Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT : CHEMISTRY

CLASS IX

Week : 11 January 2021 to 16 January 2021

CHAPTER 2 : IS MATTER AROUND US PURE

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for ch 1 is given below :

https://youtu.be/HoKG5Jqthk0

https://youtu.be/98jh1RS3GuM

https://youtu.be/2SNjYYyebeU

Learning outcomes

Each student will be able to :

1. Learn about pure substance
2. Difference between true solution , colloids , suspension
3. Mixtures and compounds
4. Tyndall effect
5. Physical and chemical properties

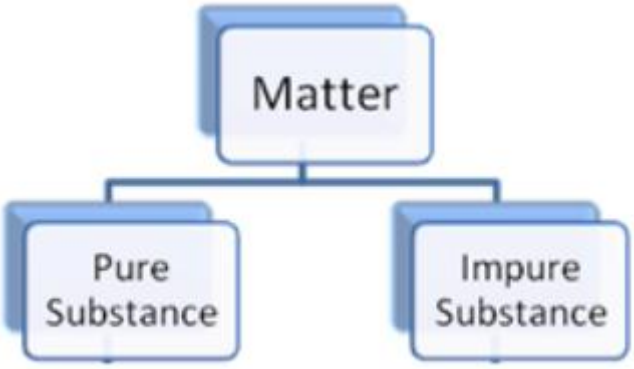
Sub topics :

- Pure substances
- Mixtures
- Difference between homogeneous and heterogeneous mixture
- True solutions , colloids and suspension
- Physical and chemical properties

LESSON DEVELOPMENT

What is a substance?

- Anything that cannot be broken into further particles by applying any physical processes is called a **Substance**.
- Matter can be classified into two types of substances – Pure substances and Mixtures



What is a pure substance?

A substance that consists of only one type of particle is called a **Pure Substance**. **For Example**, Diamond, Salt, Sulfur, Tin.

What is a mixture?

- When we combine different substances into each other a mixture is formed. **For Example**, Lemonade is a mixture of three substances, Lemon Juice, Sugar and Water.
- Which of these is a mixture or a pure substance?

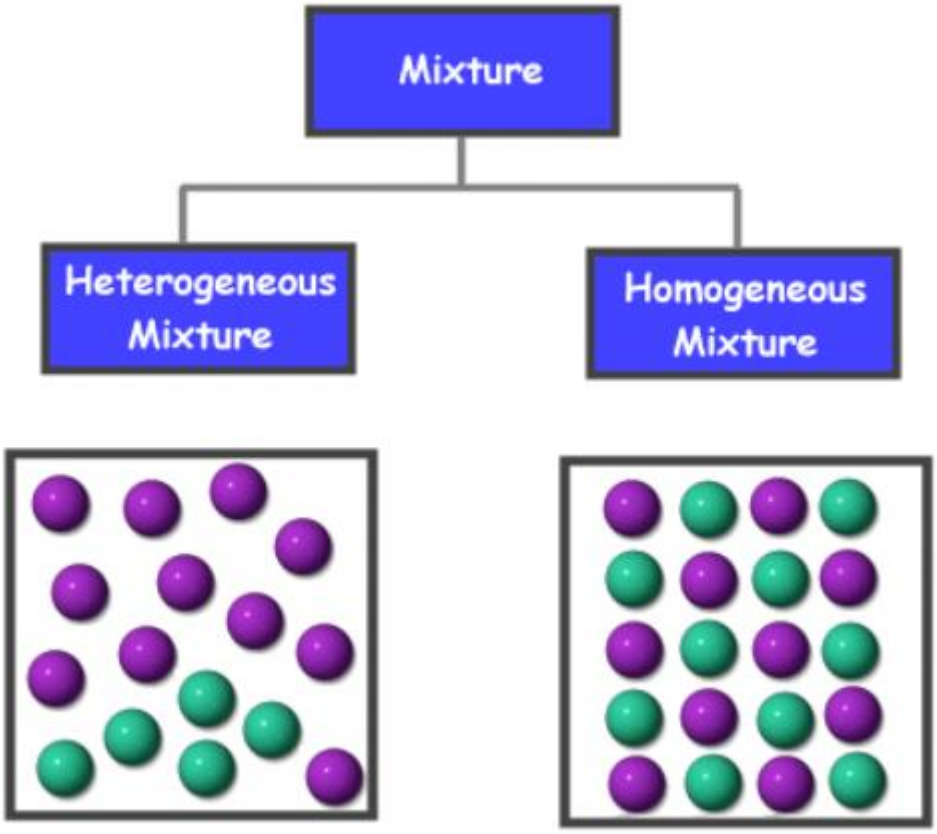
Water, Copper, Chocolate cake, Hydrogen, Soil, Air

Mixture – Chocolate cake, Soil, Air

Pure substance – Water, Copper, Hydrogen

Types of Mixtures

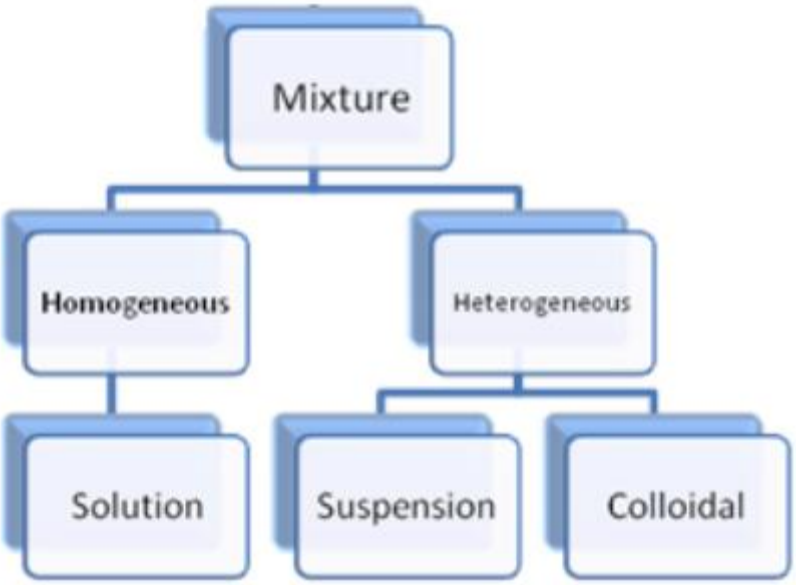
There are two categories of mixtures: Homogeneous Mixtures and Heterogeneous Mixtures



differences between homogeneous and heterogeneous mixtures –

Homogenous Mixtures	Heterogeneous Mixtures
They have a uniform composition throughout	They have a non-uniform composition
We cannot separate the components of the mixture through physical processes	We can separate the components through physical processes
Components cannot be seen through naked eyes	Components can easily be seen through naked eyes
The mixture is in single phase throughout	The substances can be of two different phases and we may see separate layers of the substances
Example: A mixture of water and milk	**Example**: A mixture of oil in water

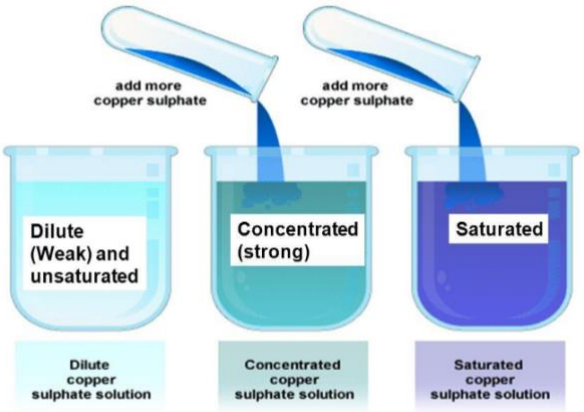
What is a solution?



A solution is nothing but a uniform mixture of two or more substances. Homogenous Mixtures are solutions.

Solution constitutes of two types of substances, a solute and a solvent.

Solution = Solute + Solvent



What is concentration?

C**oncentration** refers to the amount of a substance per defined space or can be defined as the ratio of solute in a solution to either solvent or total solution.

- **Percent by Mass** = (Mass of solute / Mass of solution) X 100
- **Percent by Volume** = (Volume of solute / Volume of solution) X 100

What is a suspension?

A suspension is formed when two or more substances are mix in a non-uniform manner. Heterogeneous mixtures are suspensions. The solute does not mix with the solvent and can be viewed through naked eyes.

Properties of Suspensions:

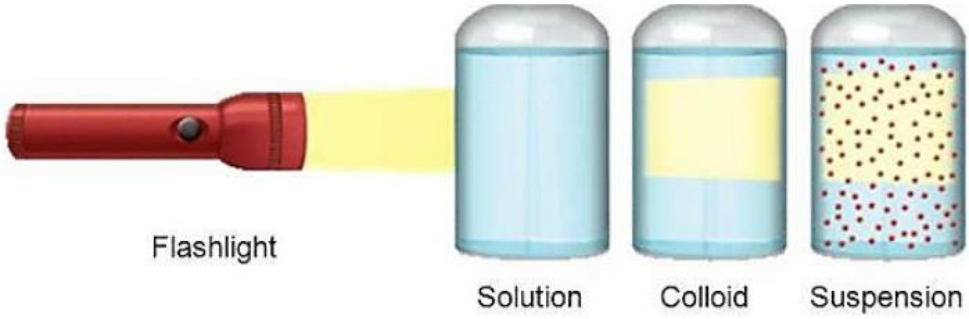
- A suspension is a heterogeneous mixture.
- We can see the particles of suspensions through naked eyes.
- We can see the path of light through the particles of a suspension.
- The particles of suspension tend to settle down when left undisturbed. Then, they can be separated using filtration.

What are colloids or colloidal solutions?

A colloidal solution or a colloid is a uniform solution of two or more substances. The particles are relatively very small that the solution appears as a homogeneous mixture but it is not.

Properties of colloids:

- Colloids are heterogeneous in nature.
- The particles of a colloid cannot be seen through naked eyes.
- The particles scatter a beam of light passed through a colloid and produce Tyndall effect.
- Colloids are stable in nature. The particles of colloids do not settle down if left uninterrupted.
- We cannot separate the particles of a colloid through filtration. We use a method called **Centrifugation** to separate the particles of a colloid.



What is the Tyndall Effect?

When a beam of light is passed through a colloid the particles of the colloid scatter the beam of light and we can see the path of light in the solution. **For Example**, when a ray of light enters a dark room it is scattered by the dust particles present in the air and we can see the path of light clearly.

Classification of Colloids

Dispersed Phase – The dispersed particles or the solute-like components in a colloid
Dispersing Medium – The substance in which these solute-like particles are added

Based on the state of the dispersing medium colloids are classified as:

How to separate components of a mixture?

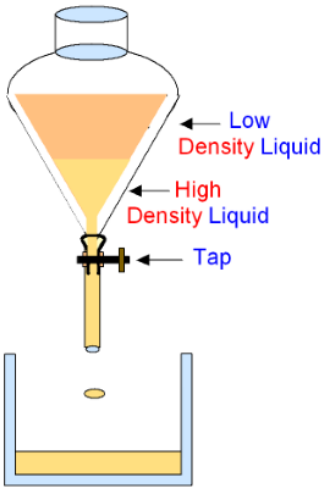
1. Evaporation – For separating a mixture of a non-volatile and a volatile substance

- **Applications:**
  - Separating coloured component from the ink
  - Salt from water
  - Sugar from Water
- **Method:**
  - Mix some ink into water and heat it. After some time the water will evaporate leaving behind the coloured substance.

2. Centrifugation – Separating dense particles from lighter particles

- **Applications:**
  - Separating milk from cream
  - Separating butter from cream
  - Squeezing out water from wet clothes
- **Method:**
  - Milk is put in a centrifuging machine or milk churner and the cream thus separates from milk.

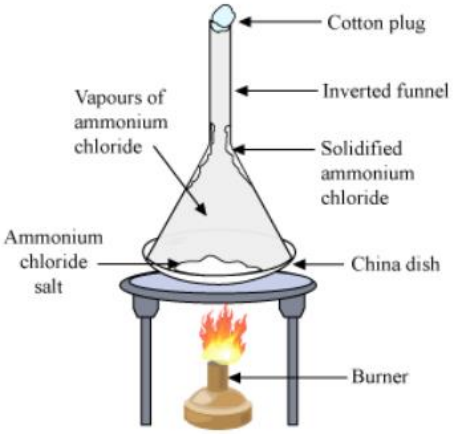
3. Using a Separating funnel – To separate two immiscible liquids



- **Applications:**
  - Oil from water
  - Iron and iron ore
- **Method:**

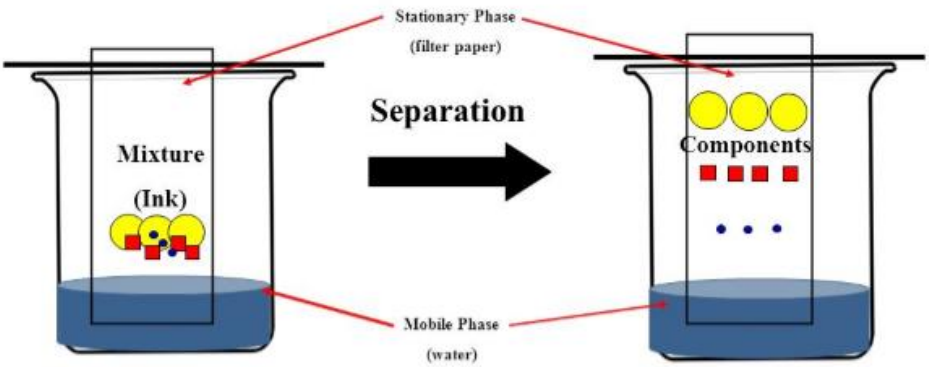
- The immiscible liquids are allowed to settle in the funnel. They soon form separate layers due to varying densities. The first liquid is allowed to flow out of the funnel and as soon as it is completely poured out, the stopcock is closed thereby separating the two liquids from each other.

4. Sublimation – To separate a sublimable component from a non-sublimable component



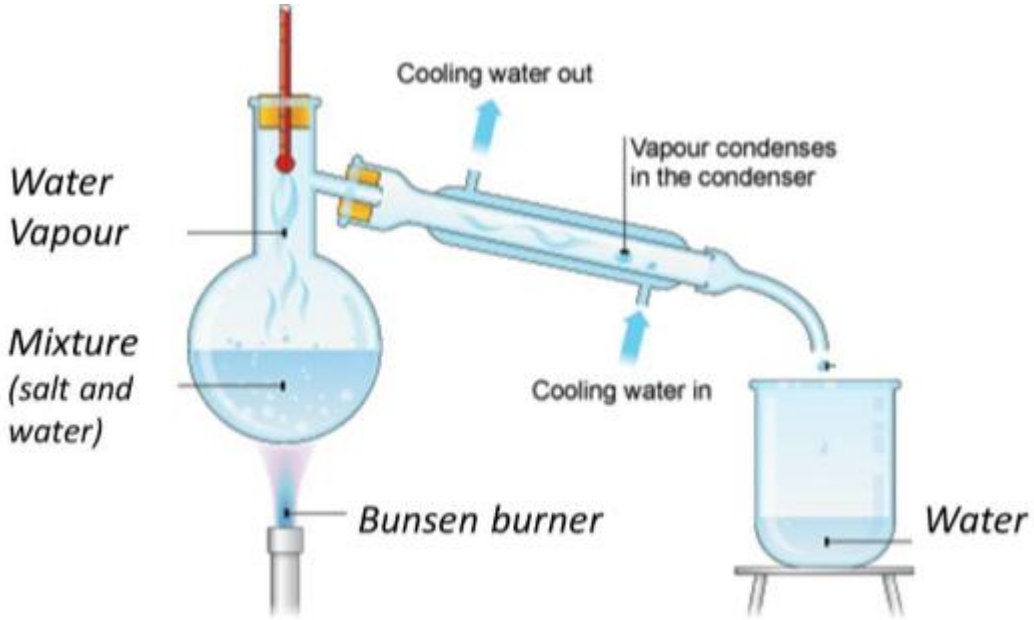
- **Applications:**
  - Ammonium chloride / camphor / naphthalene and salt
- **Method:**
  - Heat the mixture in an inverted funnel so that the sublimable component sublimes in the air and settles over the walls of the funnel and the non-sublimable component, on the other hand, is left behind.

5. Chromatography – To separate solutes that can dissolve in the same solvent



- **Applications:**
  - Separating colour components of a dye
  - Drugs from blood
- **Method:**
  - Take a filter paper or a blotting paper and place a drop of ink at the rear end. Dip the end in water. Since ink is a mixture of two or more colors, the component of ink which is soluble in water mixes into it and then separates quickly from the other components that are less soluble in water.

6. Distillation – To separate miscible liquids (the boiling points of the liquids must be sufficiently different)



- **Applications:**
  - Acetone and water
- **Method:**
  - The mixture is heated in a distillation apparatus. The one substance with lower boiling point evaporates first, condenses and gets separated from the one with a higher boiling point.
  - **Simple Distillation** – when the miscible liquids have a satisfactory difference in their boiling points
  - **Fractional Distillation** – when the difference between the boiling points of the liquids is less than 25 K

Separating different Gases from the Air

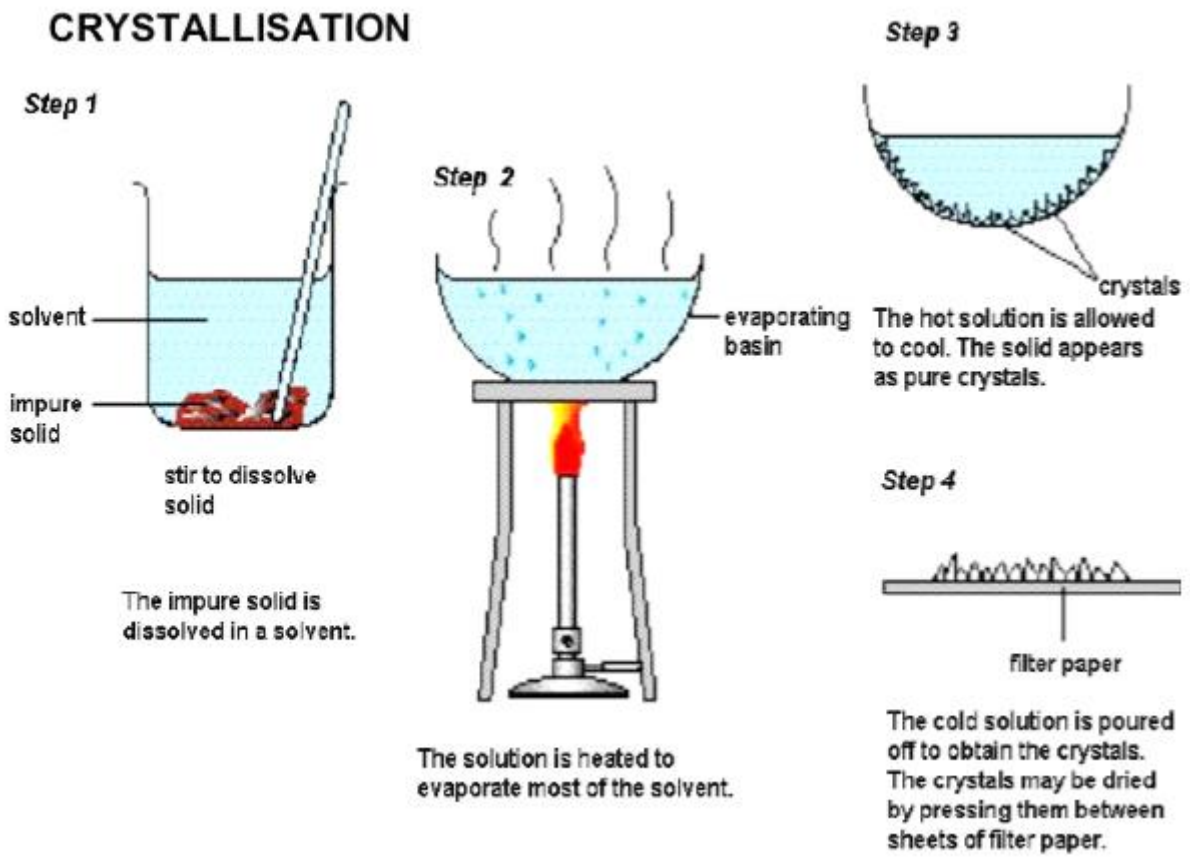
Method – Fractional Distillation

- Compress and cool the air by increasing the temperature and decreasing the pressure. The air turns to liquid air.
- Liquid air is warmed up slowly in a fractional distillation apparatus
- The several components of air get separated and are collected at various heights on the basis of their boiling points

Purifying Solids

Method used – Crystallization

In the crystallization method, we can obtain a pure solid in the form of crystals from its solution



- **Applications:**
  - Salt from sea water
  - Purification of copper sulphate
- **Method:**
  - The impurities of a substance are filtered out.
  - Water is evaporated to obtain a saturated solution.
  - The solution is covered with filter paper and left as it is.
  - After some time, the crystals of pure solid are formed.
- **Is evaporation better than crystallization?**

Simple evaporation is not better than crystallization because:

1. Some solid substances decompose because of excess heat. **For Example**, Sugar gets charred on extra heating.

2. If after filtration some impurities remain in the solution they can contaminate the solid and therefore we would not obtain a pure substance.

Physical Change and Chemical Change

Physical Property of a Substance:

Properties of a substance such as rigidity, colour, fluidity, boiling point, melting point, density and hardness which we can observe are called as **Physical Properties**.

Physical Change:

When physical properties of a substance change it is known as a **Physical Change**. When we convert a substance from one state to another, such as a solid into a liquid or vice-versa, it is also a physical change as only the physical nature of the substance changes without affecting its chemical nature.

For Example, Change of ice into water. The chemical properties of water remain the same.

Chemical Property of a Substance:

The chemical nature of a substance is known as its **Chemical Property** such as its odour or its chemical composition.

Chemical Change:

When the chemical properties or chemical composition of a substance gets altered it is called a chemical change. It is also called as a **Chemical Reaction**.

For Example, Burning of paper

Mixtures vs. Compounds

Mixtures	Compounds
Properties of a mixture Reflect the properties of the materials it contians.	Different properties from that of the elements that make up the compounds.
No uniform composition	Definite composition. Definite ratio/formula
Can be separated by physical means.	Cannot be separated by physical means.

ASSIGNEMENT

1) Which of the following statements are true for pure substances?
(i) Pure substances contain only one kind of particles
(ii) Pure substances may be compound 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)

2) Tincture of iodine has antiseptic properties. This solution is made by dissolving
(a) iodine in potassium iodide
(b) iodine in vaseline
(c) iodine in water
(d) iodine in alcohol

3) 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)

4) In a water-sugar solution
(a) water is solute and sugar is solvent
(b) water is solvent and sugar is solute
(c) water is solute and water is also solvent
(d) none of these

5) 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)

6) Which of the following methods would you use to separate cream from milk?
(a) Fractional distillation
(b) Distillation
(c) Centrifugation
(d) Filtration

7) Differentiate between a true solution and a colloid.

8) You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents from the mixture

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

10) 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.

11) Calculate the mass of water and glucose required to make 250 g of 40% solution of glucose.
Solution:

12) 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.

13) What are the two components of a colloidal solution?

14) How can you change a saturated solution to an unsaturated solution without adding any more solvent to it

15) Identify colloids and true solutions from the following:
Pond water, fog, aluminium paint, vinegar and glucose solution.

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SUBJECT : CHEMISTRY

CLASS IX

Week : 18 January 2021 to 22 January 2021

CHAPTER 3 : ATOMS AND MOLECULES

Guidelines

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Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/cGAlfRzxH-A

https://youtu.be/riaoGnwoISk

https://youtu.be/sHMlOvSPrUU

Learning outcomes

Students will able to learn about

1. Dalton's theory
2. Atoms and molecules
3. Compounds
4. Mole concept

Sub topics :

- law of conservation of mass
- law of constant proportion
- Dalton's atomic theory
- Atoms and molecules
- Atomicity
- Compound names
- Mole concept

LESSON DEVELOPMENT

Atoms and Molecules

The invisible and unknown form of matter

The idea of divisibility by Indian philosophers

Maharishi Kanad – He postulated that if we keep on dividing the matter (called as 'padarth') we will get smaller and smaller particles. And soon we will achieve the smallest of particles (called as 'parmanu') which may not divide further.

Pakudha Katyayama – He postulated that there are various forms of matter because the particles of matter exist together in combinations.

The idea of divisibility by Greek philosophers

Democritus and Leucippus – They suggested that when we keep on dividing the matter there comes a time when no more division of particles can take place. Such particles are called atoms which means being invisible.

But all these ideas were not backed up by many experimental pieces of evidence until Antoine L. Lavoisier provided two laws of chemical combination.

Laws of Chemical Combination

1. Law of conservation of mass – mass can neither be created nor destroyed in a chemical reaction

2. Law of constant proportion/Law of definite proportion – the elements are always present in definite proportions by mass in a chemical substance

For example, Hydrogen and oxygen are present in water in a ratio of 1:8. So if we decompose 9g of water we will obtain 1g of hydrogen and 8g of oxygen.

The Atomic Theory

John Dalton proposed an atomic theory which acted as an explanation of the above two laws. As per the theory, all matter whether it is an element, a compound or a mixture consists of tiny invisible particles called 'atoms'.

The postulates of the atomic theory by John Dalton

1. The matter is made up of tiny particles called atoms that cannot be divided.
2. Atoms are never formed or destroyed during a chemical reaction.
3. Atoms of an element exhibit same nature. They have the same size, mass, and character.
4. Atoms of different elements exhibit variant nature. They do not have same characteristics.
5. Atoms form compounds by combining in a ratio of whole numbers.
6. A compound contains a constant number and kinds of atoms

Atoms

We can call atoms as the building blocks of matter. Just like bricks are the building blocks of a building.

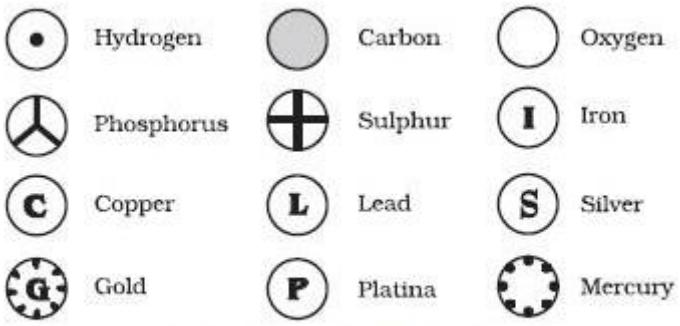
What is the size of an atom?

Atoms are extremely small. Their size is measured in nanometers where 1nm = 1/109 m.

Atomic radius is measured in nanometers 1/109 = 1nm 1m = 109 nm	
Relative Sizes	
Radii (in m)	**Example**
10^{-10}	Atom of hydrogen
10^{-9}	Molecule of water
10^{-8}	Molecule of haemoglobin
10^{-4}	Grain of Sand
10^{-2}	Ant
10^{-1}	Watermelon

Symbols for Atoms

Here are some examples of the symbols that are used to represent different atoms



Symbols for some elements as proposed by Dalton

The symbols for representing an atom are generated from the first two letters of the element's name. The first letter is always in uppercase (capital letter) while the second letter is written in lowercase. Here are some examples –

Element	Symbol	Element	Symbol	Element	Symbol
Aluminium	Al	Copper	Cu	Nitrogen	N
Argon	Ar	Fluorine	F	Oxygen	O
Barium	Ba	Gold	Au	Potassium	K
Boron	B	Hydrogen	H	Silicon	Si
Bromine	Br	Iodine	I	Silver	Ag
Calcium	Ca	Iron	Fe	Sodium	Na
Carbon	C	Lead	Pb	Sulphur	S
Chlorine	Cl	Magnesium	Mg	Uranium	U
Cobalt	Co	Neon	Ne	Zinc	Zn

The Atomic Mass

The Dalton's Atomic Theory suggested that each element has a distinguishing atomic mass. With this theory, the law of constant proportions could be explained easily.

But it is indeed difficult to evaluate the mass of an atom since the size of an atom is relatively small.

Therefore scientists started evaluating the mass of an atom by comparing it with the mass of a standard atom.

Earlier 1/16 of the mass of an oxygen atom was used as a standard for calculating the mass of other elements. Now, carbon - 12 is considered a standard atom for calculating the mass.

Its atomic mass is 12u (12 atomic mass units). Thus we can say that one atomic mass unit is the mass of 1/12 the mass of a carbon-12 atom. Here is a list of atomic masses of a few elements.

Element	Atomic Mass
Hydrogen	1 µ
Carbon	12 µ
Nitrogen	14 µ
Oxygen	16 µ
Sodium	23 µ
Magnesium	24 µ
Sulphur	32 µ
Chlorine	35.5 µ
Calcium	40 µ

Can atoms exist independently?

Atoms cannot survive independently. So, atoms join together and form molecules or ions.

Molecule

- A molecule is a collection of various atoms that combine chemically with each other.
- These atoms are bound together by certain forces of attraction.
- Atoms of the same elements or different elements can bind together to form molecules.
- Therefore, a molecule is the smallest particle of a substance that can exist independently and shows all the properties of that substance.

Molecules of Elements

- The molecules of an element are formed by combinations of similar types of atoms. For example, Helium (He) is made up of only one atom while oxygen is made up of two atoms.
- **Atomicity** – the number of atoms in a molecule of an element is called its atomicity. For example, helium is monoatomic and oxygen is diatomic.
- **Monoatomic** – when an element comprises of a single atom. Example – all metals
- **Diatomic** – when an element comprises of two atoms. Example – all gases
- **Triatomic** – when an element comprises of three atoms

- **Tetra-atomic** – when an element comprises of four atoms
- **Poly-atomic** – when an element comprises of more than two atoms

Here a few examples of atomicity of elements –

Atomicity of some Elements		
Name	**Atomicity**	**Formula**
Argon	Monoatomic	Ar
Helium	Monoatomic	He
Oxygen	Diatomic	O_2
Hydrogen	Diatomic	H_2
Nitrogen	Diatomic	N_2
Chlorine	Diatomic	Cl_2
Phosphorous	Tetra – atomic	P_4
Sulphur	Poly – atomic	S_8

Molecules of Compounds

Molecules of compounds constitute atoms of different elements that combine together in a fixed proportion. For example, water comprises of two atoms of hydrogen and one atom of oxygen.

Molecules of some compounds :-

Compound	Combining elements	Number of atoms of each elements
Water – H_2O	Hydrogen, Oxygen	2 - Hydrogen, 1 - Oxygen
Ammonia – NH_3	Nitrogen, Hydrogen	1 - Nitrogen, 3 - Hydrogen
Carbon dioxide CO_2	Carbon, Oxygen	I - Carbon, 2 - Oxygen
Hydrochloric acid HCl	Hydrogen, Chlorine	1 - Hydrogen, 1 - Chlorine
Nitric acid HNO_3	Hydrogen, Nitrogen, Oxygen	1 - Hydrogen, 1 - Nitrogen, 3 - Oxygen
Sulphuric acid H_2SO_4	Hydrogen, Sulphur, Oxygen	2 - Hydrogen, 1 - Sulphur, 4 - Oxygen

Ions

- Compounds contain metals as well as non-metals. These elements include charged species which are known as ions.
- Thus, ion is a particle that has a positive or negative charge.
- **Anion** – negatively charged ion

- **Cation** – positively charged ion
- There can be a single charged atom in an ion or there may be a group of charged atoms in an ion that have a net charge on the compound.
- When a group of atoms carries a charge in a compound it is called as a **polyatomic ion.**

Chemical Formula

We use a chemical formula to represent the composition of a compound in the form of symbols. To write a chemical formula you must know two things –

1. Symbols of elements

2. Valency

Valency – it is also known as the combining capacity of an element. In other words, valency explains how atoms of one element will mix with atoms of another element. For example, the hydrogen ion is represented as H+ which means that its valency is 1. Similarly, the oxygen ion is represented as O2- which means that its valency is 2. Here is a list of valancies of various elements.

Name of the Element	Symbol	Valency	Ion.
Hydrogen	H	1	H^+
Helium	He	0	–
Lithium	Li	1	Li^+
Beryllium	Be	2	Be^{2+}
Boron	B	3	B^{3+}
Carbon	C	4 (Shares electrons)	–
Nitrogen	N	3	N^{3-}
Oxygen	O	2	O^{2-}
Fluorine	F	1	F^-
Neon	Ne	0	–
Sodium	Na	1	Na^+
Magnesium	Mg	2	Mg^{2+}
Aluminium	Al	3	Al^{3+}

Rules of writing a Chemical Formula

- Valencies of on the ions must balance.
- In a case where both metal and non-metal substances are present in a compound, the name of the metal is always written first in the chemical formula. For example, Sodium Chloride is written as NaCl
- In case of polyatomic ions, the ion is written in brackets before writing the number of ions associated to it. In case of a single ion, there is no need to mention the ion in brackets

Writing the Formulae of Simple Compounds

Binary compounds – compounds that consist of two different elements

How to write a Formula of a Compound

- Write the symbols of the corresponding elements of the compound as explained above
- Write the valencies of the elements of the compound
- Crossover the valencies of the elements

Here are a few examples of writing the chemical formula

(i) Formula of Sodium Oxide

Symbol → Na O

Charge → +1 –2

Formula → Na_2O

(ii) Formula of aluminium chloride

Symbol → Al Cl

Charge → +3 – 1

Formula → $AlCl_3$

(iii) Formula of Sodium Oxide

Symbol → Na S

Charge → +1 –2

Formula → Na_2S

(iv) Formula of magnesium hydroxide

Symbol → Mg OH

Charge → +2 1

Formula → $Mg(OH)_2$

Molecular Mass and the Mole Concept

Molecular Mass – summation of all the atomic masses in a molecule

Molecular mass is expressed in atomic mass units (amu).

For example, the molecular mass of HNO3 can be calculated as:

Atomic mass of H =1u

Atomic mass of N =14u

Atomic mass of O =16u

Molecular mass of HNO3 = 1 + 14 + (16*3) = 63u

Formula Unit Mass

The sum of atomic masses of all atoms in a formula unit of a compound is called as its formula unit mass. The formula unit mass is used in case of substances that constitute ions. For example, formula unit mass of Sodium Chloride (NaCl) can be calculated as: (1*23) + (1*35.5) = 58.5u

Formula unit mass of ZnO

= 1 × atomic mass of Zn + 1 × atomic mass of O

= 1 × 65 u + 1 × 16 u = **81 u**

Formula unit mass of Na_2O

= 2 × atomic mass of Na + 1 × atomic mass of O

= 2 × 23 u + 1 × 16 u = **62 u**

Formula unit mass of K_2CO_3

= 2 × atomic mass of K + 1 × atomic mass of C + 3 × atomic mass of O

= 2 × 39 u + 1 × 12 u + 3 × 16 u

= 78 u + 12 u + 48 u = **138 u**

Mole Concept

How do we interpret a chemical equation?

$2C + O_2 = 2CO_2$

We say that two molecules of carbon combine with one molecule of oxygen to form two molecules of carbon dioxide.

We can also say that 24u of Carbon molecules combine with 32u of oxygen molecules to form 56u of carbon dioxide molecules.

Therefore, we can characterize the quantity of a substance by its mass or by its number of molecules.

A chemical equation directly indicates the number of molecules participating in the reaction. Thus, it is convenient for us to refer to the number of substances in a chemical reaction as numbers of molecules or atoms.

Mole

Mole is a numerical quantity that has a mass equal to the atomic or molecular mass of species (atoms, molecules, ions or particles).

1 mole of any substance = 6.022 X 1023 number of particles (atoms, ions or molecules)

This is called the **Avogadro number or Avogadro Constant** which is represented as N0

The mass of 1 mole of a substance is the same as that its atomic mass or molecular mass expressed in grams.

Gram atomic mass of a substance – the atomic mass of a substance when expressed in grams is known as its gram atomic mass.

Gram molecular mass of a substance – the molecular mass of a substance when expressed in grams is known as its gram molecular mass.

For example, the atomic mass of Sulphur is 32u. Gram atomic mass of Sulphur is 32g.

Also, 32u of Sulphur has 1 atom of Sulphur. 32g of Sulphur has 1 mole atoms, that is, 6.022 X 1023 atoms of Sulphur.

Similarly, we can say that the gram molecular mass of Carbon Dioxide is 56g.

But we know that in the case of chemical equation mole is the measuring unit.

Therefore, 1 mole = 6.022 × 1023 number = Relative mass in grams

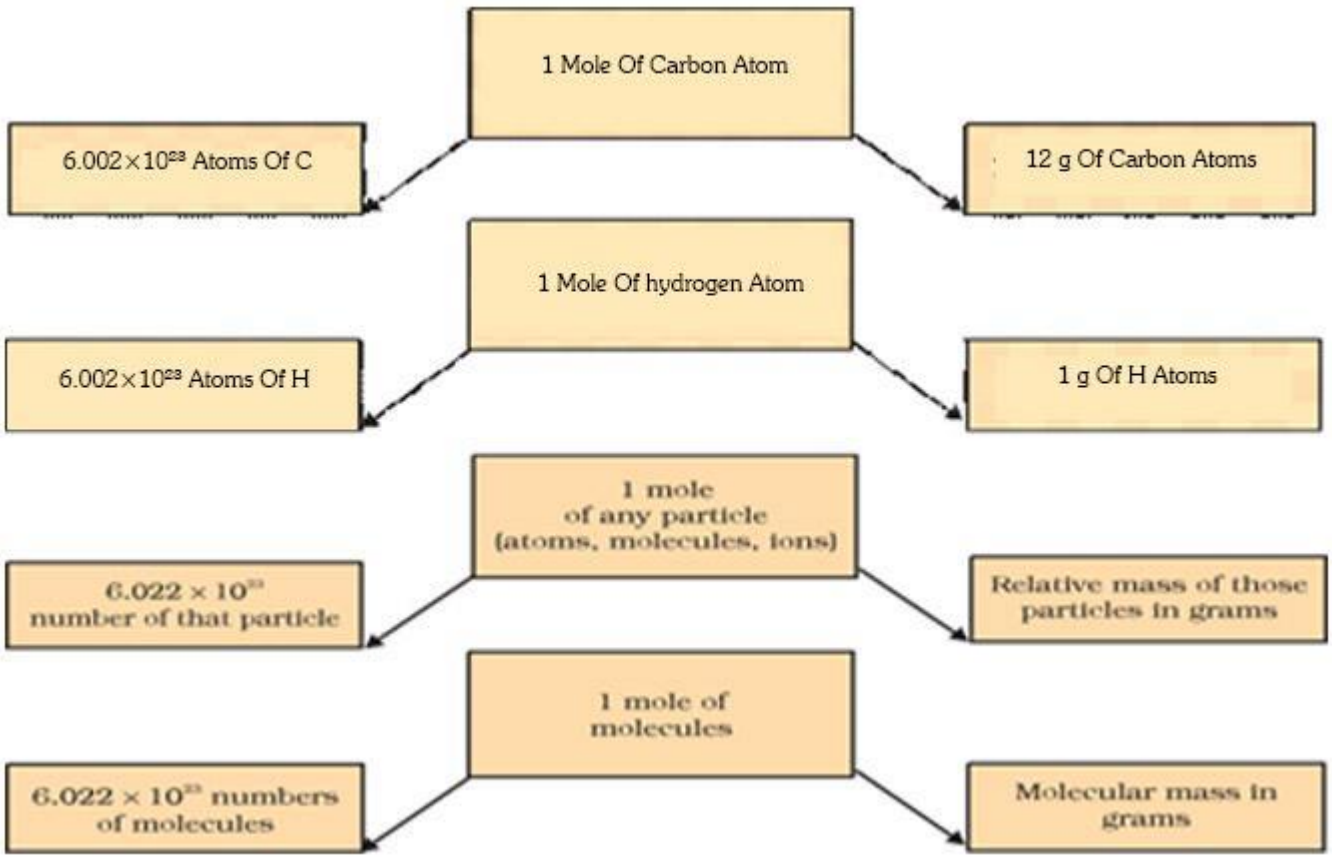
Wilhelm Ostwald introduced the word 'mole' which actually means a heap or a pile. Therefore, we consider a substance as a heap of atoms or molecules.

Consider these formulae –

$$\text{Number of moles} = \frac{\text{Mass of substance}}{\text{Molar mass}}$$

$$\text{Number of moles} = \frac{\text{Number of particles}}{\text{Avogadro number}}$$

A quick review of how mole, Avogadro number and Mass are related to each other –



ASSIGNMENT

1. Atoms of most elements are not able to exist independently'. Name two atoms which exist as independent atoms.
2. What is the number of electrons in Mg atom and **Mg2+** ion
3. Write atomicity of the following:
   (i) Sulphur, (ii) Phosphorus
4. Which postulate of Dalton's atomic theory is the result of the law of conservation of mass ?
5. Give the electronic configuration of:
   (i) Al atom and its ion
   (ii) O atom and its ion
6. Give the names of the elements present in the following compounds:
   (a) Quicklime (b) Hydrogen bromide
   (c) Baking powder (d) Potassium sulphate.
7. State two examples in each case and write their chemical formulae:
   (a) Molecules having (me kind of atoms only.
   (b) Molecules having two different kinds of atoms.
   (c) Molecules having three different kinds of atoms.
8. Classify the following compounds diatomic, triatomic and polyatomic molecules: [SAII-2014]
   $HCl, H_2, H_2O, NH_3, CH_3OH, PCl_5$
9. Write the names of the following compounds:
   (a) NiS (b) $Mg(NO_3)_2$ (c) Na_2SO_4 (d) $Al(NO_3)_3$
   (e) K_3PO_4 (f) Ca_3N_2 [SA II–2014]
10. In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass, sodium carbonate + ethanoic acid —> sodium ethanoate + carbon dioxide + water.
11. Calculate the formula unit masses of ZnO, **Na_2O**, **K_2CO_3**, given atomic masses of Zn = 65u, Na = 23u, K = 39 u, C = 12 u, and O = 16 u.
12. Write the chemical formulae of the following: [SAII-2015]
    (a) Magnesium chloride (b) Calcium oxide
    (c) Copper nitrate (d) Aluminium chloride
13. Calculate the number of molecules of sulphur (**S_8**) present in 16 g of solid sulphur.
14. Calculate the number of aluminium ions present in 0.051 g of aluminium oxide.(Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u). [SAII-2011]
15. (a) Define: (i) Molecular mass, (ii) Avogadro constant.
    (b) Calculate the number of molecules in 50 g of $CaCO_3$. (Atomic mass of Ca = 40 u, C = 12 u and O = 16 u)
    (c) If one mole of sodium atom weighs 23 g, what is the mass (in g) of one atom of sodium ?
16. A sample of vitamin C is known to contain 2.58 x10^{24} oxygen atoms. How many moles of oxygen atoms are present in the sample ?

CHAPTER : STRUCTURE OF ATOM

Structure of Atom

Quick Revision

- Atoms are the basic building blocks of matter.
- Different kinds of matter exist because there are different kinds of atoms present in them.

Charged Particles in Matter

- Whenever we rub two objects together, they become electrically charged. This is because atoms contain charged particles in them. Therefore, atoms can be divided further into particles i.e proton, electron and neutron.

Protons were discovered by Ernest Rutherford, in his famous gold foil experiment.
Electrons were discovered by J.J. Thomson, in his cathode ray tube experiment.
Neutrons were discovered by James Chadwick.

Name	Location	Charge (C)	Unit Charge	Mass (amu)	Mass (g)
electron	outside nucleus	-1.602×10^{-19}	1−	0.00055	0.00091×10^{-24}
proton	nucleus	1.602×10^{-19}	1+	1.00727	1.67262×10^{-24}
neutron	nucleus	0	0	1.00866	1.67493×10^{-24}

- Atoms consist of protons and electrons in a balanced proportion.
- Protons exist in the interiors of the atom and electrons exist in the exteriors of the atom. Therefore, electrons can be removed from an atom.

Failure of Dalton's Atomic Theory

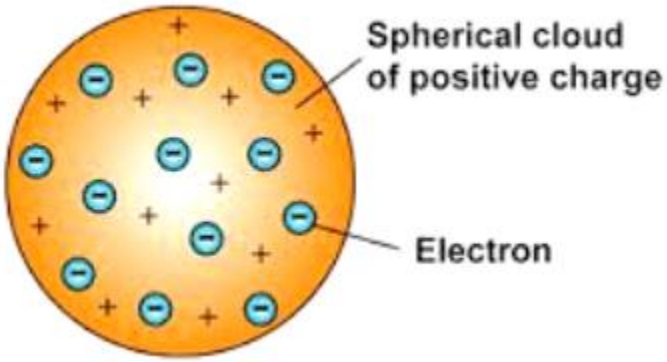
The postulates of the atomic theory by John Dalton

- The matter is made up of tiny particles called **Atoms** that cannot be divided.
- Atoms are never formed or destroyed during a chemical reaction.
- Atoms of an element exhibit same nature. They have the same size, mass, and character.
- Atoms of different elements exhibit variant nature. They do not have same characteristics.
- Atoms form compounds by combining in a ratio of whole numbers.
- A compound contains a constant number and kinds of atoms

Dalton suggested that atoms can neither be created nor destroyed and are indivisible. But the discovery of electrons and protons in atoms lead to failure of this aspect of Dalton's theory.

Thomson's Model of an Atom

According to J.J. Thomson, the structure of an atom can be compared to Christmas pudding where electrons are present inside a positive sphere.



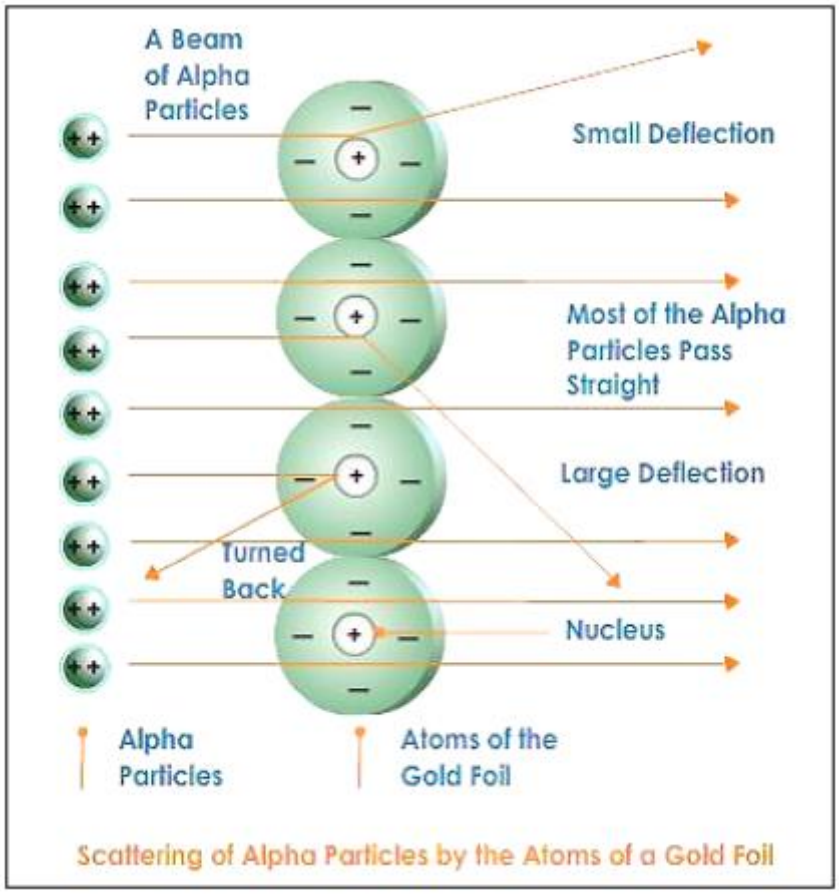
An atom is composed of a positively charged sphere in which electrons are embedded.

Atom is neutral as the positive and negative charged are equal in proportion.

Rutherford's Model of an Atom

Rutherford's Experiment

- He experimented with thin gold foil by passing alpha rays through it.
- He expected that the gold atoms will deflect the Alpha particles.



Observations	Inferences
Alpha particles which had high speed moved straight through the gold foil	Atom contains a lot of empty space

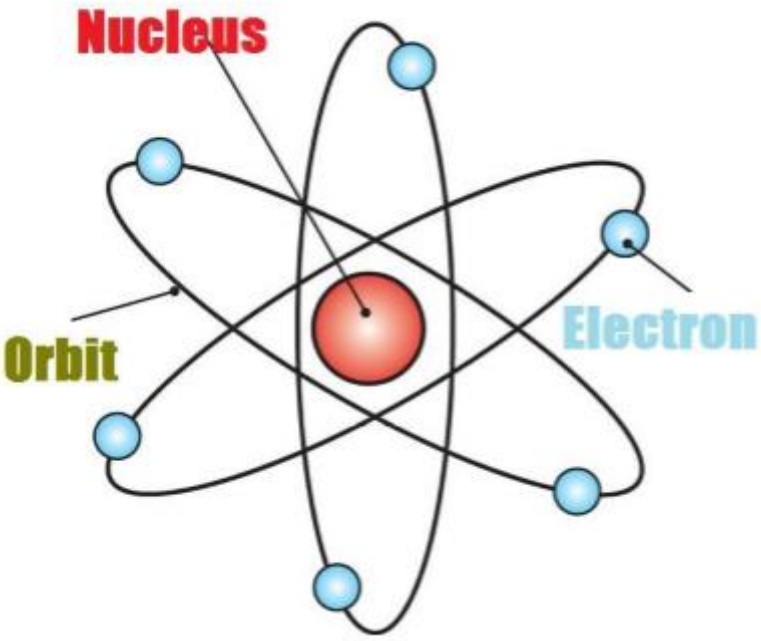
Some particles got diverted a by slide angles	Positive charges in the atom are not occupying much of its space
Only one out of 12000 particles bounced back	The positive charges are concentrated over a particular area of the atom.

Thus, Rutherford gave the nuclear model of an atom based on his experiment which suggests that -

- Atoms contain a lot of unoccupied space
- There is a heavily positively charged substance present in the center of the atom which is called the nucleus
- The nucleus contains an equal amount of positive and negative charge.

The Nucleus of an Atom

- The nucleus id located at the center of the atom.
- All the mass of the atom is because of the nucleus.
- The electrons revolve around the nucleus in circular parts which are called **Orbits**
- If we compare the size of the atom and nucleus, the nucleus is much smaller than the atom.



Drawbacks of the Nuclear Model of an Atom

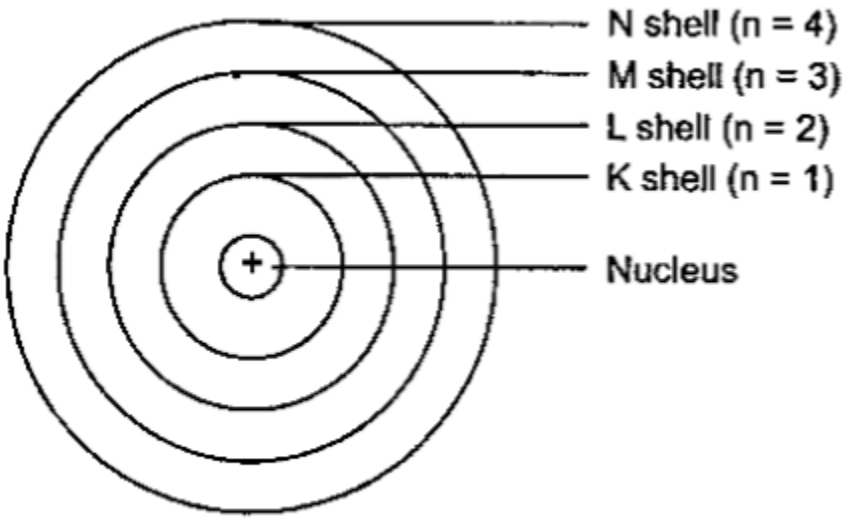
The Nuclear Model of the Atom failed to explain how an atom remains stable despite having positive and negative charges present in it. Maxwell has suggested a theory according to which if any charged particle moves in a circular motion it radiates energy. So, if electrons start moving in a circular motion around the nucleus they would also radiate some energy which would decrease at the speed of the electrons. As a result, they would fall into the nucleus because of its high positive charge.

What are nucleons? – Protons and Neutrons are collectively called as **Nucleons**.

Bohr's Model of an Atom

Bohr suggested that –

- Electrons spin around the nucleus in an individualized separate path or unattached orbit.
- The electrons do not emit any energy while moving Indies special orbits.
- These orbits are also called as **Energy Levels**.
- They are represented using letters or numbers as shown in the figure below –



Bohr's Model

The Neutrons

J. Chadwick discovered that there is another sub-atomic particle present in the atom. This particle carries no charge and is known as a **Neutron**. Therefore, we can conclude that atom consists of three types of particles -

Electrons	which carry a negative charge
Protons	which carry a positive charge
Neutrons	they are neutral

The distribution of electrons in different shells or orbits

- If Orbit number = n
- Then number of electrons present in an Orbit = $2n^2$
- So, for n =1
- Maximum electrons present in shell – K = $2 * (1)^2 = 2$
- The outermost shell can contain at most 8 electrons.
- The shells in an atom are filled in sequence.
- Thus, until the inner shells of an atom are filled completely the outer shells cannot contain any electrons.

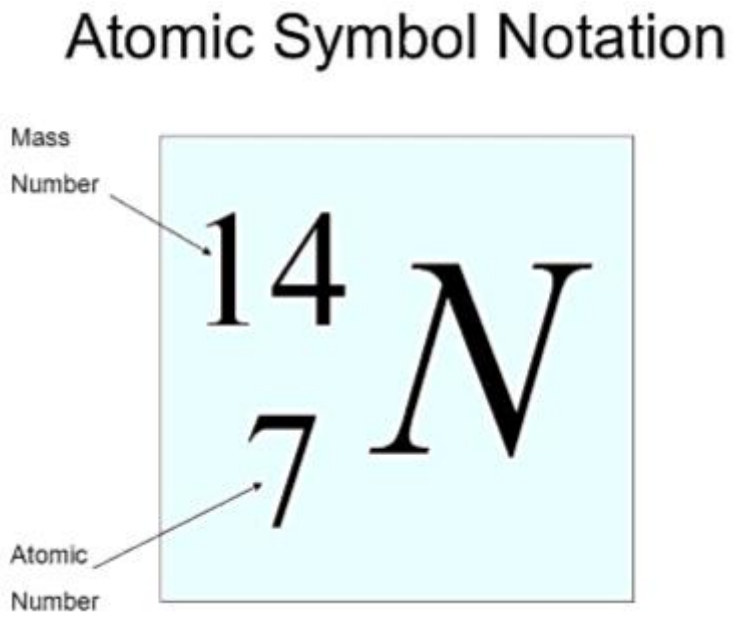
Valency

- **Valence Electrons** – Electrons existing in the outermost orbit of an atom are called **Valence Electrons**.

- The atoms which have completely filled the outermost shell are not very active chemically.
- The valency of an atom or the combining capacity of an atom is given by the number of elements present in the outermost shell.
- **For Example**, Helium contains two electrons in its outermost shell which means its valency is two. In other words, it can share two electrons to form a chemical bond with another element.
- **What happens when the outermost shell contains a number of electrons that are close to its maximum capacity?**

Valency in such cases is generated by subtracting the number of electrons present in the outermost orbit from octet (8). For example, oxygen contains 6 electrons in its outermost shell. Its valency is calculated as: 8 – 6 = 2. This means oxygen needs two electrons to form a bond with another element.

Atomic Number of an Element
Atomic Number (Z) = Number of protons in an atom
Mass Number of an Element
Mass Number = Number of protons + Number of neutrons

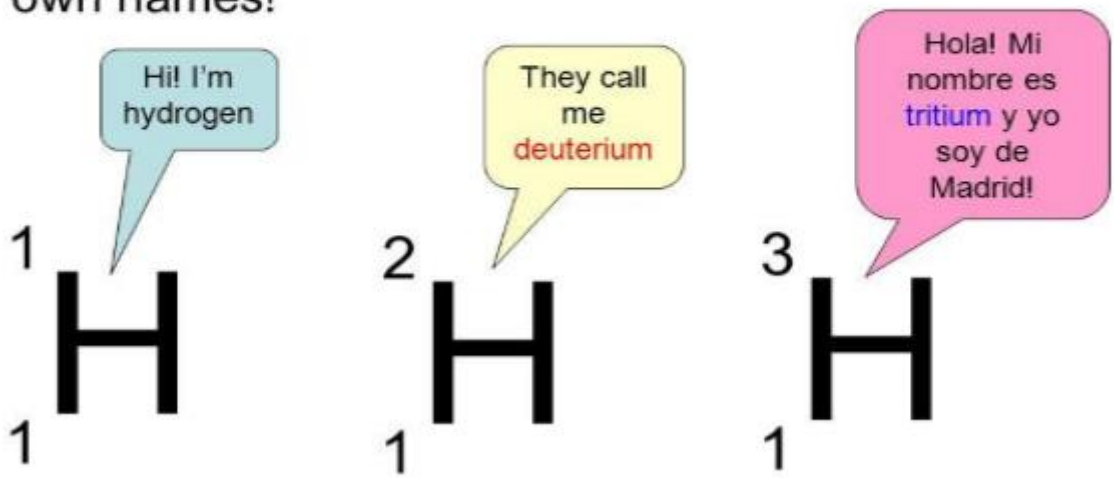


Isotopes

- The atoms of an element can exist in several forms having similar atomic numbers but varying mass numbers.
- Isotopes are pure substances.
- Isotopes have a similar chemical nature.
- Isotopes have distinct physical characteristics.

Isotopes of Hydrogen

The three isotopes of Hydrogen even have their own names!



Where can we use Isotopes?

1. The fuel of Nuclear Reactor – Isotope of Uranium
2. Treatment of Cancer – Isotope of Cobalt
3. Treatment of Goiter – Isotope of Iodine

Example: Consider two atomic species namely U and V. Are they isotopes?

	U	V
Protons	5	5
Neutrons	5	6
Mass Number	5 + 5 = 10	5 + 6 = 11
Atomic Number	5	5

From the above example, we can infer that U and V are isotopes because their atomic number is the same.

Isobars

The atoms of several elements can have a similar mass number but distinct atomic masses. Such elements are called **Isobars**.

Isobars	Atomic number (Z)	Mass number (A)	Electrons (e)	Protons (p)	Neutrons (n)
$^{40}_{18}Ar$	18	40	18	18	22 (40-18)
$^{40}_{19}K$	19	40	19	19	21 (40-19)
$^{40}_{20}Ca$	20	40	20	20	20 (40-20)

ASSIGNMENT

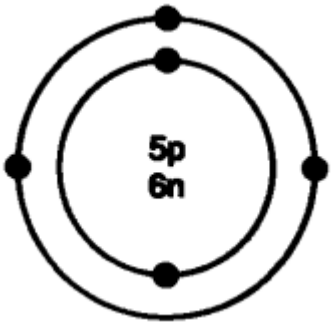
1. The nucleons are
   (a) protons and electrons (b) neutrons and electrons
   (c) protons and neutrons (d) none of these
2. The isotope deuterium of hydrogen has
   (a) no neutrons and one proton (b) one neutron and two protons
   (c) one electron and two neutron (d) one proton and one neutron
3. An alpha-particle contains
   (a) 4 positive charge and 2 mass unit
   (b) 2 positive charge and 4 mass unit
   (c) 2 positive charge and 2 mass unit
   (d) 4 positive charge and 4 mass unit
4. The atomic number of sodium is 11 and its mass number is 23. It has
   (a) 11 neutrons and 12 protons (b) 12 protons and 11 electrons
   (c) 11 electrons and 12 neutrons (d) 12 electrons and 11 neutrons
5. The electronic configuration of chlorine is
   (a) 2, 7 (b) 2, 8, 8, 7
   (c) 2, 8, 7 (d) 2, 7, 8
6. The isobars among the following is

   (a) $^{40}_{20}Ca$ $^{35}_{17}Cl$ (b) $^{20}_{18}Ar$ $^{20}_{19}K$

   (c) $^{16}_{8}O$ $^{18}_{8}O$ (d) $^{19}_{7}X$ $^{13}_{7}Y$
7. The elements with same valence electrons and form same type of ions

   (a) $^{16}_{8}O$ $^{23}_{11}Na$ (b) $^{20}_{18}Ar$ $^{20}_{19}K$

   (c) $^{14}_{5}N$ $^{27}_{13}Al$ (d) $^{23}_{11}Na$ $^{20}_{19}K$
8. Draw the atomic structure of sodium atom.
9. Find the valency of $^{14}_{7}N$ and $^{35}_{17}Cl$.
10. What are isotopes? State its characteristics
11. Aryan could not solve the following question in the group; his group mate explained him and solved his difficulty. The question was as follows:
    What information do you get from the given figure about the atomic number, mass number and valency of the given atom X'.



(a) What is the answer for-the above question?

(b) Name the element X'.

12. Draw the atomic structure of (i) an atom with same number of sub-atomic particles, (ii) an atom with same number of electrons in L and M shell.

13. Complete the following table.

Atomic Number	Mass Number	Number of Neutrons	Number of Protons	Number of Electrons	Name of the Atomic Species
9	–	10	–	–	–
16	32	–	–	–	Sulphur
–	24	–	12	–	–
–	2	–	1	–	–
–	1	0	1	0	–

Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT : CHEMISTRY

CLASS IX

Week : 25 January 2021 to 31 January 2021

CHAPTER 2 : IS MATTER AROUND US PURE

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/ee58VOxeykM

https://youtu.be/ij3qHqY2KFw

https://youtu.be/YB9o6Jg1EuM

Learning outcomes

Students will able to learn

- About cell
- Cell organelle
- Functions of cell organelle

Sub topics :

- Cell
- Difference between plasma membrane and cell wall
- Various cell organelle
- Functions of cell organelle
- Chromosomes

LESSON DEVELOPMENT

The Fundamental Unit of Life

Discovered By	Period of time	What they discovered?
Robert Hooke	1665	noticed the presence of cells in a cork slice
Leeuwenhoek	1674	found the presence of living cells in the pond water
Robert Brown	1831	recognized the existence of a nucleus in the cell
Purkinje	1839	invented the term 'Protoplasm' which is the liquid present in a cell
Schleiden and Schwann	1838, 1839	presented the cell theory that all organisms are actually made up of cells
Virchow	1855	suggested that all cells come from cells that already exist in nature

The Cell Theory

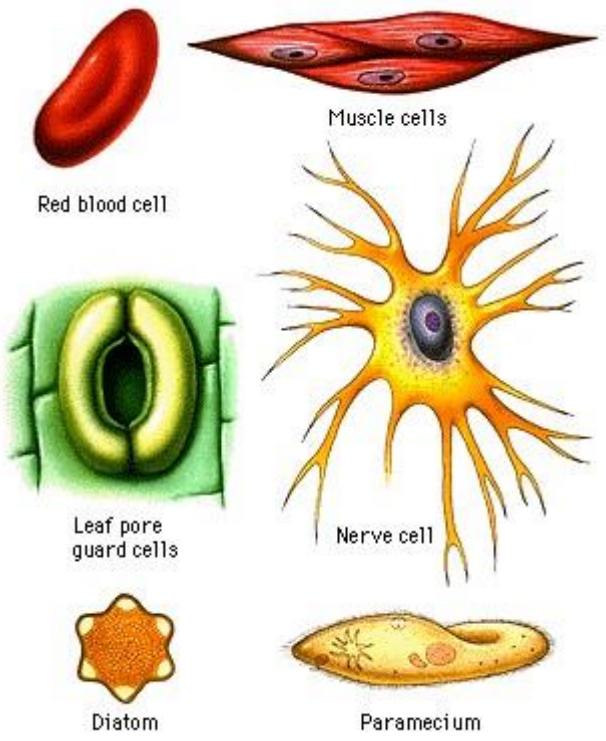
1. A cell is the structural and functional unit of all living organisms.
2. All the living organisms are made up of cells.
3. Cells are formed from pre-existing cells.

Q 1 what are unicellular and multicellular organisms

- **Unicellular Organisms** – The organisms that consist of a single cell such as ***Amoeba***.
- **Multicellular Organisms** – The organisms which contain various cells that perform different functions in the organism such as plants fungi and animals

The Shape of the Cell

- The shape of the cell may vary depending upon the type of function they perform in an organism.
- Cells are capable of changing their shape. For example, the white blood cells and amoeba can change shapes on their own.



A cell contains three features –

- The Plasma Membrane
- Nucleus
- Cytoplasm

Q 2 difference between plasma membrane and cell wall

Plasma Membrane	**Cell Wall**
• Plasma membrane is the outermost covering of the cell that separate the content of the cell from its external environment	• Plant cells, in addition to the plasma membrane have another rigid outer covering called cell wall

• Plasma membrane is flexible and is made up of organic molecules called lipids and protein	Cell wall is consist of cellulose

Q3 How can substances move in and out of a cell?

OR Explain diffusion and osmosis

Spontaneous movement of substances like CO_2 and O_2 gas from a region of high concentration to a region where its concentration is low is called **diffusion**

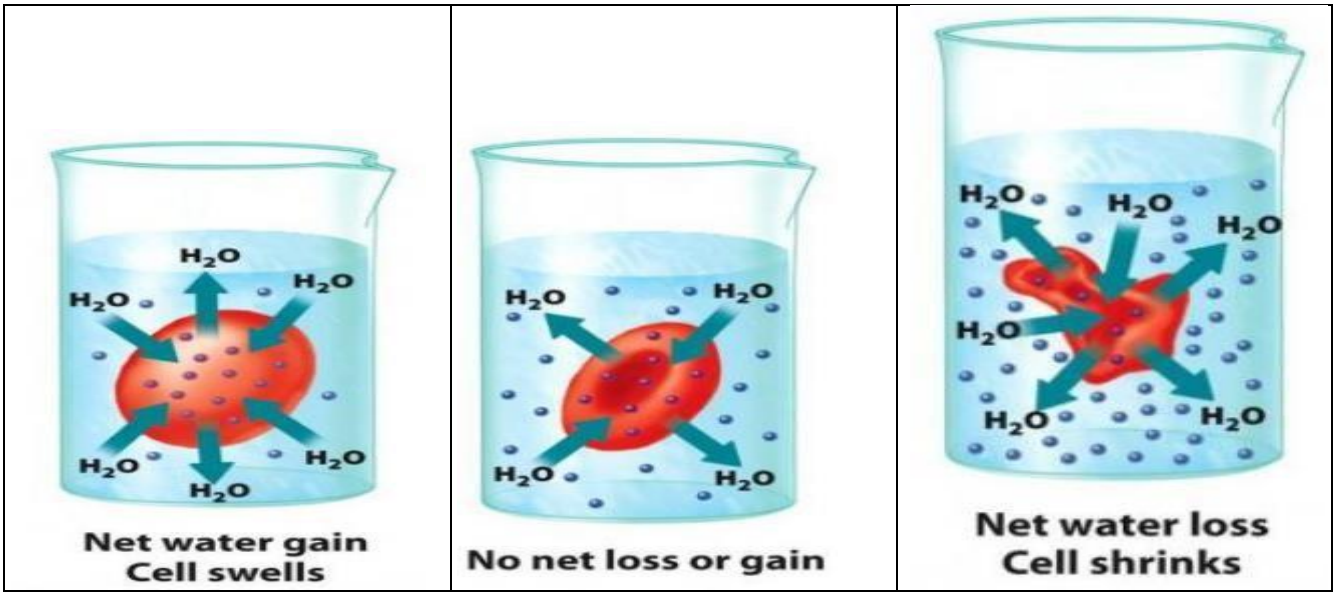
Role of Diffusion

Diffusion play an important role in gaseous exchange between cell as well as cell and its external environment

. **Osmosis** is a process in which water moves from the region of high concentration to one where its concentration is low through a semi permeable membrane.

Q 4 Difference between hypertonic solution hypotonic solution, isotonic solution

Hypotonic Solutions	**Isotonic Solutions**	**Hypertonic Solutions**
• If the concentration of water outside the cell is higher than the concentration of water inside the cell , the cell gains water by the process of	• If the cells are put in an environment which has similar concentration of water as present inside. There will be no net movement	• If the cells are kept in an environment which has lower concentration of water than what is present inside the cells then due to the
osmosis , which results in swelling of the cells.	of water across the cell membrane that is amount of water going in is same as amount of water going out .	process of osmosis water moves out of the cells. • This results in a decrease in size of the cells (they shrink) as more amount of water comes out of the cell.



Q 5 What is Endocytosis?

It is a process by which the plasma membrane engulfs food and other materials inside the cell from external environment. Amoeba acquires its food through such process

Q 6 What is plasmolysis?

When are living plant cell loses water through Osmosis there is shrinkage for contraction of the contents of the cell away from the cell wall. This phenomena is known as plasmolysis **Q 7 Can dead cells absorb water**?

No, dead cells cannot absorb water through osmosis.

Q 8 How plants, fungi, and bacteria can exist in hypotonic medium? Plants, fungi, and bacteria exist in such situations because of their rigid cell membranes. Even if the cells swell up the cell membrane is able to prevent them from bursting out

Q 9 explain structure of nucleus

The Nucleus

Nucleus is a prominent, organelle present in cell which is the controlling centre of all activities of cell.

The Structure of the Nucleus

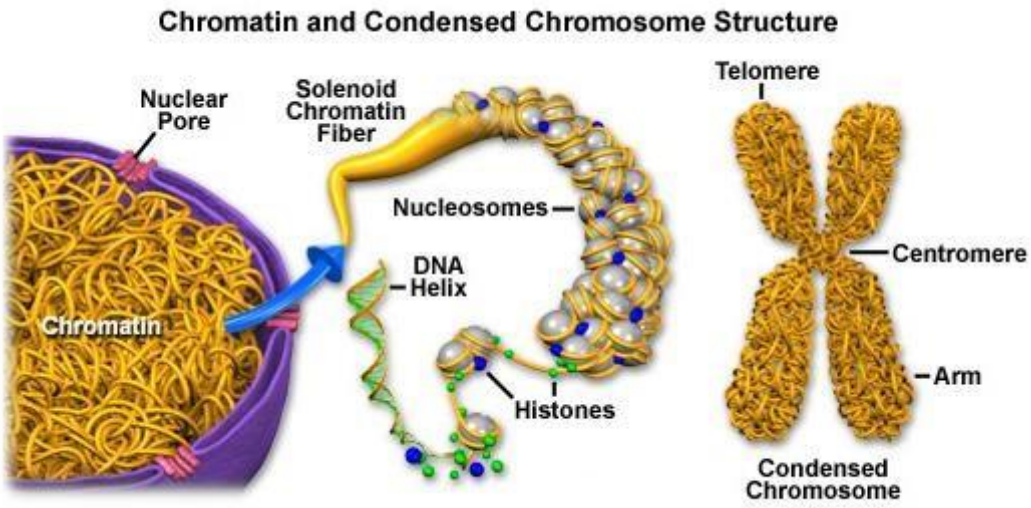
- A nucleus has a nuclear membrane which covers it all around.
- There are pores present on the nuclear membrane that allow movement of substances in and out of the nucleus.
- There are chromosomes, rod-shaped structures present in the nucleus which contain genetic information.

The chromosomes contain two types of things -

1. **DNA** - This is responsible for organizing and constructing new cells
2. **Proteins -** These help in packaging and condensation of DNA.

Chromatin

Chromatin is thread-like material present in a cell. The chromatin organizes itself into chromosomes whenever the cell is about to divide.



Q 10 What is a nucleoid?
Sometimes cells do not have a well-defined nucleus because they lack a nuclear membrane. Such a nucleus with no definite nuclear boundaries is called a **Nucleoid Q 11 What are the prokaryotes?**
Organisms whose cells do not have a definite cell membrane are called **Prokaryotes**.
Q12 What are eukaryotes?
Organisms whose cells contain a well-defined nuclear membrane are called **Eukaryotes**.

Q13 define cytoplasm and its function Cytoplasm

- The plasma membrane has a fluid like substance in it which is called the cytoplasm.
- The cytoplasm contains several organelles that can perform distinct functions of the cell

Functions of Cytoplasm

- It supports and suspends the cell organelles and molecules.
- The cellular processes occur in cytoplasm such as formation of proteins.
- It allows movement of substances in the cell such as hormones.
- It dissolves cellular wastes.

ASSIGNMENT

1. What are the colours absorbed by plants? The green light of the sunlight is blocked. How will the photosynthesis be affected?
2. Draw a labelled diagram of mitochondria. Write the functions of mitochondria.
3. Draw a neat labelled diagram of an animal cell.
4. Differentiate between rough and smooth endoplasmic reticulum
5. Differentiate between diffusion and osmosis.
6. If you are provided with some vegetables to cook, you generally add salt into the vegetables. After adding salt, vegetables release water. Why
7. Why is the Golgi apparatus called the secretary organelle of the cell?
8. There would be no plant life if chloroplasts did not exist. Justify.
9. Name a cell organelle which is non-membranous
10. Which organelles other than nucleus contain DNA?
11. What are chromosomes made up of?
12. Which organelle serves as a channel for transport of materials between cytoplasm and nucleus?
13. Which organelle is involved in the formation of lysosomes?
14. Cell wall is made up of which component?
15. LABEL IT