Elements, Compounds and Mixtures

Points to Remember :

1. Every substance is made up of very tiny particles, called molecules. Molecules are formed from even smaller particles called atoms.
2. **Element—** (a) Element is the simplest pure substance. It cannot be divided further into simpler substances by any chemical method, e.g. oxygen, hydrogen, sulphur, etc.
   (b) At present 116 elements are known, of which 92 are natural elements.
3. Based on their properties, elements are classified into : metals, non-metals, metalloids, noble gases.
4. Metals are ductile, malleable, good conductors of heat and electricity, high melting and boiling points. Metals are sonorous, e.g., Iron, Gold, Silver, etc.
5. Non-metals are solids and brittle in nature, bad conductor of heat and electricity (exception Graphite) low melting and boiling points, e.g. sulphur, carbon, hydrogen, etc.
6. **Metalloids**— These elements show properties of both metals and non-metals. They are hard solids, e.g. Boron, Silicon, Arsenic.
7. **Inert or noble gases—** These elements do not react chemically with other elements or compounds are called noble (Inert) gases, e.g., helium, neon, argon, etc.
8. **Symbols of Elements—** Each element is denoted by a symbol usually to first letter.
   Examples : Oxygen by O Hydrogen by H.
9. **Atom—** “An Atom is the smallest particle of an element that can take part in a chemical reaction but may or may not have independent existence.”
   The atom of an element exhibits all the properties of that element.
10. **Molecule—** A molecule is the smallest particle of a pure substance of element or compound which has independent existence. It exhibits all the properties of pure substance.
11. **Atomicity—** The number of atoms of an element that join together to form a molecule of that element is known as the atomicity.
12. **Molecular Formula—** of an element is the symbolic representation of its molecule. It indicates the number of atoms present in it. e.g. Magnesium oxide – MgO.

EXERCISE – I

Question 1.
Write the symbols of helium, silver, krypton, antimony, barium.
Answer:

Element	Symbol
Helium	He
Silver	Ag
Krypton	Kr
Antimony	Sb
Barium	Ba

Question 2.
Write the names of following elements Na, C, Kr, U, Ra, Fe, Co.
Answer:

Symbol	Element
Na	Sodium
C	Carbon
Kr	Krypton
U	Uranium
Ra	Radium
Fe	Iron
Co	Cobalt

Question 3.
Define :

1. **Elements :** An element is the basic form of matter that cannot be broken down into simpler substances by chemical reactions.
2. **Compounds :** A compound is a pure substance formed by the chemical combination of two or more elements in a fixed ratio by mass.

Question 4.
Name the main metal present in the following :
Answer:

(a) Haemoglobin	Iron
(b) Chalk	Calcium
(c) Chlorophyll	Magnesium
(d) Chocolate wrappers	Aluminium

Question 5.
Give four examples of non-metallic elements.
Answer:
Examples : Hydrogen, oxygen, nitrogen, carbon, chlorine, sulphur, phosphorus, etc.

Question 6.
What do you understand by :
Answer:

1. **Metalloids :** Metalloids are those substances which have some properties of metals and some of non-metals e.g. boron, silicon.
2. **Noble gases :** Noble gases are those which do not react chemically with other elements or compounds e.g. helium, neon, etc.

Question 7.
Select elements and compounds from the following list: Iron, plaster of paris, chalk, common salt, copper, aluminium, calcium oxide, cane sugar, carbon, silica, sodium sulphate, uranium, potassium carbonate, silver, carbon dioxide.
Answer:

Element	Compounds
Iron	Plaster of paris
Copper	Chalk
Aluminium	Common salt
Carbon	Calcium oxide
Uranium	Cane sugar
Silver	Silica
	Sodium sulphate
	Potassium carbonate
	Carbon dioxide

EXERCISE – II

Question 1.
State four difference between compounds and mixtures.
Answer:

Compound	Mixture
1. A compound is a pure substance.	1. A mixture is an impure substance.
2. Compounds are always homogeneous.	2. Mixtures may be homogeneous or heterogenec
3. A compound has a fixed composition, i.e., it is formed when two or more pure substances chemically combine in a definite ratio by mass.	3. A mixture has no fixed composition, i.e., it is forı by mixing two or more substances in any ratio witl any chemical reaction.
4. Formation of a compound involves change in energy.	4. Formation of a mixture does not involve any cha in energy.
5. Compounds have specific set of properties.	5. Mixtures do not have any specific set of propert
6. Components of compounds can be separated only by complex chemical processes.	6. Components of mixtures can be separated by simple physical methods.

Question 2.

What are the characteristic properties of a pure substance? Why do we need them?

Answer:

Pure substance : Pure substances have a definite set of properties such as boiling point, melting point, density, etc. They are all homogeneous i.e., their composition is uniform throughout the bulk. Both elements and compounds are pure substances.

Pure substances are needed to :

1. Manufacture medicines.
2. To prepare chemicals in industry.
3. For scientific purposes.
4. To maintain the good health of human beings.

Question 3.

Give two examples for each of the following :

(a) Solid + Solid mixture

(b) Solid + Liquid mixture

(c) Liquid + Liquid mixture

Answer:

(a) Solid + Solid mixture :Sand and sugar,

- Sand and stone,
- sand and sugar.

(b) Solid + Liquid mixture :

- Sand and water,
- Charcoal and water.

(c) Liquid + Liquid mixture :

- Oil in water,
- Alcohol and water.

Question 4.
Define :

1. **Evaporation :** Is the process ~of converting a liquid into its vapours state either by exposing it to air or by heating.
2. **Filtration :** The process of separating solid particles from liquid by allowing it to pass through a filter paper is called filtration.
3. **Sublimation :** The process in which a solid changes directly into its vapours on heating is called sublimation.
4. **Distillation :** Distillation is the method of getting a pure liquid from a solution by evaporating and then condensing the vapours.
5. **Miscible liquids :** Homogeneous liquid-liquid mixtures are called miscible liquids.
6. **Immiscible liquids :** Heterogeneous liquid-liquid mixtures are called immiscible liquids.

Question 5.
Name the process by which the components of following mixtures can be separated.

1. Iron and sulphur
2. Ammonium chloride and sand
3. Common salt from sea water
4. Chaff and grain
5. Water and mustard oil
6. Sugar and water
7. Cream from milk

Answer:

1. Magnetic separation.
2. Sublimation.
3. Evaporation.
4. Winnowing separates chaff (lighter) from heavier grains in two different heaps.
5. Mustard oil and water is liquid-liquid immiscible mixture and is separated by separating funnel. Water being the heavier forms the lower layer.
6. By evaporation in this process of converting a liquid into its vapour state by heating. Liquid is heated and water evaporate and sugar is obtained.
7. Centrifugation.

Question 6.
How will you separate a mixture of common salt, chalk powder and powdered camphor? Explain.
Answer:
Comphor with sublimation. Chalk powder by Alteration then the residual left is common salt.

Question 7.
How is distillation more advantageous than evaporation?
Answer:
The advantage of distillation is that both components of the
solid and liquid mixture are obtained. Whereas in evaporation only solid is obtained.

Question 8.

1. What is chromatography?
2. Why is it named so?
3. What are the advantages of chromatography?
4. Name the simplest type of chromatography?
5. On what principle is this method based?
6. What is meant by stationary phase and mobile phase in chromatography?

Answer:

1. The process of separating different dissolved constituents of a mixture by their absorption on an appropriate material is called chromatography.
2. It is named so, because earlier it was used to separate mixtures containing coloured components only but these days this technique is applied to colourless substances too.
3. **Advantages of chromatography :**
   (i) A very small quantity of the substance can be separated.
   (ii) Components with very similar physical and chemical properties can be separated.
   (iii) It identifies the different constituents of a mixture.
   (iv) It also helps in quantitative estimation of components of a mixture.
4. The simplest type of chromatography is “Paper chromatography”.
5. Chromotography is based on differential affinities of compounds towards two phases i.e. stationary and mobile phase.
6. The filter paper acts as “stationary phase” while the solvent act as “mobile phase”.

Question 9.
On what principle are the following methods of separation based? Give one example of a mixture for each of the methods mentioned in which they are used
Answer:

1. **Sublimation :** Change of solid into vapours directly on heating and change of vapours into solid again on
   Example : Salt from ammonium chloride.
2. **Filtration :** The process of separating insoluble solid particles from a liquid by allowing it to pass through a filter is called Alteration. These filters allow liquids to pass through them but not solids. The insoluble solid left on the filter is called the residue, while the liquid which passes through the filter is called the filtrate.

Mixtures like chalk and water, clay and water, tea and tea leaves, sawdust and water, etc., are separated by this method.

3. **Sedimentation and decantation :** The settling down of suspended, insoluble, heavy, solid particles in a solid- liquid mixture when left undistrubed is called sedimentation.
   The solid which settles at the bottom is called sediment while the clear liquid above it is called supernatant liquid.
   The process of pouring out the clear liquid, without disturbing the sediment, is called decantation.
   Example : A mixture of sand and water.
4. **Solvent extraction method :** This method is used when one of the solid components is soluble in a liquid.
   Example : A mixture of sand and salt can be separated by this method. Salt gets dissolved in water while sand settles down in the container. The salt solution is then decanted. Salt is separated from the solution by evaporation. In this way, they can be separated.
5. **Magnetic separation :** This method is used when one of the components of the mixture is iron. Iron gets attracted towards a magnet and hence can be separated. Mixtures of iron and sulphur, iron and sand, etc., can be separated by moving a magnet over them. Iron gets attached to the magnet and is separated.
6. **By using a separating funnel :** It is a simple device used to separate the components of a liquid-liquid heterogeneous mixture.
   Example : Kerosene oil and water. The mixture is placed in a separating funnel and allowed to stand for sometime. The components form two clear layers. Water being heavier forms the lower layer and oil being lighter forms the upper layer. When the stopper of the funnel is opened, the heavier liquid trickles out slowly and is collected in a vessel. The stopper is closed when the bottom layer is entirely removed the funnel. In this way, the two liquids are separated.
7. **Fractional distillation :** The process of distillation is used for separating the components of a homogeneous liquid-liquid mixture, like water and alcohol. This is based on the fact that alcohol boils at a lower temperature than water. The vapour of alcohol are collected and cooled while water is left behind in the original vessel. Thus, two liquids having different boiling points can be separated by distillation provided that difference in their boiling points must be 25 °C or more.

OBJECTIVE TYPE QUESTIONS

Question 1.
Fill in the blanks:
Answer:

1. **Elements** are made up of same kind of atoms.
2. **Elements** and **compounds** are pure substances.
3. In a **mixture** the substances are not combined chemically.
4. Clay is separated from water by the method called **loading and decantation**.

5. **Crystallisation** is a process to obtain a very pure form of a solid dissolved in a liquid.
6. Camphor and ammonium chloride can **sublimate.**

Question 2.
Give one word answers for the following :
Answer:

1. The solid particles which remain on the filter paper after the filtration **residue.**
2. The liquid which evaporates and then condenses during the process of distillation **distillate.**
3. The process of transferring the clean liquid after the solid settles at the bottom of the container **decantation.**
4. The process by which two miscible liquids are separated **fractional distillation.**

MULTIPLE CHOICE QUESTIONS

Select the correct alterative from the choices given for the following statements:
Question 1.
A pure liquid is obtained from a solution by :
Answer:

1. evaporation
2. **distillation**
3. Alteration
4. crystallisation

Question 2.
Components of crude petroleum can be separated by :
Answer:

1. distillation
2. evaporation
3. filtration
4. **fractional distillation**

Question 3.
Example of a homogeneous mixture is :
Answer:

1. **tap water**
2. distilled water
3. sand and water
4. water and oil

Question 4.
In chromatography the filter paper is :
Answer:

1. **stationary phase**
2. mobile phase
3. mixture
4. none of the above

Question 5.
A set of mixture is :
Answer:

1. **ink, honey, icecream, milk**
2. tapwater, gold, common salt, alloy
3. milk, brass, silver, honey
4. butter, petroleum, tapwater, iron

ADDITIONAL QUESTIONS

Check Your Progress 1

Question 1.
Fill in the blanks.

1. A pure substance has definite **composition** and constant **properties.**
2. Mixtures can be **heterogeneous** or **homogenous.**
3. Use of a **sieve** to separate the components of a mixture of solids is based on the difference in the size of the components.
4. **Winnowing** is used when the constituents of a mixture of solids have difference in their weights.
5. Iodine, camphor, naphthalene, ammonium chloride and dry ice are some substances that **sublimate.**

Check Your Progress 2

Question 1.
Filtraction is a method used to separate fine particles of solid from a liquid.
Answer:
Filtraction is a method used to separate fine particles of **insoluble** solid from a liquid.

Question 2.
Loading is basically speeding up ……
Answer:
Loading is basically speeding up **sedimentation.**

Question 3.
Name the techniques used to separate a solid from its solution.
Answer:
Sedimentation and Decantation

Question 4.
A separating funnel can be used for separating a mixture of immiscible liquids. True or false ?
Answer:
True

Question 5.
During centrifugation, solid particles of the mixture move towards the bottom. True or false ?
Answer:
True

EXERCISES

A. Tick the most appropriate answer.
Question 1.
The constituents of a mixture are present in a fixed ratio
Answer:

1. a fixed ratio
2. **a variable ratio,**
3. the ratio of 2 : 1
4. none of these

Question 2.
Solutions are
Answer:

1. heterogeneous mixtures.
2. compounds,
3. **homogeneous mixtures.**
4. elements.

Question 3.
The methods of separating components of a given mixture are based on the
Answer:

1. **physical properties and state of the components.**
2. colour of the components only.
3. state of the components.
4. none of these.

Question 4.
Winnowing is the method used to separate
Answer:

1. **chaff from grain.**
2. stones from rice.
3. oil from water.
4. salt from sand.

Question 5.
During filtration the substance left behind on the filter paper is called
Answer:

1. distillate,
2. filtrate
3. sublimate.
4. **residue.**

Question 6.
Loading is a process in which
Answer:

1. **impurities become heavy and sink to the bottom.**
2. impurities float on the top.
3. impurities vaporize.
4. none of these

Question 7.
Fractional distillation is used to separate liquids having an appreciable difference in their
Answer:

1. size and shape
2. solubility
3. **boiling points.**
4. none of these

Question 8.
The different constituents of an ink are separated by
Answer:

1. handpicking.
2. **paper chromatography**
3. filtration.
4. magnetic separation.

B. Fill in the blanks.
Question 1.

1. A **pure** substance has only one kind of matter.
2. The composition and properties of a **homogenous** mixture is uniform throughout.
3. An **alloy** is a homogeneous mixture of two or more metals.
4. Chalk powder dissolved in water is an example of a **suspension.**
5. An **emulsion** is formed when one liquid is dispersed as tiny droplets throughout another liquid.
6. Immiscible liquids are separated by using a **separating funnel.**

C. Write true or false for each statement. Rewrite the false statements correctly.
Question 1.
All pure substances have characteristic melting and boiling points.
Answer:
True

Question 2.
Milk is an emulsion.
Answer:
True

Question 3.
A heterogeneous mixture has a uniform composition throughout the mixture.
Answer:
False. A heterogeneous mixture has a non-uniform composition throught the mixture.

Question 4.
The constituents of a mixture can only be separated by chemical means.
Answer:
False. The constituents of a mixture can be separated by chemical means and physical means.

Question 5.
Handpicking can be used as a separation technique if the particle size of the constituents of the mixture is the same.
Answer:
False. Handpicking can be used as a separation technique if the particle size of the constituents of the mixture is the not the same.

D. Match the columns.
Question

1. to separate grain from chaff	**a. filtration**
2. to separate sawdust from water	**b. sedimentation and decantation**
3. to separate iodine from sodium chloride	**c. winnowing**
4. to separate iron fillings from sand	**d. sublimation**
5. it is used to separate sand and water	**e. magnetic separation**
	f. handpicking

Answer:

1. to separate grain from chaff	c. winnowing
2. to separate sawdust from water	a. filtration
3. to separate iodine from sodium chloride	d. sublimation
4. to separate iron fillings from sand	e. magnetic separation
5. it is used to separate sand and water	b. sedimentation and decantation

E. Differentiate between the following.

1. solution and suspension

Solution	Suspension
1. It is an example of homogeneous mixture.	1. It is an example of heterogeneous mixture.
2. It is formed when a solid dissolves in liquid.	2. It is formed when an insoluble solid is added to solvent.
3. For example – sugar dissolved in water.	3. For example-chalk dissolved in water.

2. Supernatant liquid and Fill rate

Solution	Suspension
1. It is an example of homogeneous mixture.	1. It is an example of heterogeneous mixture.
2. It is formed when a solid dissolves in liquid.	2. It is formed when an insoluble solid is added to solvent.
3. For example – sugar dissolved in water.	3. For example-chalk dissolved in water.

3. Filter Paper

Filter Paper	Alum
1. It is a special paper fitted in funnel during filtration.	1. It is a solid which is used to load suspended mud particles in water.
2. It does not dissolve in water.	2. It dissolves easily in water
3. It does not speeds up- loading.	3. It speeds up loading.

F. Write short answers.

Question 1.
Is food that we eat a mixture ?
Answer:
Yes food that we eat is a mixture of carbohydrates, proteins, fats, minerals and vitamins.

Question 2.
Name two methods by which solid-solid mixtures can be separated.
Answer:

- Winnowing
- Hand Picking

Question 3.
How can you separate iron metal from non-magnetic impurities ?
Answer:
We can separate iron metal from non-magnetic impurities by the method of magnetic separation.

Question 4.
Name the technique that you use if only the solid component of a solution is required.
Answer:
Evaporation.

Question 5.
Name the substance you will add to speed up sedimentation.
Answer:
Alum

Question 6.
Name the different types of chromatographic techniques.
Answer:

- Paper Chromatography
- Column Chromatography
- Thin Layer Chromatography
- Gas Chromatography.

G. Answer in detail.

Question 1.
What is the difference between a pure substance and a mixture ?
Answer:

- **A pure substance consists** of only one kind of matter, that is, all the particles are same. It has a definite composition and constant properties. It cannot be split into simpler substances by physical means. All pure substances have characteristic melting and boiling points. A pure substance is either a compound or an element.
- **A Mixture contains** two or more substances in any proportion which can be separated by physical methods. Mixtures are generally of two types : Homogeneous and Heterogeneous.
  In a mixture, the constituents can be present in any ratio. They do not have characteristic melting and boiling points. In a mixture each constituent retain its original properties. These can be separated by physical means.

Question 2.
What are the different types of mixtures ?
Answer:
Mixtures are basically of two types :

- **Homogeneous Mixtures** : The composition of these mixtures is uniform throughout the mixture. Besides the properties of the mixture are the same in all the parts of the mixture, e.g. sugar dissolved in water.
- **Heterogeneous Mixtures** : A heterogenous mixture composition is not uniform throughout the mixture. The properties of the mixture are different in different parts of mixture e.g. chalk dissolved in water.

Question 3.
Why is filtration a better technique than sedimentation and decantation ?
Answer:
Filtration is a better technique than sedimentation and decantation because it can separate very fine insoluble particles as compared to the latter. Besides the filtrate obtained is generally pure solvent. In decantation when we pour out supernatant liquid there are chances of their getting mixed up with solute particles.

Question 4.
How is distillation method different from evaporation?
Answer:
In distillation and evaporation both the solution is allowed to boil by giving heat. Evaporation does not involves the collection of vapour thus obtained.Distillation involves the condensation of the vapour obtained to obtain pure solvent. This is done in specially designed condensation chamber.

Question 5.
What is centrifugation ? Also write the principle on which it works.
Answer:

- **Centrifugation :** It is a technique used to speed up sedimentation of fine particles suspended in a solid-liquid mixture.
- **Principle :** The principle of centrifugation is that an object, when spun at high speed, experiences an outward force away from the centre of rotation.