Chemistry (Class - IX)
Chapter - 2 (Is Matter Around Us Pure)

Introduction

Matter is made of one or more components as substances.
Substance is a kind of matter which cannot be separated into any other types of matter by some physical means.

Element : An element is the simplest or basic form of a pure substance which can not be broken into anything simpler than it by physical or chemical methods.

Compound : A pure substance containing two or element which are combined together in a fixed proportion by mass.

What is a mixture?

The combination of two or more substances (elements or compounds) which are not chemically combined with each other and may also be present in any proportion.

Types of mixture :

Homogeneous Mixture : Mixture in which composition is uniform throughout. Eg. air (O_2, Co_2, N_2) vapour etc.

Heterogeneous Mixture : Mixture in which composition is not uniform throughout. Example, Muddy water, smoke etc.

Homogeneous Mixture	Heterogeneous Mixture
1) The composition remains uniform throught.	1) The composition does not remain uniform throughout
2) The components of the mixture cannot be separated by visible boundaries.	2) The components of the mixture can be separated by visible boundaries.
3) Example : A mixture of salt and water, ethanol and water.	3) Example : A mixture of sand, sugar, chalk and water.

Pure and Impure Substance

Pure Substance: A pure substance is one which is made up of only one kind of particles. These may be atoms or molecules and can't be separated by any physical method for example water, sulphure, hydrogen, carbon etc. are know as pure substances because they are made up of only one kind of particles. A pure substance has a fixed composition as well as a fixed melting and boiling point.

Impure Substance: An impure substances is that which made by two or more than two different kinds of particles (atoms or molecules) and can be separated by physical method. All mixtures are impure substances.
Examples: salt solution, sugar solution, milk, sea-water, air, juice, drinks, rocks, minerals, LPG etc.

A mixture may be homogeneous or hetergeneous.
A mixture does not have a fixed composition or a fixed melting point and boiling point.

What is a Solution?

A solution is a homogeneous mixture of two or more substances. Example, lemonade, soda water etc.

A solution has a solvent and a solute as its components.

Solvent: The component of the solution that dissolves the other component in it (present in larger amount) is called solvent.

Solute: The component of the solution that is dissolved in the solvent (present in lesser quantity) is called the solute.

Examples of Solution

(i) A solution of sugar in water is a solid in liquid solution. Sugar is solute and water is solvent.

(ii) A solution of iodine in alcohol known as 'tincture of iodine' has iodine (solid) as solute and alcohol (liquid) as the solvent.

(iii) Aerated drinks like soda water or are gas in liquid solutions. These contain carbon dioxide (gas) as solute and water (liquid) as solvent.

(iv) Air is a mixture of gas in gas. Air is a homogeneous mixture of a number of gases. Main constituents are: oxygen (21%) and nitrogen (78%).

Properties of a solution

1) A solution is a homogeneous mixture.

2) The particles of a solution are smaller than 1 nm (10^{-9} m) in diameter. So, they cannot be seen by naked eye.

(3) Because of very small particle size, they do not scatter a beam of light passing through a solution. So, the path of light is not visible in a solution.

(4) The solute particles cannot be separated from the mixture by the process of filtration.

(5) The solute particles do not settle down when left undisturbed, that is, a solution is stable.

Concentration of a Solution

The concentration of a solution is the amount of solute present in a given amount (mass or volume) of solution, or the amount of solute dissolved in a given mass or volume of solvent.

$$\text{Concentration of solution} = \frac{\text{Amount of Solute}}{\text{Amount of solution}}$$

or

$$\text{Concentration of solution} = \frac{\text{Amount of Solute}}{\text{Amount of solvent.}}$$

(i) Mass by mass percentage of a solution

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

(ii) Mass by volume percentage of a solution

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

Example: 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.

Mass of solute (Salt) = 40 g
Mass of solvent (water) = 320 g

Mass of solution = Mass of solute + Mass of solvent
= 40 g + 320 g
= 360 g

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

$= \frac{40}{360} \times 100 = 11.1\ \%$

Saturated Solution

A solution is said to be saturated if it has maximum amount of the solute dissolved in it at a given temperature and no solute can be dissolve further.

The amount of the solute present in the saturated solution at this temperature is called its solubility.

Unsaturated Solution

A solution is said to be unsaturated if the more amount of solute can be dissolved in it at a given temperature.

Q.) 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.

Ans) Mass of sodium chloride = 36 g.
Mass of water = 100 g

Total mass of solution = (100 + 36)
= 136 g

$$\text{Concentration (Mass \%) of solution} = \frac{\text{Mass of NaCl (Solute)}}{\text{Mass of Solution}}$$

$$= \frac{36}{136} \times 100$$

$$= 26.47\%$$

What is a Suspension?

A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium. Particles of a suspension are visible to the naked eye. Example, chalk water mixture, fluorine water.

Properties of Suspension

(i) Suspension is a heterogeneous mixture.

(ii) The particles of a suspension can be seen by naked eye.

(iii) The particles of a suspension scatter a beam of light passing through it and make its path visible

(iv) The solute particles settle down when a suspension is left undisturbed, that is, a suspension is unstable.

(v) They can be separated from the mixture by the process of filtration.

Numericals

Q. 1. 0.5 g of salt is dissolved in 25 g of water. Calculate the percentage amount of the salt in the solution.

Sol. Mass of salt present = 0.5 g

Mass of water present in solution = 25 g

$$\therefore \quad \text{Percentage amount of the salt} = \frac{0.5}{0.5 + 25} \times 100 = \mathbf{1.96\%}$$

Q. 2. A solution of urea in water contains 16 grams of it in 120 grams of solution. Find out the mass percentage of the solution.

Sol. Mass of urea present in solution = 16 g

Mass of solution = 120 g

$$\text{Mass per cent of urea} = \frac{\text{Mass of urea}}{\text{Mass of solution}} \times 100$$

$$= \frac{16\ \text{g}}{120\ \text{g}} \times 100$$

$$= \mathbf{13.33\%}$$

Q. 3. A solution has been prepared by mixing 5.6 mL of alcohol with 75 mL of water. Calculate the percentage (by volume) of alcohol in the solution.

Sol. Volume of alcohol present in solution = 5.6 mL

Volume of water = 75 mL

Total volume of solution = (75 + 5.6) mL = 80.6 mL

$$\text{Percentage (by volume) of alcohol} = \frac{\text{Volume of alcohol}}{\text{Total volume of solution}} \times 100$$

$$= \frac{5.6\ \text{mL}}{80.6\ \text{mL}} \times 100$$

$$= \mathbf{6.95\%}$$

Q. 4. A solution contains 30 g of glucose, 20 g of salt in 500 mL of water. Calculate the mass per cent of (*a*) glucose, (*b*) salt (density of water = 1 g /mL).

Sol. Mass of glucose present in the solution = 30 g

Mass of salt present in the solution = 20 g

Mass of water = 500 g

Total mass of the solution = (30 + 20 + 500)g

= 550 g

(*a*) Mass % of glucose $= \frac{\text{Mass of glucose}}{\text{Total mass of solution}} \times 100$

$= \frac{30}{550} \times 100$

Mass % of glucose = **5.45%**

(*b*) Mass % of salt $= \frac{\text{Mass of salt}}{\text{Total mass of solution}} \times 100$

$= \frac{20}{550} \times 100$

Mass% of salt = **3.64%**

Q. 5. During an experiment the students were asked to prepare a 10% (Mass/Mass) solution of sugar in water. Ramesh dissolved 10 g of sugar in 100 g of water while Sarika prepared it by dissolving 10 g of sugar in water to make 100 g of the solution. *[NCERT Exemplar]*

(*a*) Are the two solutions of the same concentration?

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

Sol. (*a*) No.

$\text{Mass per cent} = \frac{\text{Mass of solute}}{\text{Mass of solute} + \text{Mass of solvent}} \times 100$

(*b*) **Solution made by Ramesh:**

$\text{Mass per cent} = \left(\frac{10}{10+100}\right)100$

$= \frac{10}{110} \times 100$

$= \mathbf{9.09\%}$

Solution made by Sarika:

$\text{Mass per cent} = \frac{10}{100} \times 100 = \mathbf{10\%}$

The solution prepared by Sarika has a higher mass per cent than that prepared by Ramesh.

Q. 6. Calculate the mass of sodium sulphate required to prepare its 20% (mass per cent) solution in 100 g of water. *[NCERT Exemplar]*

Sol. Let the mass of sodium sulphate required be x g.

The mass of solution would be = $(x + 100)$g

$$20 = \frac{x}{x+100} \times 100$$

$$20x + 2000 = 100x$$

$$80x = 2000$$

$$x = \frac{2000}{80} = \mathbf{25\ g}$$

So, the mass of sodium sulphate required is 25 g.

Q. 7. Calculate the mass of water and glucose required to make 250 g of 40% solution of glucose.

Sol. Mass of solution = 250g

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

$$40 = \frac{\text{Mass of glucose}}{250} \times 100$$

$$\therefore \quad \text{Mass of glucose} = \frac{40 \times 250}{100} = \mathbf{100g}$$

$$\text{Mass of solution} = \text{Mass of glucose} + \text{Mass of water}$$

So, $$\text{Mass of water} = \text{Mass of solution} - \text{Mass of glucose}$$

$$= 250g - 100g = \mathbf{150g}$$

Q. 8. How much water should be mixed with 12 mL of alcohol so as to obtain 12% alcohol solution?

Sol. Volume of solute = 12 mL

Let the volume of water = x mL

$\therefore$ Volume of solution = $(12 + x)$ mL

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

$$12 = \frac{12}{12+x} \times 100$$

$$12 + x = 100$$

$$x = 100 - 12 = \mathbf{88\ mL}$$

So, 88 mL of water should be mixed.

What is a Colloidal Solution?

A colloidal is a heterogeneous mixture in which particles are uniformly spread throughout the liquid phase. Particles cannot be seen by naked eye.
Example - milk.

Tyndall effect

Because of the small size of colloidal particles, we cannot see them with naked eyes. But these particles can easily scatter a beam of visible light. This scattering of a beam of light is called Tyndall effect.

Tyndall effect can be observed when a fine beam of light enters a room through a small hole. This happens due to the scattering of light by the particles of dust and smoke in air.

Tyndall effect can also be observed when sunlight passes through the canopy of a dense forest. In the forest, mist contain tiny droplets of water, which act as particles of colloid dispersed in air.

Properties of a Colloid

1) A colloid is a heterogeneous mixture

2) The size of a particle of a colloid is too small to be individually seen by naked eyes.

(3) Colloids are bid enough to scatter a beam of light passing through it and make its path visible.

(4) They do not settle down when left undisturbed, that is, a colloid is quite stable.

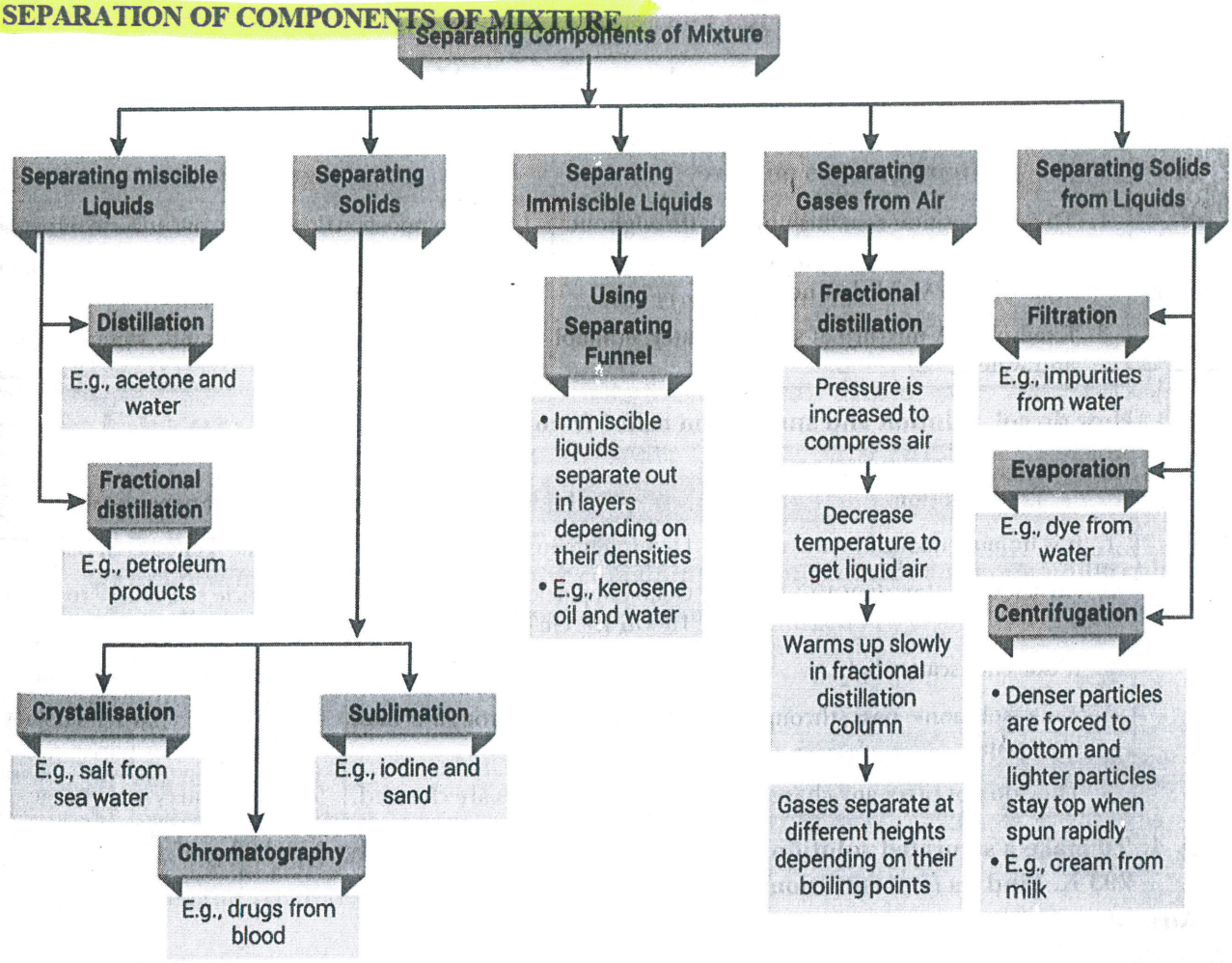
(5) They cannot be separated from the mixture by the process of filtration. But, a special technique of separation known as centrifugation can be used to separate the colloidal particles.

Dispersed phase: The solute-like components or the dispersed particles in a colloid form the dispersed phase

Dispersing Medium: The component in which the dispersed phase is suspended is known as the dispersing medium.

Solution	Colloid (Sol)	Suspension
1) It is a homogeneous mix	1) Heterogeneous mix	1) Heterogeneous mix
2) Partical size $< 10^{-7}$ cm	2) Particle size 10^{-4} to 10^{-7} cm	2) Partical size 10^{-3} to 10^{-5} cm
3) It does not scatter light	3) It scatters a beam of light	3) It scatters a beam of light.
4) True Solutions pass through filter paper	4) They also pass through a filter paper	4) Suspended particles do not pass through filter paper
5) They do not carry any charge	5) Colloidal particles are charged	5) Do not carry any charge.

SEPARATION OF COMPONENTS OF MIXTURE

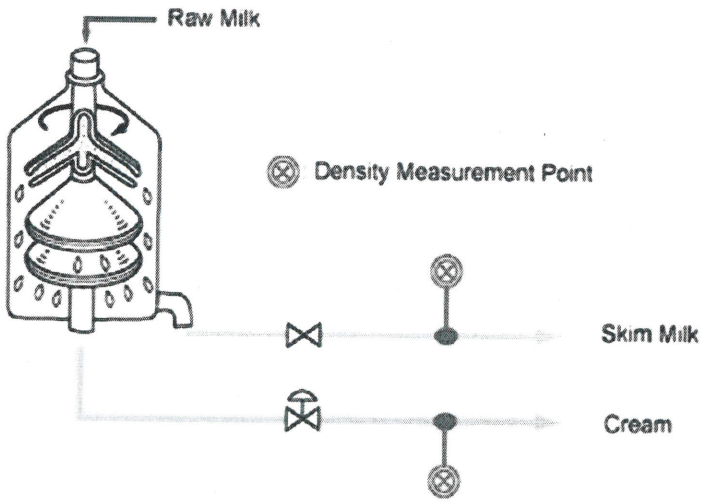


CENTRIFUGATION

In the method of centrifugation, the centripetal and centrifugal forces are used to separate lighter and heavier components of mixture of two immiscible liquids. This process is used to separate very small solids particles from a liquid mixture.

Example – Milk is the mixture of fat, water, and other constituents. Using the method of centrifugation, most of the fat can be separated from milk. In milk, fat is suspended throughout the milk which is separated out using the method of centrifugation.

When milk is churned rapidly, water which is heavier than fat, migrates away from the centre of centrifuge while fat is forced towards the bottom, which is drained out.



Application of centrifugation –

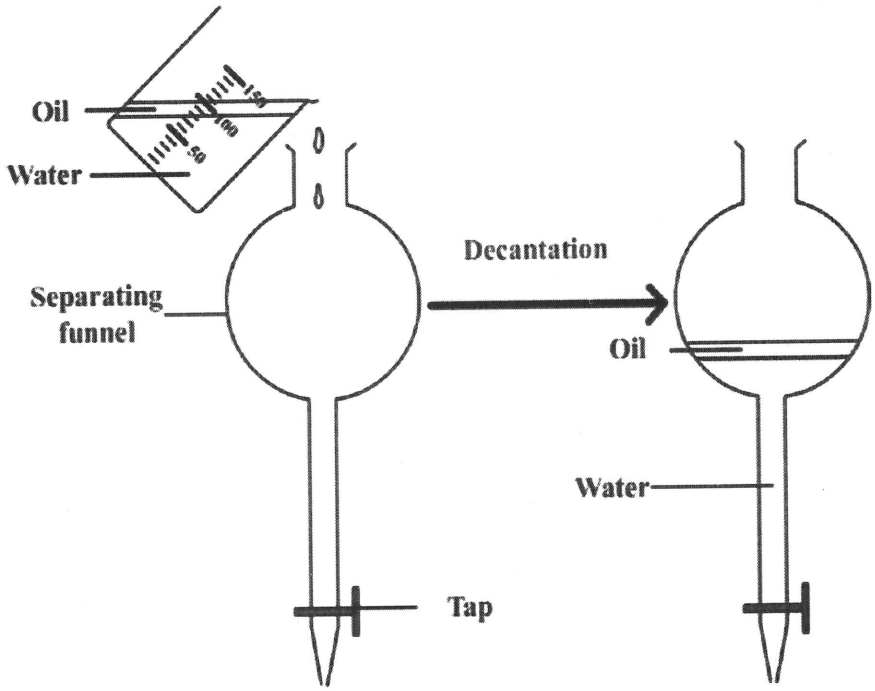
- In pathological test of blood and urine.
- In separation of fat from milk.
- In washing machines to squeeze the water from wet clothes.

DECANTATION

Decantation is used to separate the components from a mixture of two immiscible liquids, such as mixture of oil and water. In a mixture of two immiscible liquids, lighter one and heavier one form separate layer. The lighter one can be decanted after settling of mixture, carefully in other container.

In the process of decantation some of the heavier liquid also poured out with lighter one. Therefore, components from a mixture of two immiscible liquids; can be separated more easily and accurately using a separating funnel.

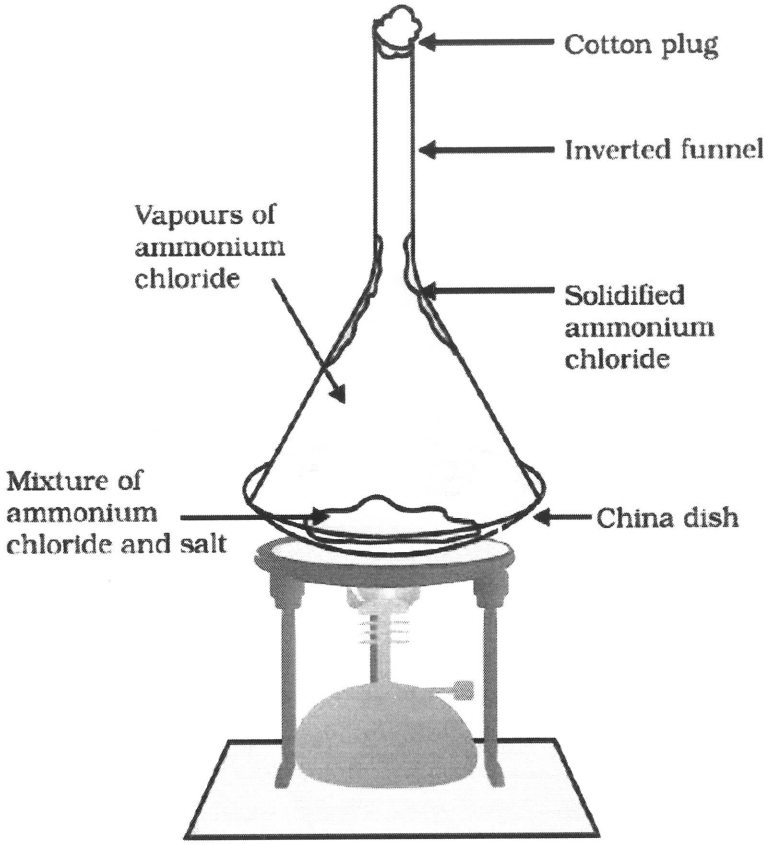
A separating funnel is usually made of glass with a stop cork with drain pipe at bottom. The heavier liquid which is settled at bottom is drained out from the mixture of two immiscible liquids by opening of stop cork from a separating funnel.



SUBLIMATION

There are many substances which are converted into gas from solid when heated, and converted from gas to solid when cooled without converting into liquid. Such substances are known as sublime. For example – ammonium chloride, naphthalene balls, camphor, etc. Therefore, mixture of one sublime and other substance can be separated using the method of sublimation.

The mixture of ammonium chloride and common salt can be separated out using the process of sublimation. For this, the mixture is heated in a China dish. The China dish is covered by an inverted funnel. Cotton is used for plugging the opening of the funnel. After heating, ammonium chloride is converted into vapour and gets deposited over the inner surface of funnel; due to cooling. This leaves the common salt in China dish. Ammonium chloride can be taken out by scratching from the inner wall of funnel.

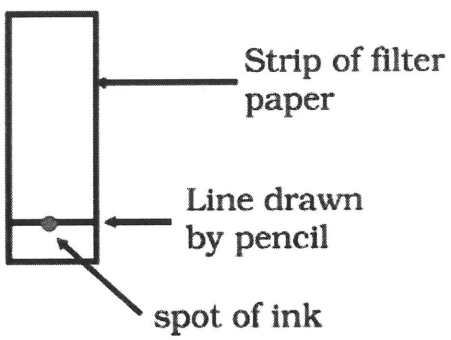


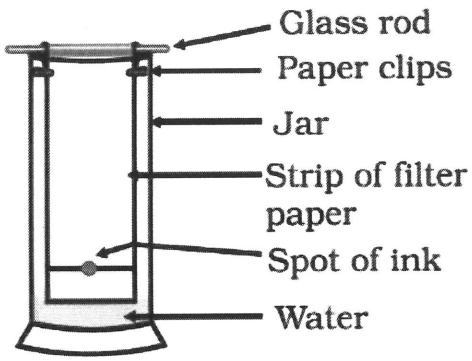
CHROMATOGRAPHY

Chromatography is a method of separation which works on the principle of travel speed of components of a mixture. This method is used for separating dyes and pigments from a mixture. Ink is the mixture of dyes of different colours.

There are many types of chromatography. The dyes from an ink can be separated using paper chromatography.

For this, a strip of filter paper is dipped in the ink. Particles of dye start rising on filter paper; along with water. Different dyes rise with different speed because of different types of solubility in water and go up to certain heights.



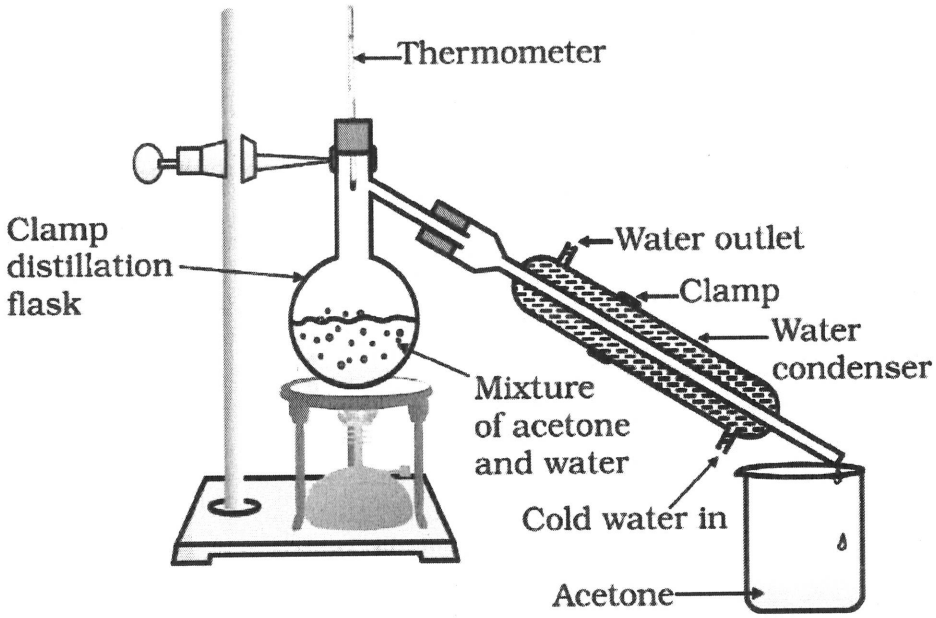


Application of chromatography -

- In the separation of colours from a dyes.
- In the separation of pigments from natural colours.
- In the separation of drugs from blood for pathological tests.

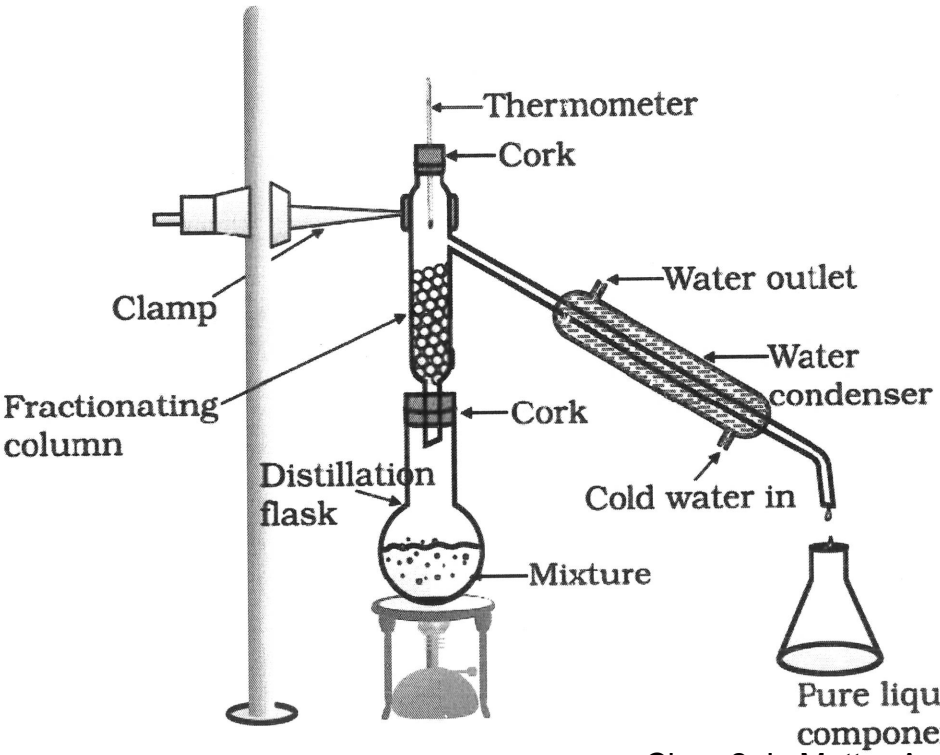
DISTILLATION

The process of distillation is used to separate two miscible liquids. The technique of distillation is based on the difference in boiling points of components of mixture of miscible liquids. Distillation is to separate the liquids which do not decompose even upto their boiling points and should boil at more than 25^0C.



In the process of distillation, the mixture is heated after keeping in a retort or distillation flask. The liquid which boils at lower temperature is vaporized at lower temperature. The vapour so obtained is passed through a tube and gets condensed in a separate container; leaving liquid with higher boiling point in the retort or distillation flask.
Distillation is used to separate the components of the mixture of two miscible liquids that boils without decomposition and have sufficient difference in their boiling points.
The process of distillation is used to purify many liquids, such as water.

FRACTIONAL DISTILLATION



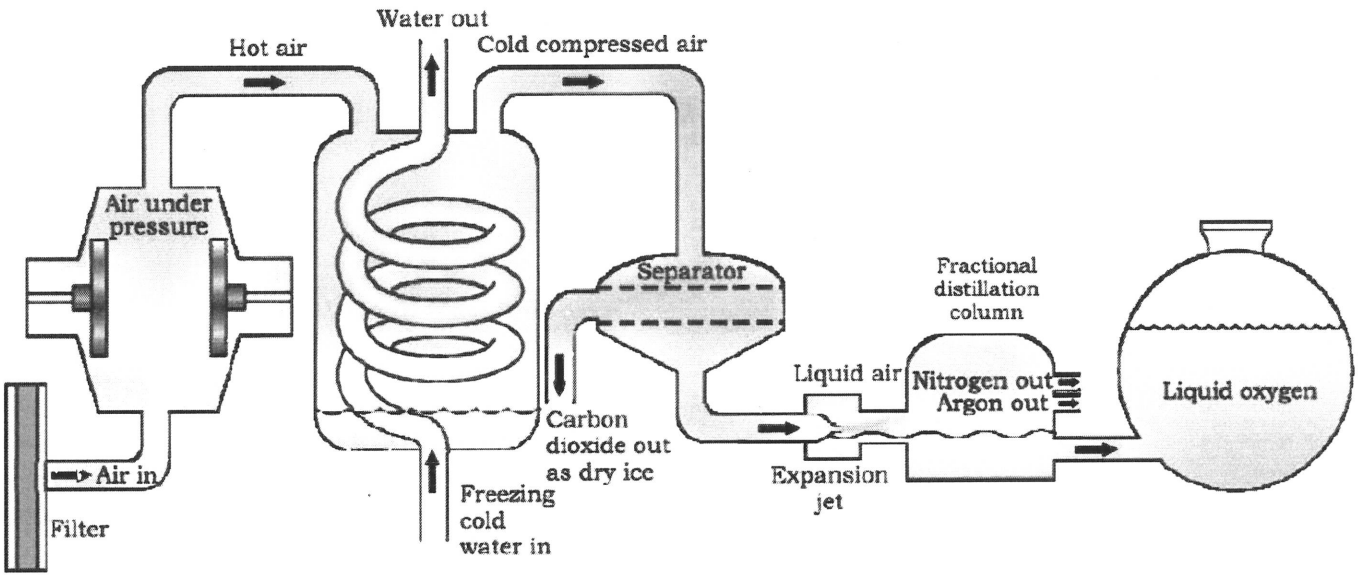
Fractional distillation is the process of separation of components of mixture into parts or fraction on the basis of fractional differences in their boiling points.
Fractional distillation is done when the difference in boiling points of the components of miscible liquids is less than 25^0C. In the process of fractional distillation, a fractional column is used along with retort or distillation flask.
Fractional column is a tube which contains glass beads, which facilitate surface for the vapour to cool and condense repeatedly.
Example – Ethanol and water are separated from their mixture using fractional distillation. The boiling point of water is 100^0C while the boiling point of ethanol is 78.4^0C. Since the difference of their boiling point is less than 25^0C, thus they are separated using fractional distillation.

Some of the Applications of Fractional Distillation:

- In petroleum refineries, petrochemical and chemical plants, natural gas processing and cryogenic air separation plants.
- In oil refineries to separate crude oil into useful substances (or fractions).
- In the process of organic juice.
- In the separation of oxygen, liquid nitrogen and argon from air.

SEPARATION OF DIFFERENT GASES FROM AIR
Air comprises of nitrogen, oxygen, carbon dioxide and argon as major components. Since air is the cheapest source of these gases, thus these are extracted from air at large scale
After liquefaction of air by repeated compression and cooling; nitrogen, oxygen, carbon dioxide and argon are extracted using fractional distillation.
Liquid nitrogen has boiling point equal to - 190^0C and thus turns into gas first and separated from air.
The boiling point of argon is - 186^0C, therefore it is extracted after argon.
The boiling point of oxygen is - 183^0C, thus it is collected after the extraction of argon.
Carbon dioxide turns into solid at a temperature of - 97^0C, therefore, it is removed while air is put under liquefaction.

USE
Nitrogen is used as fertilizers, oxygen is used in hospitals and argon is used in bulbs.



Separation of components of air

CRYSTALLIZATION

Crystallisation is a process that separates a pure solid in the form of its crystals from a solution. The crystallisation method is used to purify solids. For example, the salt we get from sea water can have many impurities in it. To remove these impurities, the process of crystallisation is used.

Crystallisation technique is better than simple evaporation technique as –

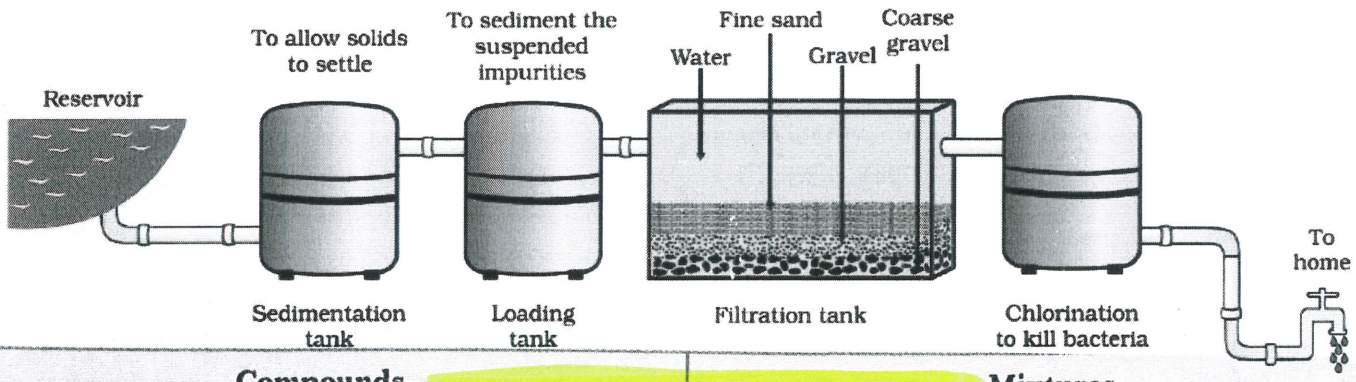
- some solids decompose or some, like sugar, may get charred on heating to dryness.
- some impurities may remain dissolved in the solution even after filtration. On evaporation these contaminate the solid.

APPLICATIONS

- Purification of salt that we get from sea water.
- Separation of crystals of alum (*phitkari*) from impure samples.

Thus, by choosing one of the above methods according to the nature of the components of a mixture, we get a pure substance. With advancements in technology many more methods of separation techniques have been devised.

In cities, drinking water is supplied from water works. A flow diagram of a typical water works is shown in below figure. From this figure write down the processes involved to get the supply of drinking water to your home from the water works and discuss it in your class.



Water purification system in water works

Compounds	Mixtures
1. Compounds are formed as a result of chemical reactions between two or more elements or compounds.	1. Mixtures are formed by simply mixing two or more constituents. There are no chemical reactions between the constituents.
2. The components of a compound are always present in a definite ratio by mass.	2. The components of a mixture may be present in any ratio.
3. The properties of a compound are entirely different from its constituents.	3. The properties of a mixture are same as those of its constituents.
4. Compounds are always homogeneous in nature.	4. Mixtures are usually heterogeneous (except in solutions).
5. Compound formation is accompanied by absorption or evolution of light, heat or electrical energy.	5. Heat, light or electrical energy may not be evolved or absorbed during the formation of a mixture.
6. Melting and boiling points of a compound are usually sharp and fixed.	6. Melting and boiling points of a mixture are usually not sharp and fixed.
7. The constituents of a compound cannot be separated by physical or mechanical means. They can, however, be separated by chemical methods.	7. The components of a mixture can be easily separated by physical methods.

Q. 1. Differentiate between a true solution and a colloid.

Ans.

True solution	Colloid
1. A true solution is a homogeneous mixture of two or more substances.	1. A colloidal solution is a heterogeneous mixture of two substances.
2. The size of the particles is less than one nanometer.	2. The range of particle size is between one nanometer to 1000 nanometer.
3. It is always transparent.	3. It is translucent.
4. The particles cannot be seen even with microscope.	4. The particles of a colloidal solution can be seen with microscope.
5. It does not show Tyndall effect.	5. It shows Tyndall effect.

Q. 2. Distinguish between physical change and chemical change.

Ans.

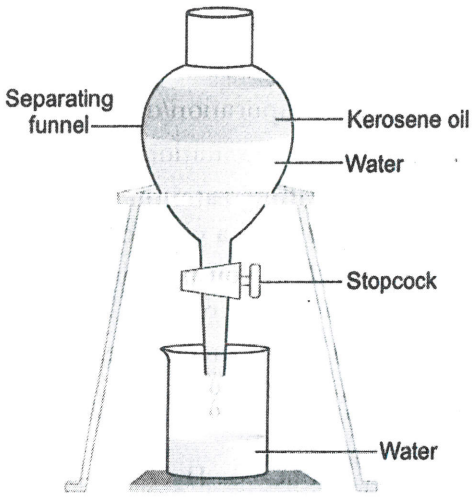
Physical change	Chemical change
1. In a physical change, only physical properties such as colour, physical state, density, volume, etc. change; chemical properties remain unchanged.	1. In a chemical change, the chemical composition and chemical properties undergo a change.
2. No new substance is formed in a physical change.	2. A new substance is formed in a chemical change.
3. Very little or no energy in the form of heat, light or sound is usually absorbed or given out in a physical change.	3. A chemical change is always accompanied by absorption or evolution of energy.
4. A physical change is a temporary change.	4. A chemical change is a permanent change.
5. The original form of substance can be regained by simple physical methods.	5. Original substance cannot be obtained by simple physical methods.
6. A physical change is reversible.	6. A chemical change is irreversible.

Q. 3. Distinguish between metals and non-metals.

Ans.

Metals	Non-metals
1. They have lustre (sheen).	1. They are non-lustrous (dull).
2. They are malleable and ductile.	2. They are neither malleable nor ductile.
3. They have high density and high melting and boiling points.	3. They have low density and low melting and boiling points.
4. Except mercury and gallium, all other metals are solid at room temperature.	4. Non-metals may exist in solid, liquid or gaseous states at room temperature.
5. They are sonorous.	5. They are not sonorous.
6. They are good conductors of heat and electricity.	6. They are poor conductors of heat and electricity.
7. They are generally hard (except sodium and potassium).	7. Non-metals are generally soft (except diamond).
8. They have high tensile strength.	8. They have low tensile strength.

Q. 4. State the principle of separating two immiscible liquids by separating funnel. Describe an activity with diagram to separate a mixture of water and kerosene oil.



Ans. Immiscible layers separate out in layers depending on their densities in separating funnel.

Activity to separate kerosene oil from water using a separating funnel:

- Pour the mixture of kerosene oil and water in separating funnel as shown in figure.
- Let it stand undisturbed for sometime so that separate layers of oil and water are formed.
- Open the stopcock of the separating funnel and pour out the lower layer of water carefully.
- Close the stopcock of the separating funnel as the oil reaches the stopcock.

Q. 5 What would you observe when

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

(*b*) an aqueous sugar solution is heated to dryness?

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

Ans. (*a*) Solid potassium chloride will separate out.

(*b*) Initially the water will evaporate and then sugar will get charred.

(*c*) Iron sulphide will be formed.

Q. 6. Suggest separation technique (s) one would need to employ to separate the following mixtures:

(*a*) Mercury and water

(*b*) Potassium chloride and ammonium chloride

(*c*) Common salt, water and sand

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

Ans. (*a*) Separation by using separating funnel

(*b*) Sublimation

(*c*) Filtration to separate sand followed by evaporation/distillation

(*d*) Separation by using separating funnel to separate kerosene oil followed by evaporation or distillation.

Q. 7 Name the process associated with the following:

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

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

(*c*) An acetone bottle is left open and the bottle becomes empty.

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

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

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

Ans. (a) Sublimation (b) Dissolution/diffusion
(c) Evaporation/diffusion (d) Centrifugation
(e) Sedimentation (f) Scattering of light (Tyndall effect).

Q. 8. On heating, calcium carbonate gets converted into calcium oxide and carbon dioxide.
(a) Is this a physical or a chemical change?
(b) Can you prepare one acidic and one basic solution by using the products formed in the above process? If so, write the chemical equation involved. [*NCERT Exemplar*]

Ans. (a) Chemical change.
(b) Acidic and basic solutions can be prepared by dissolving the products of the above process in water.

$CaO + H_2O \longrightarrow Ca(OH)_2$ (basic solution)

$CO_2 + H_2O \longrightarrow H_2CO_3$ (acidic solution)

Q. 9. Non-metals are usually poor conductors of heat and electricity. They are non-lustrous, non-sonorous, non-malleable and are coloured.
(a) Name a lustrous non-metal.
(b) Name a non-metal which exists as a liquid at room temperature.
(c) The allotropic form of a non-metal is a good conductor of electricity. Name the allotrope.
(d) Name a non-metal which is known to form the largest number of compounds.
(e) Name a non-metal other than carbon which shows allotropy.
(f) Name a non-metal which is required for combustion. [*NCERT Exemplar*]

Ans. (a) Iodine (b) Bromine
(c) Graphite (d) Carbon
(e) Sulphur (f) Oxygen

Q. 10 Classify the following into metals, non-metals and metalloids:
(i) Germanium (ii) Boron
(iii) Diamond (iv) Iodine
(v) Copper (vi) Helium.

Ans. Metal – Copper
Non-metals – Diamond, iodine and helium
Metalloids – Germanium, boron.

Q. 11. Classify the following into elements, compounds and mixtures.
(i) Pure sand (ii) Air
(iii) Ammonia gas (iv) Ice
(v) Glass (vi) CaO.

Ans. Elements – Nil
Compounds – Pure sand, Ice, CaO, Ammonia gas
Mixture – Air, Glass.

Q. Give two points of differences between an element and a compound.

Ans.

Element	Compound
1. An element is made up of same kind of atoms.	1. A compound is obtained from different kinds of atoms.
2. An element cannot be split by physical or chemical methods.	2. A compound can be split into new substances by chemical methods.

Q. 12 Which separation technique will you apply to separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25°C), which are miscible with each other?

Ans. The miscible mixture of kerosene and petrol can be separated by fractional distillation. On heating the distillation flask, petrol having lower boiling point than kerosene, distills out first.

Q. 13 Name the technique to separate—

(*i*) butter and curd **(*ii*) salt and sea water**

(*iii*) camphor from salt.

Ans. (*i*) Centrifugation (*ii*) Evaporation

(*iii*) Sublimation

Q. 14 What type of mixtures are separated by the technique of crystallisation?

Ans. The homogeneous mixtures containing dissolved salt are separated by crystallisation.

Q. 15 Classify the following as chemical or physical changes:

(*i*) cutting of trees, **(*ii*) melting of butter in a pan,**

(*iii*) rusting of almirah, **(*iv*) boiling of water to form steam,**

(*v*) passing of electric current through water and water breaking down into hydrogen and oxygen gases,

(*vi*) dissolving common salt in water,

(*vii*) making a fruit salad with raw fruits, and

(*viii*) burning of paper and wood.

Ans. (*i*) Physical change (*ii*) Physical change

(*iii*) Chemical change (*iv*) Physical change

(*v*) Chemical change (*vi*) Physical change

(*vii*) Physical change (*viii*) Chemical change

Q. 16 Which separation techniques will you apply for the separation of the following?

(*a*) Sodium chloride from its solution in water – Evaporation

(*b*) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride – Sublimation

(*c*) Small pieces of metal in the engine oil of a car – filtration

(*d*) Different pigments from an extract of flower petals – Chromatography

(*e*) Butter from curd – Centrifugation

(*f*) Oil from water – Separating funnel

(*g*) Tea leaves from tea – Filteration

(*h*) Iron pins from sand – Magnetic separation

(*i*) Wheat grains from husk – winnowing

(*j*) Fine mud particles suspended in water. – filtration

Q.17 Explain the following giving examples:

(a) Saturated solution **(b) Pure Substance**

(c) Colloid **(d) Suspension.**

Ans. **(a) Saturated solution:** The solution in which no more solute can be dissolved in the same amount of solvent at a particular temperature is called saturated solution. *E.g.*, if we dissolve 21 g of KNO_3 at 283 K, we will get saturated solution.

(b) Pure substance: The substance which always has the same characteristic at a given temperature and pressure is called pure substance. *E.g.*, distilled water.

(c) Colloid: Colloid consists of particles bigger than that of solution, smaller than that of suspension. It appears to be homogeneous but actually it is heterogeneous. *E.g.*, milk.

(d) Suspension: It consists of particles which are large in size and are visible with naked eye. It is heterogeneous. *E.g.*, chalk powder in water is a suspension.

Q.18. Classify each of the following as a homogeneous or heterogeneous mixture:

Soda water, wood, air, soil, vinegar, filtered tea.

Ans. **Homogeneous:** Soda water, vinegar, filtered tea, air

Heterogeneous: Soil, wood.

Q.19. How would you confirm that a colourless liquid given to you is pure water?

Ans. A pure water boils at 100°C (373 K). Hence, the purity of water can be confirmed by determining its boiling point.

Q.20 Which of the following materials fall in the category of a "pure substance"?

(a) Ice **(b) Milk** **(c) Iron**

(d) Hydrochloric acid **(e) Calcium oxide** **(f) Mercury**

(g) Brick **(h) Wood** **(i) Air**

Ans. Ice, iron, hydrochloric acid, calcium oxide, mercury belong to the category of pure substances.

Q.21 Identify the solutions among the following mixtures:

(a) Soil **(b) Sea-water** **(c) Air**

(d) Coal **(e) Soda water**

Ans. Sea-water, air, soda water are solutions.

Q.22 Which of the following will show 'Tyndall effect'?

(a) Salt solution **(b) Milk**

(c) Copper sulphate solution **(d) Starch solution.**

Ans. Milk and starch solution will show Tyndall effect because they are colloidal solutions.

Q. 23. Classify the following into elements, compounds and mixtures:

(a) Sodium **(b) Soil** **(c) Sugar solution** **(d) Silver**

(e) Calcium carbonate **(f) Tin** **(g) Silicon** **(h) Coal**

(i) Air **(j) Soap** **(k) Methane**

(l) Carbon dioxide **(m) Blood**

Ans.

Element	Compound	Mixture
Sodium, Silver, Tin, Silicon	Calcium carbonate, methane, soap, carbon dioxide	Soil, sugar solution, coal, air, blood

Q.24. Which of the following are chemical changes?

(a) Growth of a plant **(b) Rusting of iron**

(c) Mixing of iron filings and sand **(d) Cooking of food**

(e) Digestion of food **(f) Freezing of water**

(g) Burning of a candle