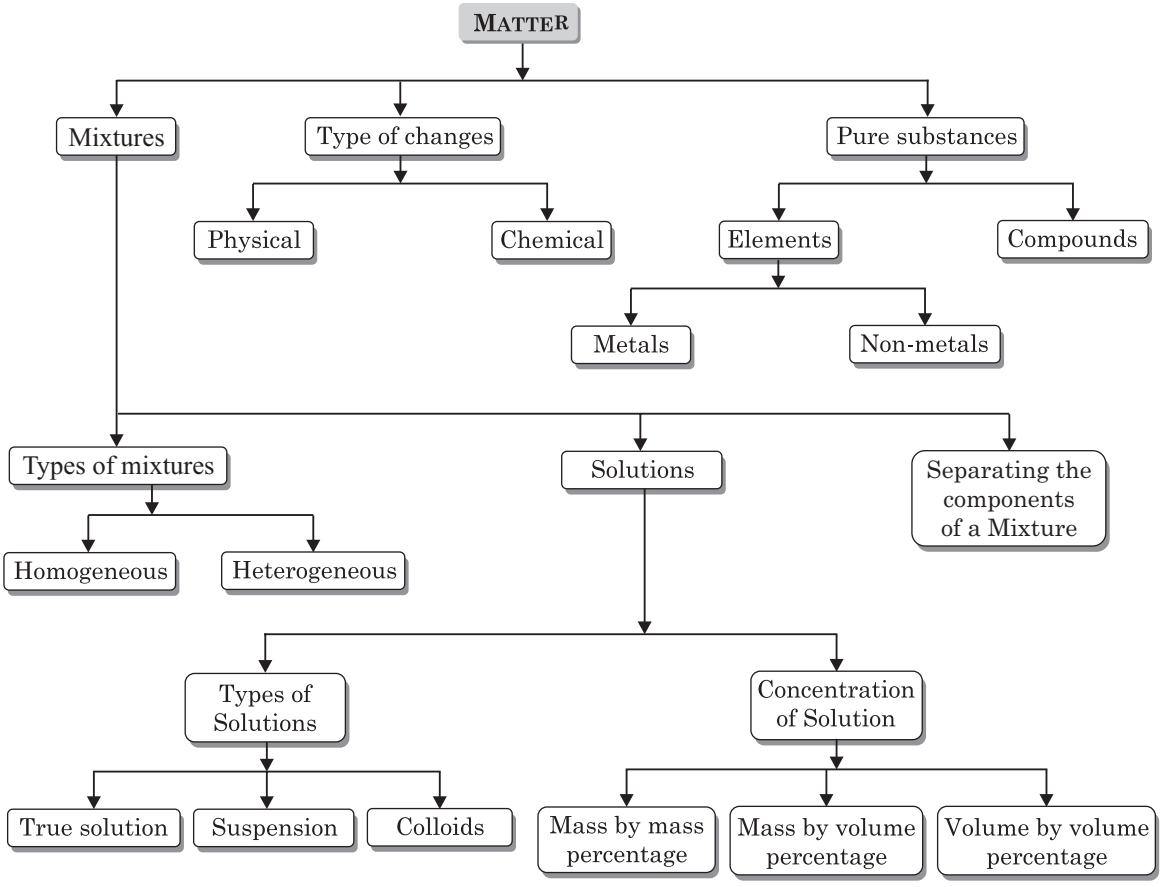
2 Is Matter Around Us Pure

TOPICS COVERED

2.1 Mixtures, Type of Mixtures, Solutions, Suspension and Colloidal Solutions
2.2 Separating Components of a Mixture; Physical and Chemical Changes; Elements, Compounds and Mixtures

CHAPTER MAP



Quick Revision Notes

- **Pure substances** consist of single type of particles, e.g. elements and compounds are pure substances.
- **Mixture** contains two or more type of particles.
- Mixture contains two or more elements or compounds, e.g. Air is a mixture of oxygen, nitrogen, carbon dioxide and water vapours.
- Mixture can be homogeneous or heterogeneous. Salt solution is a homogeneous mixture, whereas iron filings and sulphur powder forms a heterogeneous mixture.
- **Solution** is a homogeneous mixture of two or more substances, e.g. salt solution. Salt is the solute and water is the solvent.
- True solutions have particle size less than 1 nm (10^{-9} m).
- **Colloids** have particle size between 1 nm to 1000 nm (10^{-9} to 10^{-6} m).
- **Suspensions** have particle size greater than 1000 nm (10^{-6} m).
- In a colloidal solution, solute is called the dispersed phase, solvent is called the dispersion medium.
- Solids in liquid form colloidal solutions called **sols**, liquid in solids form collidal solutions called **gels** and liquid in liquids form colloidal solutions called **emulsions**.
- **Solute** can be obtained from the solution by evaporation, e.g. salt can be obtained from sea water by evaporation.
- Cream is obtained from milk by centrifugation.
- Mass by mass percentage is the mass of solute dissolved in 100 g of solution.
- Mass by volume percentage is the mass of solute dissolved in 100 mL of solution.
- Volume by volume percentage is the volume of solute dissolved in 100 mL of solution.
- **Immiscible liquids** (which do not mix) are separated by separating funnel.
- If one of the component in the mixture is a volatile solid, it can be separated by sublimation.
- Coloured components of a mixture is separated by chromatography.
- **Miscible liquids** having large difference in boiling points are separated by distillation.
- Miscible liquids having less difference in their boiling points are separated by fractional distillation, e.g. petroleum.
- A pure substance can be obtained from its cooling hot saturated solution through a process called **crystallisation**.
- Saturated solutions cannot dissolve more solute at a specific temperature.
- Solubility of solid in a liquid increases with increase in temperature but solubility of gas in a liquid decreases with increase in temperature.
- In physical changes, no new substance is formed whereas in chemical changes new substance is formed.
- **Elements** can be classified into metals, non-metals and metalloids.
- Mixtures can be separated by physical methods, whereas compounds are decomposed by chemical methods.
- **Law of conservation of mass** is applicable to all the chemical reactions but not in nuclear reactions.
- All compounds are formed as per the law of constant proportions.
- **Metals** are good conductors of electricity while non-metals are not, except graphite.
- Metals are malleable and ductile, non-metals are brittle.
- Properties of compounds are different from its constituting elements, whereas mixture shows properties of the constituting elements or compounds.
- An element cannot be broken down into simpler substances.
- The path of light becomes visible in a colloidal solution, this effect is called **Tyndall effect**. It is due to the scattering of light by colloidal particles.

- Particles of a colloidal solution are always there in a state of constant random motion called **Brownian motion**.
- Different methods of separation are used to separate mixtures, depending upon the nature of substances present in the mixture.

1. Mixtures, Type of Mixtures, Solutions, Suspension and Colloidal Solutions

Pure Substance: It is the substance which contains only one kind of atoms or molecules.

- Elements and compounds are pure substances, e.g. sugar, sodium chloride, gold.
- Pure substances have fixed melting and boiling points.

Mixtures: Those substances which contain one or more elements or compounds in any proportion are called mixtures, e.g. soil, air, sea water, minerals, soft drinks.

- They can be separated by physical methods.

Homogeneous Mixtures: Those mixtures which have the same composition throughout the mixture are called homogeneous mixtures, e.g. salt solution, sugar solution, copper sulphate solution.

- Different solutions of the same substance will have different composition. It means homogeneous mixtures can have variable composition in different solutions.

Heterogeneous Mixtures: Those mixtures which do not have the same composition throughout are called heterogeneous mixtures, e.g. NaCl and iron filings, salt and sulphur, oil and water.

Solution: It is an homogeneous mixture of two or more substances, e.g. lemonade, soda water. A liquid can dissolve solids, liquids or gases to form a solution.

Solute: The substance which is present in small amount in a solution is called solute, e.g. iodine is the solute in tincture of iodine.

Solvent: The substance which can dissolve another substance is called solvent. It is present in large amount, e.g. alcohol is the solvent in tincture of iodine.

Alloys: They are the homogeneous mixtures of metals and cannot be separated by physical methods. It is called mixture of two or more solids because it shows the properties of its components and can have a variable composition, e.g. Brass–a mixture of 30% Zinc and 70% Copper. One constituent can also be a non-metal in an alloy, e.g. Steel is an alloy of iron and carbon.

Amalgam: It is the alloy of mercury with any other metal, e.g. sodium-mercury alloy is called sodium amalgam.

Saturated Solution: The solution in which no further amount of solute can be dissolved at a particular temperature.

Properties of True Solution:

- It is an homogeneous mixture, with particle size less than 10^{-9} m (1 nm).
- The particles of a true solution cannot be seen.
- It does not scatter light, i.e. does not show Tyndall effect because the particles are very very small.
- The solute particles cannot be separated from a solution by filtration.
- The solute particles do not settle down due to force of gravity, because a solution is stable.

Concentration of Solution: The solution is called dilute, if it contains less amount of solute and more amount of solvent, e.g. dilute sulphuric acid (*aq*.), dilute NaOH (*aq*).

Aqueous Solutions: The solution in which water acts as the solvent are called aqueous solutions, e.g. salt solution, sugar solution.

Non-aqueous solutions: The solution having solvent other than water like alcohol, acetone, ether, benzene, etc. are called non-aqueous solutions.

Solubility: The amount of solute present in the saturated solution in 100 g of solution is called solubility. Different substances have different solubilities in the same solvent.

Unsaturated Solution: The solution which has less amount of solute than the saturation level is called unsaturated solution.

Concentration of Solution: It is the amount of solute present in given amount (mass or volume) of solution.

- Mass by mass percentage of solution $= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
- Mass by volume percentage of solution $= \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$
- Volume by volume percentage of solution $= \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$

Suspension: It is an heterogeneous mixture of two or more substances in which solute particles remain suspended through the bulk of the medium and do not dissolve, e.g. oil in water, chalk powder in water, sulphur in water.

- They can be separated by filtration.
- Particles are larger than 10^{-6} m (1000 nm) and are visible to naked eye.
- The particles of suspension scatter light and path of light becomes visible.

Colloidal Solution (Colloid): The particles of colloidal solution spread uniformly, it appears to be homogeneous but actually it is heterogeneous, e.g. Milk, blood, ink, soap solution.

- The particle size is in between 1 nm to 1000 nm. [1 nm = 10^{-9} m]
- We cannot see colloidal particles with naked eye.
- The scattering of beam of light by colloidal particles is called Tyndall effect. The path of light becomes clearly visible.
- The particle do not settle down due to gravity.
- They cannot be separated by filtration, but can be separated by centrifugation.

Dispersed Phase: The dispersed particles of colloidal solution is called dispersed phase.

Dispersion Medium: The medium in which colloidal particles are dispersed. It can be a solid, liquid or gas.

Types of colloidal solutions with examples are given in the table.

- Gas dispersed in gas is not a colloidal solution, it is called a mixture.

S.No.	Dispersed phase	Dispersion medium	Type	Example
1.	Liquid	Gas	Aerosol	Fog, cloud, mist
2.	Solid	Gas	Aerosol	Smoke, dust particle in air
3.	Gas	Liquid	Foam	Shaving cream
4.	Liquid	Liquid	Emulsion	Milk, face cream, Dettol in water
5.	Solid	Liquid	Sol	Milk of magnesia, mud
6.	Liquid	Solid	Gel	Jelly, cheese, butter
7.	Gas	Solid	Foam	Foam rubber, sponge, pumice stone
8.	Solid	Solid	Solid Sols	Coloured gemstone, milky glass

Exercise 2.1

I. Very Short Answer Type Questions (1 Mark)

1. Name two solvents other than water that are being used at home. For what purpose(es) are they used for?

2. What does pure substance mean? [*NCERT*]

3. Which form of water is the purest form of water?

4. Which of the following statements are true for pure substances?

(*i*) Pure substances contain only one kind of particles.

(*ii*) Pure substances may be compounds or mixtures.

(*iii*) Pure substances have the same composition throughout.

(*iv*) Pure substances can be exemplified by all elements other than nickel.

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iii*)

(*c*) (*iii*) and (*iv*) (*d*) (*ii*) and (*iii*) [*NCERT Exemplar*]

5. Rusting of an article made up of iron is called:

(*i*) corrosion and it is a physical as well as chemical change

(*ii*) dissolution and it is a physical change

(*iii*) corrosion and it is a chemical change

(*iv*) dissolution and it is a chemical change [*NCERT Exemplar*]

6. A mixture of sulphur and carbon disulphide is:

(*i*) heterogeneous and shows Tyndall effect.

(*ii*) homogeneous and shows Tyndall effect.

(*iii*) heterogeneous and does not show Tyndall effect.

(*iv*) homogeneous and does not show Tyndall effect. [*NCERT Exemplar*]

7. Tincture of iodine has antiseptic properties. This solution is made by dissolving

(*i*) iodine in potassium iodide (*ii*) iodine in vaseline

(*iii*) iodine in water (*iv*) iodine in alcohol [*NCERT Exemplar*]

8. 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*)

[*NCERT Exemplar*]

9. 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*), (*iii*) and (*iv*) (*d*) (*ii*), (*iii*) and (*iv*) [*NCERT Exemplar*]

10. 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

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*) (*c*) (*iii*) and (*iv*) (*d*) (*i*) and (*iv*)

[*NCERT Exemplar*]

11. Classify each of the following as homogeneous or heterogeneous mixtures:
soda water, wood, air, soil, vinegar, filtered tea [*NCERT*] [*CBSE*, 2014]

12. How would you confirm that a colourless liquid given to you is pure water?

13. Which of the following materials fall into the category of a "pure substance"?

(*i*) Ice (*ii*) Milk (*iii*) Iron (*iv*) Hydrochloric acid

(*v*) Calcium oxide (*vi*) Mercury (*vii*) Brick (*viii*) Wood

(*ix*) Air. [*NCERT*]

14. Identify the solutions among the following mixtures:
(*i*) Soil (*ii*) Sea water (*iii*) Air (*iv*) Coal
(*v*) Soda water [*NCERT*]

15. Which of the following will show "Tyndall effect"?
(*i*) Salt solution (*ii*) Milk
(*iii*) Copper sulphate solution (*iv*) Starch solution [*NCERT*]

16. Two substances, A and B were made to react to form a third substance, A_2B according to the following reaction:
$2\ A + B \rightarrow A_2B$
Which of the following statements concerning this reaction are incorrect?
(*i*) The product A_2B shows the properties of substances A and B
(*ii*) The product will always have a fixed composition
(*iii*) The product so formed cannot be classified as a compound
(*iv*) The product so formed is an element
(*a*) (*i*), (*ii*) and (*iii*) (*b*) (*ii*), (*iii*) and (*iv*)
(*c*) (*i*), (*iii*) and (*iv*) (*d*) (*ii*), (*iii*) and (*iv*) [*NCERT Exemplar*]

17. Two chemical species X and Y combine together to form a product P which contains both X and Y
$X + Y \rightarrow P$
X and Y cannot be broken down into simpler substances by simple chemical reactions. Which of the following concerning the species X, Y and P are correct?
(*i*) P is a compound (*ii*) X and Y are compounds
(*iii*) X and Y are elements (*iv*) P has a fixed composition
(*a*) (*i*), (*ii*) and (*iii*) (*b*) (*i*), (*ii*) and (*iv*)
(*c*) (*ii*), (*iii*) and (*iv*) (*d*) (*i*), (*iii*) and (*iv*) [*NCERT Exemplar*]

18. State any one difference between pure and impure substances. [*CBSE* 2014]

19. What are the two components of a solution? [*CBSE* 2014]

20. How can you convert a saturated solution into an unsaturated solution? [*CBSE* 2014]

21. Write the dispersed phase and dispersion medium in an emulsion. [*CBSE* 2014]

22. Give two examples of suspension. [*CBSE* 2010]

23. Choose the chemical change out of the following:
Digestion of food, Freezing of water, Glowing of electric lamp, Mixing of iron fillings with sulphur. [*CBSE* 2010]

24. Which type of solution is formed when milk and water is mixed uniformly? [*CBSE* 2010]

25. Give one example for each of the following:
(*i*) Aerosol (*ii*) Solution

II. Short Answer Type Questions–I (2 Marks)

26. List the points of differences between homogeneous and heterogeneous mixture. [*NCERT*]

27. A solution contains 40 g of common salt in 320 g of water. Calculate the concentration in terms of mass by mass percentage of the solution. [*NCERT*]

28. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature. [*NCERT*]

29. Explain the following giving examples:
(*i*) saturated solution (*ii*) pure substance
(*iii*) colloid (*iv*) suspension [*NCERT*]

30. Classify the following into elements, compounds and mixtures.

(*i*) Sodium (*ii*) Soil
(*iii*) Sugar solution (*iv*) Silver
(*v*) Calcium carbonate (*vi*) Tin
(*vii*) Silicon (*viii*) Coal
(*ix*) Air (*x*) Soap
(*xi*) Methane (*xii*) Carbon dioxide
(*xiii*) Blood [*NCERT*]

31. Which of the following are chemical changes?

(*i*) Growth of a plant (*ii*) Rusting of iron
(*iii*) Mixing of iron filings and sand (*iv*) Cooking of food
(*v*) Digestion of food (*vi*) Freezing of water
(*vii*) Burning of a candle [*NCERT*]

32. Give the names of element present in:

(*i*) Calcium oxide (*ii*) Hydrogen chloride
(*iii*) Baking soda (*iv*) Potassium nitrate

33. Define a solution. Give an example of

(*i*) gas in liquid solution (*ii*) gas in gas solution. [*CBSE* 2011]

34. How many litres of 15% (mass/volume) sugar solution would it take to get 75 g of sugar? [*CBSE* 2016]

35. Name the dispersed phase and dispersion medium and the type of colloid:

(*i*) Fog (*ii*) Milk [*CBSE* 2014]

36. (*i*) What are heterogeneous mixtures?

(*ii*) Why mixture do not have fixed melting or fixed boiling points? [*CBSE* 2015]

37. What volume of ethyl alcohol and water must be mixed to prepare 250 mL solution of 60% by volume of alcohol in water.

38. What are gels? Give some examples.

III. Short Answer Type Questions–II (3 Marks)

39. You are provided with salt solution, milk and muddy water. How can you differentiate between them on the basis of: (*i*) Homogeneity, (*ii*) Filtration, (*iii*) Tyndall effect.

40. (*i*) 20 g of sodium chloride is dissolved in 100 mL of water. How will you test whether it is saturated or unsaturated at a given temperature?

(*ii*) Suggest one method by which we can increase the solubility of saturated solutions.

(*iii*) Name the two components of colloids.

Answers 2.1

1. Ethanol is used in glue, printing ink, cough syrups, tonics; Acetone is used in nail polish removers.

2. A pure substance has only one kind of particles.

3. Distilled water

4. (*ii*) Pure substances have one kind of particles and uniform composition.

5. (*iii*) It is corrosion and it is a chemical change because a new substance is formed.

6. (*iv*) It is a true solution, i.e. a homogeneous solution, does not show Tyndall effect.

7. (*iv*) Iodine is dissolved in alcohol.

8. (*iii*) Ice and Air are homogeneous (i.e. have same composition throughout).

9. (*iii*) No new substance is formed in (*i*), (*iii*) and (*iv*).

10. (*i*) New substance(s) is being formed in (*i*) and (*ii*).

11. **Homogeneous:** Soda water, air, vinegar, filtered tea.
Heterogeneous: Wood, soil.

12. If the boiling point of the given liquid is 100°C, it means that it is pure water otherwise not. Pure substances have fixed melting and boiling points.

13. Ice, Iron, Hydrochloric acid, Calcium oxide, Mercury are considered as pure substances.

14. Sea water, soda water are solutions which are mixtures.

15. Milk and starch solution will show tyndall effect.

16. (*c*) (*i*), (*ii*) and (*iv*) are incorrect.

17. (*d*) (*i*), (*ii*) and (*iv*) are correct.

18. Pure substances have fixed melting and boiling points. Impure substances does not have fixed melting and boiling points.

19. Solute and solvent

20. It can be done by heating

21. Both are liquids

22. Chalk powder in water, sulphur powder in water.

23. Digestion of food is a chemical change because new substance(s) with new properties are formed.

24. Colloidal solution

25. (*i*) Dust particles in air is an example of aerosols.
(*ii*) Cold-drink is an example of solutions.

26.

Homogeneous mixture	Heterogeneous mixture
It is uniform throughout.	It is non-uniform throughout.
They are also called solutions. Examples: Aqueous solutions of sugar, salt	They are called suspension if solid is present in liquid. Examples: Salt + sand, chalk powder in water.

27. Mass of solute = 40 g, Mass of water = 320 g
Mass of solution = Mass of solute + Mass of solvent = 40 + 320 = 360 g
Mass percentage of solution:

$$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{40}{360} \times 100 = 11.1\%$$

28. Mass of solute = 36 g
Mass of solvent = 100 g
Mass of solution = 36 + 100 = 136 g
Mass percentage of solution:

$$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{36}{136} \times 100 = \frac{900}{34} = \frac{450}{17} = 26.47\%$$

29. (*i*) **Saturated Solution:** The solution in which no more amount of solute can be dissolved at a particular temperature, e.g. saturated solution of salt water.

(*ii*) **Pure Substance:** It is the substance which contains only one kind of particles (atoms or molecules).

- Elements and compounds are pure substances., e.g. sugar, sodium chloride, gold.
- Pure substances have fixed melting and boiling points, e.g. distilled water.

(*iii*) **Colloidal Solution (Colloid):** The particles of colloids spread uniformly, it appears to homogeneous but actually it is heterogeneous in nature, e.g. Milk, blood, ink, soap solution.

- The particle size is in between 1 nm to 1000 nm. [1 nm = 10^{-9} m]
- We cannot see colloidal particles with naked eye.
- The scattering of beam of light by colloidal particles is called Tyndall effect. The path of light becomes clearly visible due to it.
- The particle do not settle down due to gravity.
- They cannot be separated by filtration but can be separated by centrifugation.

(*iv*) **Suspension:** It is a heterogeneous mixture of two or more substances in which solute particles remain suspended through the bulk of the medium and do not dissolve, e.g. oil in water, chalk powder in water, sulphur in water.

- They can be separated by filtration.
- Particles are larger than 10^{-6} m (1000 nm) and are visible to naked eye.
- The particles of suspension scatter light and path of light becomes visible to some extent.

30. **Elements:** Sodium, Silver, Tin, Silicon.
Compounds: Calcium carbonate, Methane, Carbon dioxide.
Mixtures: Sugar solution, soil, coal, air, soap, blood.

31. Growth of plant, Rusting of iron, Cooking of food, Digestion of food, Burning of a candle

32. (*i*) Calcium and oxygen (*ii*) Hydrogen and chlorine
(*iii*) Na, H, C, oxygen (*iv*) K, N, oxygen

33. Solution is a homogeneous mixture of two or more substances.
(*i*) Cold drink, (*ii*) Air

34. Mass by Volume percentage:

$$= \frac{\text{Mass of solution}}{\text{Volume of solution}} \times 100$$

$$15 = \frac{75}{\text{Volume of solution}} \times 100$$

Volume of solution = 500 mL = 0.5 L

35. (*i*) **Fog:** Water vapours are dispersed in air (gas).
(*ii*) **Milk:** Liquid fat dispersed in water.

36. (*i*) Those mixtures which have non-uniform composition.
(*ii*) (*a*) They do not fixed composition throughout the mixture.
(*b*) Impurities increases the boiling point and decreases the melting point. It depends upon the amount of impurities, e.g. sea water boils above 100 °C, depending upon the amount of salts present in it.

37. Concentration of solution:

$$= \frac{\text{Volume of ethyl alcohol}}{\text{Volume of solution}} \times 100$$

$$60 = \frac{x}{250} \times 100$$

$$x = \frac{60 \times 250}{100} = 150 \text{ mL}$$

38. When liquids are dispersed in solids, they are called gels, e.g. cheese, hair gel.

39.

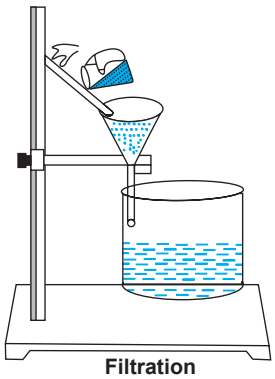
Salt solution (True solution)	Milk (Colloidal solution)	Muddy water (Suspension)
It is homo-geneous.	It appears to be homogeneous but is actually heterogeneous.	It is hetero-geneous.
It passes through the filter paper and therefore cannot be separated.	It cannot be separated by filtration.	It can be easily filtered.
It does not show Tyndall effect.	It shows Tyndall effect, due to scattering of light.	It shows Tyndall effect.

40. (*a*) Add more NaCl. If it dissolves, it is unsaturated. If it does not dissolve, it is saturated.
(*b*) It can be done by increasing the temperature.
(*c*) Dispersed phase and dispersion medium.

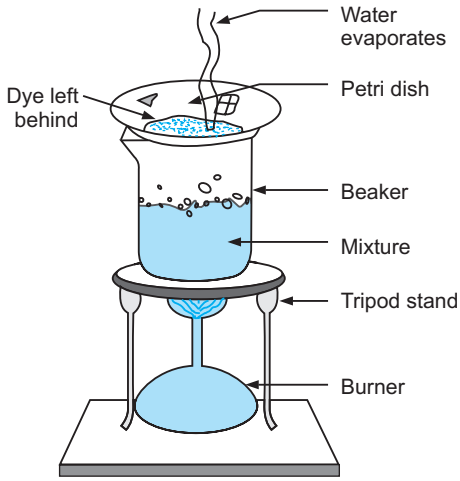
2. Separating Components of a Mixture; Physical and Chemical Changes; Elements, Compounds and Mixtures

Methods of Separation of a Mixture

Filtration: It is used to separate the insoluble impurities from a mixture with the help of filter paper.
Basic principle: Insoluble impurities cannot pass through small pores of filter paper.
Example: Separation of water and sand. Sand remains on a filter paper and water gets separated in a beaker.



Filtration



Evaporation

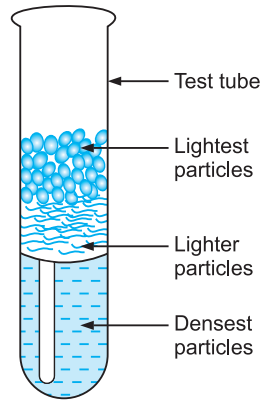
Evaporation: It is the process of separating a solid substance from a liquid which is soluble, e.g. salt can be obtained from sea water by evaporation, blue or black dye can be obtained by evaporation of ink solution.
Basic Principle: One of the component has low boiling point which evaporates easily than the other one having high boiling point.
Example: Black dye from ink can be separated by evaporation. Water gets evaporated while dye left behind in a china dish.

Centrifugation: It is the process in which components of a colloidal solution or mixture are separated by rotating the colloidal solution at high speed in a centrifugal machine.

Basic Principle: When a mixture is rotated at high speed, denser particles settles down whereas lighter particles float which can be separated.

Examples:

- Cream from milk
- Butter from buttermilk (Lassi)
- Blood and urine test in pathological labs
- Used in washing machine in dryers, to squeeze out water from clothes



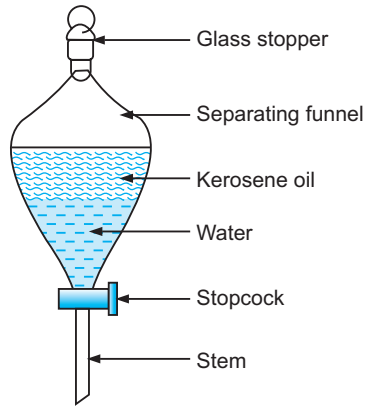
Centrifugation

Separation of Immiscible Liquids (Differential Extraction): It is the process in which two liquids which do not mix with each other and can be separated with the help of a separating funnel.

Basic Principle: It is based on the difference in density of the immiscible liquids. Lighter liquid forms the upper layer, while heavier liquid forms the lower layer.

Examples:

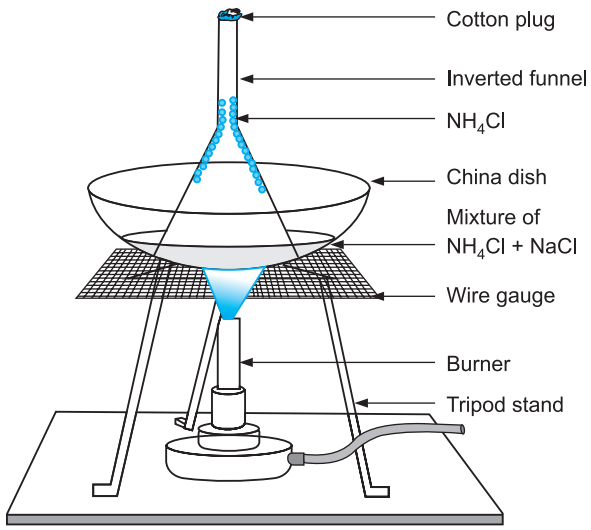
- Kerosene oil and water
- Petrol and water
- Removal of slag from molten iron in the extraction of iron



Separation of Immiscible Liquids

Sublimation: It is a process in which one solid changes into vapours whereas other does not.

Basic Principle: One of the component is volatile and other is non-volatile.



Sublimation

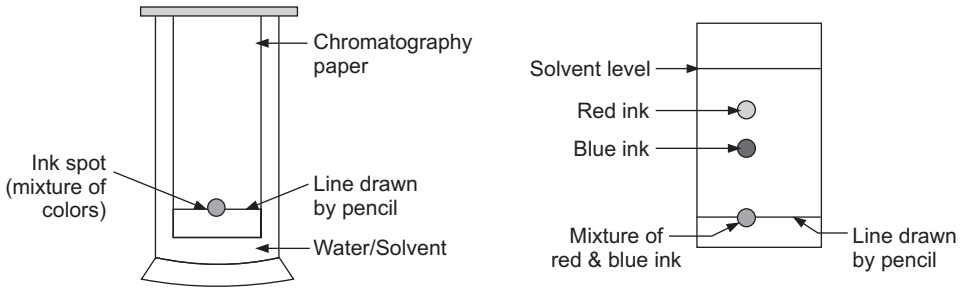
Examples: NH_4Cl + NaCl, Iodine and Sand, Camphor and Sand, Naphthalene + NaCl, Anthracene + Sand.

Chromatography: It is based on the principle of differential adsorption. The substance which is adsorbed to more extent moves slowly whereas the other moves faster and get separated. It is used to separate coloured compounds.

Basic Principle: Coloured components can be separated using an adsorbent on which these are adsorbed to different extent.

Examples:

- Mixture of blue and red ink can be separated.
- Pigments can be separated because they adsorb on the adsorbent to a different extent.
- To separate drugs from blood.



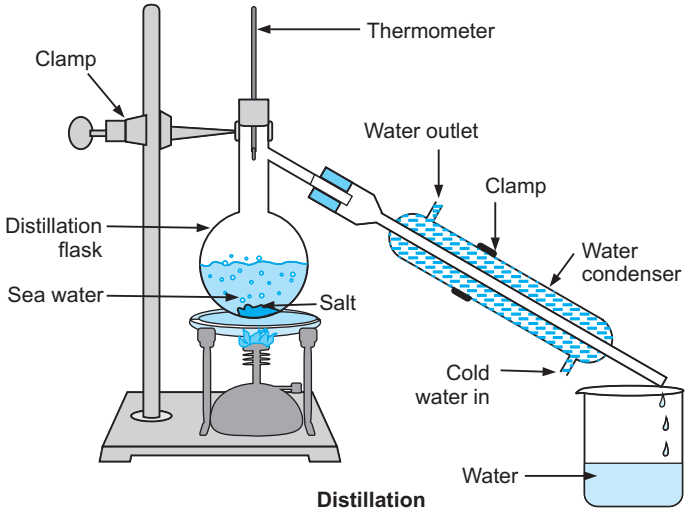
Separation of dyes using chromatography

Distillation: It is a double process of evaporation followed by condensation.

Basic Principle: It is used to separate miscible liquids having large difference in their boiling points. Liquids with lower boiling point will get vapourise first and on cooling it changes into liquid and thus get separated.

Example:

- Benzene and Toluene
- Acetone and water



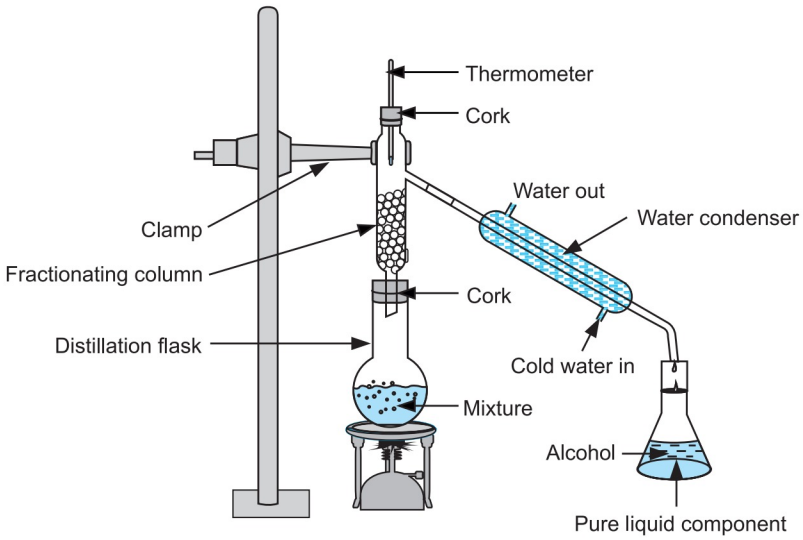
Distillation

Fractional Distillation: It is a process in which a fractional column is used which gives the effect of repeated distillation.

Basic Principle: It is used to separate those liquids which do not differ appreciably in their boiling points.

Examples:

- Refining of petroleum to get kerosene, diesel, petrol, fuel oil, LPG, Paraffin wax, lubricating oil.
- Separation of alcohols.
- Separation of components of air from liquid air.



Fractional Distillation

Crystallisation: It is a process in which a hot saturated solution of a soluble solid substance is cool down. Crystals of a pure substance is formed.

Basic Principle: Pure compound and impurities are soluble in the same solvent to different extent.

Examples:

- Preparation of sugar crystals from sugar solution.
- Separation of $CuSO_4$ crystal from impure sample of $CuSO_4$ solution.
- Separation of salt from sea water.

Physical change:

- Those changes in which no new substance is formed.
- These are reversible changes.
- Change in physical state of the substance takes place.
  e.g. melting of ice, evaporation of water.

Chemical changes:

- Those changes in which new compound is formed.
- These changes cannot be easily reversed.
- New products are formed.
- Heat or light is involved in these changes.
- It may produce or use electricity.
- Precipitate may be formed in these changes.

Examples:

- Burning of fuel
- Cooking of food
- Rusting of iron

Elements:

- Those substances which contain only one type of atoms.
- They cannot be broken down further into simpler substances.
- They have fixed melting and boiling points.
- 118 elements have been discovered so far.
- These can be classified into metals, non-metals and metalloids.

Metals:

- They can lose electrons easily.
- They are lustrous.
- They are malleable and ductile.
- They are sonorous i.e. produce sound when struck with a hard substance.

Examples: Gold, Silver, Iron, Copper, Aluminium.

Non-metals:

- They gain electrons easily.
- They are brittle.
- They are non-lustrous except iodine and diamond.
- They do not conduct electricity, except graphite.

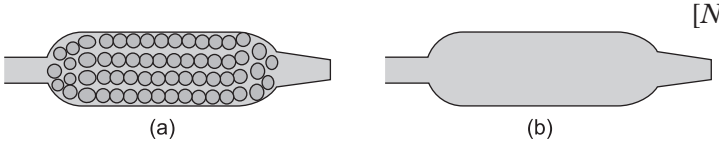
Metalloids: They resemble with metals as well as non-metals, e.g. Boron, Silicon, Germanium.

	Mixture		**Compounds**
(*i*)	Does not have a fixed composition.	(*i*)	They have a fixed composition.
(*ii*)	Mixing of elements or compounds form mixtures.	(*ii*)	Elements are chemically combined in a fixed ratio.
(*iii*)	It shows properties of its components.	(*iii*)	It does not show properties of its components.
(*iv*)	Components can be easily separated by physical methods.	(*iv*)	Their components can by be separated by certain chemical methods.
(*v*)	They do not have fixed melting point.	(*v*)	They have fixed melting point.
(*vi*)	Little or no heat is involved in their formation.	(*vi*)	Heat/light/electricity is absorbed or evolved in their formation.
(*vii*)	e.g. Mixture of iron filings and sulphur, sand + iodine, sea water, brass.	(*vii*)	e.g. NaCl, KCl, $CuSO_4$, $ZnSO_4$ are compounds.

Exercise 2.2

I. Very Short Answer Type Questions (1 Mark)

1. Which of the tubes in Fig. (*a*) and (*b*) will be more effective as a condenser in the distillation apparatus? [*NCERT Exemplar*]



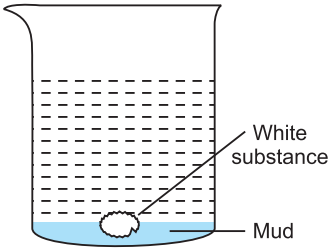
(a) (b)

2. Salt can be recovered from its solution by evaporation. Suggest some other technique for the same? [*NCERT Exemplar*]

3. Have you seen dust particles from clothes settled at the bottom of a washing tub. Do you know why? **[HOTS]**
4. Name the process for the separation of different components of air.
5. How is air liquified?
6. Name two gases which are soluble in water. **[HOTS]**
7. A solution is prepared by adding 40 g of sugar in 100 g of water. Calculate the concentration in terms of mass by mass percentage of solution. [*CBSE* 2012]
8. Fishes prefer to go deep in water during daytime. Why?
9. Calculate the amount of glucose required to prepare 250 g of 5% solution of glucose by mass.
10. What are the favourable qualities given to gold when it is alloyed with copper or silver for the purpose of making ornaments?
11. Sucrose (sugar) crystals obtained from sugarcane and beetroot are mixed together. Will it be considered a pure substance or a mixture? Give reasons for the same.
12. What term is given to a mixture having uniform composition and no distinct components?

II. Short Answer Type Questions–I (2 Marks)

13. A student was having a beaker full of muddy water. He put a whitish stone like substance in it and suddenly the mud settled down. What is this white substance and what do we call this process? **[HOTS]**



14. Work out a process for separating a mixture of sand, NH_4Cl and common salt?
15. The municipality water that we get in our homes may still have germs in it. What can we do in order to make it clean?
16. An athlete underwent a dope test and was found positive for drugs. What could be the process used to identify that his blood contained those drugs? Explain the principle and process.
17. (*i*) Name the metals which have no insoluble salts.
    (*ii*) Name one other group of salts which are always soluble. **[HOTS]**
18. What does this term mean? Give an example.
    (*i*) Filtrate (*ii*) Residue **[HOTS]**
19. You have a solution of sugar in water. You want to get sugar from it.
    (*i*) Explain, why filtration will not work.
    (*ii*) Which method will you use instead?
20. How do sol and gel differ from each other? Give one example.
21. Define solubility. How does solubility of a solid in water changes with temperature?
22. Two students 'A' and 'B' were given 10 ml of water in a bowl and a plate, respectively. Name the student whose water evaporates faster and explain the reason. [*CBSE* 2016]
23. Differentiate between an element and a compound. (Any two points). Write one example of each.
24. Identify the physical and chemical changes from the following:
    (*i*) Heating the mixture of iron and sulphur
    (*ii*) Ripening of fruits (*iii*) Dissolution of salt in water
    (*iv*) Rusting of iron chair (*v*) Making egg omelette
25. While diluting a solution of salt in water, a student by mistake added acetone (boiling point 56 °C). What technique can be employed to get back the acetone? Justify your choice.

26. Explain why particles of a colloidal solution do not settle down when left undisturbed, while in the case of a suspension they do. [*NCERT Exemplar*]

27. Smoke and fog both are aerosols. In what way are they different? [*NCERT Exemplar*]

28. Classify the following as physical or chemical properties:

(*i*) The composition of a sample of steel is: 98% iron, 1.5% carbon and 0.5% of other elements.

(*ii*) Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas.

(*iii*) Metallic sodium is soft enough to be cut with a knife.

(*iv*) Most metal oxides form alkalies on reaction with water. [*NCERT Exemplar*]

29. An element is sonorous and highly ductile. Under which category would you classify this element? What other characteristics do you expect the element to possess? [*NCERT Exemplar*]

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

(*i*) A volatile and a non-volatile component.

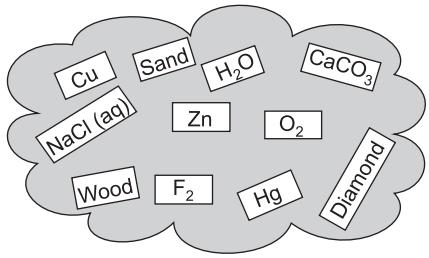
(*ii*) Two volatile components with appreciable difference in boiling points.

(*iii*) Two immiscible liquids.

(*iv*) One of the components of the mixture changes directly from solid to gaseous state.

(*v*) Two or more coloured constituents soluble in the same solvent. [*NCERT Exemplar*]

31. Classify the substances given in below figure into elements and compounds.



[*NCERT Exemplar*]

32. Suggest separation technique(s) one would need to employ to separate the following mixtures:

(*i*) Mercury and water

(*ii*) Potassium chloride and ammonium chloride

(*iii*) Common salt, water and sand

(*iv*) Kerosene oil, water and salt [*NCERT Exemplar*]

III. Short Answer Type Questions–II (3 Marks)

33. Write the basic principles behind:

(*i*) Chromatography (*ii*) Crystallisation

(*iii*) Distillation (*iv*) Centrifugation

34. What is full cream, toned and double toned milk? **[HOTS]**

35. Explain the following terms in your own words:

(*i*) Soluble (*ii*) Insoluble (*iii*) Aqueous solution

36. How will you separate sugar and salt from the from the mixture of their aqueous solutions? What precaution should we take? **[HOTS]**

37. (*i*) Define Tyndall effect.

(*ii*) Why is water considered a compound? Mention two points.

38. Write down the processes involved in sequential order to get the supply of drinking water to your home from waterworks. [*CBSE* 2012]

39. Why is inter-conversion of states is a physical change? Give three reasons. [*CBSE* 2016]

40. (*i*) Define an element.

(*ii*) What is meant by malleability? Name two substances which are malleable. [*CBSE* 2016]

41. A student was given a mixture of iron filings and sulphur? He was told to heat it and observe the compound: [*CBSE* 2016]

(*i*) What is the colour of the compound formed?

(*ii*) Write the effect of magnet on it.

(*iii*) Write the action of carbon disulphide on it.

(*iv*) Describe the effect of adding dilute HCl to it. Identify the gas evolved and write two of its properties.

42. The teacher instructed three students 'A', 'B' and 'C' respectively to prepare a 50% (mass by volume) solution of sodium hydroxide (NaOH). 'A' dissolved 50 g of NaOH in 100 mL of water, 'B' dissolved 50 g of NaOH in 100 g of water while 'C' dissolved 50 g of NaOH in water to make 100 mL. Who has made the solution correctly? [*NCERT Exemplar*] **[HOTS]**

43. Name the process associated with the following:

(*i*) Dry ice is kept at room temperature and at one atmospheric pressure.

(*ii*) A drop of ink placed on the surface of water contained in a glass spreads throughout the water.

(*iii*) A potassium permanganate crystal is placed in a beaker and water is poured into the beaker with stirring.

(*iv*) Acetone bottle is left open and the bottle becomes empty.

(*v*) Milk is churned to separate cream from it.

(*vi*) Settling of sand when a mixture of sand and water is left undisturbed for sometime.

(*vii*) Fine beam of light entering through a small hole in a dark room, illuminates the dust particles in its path. [*NCERT Exemplar*]

44. On heating, calcium carbonate gets converted into calcium oxide and carbon dioxide.

(*i*) Is it a physical or a chemical change?

(*ii*) Can you prepare one acidic and one basic solution by using the products of the reaction.

45. What would you observe when:

(*i*) a saturated solution of potassium chloride prepared at 60°C is allowed to cool to room temperature.

(*ii*) an aqueous sugar solution is heated to dryness.

(*iii*) a mixture of iron filings and sulphur powder is heated strongly. [*NCERT Exemplar*]

46. Suggest suitable methods used for separating

(*i*) Husk from wheat (*ii*) Sand from water

(*iii*) Stones from *daal* (pulses) (*iv*) Camphor powder and common salt powder

(*v*) Butter from milk

(*vi*) Pure potash alum from impure potash alum (*Phitkari*)

47. Which of the following are not compounds?

(*i*) Chlorine gas (*ii*) Potassium chloride (*iii*) Iron

(*iv*) Iron sulphide (*v*) Aluminium (*vi*) Iodine (*vii*) Carbon

(*viii*) Carbon monoxide (*ix*) Sulphur powder [*NCERT Exemplar*]

IV. Long Answer Type Questions (5 Marks)

48. Look at the following table:

	Compound	Mass (g) dissolved in 100 g of water of 25°C
1.	$AgNO_3$	241.3
2.	$Ca(NO_3)_2$	102.1
3.	Sugar (glucose)	91.0
4.	KNO_3	37.9
5.	K_2SO_4	12.0
6.	$Ca(OH)_2$	0.113
7.	$CaCO_3$	0.0013
8.	AgCl	0.0002

(*i*) Which substance among them is most soluble?

(*ii*) About how many times more soluble is this substance than K_2SO_4 at 25°C?

(*iii*) The substance in (*a*) gives a colourless solutions. What will be seen if we add 300 g of it to 100 g of water at 25°?

(*iv*) What will you see if you heat up the mixture? **[HOTS]**

49. How would you obtain pure water from sea water?

50. Name the principle used to separate kerosene and water. Draw a neat and labelled diagram of the apparatus used in this separation.

51. **Fill in the blanks**

(*i*) A colloid is a _____ mixture and its components can be separated by the technique known as _____.

(*ii*) Ice, water and water vapour look different and display different _____ properties but they are _____ the same.

(*iii*) A mixture of chloroform and water taken in a separating funnel is mixed and left undisturbed for sometime. The upper layer in the separating funnel will be of _____ and the lower layer will be that of _____.

(*iv*) A mixture of two or more miscible liquids for which the difference in the boiling points is less than 25 K can be separated by the process called _____.

(*v*) When light is passed through water containing a few drops of milk, it shows a bluish tinge. This is due to the _____ of light by milk and the phenomenon is called _____. This indicates that milk is a _____ solution. [*NCERT Exemplar*]

52. Non metals are usually poor conductors of heat and electricity. They are non-lustrous, non-sonorous, non-malleable and coloured.

(*i*) Name a lustrous non-metal.

(*ii*) Name a non-metal which exists as a liquid at room temperature.

(*iii*) An allotropic form of a non-metal is a good conductor of electricity. Name the allotrope.

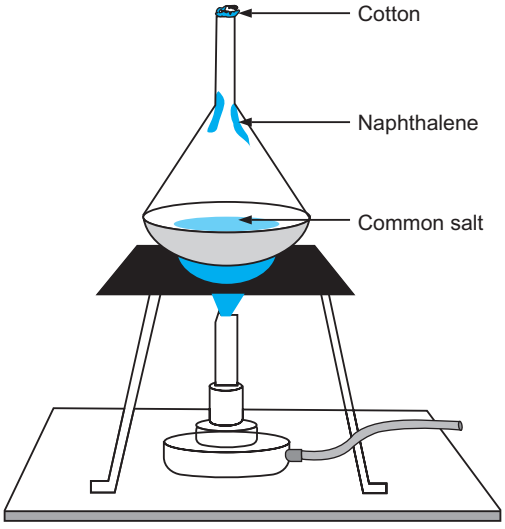
(*iv*) Name a non-metal which is known to form the largest number of compounds.

(*v*) Name a non-metal other than carbon which shows allotropy.

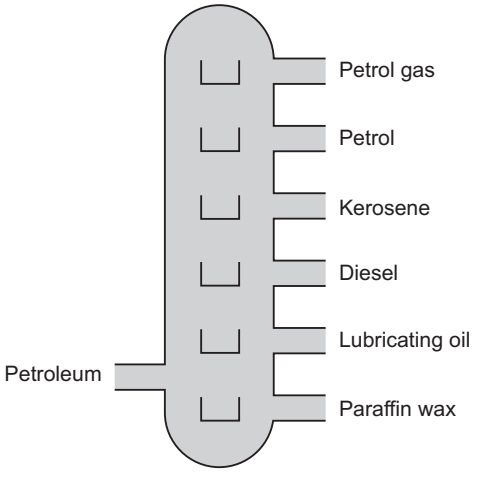
(*vi*) Name a non-metal which is required for combustion. [*NCERT Exemplar*] **[HOTS]**

53. How can we separate alcohol from water? Explain the whole process with a labelled diagram?

54. Explain the techniques used in the following figures:



(*i*)



(*ii*)

Answers 2.2

1. (*i*) will be more effective.

2. Crystallisation is a better process to get pure salt from its solution.

3. While washing clothes they get separated by centrifugation as these are heavy and so they settle down.

4. Fractional distillation of liquid air.

5. It is liquified at low temperature and high pressure.

6. (*i*) Carbon dioxide (*ii*) Ammonia

7. Mass of solution = Mass of solute + Mass of solvent = 40 + 100 = 140 g

$$\text{Mass percentage of solution} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{40}{140} \times 100 = \frac{200}{7} = 28.57\%$$

8. It is because the surface water becomes hot which has less amount of oxygen dissolved in it cold water in deep has more oxygen.

9. Percentage by mass:

$$= \frac{\text{Mass of glucose}}{\text{Mass of solution}} \times 100$$

$$5 = \frac{x}{250} \times 100$$

$$x = \frac{1250}{100} = 12.5 \text{ g.}$$

10. It makes it hard and suitable for making ornaments.

11. It will be considered as a pure substance. Sugar has fixed composition whatever may be the source.

12. Homogeneous mixtures

13. The white substance is potash alum. The process is called loading. It speeds up the rate of sedimentation.

14. **Sublimation:** On strong heating NH_4Cl will change into vapours on heating and on cooling solid NH_4Cl will get separated on a inverted funnel.
Dissolution: On dissolving in water common salt will dissolve in water, but sand will not.
Filtration: Sand can be removed by filtration. Salt solution will be obtained as the filtrate.
Evaporation: Common salt can be recovered by evaporating the salt solution.

15. **Add bleaching powder:** It will act as a disinfectant. This process is called chlorination. The water will become fit for drinking.

16. Chromatography is used to identify drugs present in blood. They have different adsorbing power on adsorbent and thus get separated.

17. (*i*) Sodium and potassium (All salts are soluble in water).
(*ii*) All nitrates are soluble in water.

18. (*i*) **Filtrate:** The solution so obtained after filtration is called filtrate, e.g. when sand and common salt dissolved in water is filtered, salt-solution is obtained as the filtrate.
(*ii*) **Residue:** The insoluble substance left on the filter paper after filtration is called residue, e.g. sand will be the residue when we filter sand and water solution.

19. (*i*) It is because sugar solution will pass through the filter paper.
(*ii*) Crystallisation will be used to get the the pure crystal of sugar.

20. Sol is a solid substance dispersed in a liquid, e.g. starch in water, gum in water.
Gel is a liquid substance dispersed in a solid, e.g. cheese, hair gel.

21. Solubility is defined as the amount of substance dissolved in a fixed amount of solvent.
It increases with increase in temperature.

22. Water of student 'B' will get evaporated faster because plate has more exposed surface area, therefore the rate of evaporation will be more.
That is why we put very hot tea in a plate or saucer so that it cools faster.

23.

Element	Compound
It consist of only one type of atoms.	It contains two or more type of atoms.
It can not be broken further into simpler substances.	It can be broken into elements by suitable chemical methods.
e.g. Iron	e.g. Proteins

24. (*i*) Chemical change (*ii*) Chemical change
(*iii*) Physical change (*iv*) Chemical change (*v*) Chemical change

25. Distillation process could be used because there is a large difference in the boiling point of acetone and the salt solution.
Acetone has lower boiling point (56 °C). It will change into vapours form and on condensation, we can get back acetone.

26. Particles of colloidal solution are small and lighter than the particles of a suspension, therefore these particles of colloidal solution do not settle down whereas particles of suspension being heavier settles down.

27. In smoke carbon particles (solid) are dispersed in air (gas).
In fog, water vapours (liquid) are dispersed in air (gas).
Both are aerosols because dispersion medium is gas (air).

28. (*i*) Physical (*ii*) Chemical (*iii*) Physical (*iv*) Chemical

29. (*i*) It is a metal. (*ii*) It is lustrous.
(*iii*) It is malleable and ductile.
(*iv*) It is a good conductor of heat and electricity.

30. (*i*) Salt and water solution which can be separated by distillation if it is solution.
(*ii*) Benzene and toluene solution which can be separated by distillation.
(*iii*) Kerosene and oil which can be separated by separating funnel (Differential extraction).
(*iv*) Iodine and sand, the mixture components are separated using sublimation.
(*v*) Mixture of blue and red ink, which can be separated chromatography.

31. **Elements:** Cu, Hg, F_2, O_2, Zn, Diamond
Compounds: $CaCO_3$, H_2O

32. (*i*) Distillation (*ii*) Sublimation
(*iii*) Filtration followed by crystallisation of filtrate or evaporation of filtrate.
(*iv*) Separation by separating funnel, followed by evaporation of salt solution.

33. (*i*) **Chromatography:** It is based on the principle of differential adsorption.
(*ii*) **Crystallisation:** It is based on the difference in solubility of the substance to be separated and the impurities present in it.
(*iii*) **Distillation:** It is based on the principle of difference in boiling point of the two miscible liquids.
(*iv*) **Centrifugation:** If a mixture is rotated at high speed, lighter impurities can be separated from the heavy substance.

34. **Full cream** milk contains 6% fats and cream is not removed from the milk. It is good for childrens and people who are under weight.
Toned milk: It contains 3% of fats and cream is removed from it upto 50%. It is good for children and people who have normal weight.
Double toned milk: It contains 1.5% fats and 75% of cream is removed from the milk. It is also called slim milk. It is good for overweight people and those who have high cholesterol and triglycerides.

35. (*i*) **Soluble:** The substance which dissolve in a solvent forming a homogeneous solution is soluble, e.g. salt is soluble in water, iodine is soluble in alcohol.
(*ii*) **Insoluble:** The substance which does not dissolve in a solvent and forms a suspension or a precipitate is called insoluble, e.g. sand is insoluble in water.
(*iii*) **Aqueous solution:** Solution of a substance in water is called aqueous solution, e.g. sugar dissolved in water is aqueous solution.

36. (*i*) Add ethanol, sugar will dissolve, salt will not.
(*ii*) Separate salt by filtration. Salt will be the residue, sugar solution will be the filtrate.
(*iii*) Evaporate sugar solution in alcohol over water bath.
Precaution: Heat sugar and alcohol solution over water bath because alcohol vapours are highly inflammable, it may catch fire if heated directly.

37. (*i*) The path of light is clearly visible due to scattering of light by colloidal particles this phenomena is called Tyndall effect.
(*ii*) (*a*) Water is a compound because it contains hydrogen and oxygen in a fixed ratio 2 : 16, i.e. 1 : 8 by mass.
(*b*) Its properties are different from the properties of its components.

38. Reservoir → Sedimentation → Loading tank → Chlorination to kill bacteria → To home
(*i*) **Sedimentation:** It is done so as to settle the insoluble heavy impurities.
(*ii*) **Loading:** Potash alum is added to speed up the rate of sedimentation.
(*iii*) **Filtration:** It will remove the insoluble impurities.
(*iv*) **Chlorination:** It will kill bacteria.

39. (*i*) It is because no new substance is formed.
(*ii*) Physical properties will change and not the chemical properties.
(*iii*) There is no change in composition of the substance.

40. (*i*) Element has only one kind of atoms. It is a pure substance.
(*ii*) It is the property due to which a metal can be beaten into thin sheets. Gold and silver are highly malleable metals.

41. (*i*) Black coloured FeS is formed. (*ii*) No effect
(*iii*) No effect (*iv*) $FeS + 2HCl \rightarrow FeCl_2 + H_2S$
H_2S gas is liberated.
(*i*) It has smell of rotton eggs. (*ii*) It turns blue litmus red.
(*iii*) It turns lead acetate paper black.

42. 'C' has made the solution correctly. 50% mass by volume means 50 g of solute dissolved in 100 mL of solution.

43. (*i*) Sublimation (*ii*) Diffusion
(*iii*) Dissolution (*iv*) Evaporation
(*v*) Centrifugation (*vi*) Sedimentation
(*vii*) Tyndall effect.

44. (*i*) It is chemical change.
(*ii*) Yes, $CaO + H_2O \rightarrow \underset{\text{Basic solution}}{Ca(OH)_2}$
$CO_2 + H_2O \rightarrow H_2CO_3$ (Acidic solution)

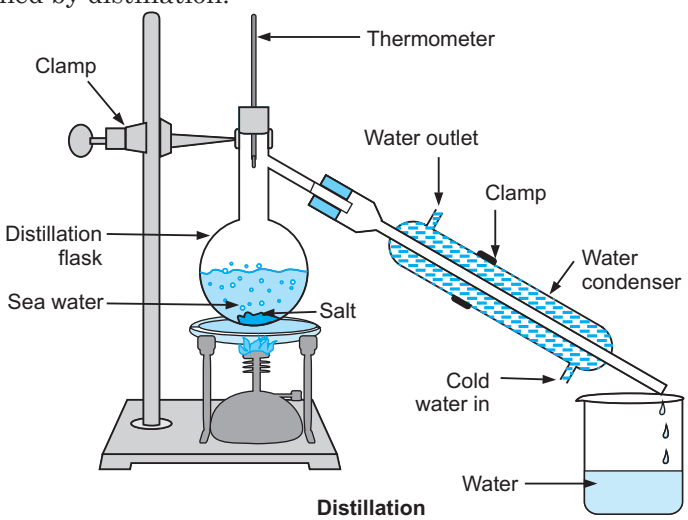
45. (*i*) We will get crystals of KCl. (*ii*) Sugar will get charred.
(*iii*) Black coloured iron sulphide will be formed.

46. (*i*) Winnowing (*ii*) Filtration
(*iii*) Hand-picking (*iv*) Sublimation
(*v*) Centrifugation (*vi*) Crystallisation

47. (*i*) Chlorine gas (*iii*) Iron
(*v*) Aluminium (*vi*) Iodine
(*vii*) Carbon (*ix*) Sulphur powder [*NCERT Exemplar*]

48. (*i*) $AgNO_3$ (Silver nitrate)
(*ii*) The substance is 20 times more soluble.
(*iii*) It will form a saturated solution because whole of $AgNO_3$ will not dissolve. Undissolved $AgNO_3$ will be visible.
(*iv*) It will become unsaturated because whole of the $AgNO_3$ will not dissolve because solubility increases with increase in temperature.

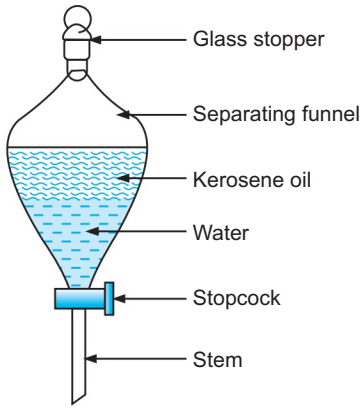
49. It can be obtained by distillation.



Distillation

(*i*) Set the apparatus as shown in the diagram.
(*ii*) Water will get vapourised and get condensed. We will now get pure water.
(*iii*) Salts will remain in the distillation flask.

50. Kerosene oil and water are immiscible and they differ in their densities, therefore we can separate them by using a separating funnel.

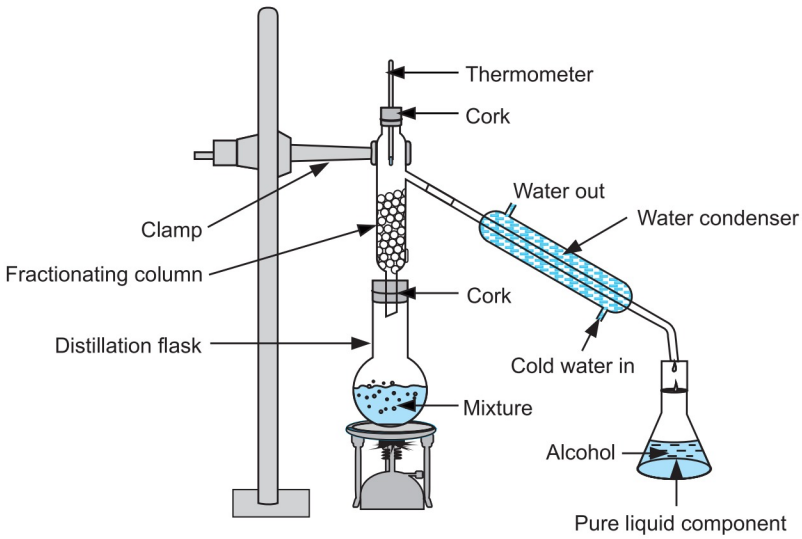


Separation of Immiscible Liquids

51. (*i*) Heterogeneous, centrifugation
(*ii*) Physical, chemically
(*iii*) Water, chloroform
(*iv*) Fractional distillation
(*v*) Scattering, Tyndall effect, colloidal

52. (*i*) Iodine, Diamond (*ii*) Bromine (*iii*) Graphite (*iv*) Carbon
(*v*) Sulphur (*vi*) Oxygen

53. Fractional distillation is used to separate water and alcohol. Alcohol has lower boiling point (78°C) than water (100°C), so it will change into vapours, which on distillation gives pure alcohol.
Water will boil at 100 °C and vapours formed, on cooling will form pure water.



Fractional Distillation

54. (*i*) Naphthalene will change into vapours form which gets condensed on the walls of the inverted funnel, whereas common salt remains in the china dish. This process is called sublimation.

(*ii*) • It is fractional distillation of petroleum. It is based on the difference in the boiling point of various fractions of petroleum.
- Petroleum is heated upto 400°C and vapours are then passed through a long fractionating column.
- The vapours are condensed in different compartments, depending upon their boiling points.
- The vapours having highest boiling point get condensed first and get separated and lower boiling point components are obtained from the top.

VALUE BASED QUESTIONS

1. Rita got hurt in the school while playing. Her teacher Mrs. Madhur applied tincture of iodine kept in chemistry lab. She felt relief and thanked her teacher.

(*i*) What values are associated with Mrs. Madhur?

(*ii*) Which solvent is used in tincture of iodine?

(*iii*) Which property of this solution helps in healing?

2. Dr. D.R. Singh advised villagers to add a tablet of bleaching powder to a bucket of drinking water. Villagers followed his advice and are now living healthy life.

(*i*) What values are associated with Dr. D.R. Singh?

(*ii*) What is the use of bleaching powder?

(*iii*) Can we use any other method if bleaching powder is not available?

Answers

1. (*i*) She is concerned about her students and has applied knowledge of chemistry in daily life.

(*ii*) Alcohol

(*iii*) It is an antiseptic.

2. (*i*) He is helpful and concerned about the health of the villagers.

(*ii*) It kill germs causing diseases.

(*iii*) We can boil water and then cool it. It will also kill germs.

PRACTICAL BASED QUESTIONS

EXPERIMENT 2: *To prepare:*

(*a*) *a true solution of common salt, sugar and alum.*

(*b*) *a suspension of soil, chalk powder and fine sand in water.*

(*c*) *a colloidal sol of starch in water and egg albumin in water and distinguish between these on the basis of:*

(*i*) *transparency* (*ii*) *filtration criterion* (*iii*) *stability*

Q1. There are two test tubes provided to you. One has aqueous sugar solution and the other has starch dissolved in water. What is the correct way to differentiate one solution from another? (EXPERIMENTAL SKILLS) [*Delhi* 2016]

Ans. (*i*) Aqueous sugar solution is homogeneous because it is a true solution whereas starch dissolved in water is heterogeneous because sugar solution is true solution where as starch in water is colloidal solution.

(*ii*) Aqueous sugar solution is transparent whereas starch in water is translucent because it is a colloidal solution.

Q2. List two important precautions that we must observe while preparing a colloidal solution of starch. (Experimental Skills) [*Delhi* 2016]

Ans. (*i*) Solution must be prepared in boiling water.

(*ii*) Mixture should be constantly stirred while adding the paste of starch to a boiling water to avoid the formation of lumps.

Q3. When light passes through a solution of alum in water, one cannot see the path of light through it, why? Give two examples of solution where similar results will be obtained. (Reasoning Skills) [*Delhi* 2015]

Ans. Particles of true solution of alum in water are very small and they do not scatter light, therefore, path of light cannot be seen. Solution of sugar in water and solution of copper sulphate in water will show similar results.

Q4. A student prepared three solutions, a solution of alum, soil and milk in water. Can you distinguish between the three on the basis of transparency and stability. (Observation Skills) [*Delhi* 2016]

Ans. Yes, we can differentiate between them as follows:

Basis	Alum in water	Soil in water	Milk in water
(*i*) Transparency	Clear, transparent	Opaque	Translucent
(*ii*) Stability	Most stable	Unstable	Stable

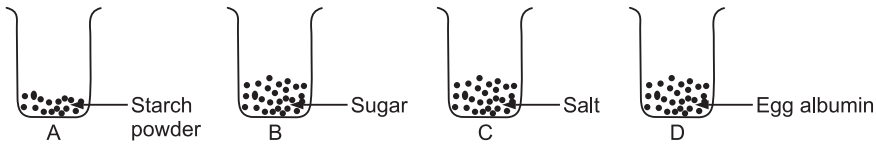
Q5. Identify the clear and transparent solutions from the following mixtures:
(*i*) Milk and water (*ii*) Sugar in water (*iii*) Chalk powder in water (*iv*) Starch powder in water (*v*) Glucose in water (Observation Skills) [*Delhi* 2015]

Ans. Sugar in water and Glucose in water form the clear and transparent true solutions.

Q6. You are asked to prepare an aqueous solutions of sodium chloride and starch powder. How would you compare them on the basis of transparency and stability. (Observation Skills) [*Delhi* 2015]

Ans. Aqueous solution of sodium chloride in water is transparent and more stable. Colloidal solution of starch in water is translucent and less stable.

Q7.



Four students A, B, C and D were asked to prepare a colloidal solution. The above diagram show the preparation done by them. Name the student who will be able to prepare colloidal solution. Write two properties of the colloidal solution. (Observation Skills) [*Delhi* 2015]

Ans. A and D will be able to form a colloidal solution.

Properties:

(*i*) The solution is translucent.

(*ii*) The solution will pass through the filter paper and filtrate formed will be translucent.

Q8. A student take three test tubes A, B and C having salt solution, starch in water and suspension of sand in water. He paste small strips of coloured paper on one side of each test tube. He then observes the coloured paper from the other side of the test tube through the liquid one by one. Write your observations. Give reason. (Observation Skills)

Ans. Coloured paper (spot) is clearly seen in 'A', it appears dim in 'B' and it is not visible in 'C' because 'A' is transparent, 'B' is translucent and 'C' is opaque solution, respectively.

Q9. Four students were asked to add water to glucose powder, milk, sand and soil separately in four beakers. Classify the mixture as true solution, colloid and suspension.
(Interpretation Skills) [*Delhi* 2015]

Ans. Glucose in water forms true solution, soil and sand forms suspension with and milk will form colloidal solution with water.

Q10. Rama took fine chalk powder, albumin, starch powder and alum in four test tubes A, B, C and D. After adding water to all the test tubes, identify the type of solution in each test tube. (Interpretation Skills) [*Delhi* 2014]

Ans. Chalk powder in water forms the suspension, starch powder and egg albumin will form the colloidal solution. Alum dissolved in water forms the true solution.

Experiment 3: *To prepare:*

(*a*) *A mixture*

(*b*) *A compound using iron filings and sulphur powder and distinguish between these on the basis of—*

(*i*) *appearance, i.e., homogeneity or heterogeneity*

(*ii*) *behaviour towards a magnet*

(*iii*) *behaviour towards carbon disulphide, as a solvent*

(*iv*) *effect of heat.*

Q1. Give two methods of separation of iron filings and sulphur powder.

Ans. (*i*) Roll a magnet over the mixture, iron filings will get attracted towards the magnet whereas sulphur powder will be left behind.

(*ii*) Add carbon disulphide, sulphur will dissolve whereas iron filings will not. Filter the contents and iron filings will be left as a residue and sulphur solution in carbon disulphide will be the filtrate, which on evaporation on water bath will give back sulphur.

Q2. Which type of method is used to separate (*i*) mixture of iron filings and sulphur powder (*ii*) Fe and S from FeS (Experimental Skills)

Ans. (*i*) Physical method (*ii*) Chemical method

Q3. Name one solvent in which sulphur is soluble. What precaution should be taken while handling carbon disulphide. (Experimental Skills)

Ans. (*i*) Carbon disulphide is a solvent which can dissolve sulphur.

(*ii*) Carbon disulphide should be kept away from the flame as it is highly combustible.

Q4. Write two observations when iron filings are mixed with sulphur powder.
(Experimental Skills)

Ans. (*i*) Greyish yellow coloured mixture is formed.

(*ii*) A heterogeneous mixture is formed because sulphur powder and iron filings not uniformly distributed.

Q5. When iron filings and sulphur power is heated strongly in a boiling tube a black mass of iron sulphide is formed. Identify the type of change and give reason.
(Reasoning Skills) [*Delhi* 2016]

Ans. Chemical change will take place.
Reason: New substance, FeS is formed which differs in properties from Iron and sulphur.

Q6. What will happen if a magnet is rolled over iron(II) sulphide formed by heating iron filings and sulphur powder. Justify your answer. (Reasoning Skills)

Ans. There will be no effect. FeS is a compound of iron and sulphur. It is not attracted by magnet as it does not possess the properties of Iron.

Q7. At what temperature iron reacts with sulphur powder? Is reaction exothermic or endothermic? Give reason. (Reasoning Skills)

Ans. Iron reacts with sulphur powder at high temperature. The reaction is exothermic.
Reason: It is because iron melts at high temperature and reacts with sulphur.

Q8. What will happen if we add dilute H_2SO_4 to a
(*i*) Mixture of iron filings and sulphur powder,
(*ii*) Compound formed by heating iron filings and sulphur powder? (Observation Skills)

Ans. (*i*) Colourless and odourless hydrogen gas will be evolved.
$Fe(s) + 2HCl(dil) \rightarrow FeCl_2\ (aq) + H_2(g)$
(*ii*) A foul smelling hydrogen sulphide gas with the smell of rotten eggs will be evolved.
$FeS(s) + H_2SO_4(dil) \rightarrow FeSO_4(aq) + H_2S(g)$

Q9. Give one example of:
(*i*) a mixture of two elements.
(*ii*) a mixture of an element and compound. Which of them is homogeneous?
(Observation Skills)

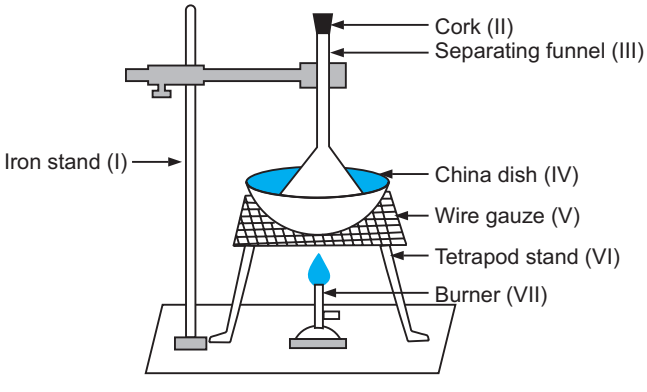
Ans. (*i*) Mixture of iron filings and sulphur powder.
(*ii*) Sulphur and carbon disulphide. It is homogeneous because sulphur will dissolve in carbon disulphide.

Q10. Give the two physical properties of iron sulphide and one chemical property. Write the chemical reaction involved. (Observation Skills)

Ans. Physical properties:
(*i*) It is black in colour.
(*ii*) It is a solid and it is not attracted by magnet.
Chemical Property: It reacts with dilute H_2SO_4 to form foul smelling H_2S gas with the smell of rotten eggs.
$FeS + H_2SO_4(dil) \rightarrow FeSO_4(aq) + H_2S(g)$

Experiment 4: *To separate the components of a mixture of sand, common salt and ammonium chloride (or camphor) by sublimation.*

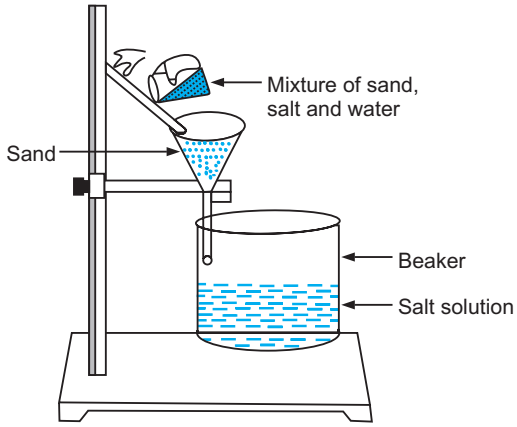
Q1. A student does the labelling, indicated below, for the apparatus used for separating a mixture of camphor and sand. Name the parts that have been incorrectly labelled. (Experimental Skills) [*Foreign* 2009]



Ans. **III** is a inverted funnel; **VI** is a Tripod stand and **II** is a cotton plug.

Q2. Students were asked to separate sand from a mixture of sand and salt. Draw a labelled diagram to carry out the process. Name the process. (Experimental Skills)

Ans. The process is called filtration.



Q3. Give two precautions to be observed while carrying out the process of filtration. (Experimental Skills)

Ans. (*i*) The stem of the funnel should touch the sides of the beaker.
(*ii*) The mixture should be added into the funnel with the help of a glass rod.
(*iii*) Do not fill the funnel more than three fourth of the cone of the filter paper.

Q4. Why do naphthalene balls disappear after sometime? (Reasoning Skills)

Ans. It is because naphthalene balls can sublime at room temperature. It changes into vapours and disappear after sometime.

Q5. A china dish containing a mixture of ammonium chloride, common salt and fine sand, is covered with an inverted glass funnel having a cotton plug at its tube end. A student heats this dish strongly. What does he observe on the inner sides of the funnel which gets condensed. (Observation Skills) [2009-C]

Ans. Dense white fumes of ammonium chloride will get condensed because it can sublime whereas common salt and sand cannot.

Q6. Give four properties of Ammonium chloride by which it can be identified.

Ans. (*i*) It is a white crystalline solid.
(*ii*) It is soluble in water.
(*iii*) It can sublime into white fumes.
(*iv*) Its dissolution is an endothermic process, i.e. test tube containing it becomes cold.

Q7. Name the substances which will undergo sublimation among the following and why?
Dry ice, Camphor, Sand and Iodine. (Conceptual Skills) [*Delhi* 2016]

Ans. Dry ice, Camphor and Iodine will undergo sublimation because they are volatile, i.e. can easily vapourise.

Q8. Name the process by which ammonium chloride and sodium chloride can be separated. During the process of sublimation what do we call the pure substance obtained on the inner side of the funnel? (Conceptual Skills)

Ans. The mixture can be separated by sublimation process because ammonium chloride can sublime whereas sodium chloride cannot. The pure substance that is obtained on the inner sides of the funnel is called sublimate.

Q9. Which type of substances are separated by the technique of sublimation?
(Conceptual Skills) [*Delhi* 2015]

Ans. Volatile and non-volatile substances solids which can and cannot sublime respectively can be separated by sublimation.

Q10. A mixture contains iodine, ammonium chloride and sand. Only iodine and ammonium chloride sublimate and iodine dissolves only in CCl_4. How will you separate the three components? What will be the sequence of steps? (Conceptual Skills) [*Delhi* 2015]

Ans. Iodine will dissolve in CCl_4 whereas ammonium chloride does not which can be separated by filtration. Residue of ammonium chloride and sand can get separated by sublimation where ammonium chloride gets sublimed. Iodine dissolved in CCl_4 can be evaporated in air to give back iodine.

IMPORTANT FORMULAE

- Mass by mass percentage $= \dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
- Mass by volume percentage $= \dfrac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$
- Volume by volume percentage $= \dfrac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$

IMPORTANT NUMERICAL PROBLEMS

1. Calculate the concentration of a solution which contains 12 g of urea in 160 g of solution.
2. Calculate the mass of glucose needed to prepare 250 g of 5% solution by mass.
3. 5 mL of H_2O_2 is dissolved in 95 mL of water. Calculate its percentage in volume by volume.
4. 10 mL of 5% sugar solution is mixed with 20mL of 10% sugar solution. What in the final concentration of solution? **[HOTS]**
5. 300 g of 25% solution and 400 g of 40% solution by mass are mixed together to get a solution. Calculate mass percentage of resulting solution. **[HOTS]**

Solutions

1. Mass percentage $= \dfrac{\text{Mass of solute}}{\text{Volume of solution}} \times 100 = \dfrac{12}{160} \times 100 = \dfrac{120}{16} = 7.5\%$

2. Mass percentage $= \dfrac{\text{Mass of glucose}}{\text{Mass of solution}} \times 100$

$$5 = \frac{\text{Mass of glucose}}{250} \times 100$$

$$\text{Mass of glucose} = \frac{1250}{100} = 12.5 \text{ g}$$

3. Volume by volume percentage $= \dfrac{\text{Volume of solute}}{\text{Volume of solution}} \times 100 = \dfrac{5}{5+95} \times 100 = 5\%$

4. 100 mL of 5% sugar solution contains 5 g of solute (sugar):

10 mL of 5% solution contains $\frac{5}{100} \times 10 = 0.5$ g

100 mL of 10% solution contains 10 g of sugar:

20 mL of 10% solution contains = $\frac{10}{100} \times 20 = 2$ g

Total amount of sugar = 0.5 + 2.0 = 2.5 g

Total volume of solution = 10 mL + 20 mL = 30 mL

% Mass by volume = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{2.5}{30} \times 100 = \frac{250}{30} = 8.33\%$

5. Total Mass of solute = $300 \times \frac{25}{100} + \frac{400 \times 40}{100} = 75 + 160 = 235$ g

Total mass of solution = 300 g + 400 g = 700 g

Mass percentage = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{235}{700} \times 100 = 33.57\%$

COMMON ERRORS

Errors	Corrections
• Students often get confused in differentiating between solid NaCl and NaCl solution.	☞ Solid NaCl is a compound and NaCl solution is a homogeneous mixture.
• Students do not know whether alloys are a kind of mixture or a compound.	☞ Alloys are mixtures because they do not have fixed composition.
• Students get confused in differentiating evaporation with crystallisation.	☞ Crystallisation is a partial evaporation leading to pure crystals whereas evaporation leads to the formation of impure crystals (compound).
• Students are not able to decide which method is suitable to separate the component of a mixture.	☞ Basic principle of each separation technique is most important to apply them in new situations.
• Children do not write formulaa while solving numericals.	☞ They must always write formulae first so as to get 1 or 1/2 mark.
• Children do not do calculations correctly.	☞ Calculations should be done carefully and rechecked before you proceed to the next question.
• Children do not take care of units, For example: g, kg, L, mL, etc.	☞ Units must be taken care off otherwise answer will come wrong.
• Children do calculations at the last page and do mistakes while copying it to the answer sheet.	☞ Calculations should be done on the side margin of the main page.
• Children do not write units along with the answer.	☞ Proper unit must be written, otherwise marks will be deducted for the same.
• Some children do not make proper diagrams.	☞ Diagram must be made with pencil with proper labelling wherever asked or necessary.

REVISION CHART