पु॰ना International School

Shree Swaminarayan Gurukul, Zundal

Class -IX

Science (Chemistry)

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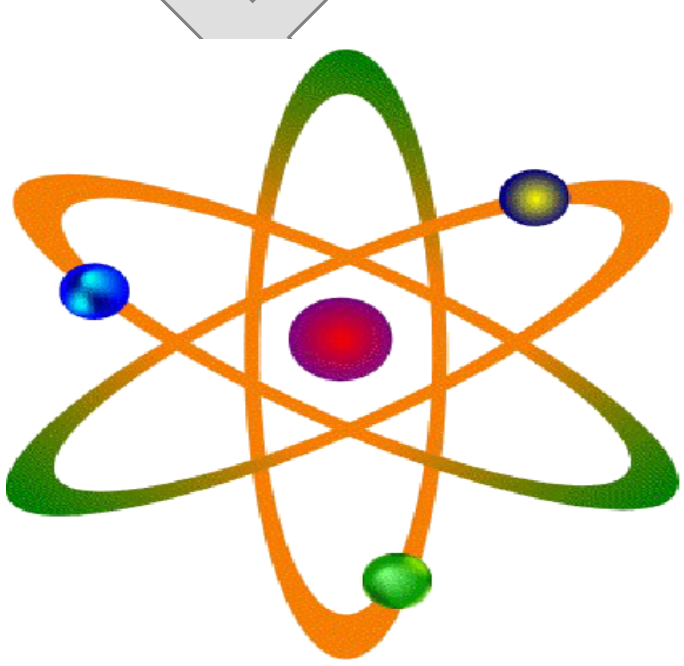
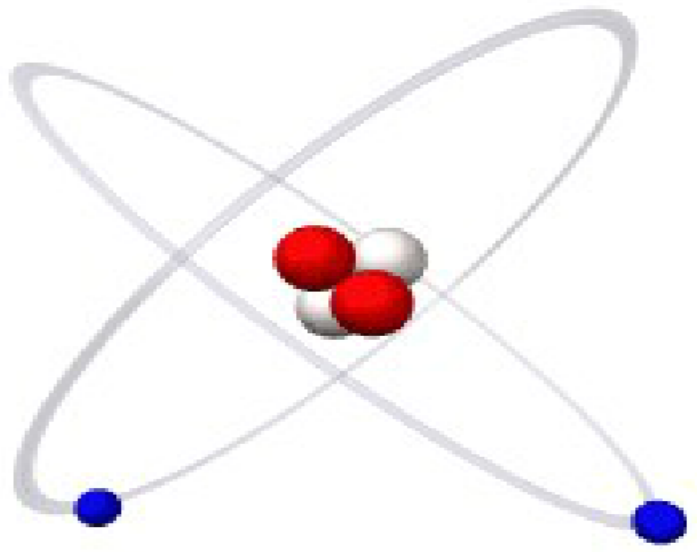
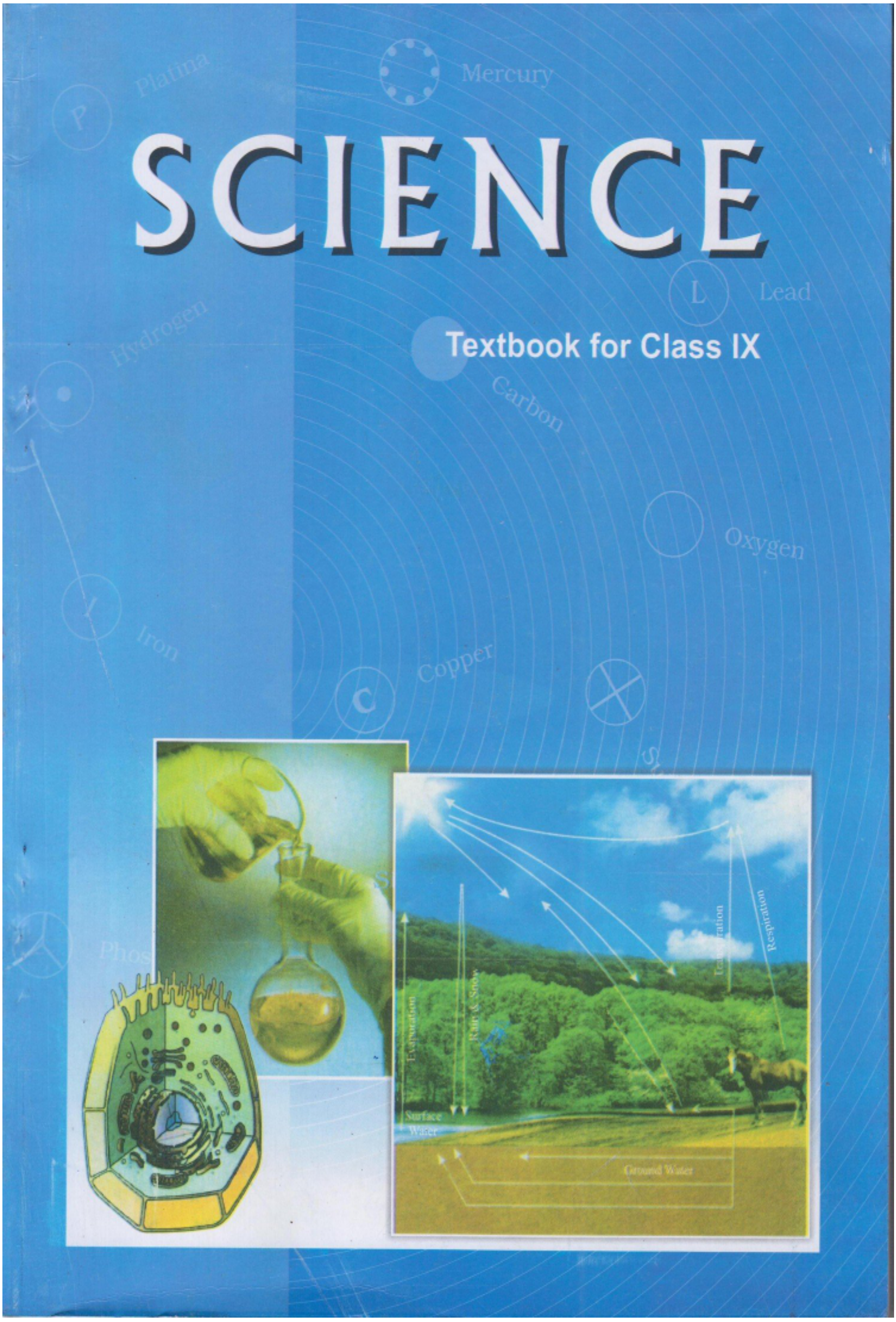
Year- 2020-21



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CHAPTER - 2

IS MATTER AROUND US PURE

1)Classification of matter :-

i)On the basis of the physical state, matter is classified into three main types. They are solids, liquids and gases.

ii) . On the basis of chemical composition matter is classified into two main types. They are pure substances and mixtures.

Pure substances are of two types. The are elements and compounds. Mixtures are of two types. They are homogeneous mixtures and heterogeneous mixtures.

2)Pure substances and mixtures :-

a)Pure substance :- is a substance which consists of a single type of substance (element or compound).
Eg:- iron, copper, hydrogen, oxygen, water, sugar, common salt etc.

a) Mixture :- is a substance which consists of two or more pure substances. Eg:- sea water, minerals, soil, air, sand and salt, sugar in water, salt in water etc.

Differences between pure substances and mixtures :-

Pure substance	Mixture
Pure substance consists of a single type of substance	Mixture consists of two or more pure substances.
Pure substance cannot be separated into other substances by physical methods.	Mixture can be separated into its components by physical methods.
Pure substance has its own definite properties.	Mixture shows the properties of its components.

3)Types of mixtures :-

Mixtures are of two types. They are homogeneous mixture and heterogeneous mixture.
a)Homogeneous mixture :- is a mixture which has a uniform composition.

-The particles of the mixture are not visible by the naked eye.
-The particles cannot be separated by filtration.
-The mixture is stable (the particles do not settle down).
-The path of a beam of light is not visible in the mixture.
Eg :- mixture of sugar in water, mixture of salt in water, mixture of copper sulphate in water etc.

b)Heterogeneous mixture :- is a mixture which has a non -uniform composition.

-The particles are visible by the naked eye.
-The particles can be separated by filtration.
-The mixture is unstable (the particles settle down).
-The path of a beam of light is visible in the mixture.
Eg :- mixture of salt and sand, mixture of sulphur and iron filings, mixture of oil and water etc.

4)True solution :-

A true solution is a homogeneous mixture of two or more substances.
A solution has a solvent and solute as its components. The component in the larger amount is the solvent and the component in the lesser amount is the solute.
Eg :- solution of salt in water, solution of sugar in water, iodine in water (tincture iodine), soda water etc.

Properties of true solutions :-
-True solution is a homogeneous mixture.
-The particles are cannot be seen by the naked eye.
-The solute particles cannot be separated by filtration.

-The solute particles do not settle down and the solution is stable.
-The particles do not scatter a beam of light passing through it and the path of light is not visible in the solution.

5)Colloidal solution :-

A colloidal solution is a heterogeneous mixture of two or more substances.
Eg :- mixture of starch in water, mixture of egg albumin in water, milk, air containing dust and smoke etc.

Properties of colloidal solution :-

-Colloidal solution is a heterogeneous mixture.
- The particles cannot be seen by the naked eye.
-The solute particles cannot be separated by filtration.
-The solute particles do not settle down and the solution is stable.
-The particles scatter a beam of light passing through it and the path of light is visible in the solution.

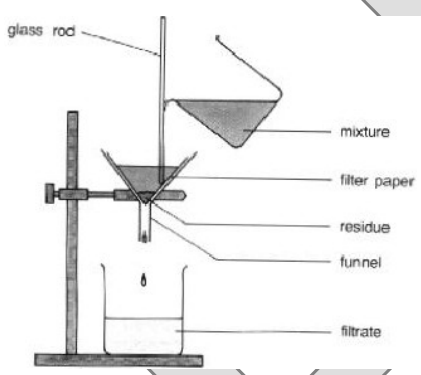
6) Suspension :-

A suspension is a heterogeneous mixture of two or more substances.
Eg :- solution of sand in water, solution of chalk powder in water etc.

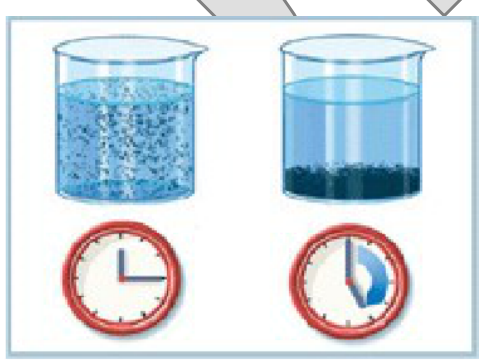
Properties of suspension :-

- Suspension is a heterogeneous mixture.
-The particles can be seen by the naked eye.
-The solute particles can be separated by filtration.
-The solute particles settle down and the solution is unstable.
-The particles scatter a beam of light passing through it and the path of light is visible in the solution.

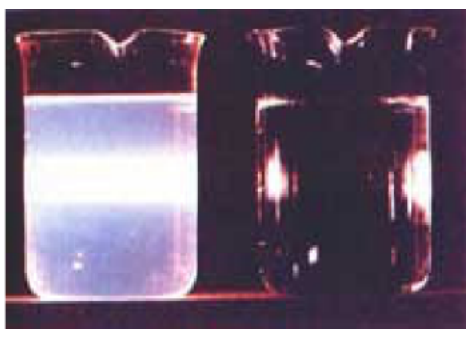
Solute particles can be separated by filtration.



Solute particles settle down and the solution is unstable.



Solute particles scatter light and the path of light is visible.



7) Tyndall effect :-

When a beam of light is passed through a colloidal solution, the colloid particles scatter the beam of light and the path of light becomes visible in the solution. This effect is called Tyndall effect.
Tyndall effect can be seen when light enters a room through a small hole due to scattering of light by

the dust and smoke particles.

Tyndall effect can be seen in a dense forest due to scattering of light by water droplets in the mist.

8) Saturated solution :-

Saturated solution :- is a solution which cannot dissolve any more of a solute at a given temperature.

Solubility :- of a substance is the amount of solute present in a saturated solution of the substance.

Unsaturated solution :- is a solution which can dissolve some more of the solute at a given temperature.

Preparation of a saturated solution :-

Take 50ml of water in two beakers. Add salt in one beaker with continuous stirring till no more salt dissolves in it. Similarly add sugar in the other beaker with continuous stirring till no more sugar dissolves in it. We get saturated solutions of salt and sugar.

If the mixtures are heated it dissolves some more of the solute.

The solubility of different substances are different.

The solubility of substances varies with temperature.

9) Concentration of a solution :-

The concentration of a solution is the amount of solute present in a given amount of the solvent or solution.

$$\text{Concentration of a solution} = \frac{\text{Amount of solute}}{\text{Amount of solvent}}$$

$$\text{Or} = \frac{\text{Amount of solute}}{\text{Amount of solution}}$$

The concentration of a solution can be expressed as mass by mass percentage or as mass by volume percentage.

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

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

10) Separating the components of a mixture :-

The components of a heterogeneous mixture can be separated by simple methods like hand picking, sieving, filtration etc.

Sometimes special techniques are used to separate the components of mixtures like :-

i) Evaporation
ii) Centrifugation
iii) Decantation (Using separating funnel)
iv) Sublimation
v) Centrifugation

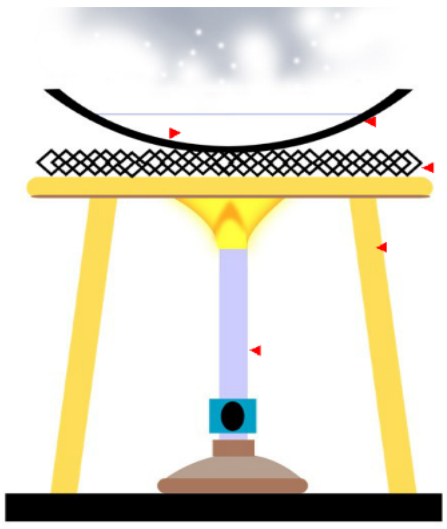
vi) Chromatography

vii) Distillation and fractional distillation

i) <u>Evaporation :-</u>

This method is used for separating a volatile component (solvent) from a non volatile component (solute) by heating the mixture.

Eg :- Ink is a mixture of a dye and water. If some ink is heated in a dish, the water evaporates and the dye is left in the dish. Similarly we can separate a mixture of salt and water or sugar and water by evaporation.



ii) <u>Centrifugation :-</u>

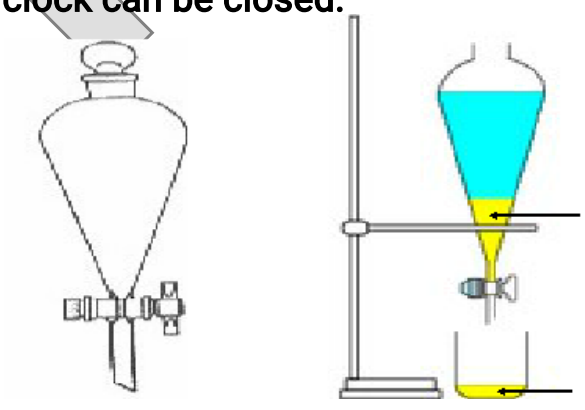
The method of separating denser particles and lighter particles from a mixture by using a centrifuging machine
is called centrifugation.

Eg : - If we take some milk in a centrifuging machine and spin it rapidly, the cream separates from the milk because cream is less dense than milk.

iii) <u>Decantation using separating funnel :-</u>

This method is used for separating a mixture of immiscible liquids. Liquids separate into different layers depending on their densities.

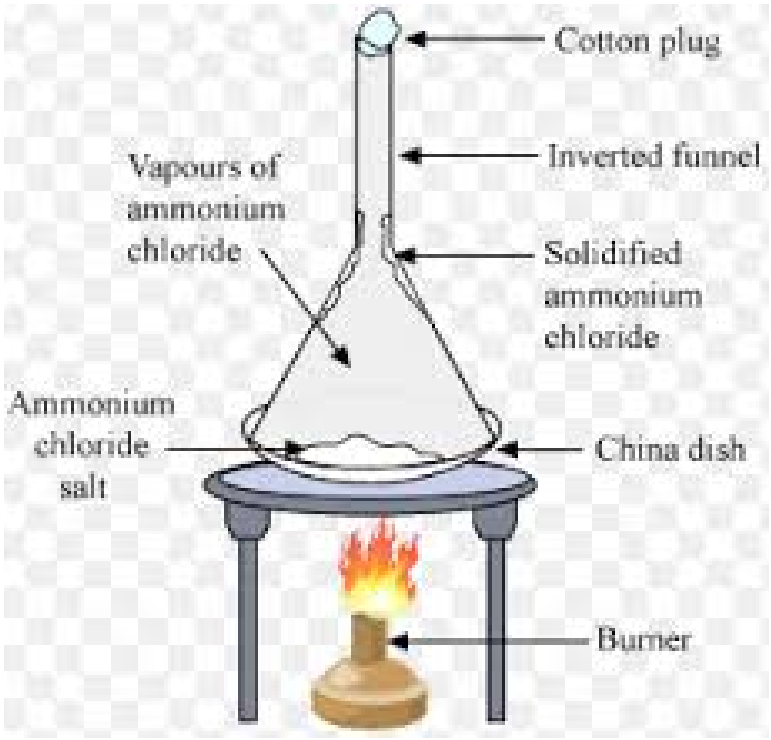
Eg :- If we take a mixture of kerosene oil and water in a separating funnel, it forms separate layers of oil and water. The water can be separated by opening the stop cock. After the water flows out the stop clock can be closed.



iv) <u>Sublimation :-</u>

This method is used to separate a mixture of a sublimable component from a non sublimable component by heating the mixture.

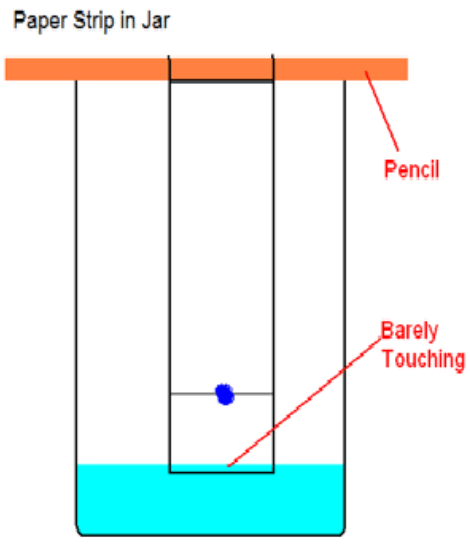
Eg : - If a mixture of ammonium chloride and common salt is heated, the ammonium chloride sublimes and can be cooled and solidified and collected and salt is left behind.

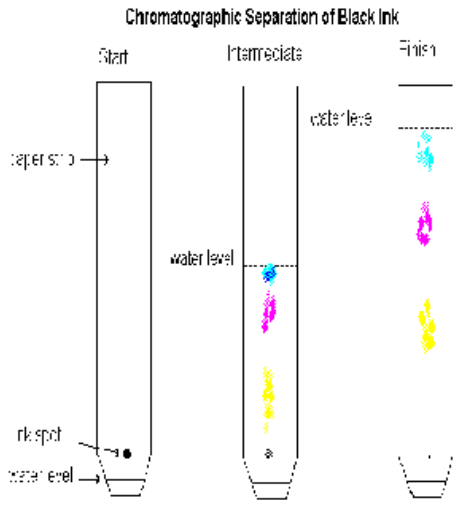


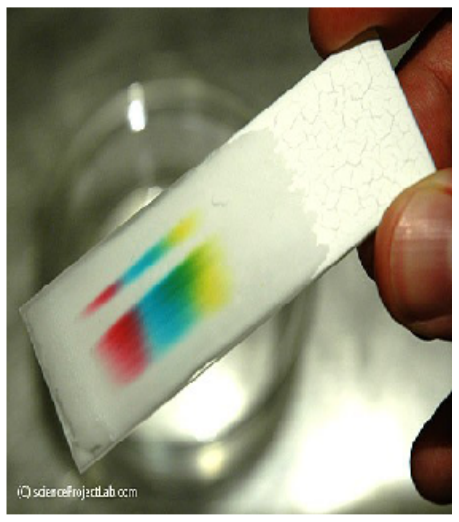
v) Chromatography :-

This method is used for separating coloured components from a liquid by using a filter paper or blotting paper.

Eg : - Put a drop of ink near one end of a strip of filter paper and dip the end of the paper in a test tube containing water. Ink is a mixture of two or more coloured components. The component which is more soluble in water rises faster and get separated.





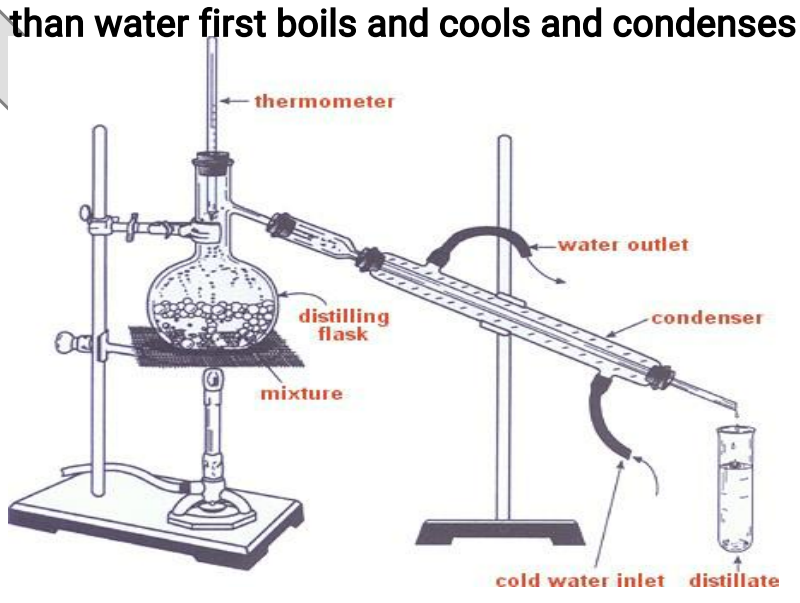


vi) Distillation :-

This method is used for separating a mixture of miscible liquids by boiling the mixture and cooling and condensing the vapours.

Simple distillation :- is used for separating a mixture of two miscible liquids having sufficient difference in their boiling points.

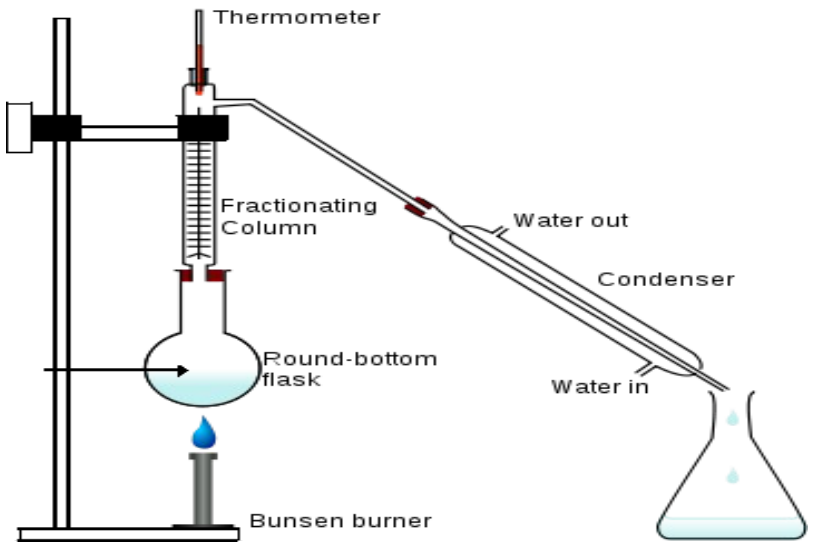
Eg :- If a mixture of acetone and water is heated in a distillation apparatus, the acetone which has a lower boiling point than water first boils and cools and condenses and is separated from the water.



Fractional distillation :- is used for separating a mixture of two or more miscible liquids whose difference in boiling points is less than 25K.

The apparatus used for fractional distillation is similar to that used for simple distillation except that a fractionating column is fitted between the distillation flask and condenser. The fractionating column

has glass beads which increases the surface for the vapours to cool and condense.
Fractional distillation is used for separating the components of petroleum, separating the different gases from air etc.



11) Separation of components of air :-

Air is a mixture of gases. The components of air can be separated by fractional distillation.
Air is compressed by increasing the pressure and cooled by decreasing the temperature to get liquid air. The liquid air is then allowed to warm up slowly in a fractional distillation column. Then the different components separate at different heights depending on their different boiling points.

Air

↓

Compress and cool by increasing pressure and decreasing temperature

↓

Liquid air

↓

Allow to warm up slowly
In fractional distillation column

↓

Gases get separated at different heights

Boiling points (^{o}C) Oxygen – 183, Argon – 186 , Nitrogen – 196

12) Purification of solids by crystallisation :-

Crystallisation is the process of obtaining a pure solid in the form of crystals from its solution.
Eg :- By crystallisation we can obtain pure copper sulphate from its solution.
Dissolve about 5g of copper sulphate in minimum amount of water. Filter the solution to remove the impurities. Evaporate the solution in a china dish to get a saturated solution. Cover the solution with a filter paper and alllow it to cool. Pure copper sulphate crystals are formed.

Impure copper sulphate	Pure copper sulphate crystals
	

13) Types of pure substances :-

Pure substances are of two types. They are elements and compounds.

i) Element :- is a basic form of matter which cannot be broken down into simpler substances by chemical

reactions. Elements are of three types. They are metals, non metals and metalloids.

Properties of metals :-
They have lustre. They are malleable and ductile. They are good conductors of heat and electricity. They are sonorous.
Eg :- iron, aluminium, zinc, mercury, copper, silver, gold etc.

Properties of non metals :-
They do not have lustre. They are not malleable or ductile. They are poor conductors of heat and electricity. They are not sonorus.
Eg :- hydrogen, oxygen, nitrogen, iodine, carbon, sulphur, phosphorus etc.

Properties of metalloids :-
Metalloids are elements which show some properties of metals and some properties of non metals.
Eg :- boron, silicon, germanium etc.

ii) Compound :-

A compound is a substance composed of two or more elements chemically combined together in a fixed ratio.

Eg :- water, carbon dioxide, sugar, salt, iron sulphide et

Differences between mixtures and compounds :-

Sr. No.	Mixture	Compound
1	It is composed of two or more elements or compounds mixed together.	It is composed of two or more elements chemically combined together.
2	The composition of the components is in any ratio.	The composition of the components is in a fixed ratio.
3	It shows the properties of the components.	It shows different properties than the components.
4	The components can be separated by physical methods.	The components can be separated only by chemical methods.

Intext Exercise:-

(Page No. 15)

1. What is meant by a Pure substance?

Ans: Such substance that has a uniform composition i.e. has particles with identical properties is called pure substance. eg. sugar, salt, water, nitrogen etc.

2. List the points of differences between homogeneous and heterogeneous mixtures.

Ans.

Homogeneous mixture	**Heterogeneous mixture**
(i)They have uniform composition throughout the mixture. (ii) Their components cannot be separated by filtration but separation takes place be distillation method only. (iii) examples are salt & water mixture, sugar & water mixture.	(i)They do not have a uniform composition throughout the mixture. (ii) Their components can be separated by filtration method. (iii) examples are a mixture of Sulphur powder and iron fillings, kerosene oil and water.

(Page No.18)

1. Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans.

Homogeneous mixture	**Heterogeneous mixture**
(i)They have uniform composition throughout the mixture. (ii) Their components cannot be separated by filtration but separation takes place be distillation method only. (iii) examples are salt & water mixture, sugar & water mixture.	(i)They do not have a uniform composition throughout the mixture. (ii) Their components can be separated by filtration method. (iii) examples are a mixture of Sulphur powder and iron fillings, kerosene oil and water.

2. How are sol, solution and suspension different from each other?

Ans.

Sol=kind of colloidal solution	**Solution= true solution**	**Suspension**
(i) It has dispersed phase and dispersion phase. (ii)It appears homogeneous but is heterogeneous. (iii) Particles are visible with the help of electron microscope. (iv) Particle size is 10^{-7} to 10^{-5}cm. E.g. gold sol, milk of magnesia etc.	(i) It has soluble solute and solvent phase. (ii) It is homogeneous. (iii) Particles are not visible by all means. (iv) Particle size is less than 10^{-7}cm. E.g. sugar solution, salt solution	(i) It has insoluble solute suspended in the solvent medium. (ii) It is heterogeneous. (iii) Particles are visible by naked eyes. (iv) Particles size is more than 10^{-5}cm E.g. muddy river water, dust storm.

3. 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 solute (sodium chloride) =36g

Mass of solvent (water) =100g
Mass of solution = Mass of Solute + Mass of solvent
= 36g +100g = 136g

$$= \frac{mass\,of\,solute}{mass\,of\,solution} \times 100 = \frac{36}{136} \times 100 = 26.47\%(w/w)$$

(Page No. 24)

1. How will you separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25∘∘C), which are miscible with each other?

Ans. We can separate a mixture containing kerosene and petrol by distillation technique since difference in their boiling points is more than 25∘∘C. Therefore, they can be easily separated by the technique of simple distillation.

2. Name the technique to separate

(i) butter from curd,

(ii) salt from sea-water,

(iii) camphor from salt.

Ans. (i) centrifugation method.

(ii) evaporation method or crystallisation method

(iii) sublimation method.

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

Ans. From impure samples of solids, pure solid crystals can be obtained by the method of crystallization for eg to obtain pure sugar from impure sample of the same.

(Page No. 24)

1. Classify the following as chemical or physical changes:

• cutting of trees,

• melting of butter in a pan,

• rusting of almirah,

• boiling of water to form steam,

• passing of electric current through water and the water breaking down into hydrogen and oxygen gases,

• dissolving common salt in water,

• making a fruit salad with raw fruits, and

• burning of paper and wood.

Ans. Cutting of trees = chemical change

Melting of butter in a pan = physical change

Rusting of almirah = chemical change

Boiling of water to form steam = physical change

Passing of electric current through water and the water breaking down into hydrogen and oxygen gases = chemical change

Dissolving common salt in water = physical change

Making a fruit salad with raw fruits = physical change

Burning of paper and wood = chemical change

2. Try segregating the things around you as pure substances or mixtures.

Ans. Distilled water, diamond, graphite, raw rubber are pure substances that can be found around us. In contrast, curd, ice cream, cooking oil , vulcanized rubber are the some of the examples of mixtures.

Exercise:-

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

(a) Sodium chloride from its solution in water.

(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.

(c) Small pieces of metal in the engine oil of a car.

(d) Different pigments from an extract of flower petals.

(e) Butter from curd.

(f) Oil from water.

(g) Tea leaves from tea.

(h) Iron pins from sand.

(i) Wheat grains from husk.

(j) Fine mud particles suspended in water.

Ans. (a) Evaporation **(b)** Sublimation

(c) Filtration **(d)** Chromatography

(e) Centrifugation **(f)** Separating funnel

(g) Filtration **(h)** with the help of a magnet

(i) Blowing air or sieving **(j)** using alum

2. Write the steps you would use for making tea. Use the words solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Ans. Take some amount of solvent (water) in a pan and after heating it add little amount of solute (sugar) to the solvent. Solute will dissolve completely in the solvent forming true solution, then add tea leaves that are insoluble along with another soluble liquid milk. After boiling allow filtration with a sieve so the filtrate you obtain is tea while the residue has tea leaves that are thrown away.

3. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution).

Substance Dissolved	Temperature in K				
	283	293	313	333	353
	Solubility				
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a) What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?

(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.

(c) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?

(d) What is the effect of change of temperature on the solubility of a salt?

Ans. (a) At 313 K temperature the amount of potassium nitrate required was 62g in 100ml of water so in 50g water we will need to dissolve = 62 X 50/100= 31g potassium nitrate.

(b) When a saturated solution of potassium chloride at 353 K is cooled, the solubility of potassium chloride in

water decreases. As a result,the amount of potassium chloride which exceeds its solubility at lower temperature separates out as crystals.

(c) Solubilities are (in 100g of water) 32,36,35,37 respectively for the mentioned salts and the highest solubility is of ammonium chloride at this temperature.

(d) Solubility of salts is directly proportional to the temperature i.e. if temperature increases then solubility will increase and if the temperature decreases solubility will also decrease.

4. Explain the following giving examples.

(a) saturated solution

(b) pure substance

(c) colloid

(d) suspension

Ans. (a) Saturated solution :- It is a solution in which no more solute particles can be dissolved at a particular temperature.

(b) pure substance :- Such substance that has a uniform composition i.e. has particles with identical properties is called pure substance eg sugar, salt, water, nitrogen etc.

(c) colloid :- It is a kind of heterogeneous mixture/solution in which particle size is between 1nm and 1000nm. Colloids have dispersion medium and dispersed phase.eg smoke, milk, shaving cream, jelly, cheese etc.

(d) suspension :- It is a kind of heterogeneous mixture in which insoluble solid particles remain suspended in the medium and dispersion particles are visible to the unaided eyes. eg muddy river water, chalk powder in water, dust storm, sand in water etc.

5. Classify each of the following as a homogeneous or heterogeneous mixture.
soda water, wood, air, soil, vinegar, filtered tea.

Ans.

Homogeneous mixture	Heterogeneous mixture
Soda water, air, vinegar, filtered tea.	Wood, soil.

* Air is also a homogeneous mixture if dust particles and other suspended impurities are excluded.

6. How would you confirm that a colourless liquid given to you is pure water?
Ans. If the boiling point and freezing point of the given liquid comes out to be 100 degrees celsius (373 K) or 0 degree celsius (273 K) respectively under one atmosphere pressure, it confirms that the given liquid is pure water.

7. 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. Pure substances are: ice,iron,calcium oxide, mercury since they contain particles of only one kind of matter.

8. Identify the solutions among the following mixtures.
(a) Soil (b) Sea water
(c) Air (d) Coal (e) Soda water.
Ans. Sea water and soda water are solutions.

9. 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 are colloidal solutions. Their particles are big enough to scatter light and hence they show Tyndall effect.

10. 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.
Classification of the given substances in elements,compounds and mixtures :
Elements: Sodium, Silver, Tin and Silicon.
Compounds: Calcium carbonate, Methane and carbon dioxide.
Mixtures: Soil, Sugar, Coal, Air, Soap and Blood.

11. 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.
Ans. Growth of a plant,Rusting of iron, cooking of food, digestion of food, burning of a candle are chemical changes.