. Ammonia from an aqueous solution of ammonia.

List II

- B: Sublimation
D: Centrifugation
A: Separating funnel
E: Distillation
C: Boiling

Q.3. The diagram represents fractional distillation for separation of mixtures. Answer the following :

**Question 1.**

Can two immiscible liquids be separated by this process.

Answer:

No, they can be separated by separating funnel.

Question 2.

Separation of liquids by this process is based on which physical property?

Answer:

The physical property on which separation is based "Difference in their boiling points."

Question 3.

If methyl alcohol & water are to be separated, which liquid would remain in flask 'X' after condensation.

Answer:

Water having boiling point 100°C will remain in flask 'X'.

Question 4.

Give a reason for the above answer.

Answer:

Alcohol having lower B.P. 78°C will evaporate first and condense in the conical flask — receiver 'Y'.

Question 5.

State the purpose of the fractionating column in the apparatus.

Answer:

The upper part of the 'Fractionating column is cooler, so as the hot vapours rise up in the column, they get cooled (condense) and trickle back into the distillation flask 'X'.

Q.4. Select the correct answer from the choice in bracket to complete each sentence :

Question 1.

Dust in air is an example of ___ [heterogeneous / homogenous] mixture.

Answer:

Dust in air is an example of **Homogenous** mixture.

Question 2.

A soluble solid is separated from an insoluble solid by ___ [fractional crystallisation / solvent extraction].

Answer:

A soluble solid is separated from an insoluble solid by solvent **extraction**.

Question 3.

The reactive element from the two monoatomic elements is ___ [neon/silicon].

Answer:

The reactive element from the two monoatomic elements is **silicon**.

Question 4.

Compounds are ___ [homogenous or heterogenous / always homogenous] in nature.

Answer:

Compounds are **always homogenous** in nature.

Question 5.

An example of a monoatomic molecule is ___ [hydrogen / helium],

Answer:

An example of a monoatomic molecule is **helium**.

Q.5. Give reasons for the following statements :

Question 1.

Components in a mixture can be separated by physical methods only.

Answer:

Components of a mixture can be separated by physical methods because particles remain separate without chemical reaction between them.

Question 2.

Centrifugation can be used for separating an insoluble heavier solid, present in an – insoluble solid-liquid mixture.

Answer:

Centrifugation is fast method to separate suspended (heavier) insoluble solid from lighter liquid by rotating the mixture fast. Heavier solid settles down at the bottom.

Question 3.

The filter paper made into a cone & placed in a funnel for filtering out the solid particles in a solid-liquid mixture, should be moistened before placing.

Answer:

Moistening the filter paper cone sticks to the walls of the funnel and also makes filtration convenient.

Question 4.

Brass & bronze are examples of mixtures, while copper sulphate & lead nitrate are examples of compounds.

Answer:

Brass and bronze are mixtures as the composition of elements is not fixed by mass and have no formula.

Lead nitrate and copper sulphate are compounds as they have fixed ratio of elements by mass and have formula like $\text{Pb}(\text{NO}_3)_2$ and CuSO_4 .

Question 5.

Zinc is considered an element, while zinc sulphide is considered a compound.

Answer:

Zinc [Zn] is an element as zinc is a pure substance made up of one kind of atoms all having same size, atomic number and atomic mass.

Zinc sulphide [ZnS] is pure substance made up of two element [atoms] of zinc and sulphur combined chemically in a fixed proportion.