Edutalk Career Institute

CHEMISTRY

CONTENTS

ATOMS AND MOLCULES

1. INTRODUCTION :

The structure of matter has been a subject of speculation from very early times. According to greek philosoper Democritus, if we go on dividing matter into smaller parts, a stage would be reached when particles obtained cannot be divided further. He called particle 'atoms' meaning indivisible.

Conclusion :

All matter is made up of small particles called atoms. Different kinds of atoms and molecules have different properties due to which different kind of matter also show different properties.

Laws of chemical combination :

By studying the result of quantitative measurement of many reactions it was observed that whenever substances react, they follow certain laws. These laws are called the law chemical combination.

(a)Law of conservation of mass.
(b) Law of constant proportions.
(c) Law of multiple proportions

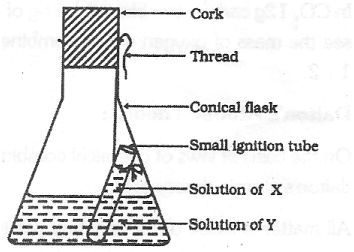
(a) Law of conservation of mass :

This law was given by the French chemist A Lavoisier in 1774. This law is every chemical reaction, the tota mass before and after the reaction remains constant.

"That is mass can neither be created nor destroyed in a chemical reaction". Lavoisier showed that when mercuric oxide was heated, it produced free mercury & oxygen. The sum of masses of mercury and oxygen was found to be equal to mass of mercuric oxide.

Mercuric oxide →	**Mercury**	**+ Oxygen**
100g	92.69 g	7.31 g

Activity : Demonstration of law of conservation of mass.



Ignition tube containing solution of X, dipped in a conical flask containing solution of Y.

- Prepare separately a 5% solution of barium chloride and 5% solution of sodium sulphate.
- Take about 20 ml of barium chloride solution in a conical flask.
- Take sodium sulphate solution in a smallest tube. Hang the test tube in mouth of the flask with the help of thread. Close the mouth of the flask with cork.
- Weigh the flask along with its contents.
- Now tilt the flask so that the two solution get mixed.
- Weigh the flask again along with its contents. What do you observe ? It is observed that on mixing the two solution a chemical reaction takes place which is indicated by the formation of a white precipitate

  Barium chloride + Sodium sulphate →Barium sulphate (white ppt) + Sodium Chloride
- The mass of the flask and its contents remains constant. Thus, during a chemical reaction mass is neither created nor destroyed.

This activity can also be carried out with the following pairs :
(a) silver nitrate and sodium chloride
(b) Copper sulphate and sodium carbonate

Q. In a reaction 5.3g of sodium carbonate reacted with 6g 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 observation are in agreement with the law of conservation of mass. [NCERT]
Sodium carbonate + ethanoic acid $\rightarrow$ sodium ethanoate + carbon dioxide + water.

Q. Hydrogen and oxygen combine in the ratio of 1 : 8 by mass of form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas ? [NCERT]

Q. Which postulate of Dalton's atomic theory is the result of the law conservation of mass? [NCERT]

(b) Law of constant proportions :

This law was given by the french chemist **A. Levoisier and Joseph Proust**. This law deals with the composition of chemical compounds.

This law is : A pure chemical compound always contains same elements combined in same proportion by mass

For example : Pure water obtained from different sources such as river, well etc. always contains hydrogen and oxygen combined together in the ratio 1 : 8 by mass similarly carbon dioxide can be obtained by different methods such as by burning of carbon, by heating lime stone. It shows that in the samples obtained, proportion of hydrogen and oxygen or carbon and oxygen always remains constant.

(C) Law of multiple proportions :

It was given by Dalton in 1808. According to it. when one element combines with the other element to form one or more different compounds, the mass of one element, which combines with a constant mass of the other, be a simple ratio to one another. Example. Carbon and oxygen when combine, can from two oxides that CO (carbon monoxide) and CO_2 (carbon dioxide).

In CO, 12g carbon combine with 16 g of oxygen. In CO_2 12 g carbon combine with 32g of oxygen. Thus, we can see the mass of oxygen which combine with a constant mass of carbon (12g) bear ratio of 16 : 32 on 1 : 2

Dalton's Atomic Theory

On the basis of laws of chemical combination John Dalton proposed atomic theory in 1808. The main points of Dalton's atomic theory are :

- All matter is made up of vary tiny particles called atoms.
- Atoms are indivisible particles , which cannot be created or destroyed in a chemical reaction.
- Atoms of a given element are identical in mass and chemical properties.
- Atoms of different element of have different masses and chemical properties.
- Atoms combine in the ratio of small whole numbers to form compounds.
- The relative number and kinds of atoms are constant in a given compound.

Dalton's atomic theory was based on the laws of chemical combination.

For example : The postulates of Dalton's atomic theory that "atoms can neither be created nor destroyed", was the result of law of conservation of mass and the postulates of Dalton's atomic theory " the element consist of atoms having fixed mass" and that the number and kind of atom in a given compound of fixed came from the law of constant proportion.

Q. Which postulate of Dalton's atomic theory can explain the law of proportion ? **[NCERT]**

Drawbacks of Dalton's Atomic Theory :

Some of the drawbacks of the Dalton's theory of matter are given below :

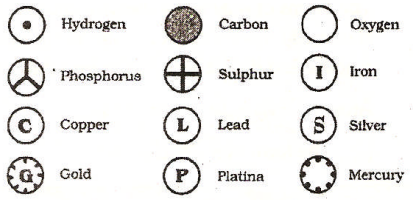
- According to Dalton's atomic theory, atoms were thought to be indivisible. But it is now known that atoms can be further divided into still smaller particle called electrons, protons and neutrons.
- Dalton's atomic theory said that all the atoms of an element have exactly the same mass. But it is now know the atoms of the same element can have slightly different masses, as in cases of isotopes.
- Dalton's atomic theory said that atoms of different elements have different masses. But it is now known that even atoms of different elements can have the same mass as in case of isobars.

Atoms :

All the matter is made up of atoms. An atom is the smallest particle of an element that can take part in a chemical reaction. Atoms of most of the elements are very reactive and do not exist in the free state (as single atom). They exist in combination with the atoms of the same elements or another element. Atoms are very small in size. The size of an atom is indicated by its radius which is called atomic radius (radius of an atom). Atomic radius atom of all, having an atomic radius of 0.037nm. Atoms are so small that we cannot see them under the most powerful optical microscope.

Symbol of elements :

Symbol may be defined as the abbreviation used for the name of an element. The symbol of an element are generally either the first letter or the first two letters or the first and the third letters of the name of the element. For example, the symbol of the following elements are the first letter of the same of that element.



Symbols for some elements as proposed by Dalton

S.NO.	Element	Symbol
1	Hydrogen	H
2	Carbon	C
3	Nitrogen	N
4	Oxygen	O
5	Fluorine	F

- Some symbols derived from the first two letters of the names of the element.

S.NO.	Element	Symbol
1	Alumininm	Al
2	Barium	Ba
3	Lithium	Li
4	Neon	Na
5	Calcium	Ca

- Some symbol derived from the fist and the third letter of the names of the elements.

S.NO.	Element	Symbol
1	Arsenic	As
2	Magnesium	Mg

3	Chlorine	Cl
4	Zinc	Zn
5	Chromium	Cr

- There are certain symbol which seen to have no relationship to their names. They symbol of these elements are derived from their latin names.

Element	Latin Name	Symbol
Iron	Ferrum	Fe
Gold	Aurum	Au
Copper	Cuprum	Cu
Potassium	Kalium	K
Sodium	Natrium	Na
Mercury	Hydrogen	Hg
Lead	Plumbum	Pb

Atomic Mass : Atomic mass of element may be defined as the average relative mass of an atom of the element as compared with mass of an atom of carbon (C – 12 isotope) taken as 12 amu.

$$\text{Atomic mass : } \frac{\text{Mass of 1 atom of element}}{\text{1/12 of the mass of an atom of C–12}}$$

How do Atoms occur :

The atoms of only a few element called noble gases (such as helium, neon, argon and krypton etc.) which are chemically uncreative and exist in the free state (as single atom). Atoms of the element are chemically vary

Atoms usually exist in two ways :

(a) In the form of molecules and (b) In the form of ions.

Q.	Define the atomic mass unit	**[NCERT]**
Q.	Why is it not possible to see atom with naked eyes ?	**[NCERT]**

Molecule :

A molecule is the smallest particle of an element or compound that has independent existence. A molecule contain one or more than one atoms.

The molecules of element contain atoms of only one kind.

The number of atoms in molecule of an element is known as atomicity of the element. For example The atomicity of the noble gases is 1, that of hydrogen, nitrogen, oxygen etc is 2 each and of ozone is 3. Thus, noble gases hydrogen and ozone are respectively monoatomic, diatomic and triatomic molecules.

Molecules of elements :

The molecules of an element contain two similar atom chemically bonded together, for example of ozone gas has 3 oxygen atom combined together, so ozone exists in the form of O_3 A recently discovered form of carbon, called buckminster fullerene has molecular formula C_{60}

Molecule of compounds :

The molecule of compound contains two or more different types of atoms chemically bonded together. For example: the molecule sulphur dioxide (SO_2) contain one atom of sulphur chemically bonded with two atoms of oxygen.

Molecular mass & Formula mass :

The molecular mass of a substance (an element or a compound) may be defined as the average relative mass of a molecule of the substance as compared with mass carbon of atom (C. 12 isotope) taken 12 amu.

$$\text{Molecular mass} = \frac{\text{Mass of 1 molecule of the substance}}{1/12 \text{ of mass of an atom of C}-12}$$

The molecular mass of compound can be obtained by adding atomic masses of all the atoms present in the molecule of the compound. Fox example, molecular mass of CO_2 is

$$12 + 16 \times 2 = 44 \text{ u}$$

Gram Molecular Mass :
Gram molecular of a substance is defined as that much quantity of the substance whose mass expressed in gram is numerically equal to its molecular mass.,

For example : The molecular mass of CO_2 is 44 u , its gram molecular mass is 44 g. Gram molecular mass of substance is also known as gram-molecular mass of the substance.

Formula Mass :

Formula mass of an ionic compound is obtained by adding atomic mass of all the atoms in a formula unit of the compound.

For example : Formula mass of potassium chloride (KCI)

= Atomic mass of potassium + atomic mass of chlorine

39 + 35.5 = 75.5

Q. Calculate the molecular masses of H_2, O_2, CI_2 CO_2, CH_4, C_2H_6, C_2H_4, NH_3, CH_3OH **[NCERT]**

Q. Calculate the formula unit masses of ZnO, Na_2O, K_2CO_3, given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u and O = 16 U **[NCERT]**

Q. Calculate the molar mass of the following substances. **[NCERT]**
(a) Ethyne, C_2H_2 (b) Sulphur molecule, S_8
(c) Phosphorous molecule, P_4 (Atomic mass of phosphorus = 31)
(d) Hydrochloric acid, HCl
(e) Nitric acid, HNO_3

Chemical formula :
The chemical formula of a compound describe the composition of molecules of the compound in terms of the symbols of element and the number of atoms of each element present in one molecule of the compound.

- In the chemical formula of compound, the elements present are denoted by their symbols and the number of atoms of each element are denoted by writing their number as subscript of the symbols of the respective element.

Example : Water is compound whose one molecule is made up of two atoms of hydrogen and one atom of oxygen and hence its chemical formula is H_2O

- While writing the formula of an ionic compound the metal is written on the left hand side while the non – metal is written on the right hand side. The name of the matel remains as such but that of the non-metal is changed to have the ending ide.

  Example : MgO is named as magnesium oxide, KCl is named potassium chloride etc.

- Molecular compounds, formed by the combination between two different non-metals, are written in such a way that the less electronegative element is written on the left hand side and the more electronegative element is written on right hand side. In naming molecular compound, the name of the less negative non-metal is written as such but the name of the more electronegative element is changed to have the ending ide

  Example : H_2S named as hydrogen sulphide.

- When there are more than one atoms of an element present in the formula of the compound. then the number of atoms are indicated by the use of appropriate prefixes (Mono for : 1, di for 2, tri for 3, tetra for 4)

  Example : CO_2 is named as carbon di oxide, CCl_4 is named carbon tetra chloride.
  The prefixes are needed in naming those binary compounds in which the two non-metals form more then one compounds (by having different number of atoms)

  Example : Two non-metals, nitrogen and oxygen, combine to form different compound like nitrogen monoxide (NO), nitrogen di – oxide (NO_2). Nitrogen tri oxide ($N_2 O_3$) etc.

- But, if two non-metals form only one compound, then prefixes are not used in naming such compounds

  Example :
  Hydrogen and sulphur combine to form only one compound H_2S, So, H_2S is named as hydrogen sulphide and not hydrogen monosulphide.

  IONS : An ion is positively or negatively charged atom (or group of atoms). There are two type of ions :

  (1) cations (2) anions

  (1) Cations : A positively charged ion is known as cation. For example : Sodium ion : Na^+
  Magnesium ion : Mg^{2+} A cation is formed by the loss of one or more electrons by an atom.

  For example : sodium atom, loses one electron to form a sodium ion Na^+

  $Na \xrightarrow{-le^-} Na^+$ sodium ion
  Sodium atom (A cation)

  (2) Anions : A negatively charged ion is know as anion. Cl^- (chloride ion) O^{-2} (oxide ion) etc.
  An anion is formed by the gain of one or more electrons by an atom. For example a chlorine atom gains one electron to form a chloride ion Cl^-

- $Cl \xrightarrow{-1e^-} Cl^-$
  Chorine atom Chloride ion (An anion)
  Valency of ions : The valecncy of an ion is same as the charge present on the ion.
  Monovalent cation (Valeny of cation + 1)
  Example : Sodium ion (Na^+). Potassium (K^+), Hydrogen ion (H^+)
  Divalent cations (valeny of cations + 2)
  Example : Magnesium ion (Mg^{+2}) Ferrous ion (Fe^{+2})
  Trivalent cation (valency of cation + 3)
  Example : Aluminium ion (Al^{+3}**)** Ferric ion (Fe^{+3})
  Monovalent anion (anion of valency - 1)
  Example : Chloride ion (Cl^-) Bromide ion (Br^-)
  Divalent anions (anions of valecny - 3)
  Example : oxide ion (O^{-2}) Peroxide ion (Br)
  Trivalent anoin (O^{-2}), Peroxide ion (O_2^{-2}) etc.
  Trivalent anion (anions of valency -3)
  Example : Nitride ion (N^{-3}) Phosphate ion (PO^{-3}_4) etc.
  Writing fo formula of Molecular compound :
  Steps : The steps to be followed for writing the formula of molecular compound are-

- First, below each symbol of the elements contributing the compound

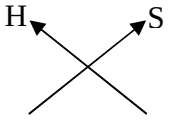
- Then, below each symbol writ is elements contributing the compound.

- Finally, we exchange the valencis of the combining atoms that is with first atom, we write the valecy of the second atom and with second atom, we write the valency of the first atom, the valencies to be written at substance to the symbols.

- If the valencies have any common factor, then the formula is divided by the common factor. This given the required formula of the compound
  Example : To work out the formula of hydrogen sulphide
  (1) Hydrogen sulphide compound is made up of hydrogen and sulphur elements. So first we write down the symbol of hydrogen and sulphur .

  (2) The vealcny of hydrogen is 1 and the valency of sulphur is 2. so below the symbol H we write 1 and below the symbol S we write 2.

Symbol	H	S
Valencies	1	2



8 • We now cross-over the valencie of H and atoms. With H atom we writhe the valecny of S (Which is 2) so that is becomes H_2 with a atom we write the valency of (Which is) so that it becomes S_1. Now, joining together H_2 and S_1 the formula of hydrogen sulphide becomes H_2S_1 or H_2S (This is becomes we don't write the subscript with an atom in a formula)

Q. What is meant by the term chemical formula ? **[NCERT]**
Q. How many atoms are present in a **[NCERT]**
Q. (i) H_2S molecule and (ii) PO_4^{3-} ion
Q. What are polyatomic ions ? Give examples **[NCERT]**
Q. Give the name of th elements present in the following compounds. **[NCERT]**
(a) Quick line (b) Hydrogen bromide (c) Baking powder (d)Potassium sulphate

Writing the formula of Ionic compound :
Steps :

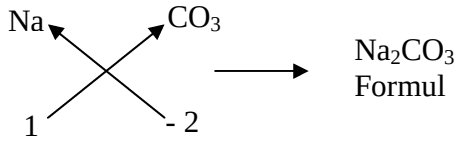
- First, write the symbols of the ions from with the ionic compound is made. As a convention. the cation is written on the left while the anion is written on the right side.
- The, the valencies of the respective cation and anion are written below their symbols.
- The valencies of cation and anion are exchanged. The number of cation and anion in the formula of the compound are adjusted in such a way that total positive charge of cation become equal to total negative charge of the anion making the ionic compound electrically neuter.
- The final formula of the ionic compound is then written but the charges present on the cation and the anion are not shown.

Example : To write the formula for sodium carbonate :

(1) First, write the symbol of sodium ion and carbonate ion and writhe their valance below their symbol are shown.

Symbols	Na	CO_3
Valencies (or charges)	+1	-2

(2) Now, are exchange the valencies of sodium ion and carbonate ion,



(3) So- 2 gets associated with Na and +1 gets associated with CO_3 in this way we get Na_2 and CO_3 and final formula of sodium carbonate is Na_2CO_3

Q. Write down the formula of **[NCERT]**
(i) sodium oxide (ii) aluminium chloride (iii) sodium sulphide (iv) magnesium hydroxide
Q. Write down the name of compounds represented by the following formulae. **[NCERT]**
(i) $Al_2(SO_4)_3$ (ii) $CaCl_2$ (iii) K_2SO_4
(iv) KNO_3 (v) $CaCO_3$
Q. Write the chemical formula of the following **[NCERT]**

(a) Magnesium chloride (b) Calcium oxide (c) Copper nitrate
(d) Aluminium chloride (e) Calcium carbonate

Name of the compound	Positive ion (cation)			Negative ion (anion)			Chemical Formula
	Name	Formula	Valency number	Name	Formula	Valency number	
Hydorgen chloride	Hydrogen	H	1	Chloride	Cl	1	HCl
Hydrogen sulphide	Hydrogen	H	1	Sulphide	S	2	H_2C
Sulphuric acid (hydrogen suplhate)	Hydrogen	H	1	Sulphate	SO_4	2	$H_2(SO_4)$, $H_2(SO_4)$
Sodium nitrate	Sodium	Na	1	Nitrate	NO_3	1	$Na_1(NO_3)_1$. $NaNO_3$
Aluminium Phosphate	Aluminium	Al	3	Phosphate	PO_4	3	$Al_3(PO_4)_3$. $AlPO_4$
Aluminium sulphate	Aluminium	Al	3	Sulphate	SO_4	2	$Al_2(SO_4)_2$
Ferrous sulphate	Ferrous	Fe	2	Sulphate	SO_4	2	$Fe_2(SO_4)_2$. $FeSO_4$
Ferric sulphate	Ferric	Fe	3	Sulphate	SO_4	2	$Fe_2(SO_4)_3$
Potassium dichromate	Potassium		1	Dichromate	Cr_2O_7	2	$K_2(Cr_2O_7)_1$ $K_2Cr_2O_7$
Magnesium nitrate	Magnesium	Mg	2	Nitrate	NO_3	1	$Mg(NO_3)_2$
Silver chromate	Silver	Ag	1	Chromate	Cr_2O_4	2	Ag_2CrO_4
Barium carbonate	Barium	Ba	2	Carbonate	CO_3	2	$Ba_2(CO_3)_2$. $BaCO_3$
Potassium permanganate	Potassium	K	1	Permanganate	MnO_4	1	$KMnO_4$
Calcium hydroxide	Calcium	Ca	2	Hydroxide	OH	1	$Ca(OH)_2$
Aluminium oxide	Aluminium	Al	3	Oxide	O	2	Al_2O_3
Magnesium phosphate	Magnesium	Mg	2	Phosphate	PO_4	3	$Mg_3(PO_4)_3$
Ammonium sulphate	Ammonium	NH_4	1	Sulphite	SO_3	2	$(NH_4)_2SO_3$
Zinc phosphate							

Mole Concept :

Mole : Mole is link between the mass of atoms (or molecules) and the number of atoms (or molecule.). A group of 6.022×10^{23} particles (atom, molecules or ions) or a substance is called a mole of that substance.

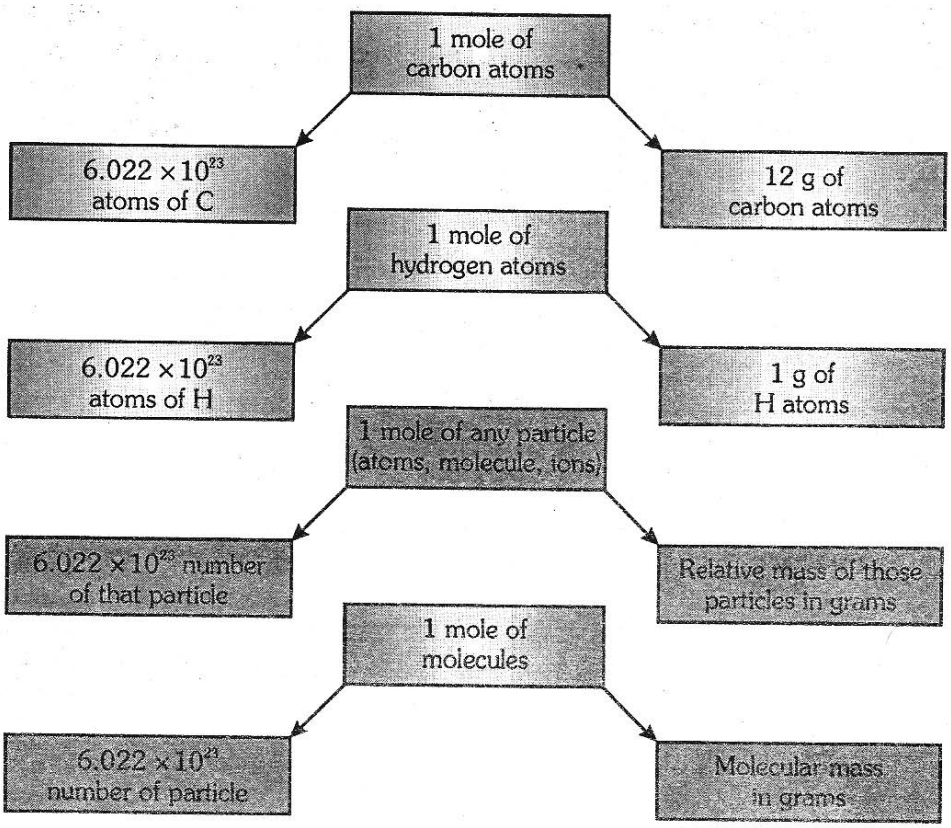
Thus, 1 mole of atoms = 6.022×10^{23} atoms.
1 mole of molecules = 6.022×10^{23} molecules.

For example : oxygen atom in O and oxygen molecules is O_2
1 mole of oxygen atoms (O) = 6.022×10^{23} oxygen atom
1 mole of oxygen molecules = 6.022×10^{23} oxygen molecules.
Number of 6.022×10^{23}, which represents a mole is known an ***Avogadro number.***

Moles of Atoms : One mole of atoms of an element has a mass equal to the gram atomic mass of the element 1 mole of atoms of an element = Gram atomic mass of the element.

For example : The atomic mass of oxygen (O) is 16 u so gram atomic mass of oxygen will be gram.
1 mole of oxygen atoms = Gram atomic mass of oxygen = 165 gram

Mole of molecules :
1 mole of molecules of an substance has mass equal to gram molecular mass of the substance.
1 mole of molecules of a substance = Gram molecular mass of the substance.
For example : The molecular mass of oxygen (O_2) is 32, u So the gram molecule mass of oxygen molecule is 32 gram.
1 mole of oxygen molecules = Gram molecular mass of oxygen = 32 gram.



Relationship between mole, Avogardro number and mass

Q. If one mole of carbon atoms weighs 12 gram, what is the mass (in grams) of 1 atom of carbon ?

Q. Which has more number of atoms, 100 grams of sodium or 100 gram of iron (given, atomic mass of N = 23u, Fe = 56 u) **[NCERT]**

Q. A 0.24 g sample of compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g o oxygen. Calculate the percentage composition o the compound by weight. **[NCERT]**

Q. When 3.0g of carbon is burnt in 8.00 oxygen, 11. 00 g of carbon dioxide is produced. Whet mass of carbon dioxide will be formed when 3.0 g of carbon is burnt in 50.00 of oxygen ? Which law of chemical combination will govern your answer ? **[NCERT]**

Mass percentage of an element from molecular formula :

The molecular formula of a compound many be defined as the formula which specifies the number or atoms of various element in the molecular of the compound.

For example : The molecular formula of glucose is $C_6H_{12}O_6$. This shows the a molecule of glucose six atoms of carbon, twelve atoms of hydrogen and six atoms of oxygen. With the help of molecule formula of a compound we can calculate its percentage composition y mass. First we calculate the molecular mass of the compound. From this we can find out mass of one mole the compound, which is equal to its gram molecular mass, The we calculate mass of element in one of the compound. The percentage of each element is the calculate by the following formula.

$$\text{Mass percentage of element X} = \frac{\text{Mass of X in one mole}}{\text{Mass of one mole of the compound that is gram molecular mass}} \times 100$$

Determination of Molecular formula:

To find out the molecular formula of a compound, the first is to determine its empirical formula from the percentage composition. The empirical formula of a compound may be defined as the formula which gives the simplest whole number ratio of atoms of the various elements present in the molecule of the compound.

For example: The empirical formula of the compound glucose($C_6H_{12}O_6$) is CH_2O which shows that C,H and O are present in the simplest ratio of 1:2:1.

Molecular formula is whole number multiple of empirical formula thus,

Molecular formula = Empirical formula × n

$$n = \frac{Molecular\ formula}{Empirical\ formula}$$

Where n = 1,2,3……

$$= \frac{Molecular\ Mass}{Empirical\ formula\ mass}$$

Q.	What is the mass of –	**[NCERT]**
	(a) 1 mole of nitrogen stoms?	
	(b) 4 moles of aluminium atoms (Atomic mass of aluminium = 27)?	
	(c) 10 moles of sodium sulphite (Na_2SO_3)?	
Q.	Convert into mole.	**[NCERT]**
	(a) 12 g of oxygen gas (b) 20 g of water (c) 22 g of carbon dioxide	
Q.	What is the mass of .	**[NCERT]**
	(a) 0.2 mole of oxygen stoms? (b) 0.5 mole of water molecules?	
Q.	Calculate the number of molecules of sulphur (S_8) present in 16 g of solid sulphur.	**[NCERT]**
Q.	Calculate the number of aluminium ions present in 0.054 g of aluminium oxide.	**[NCERT]**
	(Hint.:The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al =27 u)	

Steps for writing the empirical formula :

The percentage of the element in the compound is determined by suitable methods and from the data collected, the empirical formula is determined by the following steps-

- Divide the percentage of each. element by its stomic mass. This gives the relative number of moles of various element present in the compound.
- Divide the quotients obtained in the above step by the smallest of them so as to get a simple ratio of moles of various elements.
- Multiply the gigures, so obtained by a suitable integer, if necessary, in order to obtain whole number ratio.
- Finally write down the symbols of the various elements side by side and put the above number as the subscripts to the lower right hand corner of each symbol. This will represent the empirical formula of the compound .

Steps for writing the empirical formula :

- Calculate the empirical formula as describe above.
- Find out the empirical formula mass by adding the atomic masses of all the atoms present in the empirical formula of the compound.
- Divide the molecular mass (determined experimentally by some suitable method) by the empirical formula mass and find out the value of "n"
- Multiply the empirical formula of the compound with n so as to find out the molecular formula of the compound.

(A) OBJECTIVE TYPE QUESTIONS :

1. The element s present in baking soda are
(A) Sodium, carbon and oxygen (B) Sodium, carbon hydrogen
(C) Sodium, carbon, hydrogen and oxygen (D) Potassium, carbon and oxygen

2. The first scientist to use of the symbols of elements was
(A) Dalton (B) Berzillius (C) Kanad (D) Proust

3. The overall charge on an ionic compound equal to
(A) Charge of the cation present (B) zero
(C) Charge of the anion preset (D) sun of charges of the cation & anion

4. The chemical formula of the copper nitrate.
(A) $Cu(NO_3)_2$ (B) $CuNO_3$ (C) $Cu_2(NO_3)_3$ (D) Cu_2NO_3

5. The number of carbon atoms in 1g of $CaCO_3$ is
(A) 6.022×10^{23} (B) 6.022×10^{21} (C) $3.0\,125 \times 10^{22}$ (D) 1.204×10^{23}g

6. The mass of a single atom of carbon is
(A) 12 g (B) 1/12 g (C) 1.99×10^{-23} g (D) 1.99×10^{23}g

7. The mass of 1 u is
(A) $\frac{1}{2} \times \frac{12}{6.022 \times 10^{23}}$ g (B) $\frac{1}{6.022 \times 10^{23}}$ g
‘
(C) $\frac{12}{6.022 \times 10^{23}}$ g (D) 6.022×10^{23} g

8. How many molecules are present in 9g of water
(A) 3.01×10^{23} (B) 6.022×10^{23} (C) 6.08×10^{23} (D) 3.82×10^{23}

9. $Mg + O_2 \xrightarrow{\text{Burning}}$ ‘X’, ‘X’ is
(A) MgO (B) Mg_2O (C) MgO_2 (D) Mg_2O_3

10. The formula of sulphuric acid is
(A) H_2SO_3 (B) H_2SO_4 (C) H_2SO_5 (D) $H_2S_2O_7$

11. What is true about potassium chlorate
(A) It given oxygen gas on strong heating
(B) Its molecular mass is 122.5 kg/mol
(C) 122.5g of contain oxygen atoms three the Avogadro number
(D) Its molecular formula is $KClO_4$

12. Mass of one Avogadro’s number of O atoms is equal to

(A) 16 amu (B) 16 g (C) 32 g (D) 6 kg

13. Hydrogen reacts with oxygen to form water (H_2O). The ratio between masses of Hydrogen and oxygen is
(A) 1 : 8 (B) 63.5 : 8 (C) 2 : 1 (D) 63.5 : 16

14. The correct formula of aluminum sulphate is
(A) $AlSO_4$ (B) Al_2SO_4 (C) $Al_3(SO_4)_2$ (D) $Al_2 (SO_4)_3$

15. Which of the following has highest intermolecular force of attraction
(A) Liquid water (B) Liquid ethyl alcohol (C) Gaseous CO_2 (D) Solid CO_2

16. Which of the following is not correct regarding gases
(A) Gases exert pressure (B) Gases have same intermolecular space
(C) Gases have tendency of diffuse (D) Gases have high intermolecular force of attraction

17. The Boiling not point water at normal atmospheric pressure is
(A) 273 K (B) 373 K (C) 100 K (D) 0^o C

18. Avogadro's number represents the number of atoms in
(A)12 g of C^{12} (B) 320 of sulphur (C) 32 g of oxygen (D) 12.7 g of iodine

19. Molecular mass of ozone is
(A) 16 u (B) 32 u (C) 48 u (D) 64 u

20. Which of the following is not correct according to Dalton's atomic theory ?
(A) Matter is made up of atoms

(B) Atoms of all substance are identical in all respects

(C) Atoms combine in a simple whole number ratio

(D) Atoms of two element can combine to form more then one compound.

(B) FILL IN THE BLANKS :

21. The temperature at which a liquid change into gas is called…….
22. Intermolecular space in solid is…….. then that of liquid
23. Change of liquid state to solid sate is called…….
24. Small of cooked food reaches us in second due to the process know as…….
25. One mole atoms of oxygen contains…….. atom of oxygen
26. The number of atoms in a molecule of element substance called is…….
27. In water, the proportion of hydrogen and oxygen is……by mass.
28. Latin name of mercury is……..
29. Avogadro number is…….
30. One mole of sodium sulphate contains…….atoms of sodium……..atoms of sulphur and ……atom of oxygen
31. Intermolecular forces are maximum in…….
32. Water has boiling not equal to……
33. Fusion is change of……to state.

(C) MATCH OF COLUMN:

34. Match the following elements & compounds given in column-A with column- B

	Column – A		**Column - B**
(1)	Argon	(a)	8
(2)	Suphur	(b)	4
(3)	Oxygen	(c)	2
(4)	Phosphorous	(d)	1
(5)	Ozone	(e)	3
(6)	Bromine	(f)	5
(7)	Carbon monoxide	(g)	6
(8)	Hydrogen peroxide	(h)	7
(9)	Lime water		
(10)	Ammonia		
(11)	Quick Lime		
(12)	Baking powder		
(13)	Lime stone		
(14)	Common salt		
(15)	Sodium Suphate		

(D) VERY SHORT ANSWER TYPE QUESTION :

35. Name of the building block of all matter ?

36. What are the symbols of copper and cobalt ?

37. What is 1 u ?

38. Give symbols for the following elements : Aluminum, Tin, Bromine, Neon.

39. What is ratio between masses of (i) hydrogen and oxygen in H_2O (ii) nitrogen and hydrogen in NH_3 ?

40. What is meant by formula unit mass ?

41. What is meat by valecny of en element ?

42. 10 g silver nitrate solution are added to 10 g of sodium solution ? What change in mass of you expect after the reaction ?

43. Why is copper represented by the symbol “Cu’ while there is not letter ‘u’ in the name ?

44. What do you understand by the ‘atomicity’ of the substance ?

45. Give two examples each of bivalent cations and bivalent anions.

46. How are mass, molar mass and number of mole related to each other ?

(D) SHORT ANSWER TYPE QUESTION :

47. What is the first law of chemical combination ?

48. What is the conclusion of the Daltion's atomic theory ?

49. Define a molecule. How many molecules are present in
(i) 9g of water (ii) 17 g of ammonia

50. What is meat by the term chemical formula ?

51. What are poly atomic ions ? Give example .

52. Calculate the number of molecules of Sulphur (S_8) present in 16 g of solid sulphur.

53. Give the name of the elements present in the following compounds.

54. Define the term mole ?

55. Write the molecular formula of the following and give the ratio by mass of atoms present ?

56. A hydrogen is found to contain 14.3% hydrogen and 85.7 % carbon. If molecular mass of the hydrocarbon i 28, find out is molecular formula (17 g).

57. Write down the names of the compound represented by the following formula ?
(i) $Al_2(SO_4)_3$ (ii) $CaCl_2$ (iii) K_2SO_4 (iv) KNO_3

58. What is meant by the term chemical formula ?

59. Calculate the mass of CO_2 which will contain the same number of molecule in 1 g of methane (S = 32 u, O = 16 u, C = 12 u, H = 1 u)

60. If 1 g of SO_2 contains x molecules, what will be the number of molecule in 1 g of methane? (S = 32 u,O = 16 u, C = 12 u, H = 1 u)

61. What is molar volume ? What is its value ?

62. Define the "law of constant proportions" How does Dalton's atomic theory explain the truth of the law ?

63. What is the difference between the actor mass of a molecule and gram molecular mass ?

64. What is formula unit mass ? For what type of compounds is it use and why ?

65. What is the unit of atomic mass or molecular mass ? Define it. What is the mass of this unit in kilograms ?

(E) LONG ANSWER TYPE QUESTION:

66. State and explain Law of Conservation Mass. How does Dalton's atomic theory explain this law ?

67. State and explain the following
(i) Atom (ii) Molecule (iii) Atomic mass (iv) Molecular mass

68. Arrange the following in roder of increasing masses (i) 0.1 g atom of silver (ii) 0.1 mole of H_2SO_4 (iii) 10^{23} molecule of CO_2 gas (iv) 1 gram of carbon (v) atoms of calcium.

69. How is the molecular formula of a compound related to its empsricial formula ?

70. Valencies or the charge numbers of some ions are given below :

Aluminium ion	3^+	Magnesium ion	2^+	Potassium ion	1^+
Nitride ion	3^-	Sulphate ion	2^-	Fluoride ion	1^-

Using the above information, write down the chemical formulae of the following

(i) Aluminium ion (ii) Magnesium nitride (iii) Aluminium sulphate
(vi) Potassium fluoride (v) Magnesium fluoride (vi) Potassium nitride

71. The molecular formula of a compound is CH_3 OH Calculate its molecular mass in atomic mass unit. Also write down its molar mass (atomic masses are : H= 1 u, C = 12 u, O = 16 u)

72. Find the number of atoms of each type present 3.42 grams of canesugar (C_{12} H_{22} O_{11})

73. What are the postulates sand limitations of Dalton's atomic theory ?

ANSWER KEY

- ***Objective type questions***

1.C **2.**A **3**.B **4.**A **5.** B **6.**C **7.**B **8.**A **9.**A **10.**B
11.C **12.**B **13.**A **14.**D **15.** D **16.** D **17.** B **18.**A **19.** C **20.** B

- ***Fil in the blanks***

21. boiling point **22.** less **23.** solidification **24.** diffusion
25. Contain 6.022×10^{23} **26.**Atomicity **27.** 1 : 8
28. Hydragyrum **29.** 6.022×10^{23} **30.** 12.044×10^{23}, 6.022×10^{23} 24.088×10^{23}
31. Solid **32.** $100^{o}C$ **33.** Solid, liquid

- ***Math the column***

1. d **2.** a **3.** c **4.** d **5.** e **6.** c **7.** c **8.** b **9.** f **10.** b
11. c **12**. g **13.** f **14.** c **15.**h

- ***very short answer types question***

35. atoms **36.** Cu & Co

37. 1 u stands for one twelth (1/12) in the mass of carbon (carbon - 12) atom.

38. Al, Sn, Br, Na, **39.** (i) 1 : 8 (ii) 14 : 3 **42.** no change

43 Symbol Cu has been taken from the latin word 'cuprum' which means copper

44. The number of atoms present in one molecule of the substance is called atomicity

45. Cations = Zn^{2+}, Mg^{2+}, anions = SO_4^{2-}, CO_4^{2-}

46. Number of moles (n) = $\frac{\text{Given mass(m)}}{\text{Molar mass(M)}}$ or $m = n \times m$

IS MATTER AROUND US PURE ?

1. INTRODUCTION

We know all the matter around is not pure. If we observe some soil (Mitti) and some surge placed on two different sheets of paper with a magnifiying glass, we find soil contains clay particles, some grass particles and even some dead insects etc. That is soil canticles of different kinds is called an impure substance

We can see that most of the matter round us exist as a mixture of two more pure components, for example, milk, sea- water, minerals etc. are all mixtures.

Type of matter : -

On the basis f chemical nature, matter can be classified into two types :

(i) pure substance. (ii) Impure substance (mixture)

(i) Pure substance :- A homogeneous material which contains canticles of only one kind has a has a definite set of properties, is called a pure substance . OR

A pure substance is a distinct type of matter that can not be separated into other of matter by any physical process e..g. oxygen, sulphur, iron etc. are pure substance however, if a substance is composed of two or more different kinds of particles combined together in fixed proportion by weight, then the substance is also regarded as pure substance. e.g. Sodium chloride is a pure substance, because it has a fixed number of sodium and chloride ions, combined together in fixed proportion by weight, Similarly, magnesium oxide (MgO), Carbon dioxide (CO_2) copper sulphate ($CuSO_4$) etc. are pure substance

Note : It does not imply all homogeneous substance for example, common salt solution in water, is a homogenous solution. Yet it cannot be called a pure substance, as it made of two different substance e.g. salt and water.

(ii) Mixture :- When tow or more substance (elements, compounds or both) are mixed together in any proportion, such that they do not undergo any chemical change, but retain their individual characteristics the resulting product is called a mixture. e.g. Brass is mixture of copper and zinc.

Crude oil is a mixture of large number of different hydrocarbons.

Type of mixture :- Depending upon the nature of components a mixtures can be divided into two types

(a) Heterogeneous mixture :- A mixture is different constituents are not mixed uniformly, is called a heterogeneous mixtures. The components of a heterogeneous mixture can be observed with naked eyes or with the help of a microscope e.g. Sand and iron filings, sand & water etc.

(b) Homogeneous mixture :- A mixture in which different constituents are mixed uniform, is called a homogeneous mixture. homogeneous mixture are also know as solution. The components of such a mixture cannot be see even under a microscope e.g. salt solution, copper sulpate, sugar solution similarly alloys such brass, bronze etc. are homogeneous solid solutions of metals.

Ques. Wht is meant by a pure substance ? **[NCERT]**
Ques. List the points of differences between homogeneous and heterogeneous mixtures .**[NCERT]**
Ques. What is the other name of impure substance ? Give two example of impure substance.
Ques. Name three mixture found in nature.
Ques. Which of the following is a mixture ? Salt, Air, Water, Alum, Sugar.

Solutions :- A homogeneous mixture of two or more substance is called a solution. In a solution there is homogeneity at the particle level. Usually we think of a solution an a liquid the contains a solid or a liquid or a gas dissolved in it. However, this is not turn. We can have a solid solution in the case of Alloys.

e.g. Air is a mixture of gas. Air is a homogeneous mixture of a number of gases. It's two main constituents of gases are oxygen (21 %) and Nitrogen (78%)

Alloys :- Alloys are homogeneous mixture of metals and cannot be separated into their components by physical methods. But still, an alloy is considered as a mixture, because it shows the properties of its two main constituents and can have variable composition. For example, brass is a mixture of 30 % zinc and 70 % copper.

Components of solution :- This substance present in a homogeneous solution, are called component of the solution. A solution basically has two components i.e. solvent and a solute.

(a) Solvent :- The component of a solution which dissolves the other component in it self, is called solvent. A solvent is the large component of the solution of e.g. a solution of sugar in water is a solid in liquid solution. In this solution, sugar is the solute and water is the solvent.

(b) Solute :- The component of the solution which dissolves in the solvent, is called solute. Solute is the smaller component of the solution e.g. solution of iodine in alcohol known 'tincture of iodine' iodine it the solute.

- similarly, in carbonated drinks (Soda water), carbon dioxide gas is the solute.

Characteristics of a solution :-

- Solution is a homogeneous mixtures.
- The size of solute particle in a should is extremely small. It is less then 1 nm in diamter.
- The particles of a solution cannot be seen even with a microscope.
- The particles of a solution pass through the filter paper. So a solution cannot be separated by filtration
- The solution are very stable. The particles of solute present in a solution do not separate out on Keeping
- A true solution does not scatter light (because its particles are vary small.)

Concentration of a solution :- The concentration of a solution is the amount of solute preset in a give quantity of the solution. In other words the mass of the solute in grams, which is present in 100 of a solution

In a solution the relative proportion of the solute and solvent can be varied. Depending up on the amount of solute present in a solution. It can be called a dilute concentrated or a saturated solution. Different substance in a given solvent have different solubilies at the same temperature.

The most common method different for expressing the concentration of a solute, is called percentage of solute

The concentration of solution refers to the percentage of solute preset in the solution. The percentage of solute can be expressed in term of.

(i) Concentration of a solution in terms of mass of solute – If the solution of a 'solid solute' dissolved in a liquid, then we consider the mass percentage of solute' in calculating the concentration of solution, So in the case of a solid solute dissolved in a liquid solvent.

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

The mass of solution = mass of solute + mass of solvent

Ex. A solution contains 80 g of common salt in 640 g of water. Calculate the concentration in terms of mass by mass percentage of the solution

Sol. Mass of solute (salt) = 80 g

Mass of solvent (water) = 640 g

$\therefore$ Mass of solution = Mass of soute + Mass of sovent

80g + 640 g = 720 g

$$\text{Mass percentage of solution} = \frac{\text{Mass of solute (in gms)}}{\text{Mass of solution (in gms)}} \times 100 = \frac{80}{720} \times 100 = 11.1$$

The concentration of a solution is a pure percentage number and has no unit.

(ii) Concentration by mass by volume percentage of a solution.

mass by volume percentage of solute in Solution = $\frac{\text{Mass of solute}}{\text{Voume of soution}} \times 100$

Depending upon the unit of mass and volume, the mass by volume percentage of a solute in solution, can have following units.
(a) gram/ml (b) gram/litre

Ex. A solution contains 40g acetic acid and 500 and aq. Solution. What is the concentration of acetic acid solution ?

Sol. Mass of solute = 40 g

$\therefore$ Volume of solution = 500 ml

$$= \frac{\text{Mass of solute}}{\text{Voume of soution}} \times 100 = \frac{40\text{g}}{500 \text{ ml}} \times 100 = 8\%$$

Saturated solution : - A solution which a given temperature dissolve much solute as it is capable of dissolving, is said to be a saturated solution.

Ex. At 30^oC 55g of common salt dissolves in 100 g of water, However, if more of common salt is added the above solution, it just does not dissolve. In such situation, the solution of common salt containing 55 gm of salt in 100 gm of water, is a saturated solution at 30^o C.

- If a saturated solution at some particular temperature is heated the solution becomes unsaturated, Because of the increases in solubility.
- If a saturated solution at some higher temperate is cooled, it remains saturated. The excess solute comes out of the solution and deposits it self the form of crystals.

Unsaturated solution :- When the amount of solute contained in a solution is less then the saturation level. the solution is said to be an unsaturated solution.

Ex. At 30^oC, if 45 g common salt is dissolved in 100 g of water, such solution so formed is capable of dissolving more of the common salt, then such a solution is called unsaturated solution.

Super saturated solution :- A solution which contains more of the solute then required to make a saturated solution, is called a super saturated solution

Solubility of a solute :- The amount of solute (in gram), which dissolve in 100 g of water (solvent) at given temperature, is called soblubility of the solute at that temperature.

Suspension :- A suspension is a heterogeneous mixture in which the small particle of solid are spread throughout a liquid without dissolving in it. The particles have tendency of settle down at the bottom of solvent and can be filtered out, because their size is bigger then the size of the pores filter paper.

eg.(1) Chalk – water mixture is a suspension of fine chalk particles in water.

(2) Muddy water is a suspension of soil particle in water.

Properties of a suspension :

- A suspension is a heterogeneous mixture.
- The size of solute particles in a suspension is quite large. It is large then 100mn in diameter.
- The particles of suspension can be seen easily.
- A suspension scatter a beam of light passing through it, because it's particle are quite large.
- The particles of suspension settle down, when the suspension is kept undisturbed. The process of setting of suspension particles under the action of gravity is called sedimentation. So suspensions are unstable.

Colloidal solution Colloids :

A heterogeneous solution in which the particle size is in between 10^{-7}cm such that the solute particles neither dissolve nor settle down in a solvent, is called colloidal solution. The components of colloidal solutions are the dispersed phase and the dispersion medium. The solute-like component of dispersed particles in a colloidal form of the dispersed phase, and component in which the dispersed phase is suspended is known as the dispersing medium.

Properties of colloids :

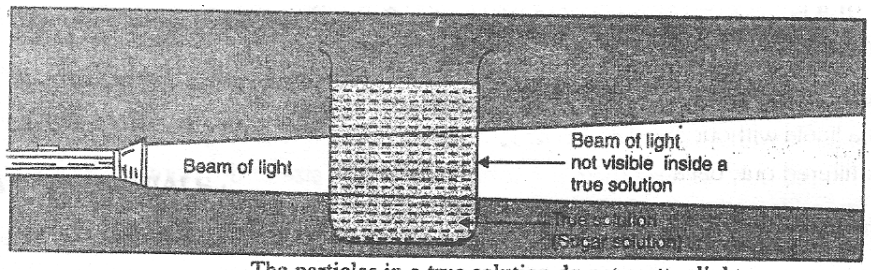
- The size of particles of a colloid is small to be individually seen by naked eyes.
- They do not settle down when left undisturbed, that is colloid is quite stable.
- They can not be separated from the mixture by the process if filteration. But special technique of separation know as centrifugation can be used to separate the colloidal particles.
- Colloidal solution are not transparent, but translucent in nature.
- The particles of a colloidal solution scatter light i.e. when strong beam of light is passed through the colloidal solution, the path of beam becomes visible.

COMMON EXAMPLES OF COLLOIDS

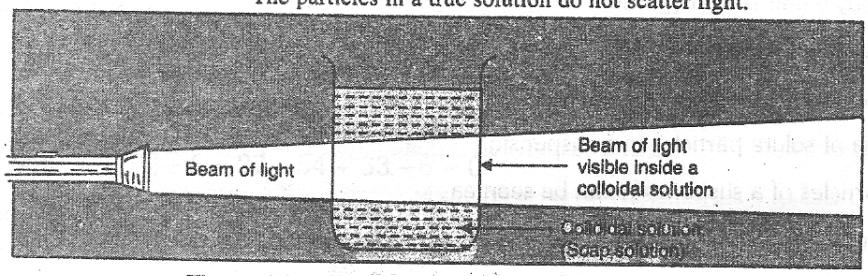
Dispersed Phase	Dispersing Medium	Type	Example
Liquid	Gas	Aerosol	Fog, clouds, mist
Solid	Gas	Aerosol	Smoke, Automobile Exhaust
Gas	Liquid	Foam	Shaving cream
Liquid	Liquid	Emulsion	Milk, face cream
Solid	Liquid	Sol	Milk of magnesia, mud
Gas	Solid	Foam	Foam, rubber, sponge, pumice
Solid	Solid	Solid Sol	Coloured gemstone, milky glass

Tyndall effect :

The phenomenon due to which the path of light become visible, due to scattering of light by the colloid particle is called Tyndall effect.



The particles in a true solution do not scatter light.



The particles in a colloidal solution (or colloid) scatter light.

Example :

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

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

DIFFERENCE BETWEEN TRUE SOLUTION AND COLLOIDAL SOUTION :-

True Solution	**Colloidal Solution**
1. The particle size is less then 10^{-7} cm	The particles size in between 10^{-7} cm to 10^{-5}cm
2. The particles are not visible under powerful microscope.	The particles are visible under microscope.
3. The particle of a solution can be recovered by evaporation and crystallization	The particles of a colloidal solution cannot be recovered by evaporation and crystallisation
4. The particle of a true solution do not scatter light	The particle of a colloidal solution scatter light.
5. True solution are clear and transparent.	Colloidal solution are translucent.

DIFFRENCE BETWEEN COLLOIDAL SOLUTION AND SUSPENSION :

Colloidal Solution		**Suspension**	
1.	The size of particles of solute is in between 10^{-7} cm to 10^{-5} cm.	1.	The size of particle of solute is more then 10^{-5}
2.	The particles of solute do not settle down when a colloidal solution in allowed to stand	2.	The particles of suspension settle down when a suspension is allowed do stand.
3	The particles of solute cannot be filtered out.	3.	The particles of suspension can easily be filtered out.

Ques. Differentiate between homogeneous and heterogeneous mixtures with examples. **[NCERT]**
Ques. How are sol, solution and suspension different from each other. **[NCERT]**
Ques. To make a saturated solution, 36g of sodium chloride dissolve in 100 of water at 293 K. Find is its concentration at this temperature. **[NCERT]**
Ques. Out of a colloid, solution and suspension
(a) which one has the smallest particles. (b) which one has the largest particles ?
Ques. Which of the two will scatter light : soap solution or sugar solution ? Why
Ques. Which of the following will show Tyndall Effect ? Why
(a) Salt solution (b) Starch solution (c) Milk (d) Copper sulphate solution
Ques. What is the concentration of a solution which contains 16g of urea in 120g of solution ? [13.3 %]
Ques. If 25 mL of acetone is present in 150 mL of its aqueous solution, calculate the concentration of solution [16.6%]

Separating the components of a maximum :

Many of the material around us are mixtures, these mixtures have tow or more then two constituents mixed in them. It may not be possible to use mixture as such in homes and in industries. We may require only one or two separate constituent of a mixture for our use. So, we have to separate the various mixtures into their individual constituents to make then useful in our daily life.

The various constituents of a maximum have different physical properties such as density, solubility, size of particle volatility, boiling points etc.
Heterogeneous mixture can be separated to their respective components by simple physical methods such as handpicking, sieving , filtration etc. in every day life. However, for separating homogeneous mixture special techniques are employed depending upon the difference in one or more.

Separation of coloured components (Dye) from Blue or Black ink :
The blue ink (or black ink) used in fountain pens is liquid mixture. It is mixture of a 'dye' in water. We can separate the 'coloued component (dye) by the process of evaporation. In process of separation we do not heat the chin dish containing ink directly over the flame. This is because the 'dye' obtained from ink can get decomposed by the high temperature produced by the direct heating with a burner. We use a 'water bath' for evaporating ink.

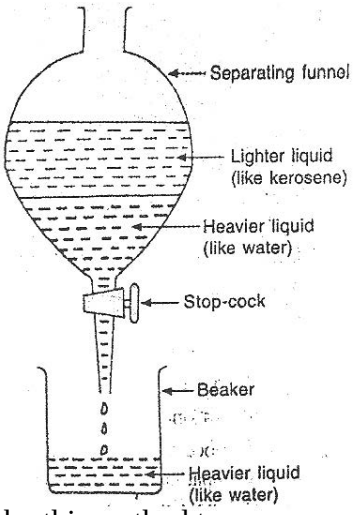
Experiment to obtain coloured component (Dye) from ink :
We take a beaker and fill it half with water (as a water bath). About 5ml in (Blue to or black ink.) is put in a chin dish. The chine dish containing ink is then placed over the mouth of beaker containing water, which is kept on a tripod stand.
We now start heating the beaker with a burner, soon the water beaker starts boiling to form steam, this steam heat the ink in the china dish. Due to this heating, the water present in ink starts evaporating gradually. When all the water has evaporated from ink. we stop heating. We will find that a small amount of solid colored material is left in the chine dish. Thus we can separate the volatile component (Solvent) from its nonn-volatile solute by the method of evaporation.

Separation of Cream from milk :
Sometime the solid particle in a liquid are vary small and pass through a filter paper. for such particles the filtration technique cannot be sued for separation. Such mixture are separated by centrifugation.
Centrifugation
The method of separating finely suspended particle in a liquid, by whirling the liquid at very high speed called centrifugation.
Principle of centrifugation : It is based on that when a very fine suspension or a colloidal solution is whirled rapidly, the heavier particles are forced towards the bottom of liquid and the lighter stey at the top.
Method :
Milk is suspension of tiny droplets of oil cream in a water of liquid. The milk is put in a closed container in big centrifugation machine. When the centrifugation machine is switched on, the milk is rotated at a very high speed in its container Due to this, the milk separated into 'cream' and' skimmed milk' The cream, being lighter, floates over the skimmed milk can then be removed. Thus, cream is separated from milk by centrifugation.
Application of centrifugation :
- It is employed in diagnostic Laboratories in testing urine and blood samples.
- It is employed in blood banks to separated different constituents of blood.
- It is used in drying machines to squeeze out water from the water clothes.

Separation of a mixture of two immiscible liquid :
The separation of two immiscible liquid on the difference in their densities. The apparatus used for separation is separating funnel.

Method :
The mixture of two immiscible liquid is put in a separating funnel and allowed to stand for some time. The mixture separates into two layers according to the densities of the liquid in it.

Water and kerosene oil are two immiscible liquids. Pour the immiscible liquids mixture in the separating funnel. Allow the mixture to sland to half an hour or more. It forms two layers. Water being heavier, forms the lower layers in the separating funnel. Whereas kerosene, being lighter, forms the upper layer: on opening the stop-cock of separating funnel the lower layer of water comes out first and collected in a beaker. When the water layer has completely run off, then the stop-cock is closed.



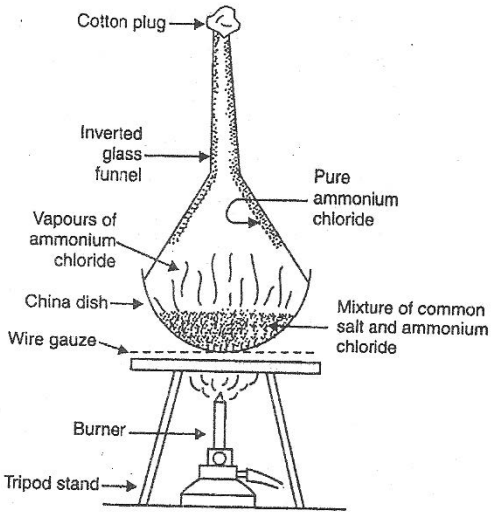
The kerosene is left behind in the separating funnel. It can be removed in a separate breaker by opening the stop-cock again.

Application:

- To separate mixture of oil and water.
- In the extraction of iron from its ore, the lighter slag is removed from the top by this method to leave the molten iron at the bottom in the furnace.

Separation of a mixture of common salt and Ammonium Chloride :

This method is used in the separation of such solid-solid mixture where one of the components sublimes on heating. However it is useful only if the components of the mixture do not react chemically on heating So. we can separate ammonium chloride from a mixture of common salt amount chloride by this process.



Separation of a mixture by sublimation. Here a mixture of common salt and ammonium chloride is being separated by sublimation

Method :

The mixture of common salt and ammonium chloride is taken in a chine and placed on a tripod stand. The chine dish is covered with an inverted glass funnel. A loose cotton plug it put the upper, open end of the funnel to prevent the ammonium chloride vapours from escaping into the atmosphere. This china dish is heated by using a low Bunsen flame on heating the mixture ammonium chloride changes into with vapour. These vapours rise up and get converted into solid amount chloride on in contact with the cold, inner walls of the funnel.

When the mixture given off no more white fumes, lift the funnel, scrap the fine powder from its sides on a piece of paper. This is pure ammonium chloride. The residue left behind in the funnel is sodium chloride. Some example of solids which sublime are camphor, naphthalene and anthracene.

Chromatography :

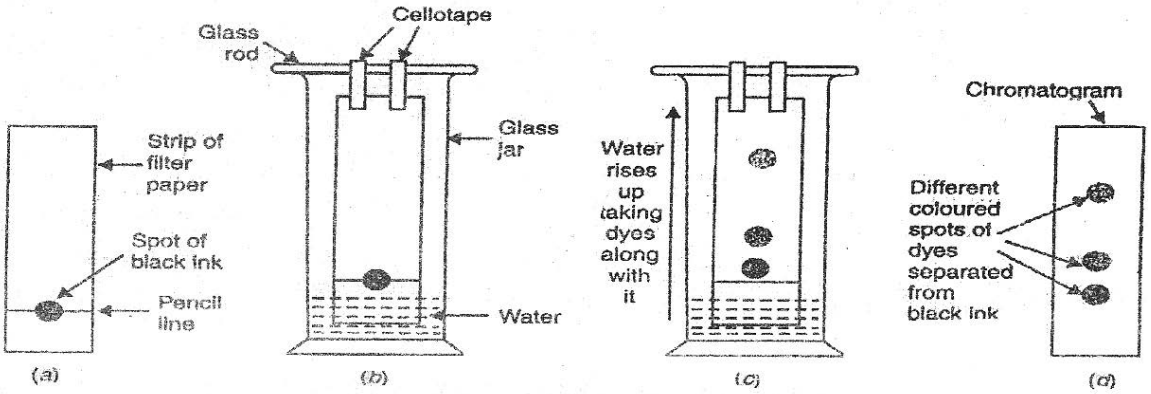
The process of separation of different dissolved constituted of mixture by adsorbing them over an appropriate adsorbent material is called. Chromomatography. Kroma in greek means colour. The adsorbent medium is generally magnesium oxide, alumina or filter paper.

There are many types of chromatography but the simplest form is the paper chromatography. This separation is based on the fact that the different constituent of a mixture get adsorbed differently on the same adsorbent material, because they have different rates of movement. The rate of movement of each adsorbed material depends upon.

- The relative solubility of the constituted of mixture in a given solvent.
- The relative affinity of the constituent of mixture for the adsorbent medium. Paper chromatography is very useful in separating various constituents of coloured solutes present in a mixture lime, ink dyes etc.

Separation of coloured constituents present in a mixtures of ink and water Method :

The different coloured dyes presents in black ink can be separated by performing a paper chromatography.



Separation of the 'dyes' in black ink by paper chromatography.

- Take a thin and long strip of filter paper. Drew a pencil line on it, about 3 centimeters from one end.
- Put a small drop of black ink on the filter paper strip at the center of the pencil line. Let the ink bry.
- When the drop of ink has dried, the filter paper strip is lowered into a tall glass jar containing water in lower part (Keeping the pencil line at the bottom). The filter paper strip is held vertically by attacking upper end to a glass dip in water but the pencil line should remains above the water level in the jar.
- The water gradually rises up the filter paper strip by capillary action. As water moves up on the paper strip it takes along the dyes present in ink. the dye which is more soluble in water moves up on the paper strip produces a coloured spot on the paper at a higher position. The less soluble dyes dissolve a little later, rise slower and form coloured spots at lower heights. In this way all the dyes present in black ink get separated.
- When the water reaches near the top end of the filter paper strip, the paper strip is removed form and dried. The paper with its separates coloured spots is called a chromatogram.
- The chromatogram obtained by using black ink in this experiment has three colouerd spots on it. This means that the given sample of black ink three different dyne mixed in it.

Application :

To separate

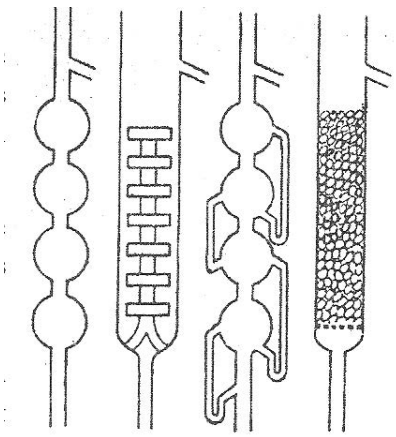
- Colours in a dye
- Pigment from netural colours
- Drugs from blood.

Separation of mixture of two miscible liquids :

Thos liquids which mix together in all proportion and form a single layer, are called miscible liquids. Alcohol and water are miscible liquids because they mix together in all proportions and form a single layer on mixing.

To separate a mixture of two or more miscible liquids for which the difference in boiling points is les than 25K, fractional distillation process is used.

A simple fractionating column is a long vertical glass tube filled with glass beads. The glass beads provides a large surface area for hot vapours to cool condense respectively.

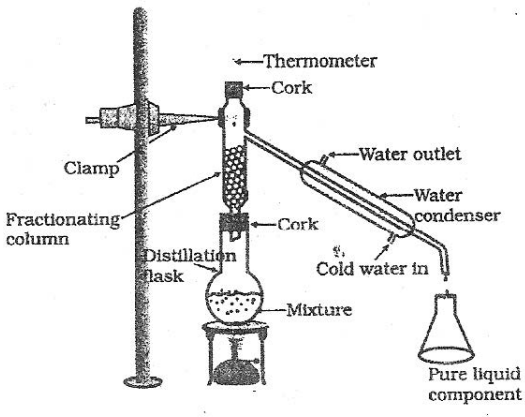


Different types of fractionating column

Separated mixture of Ethylalcohol and water

Method :

Ehtylalcohol and water and miscible liquid. The boiling point of ehtylalcohol is 78^{o} and the boiling point of water is 100^{o}C, a mixture of ehtylalcohol and water be can separated by fractional distillation. The mixture of ehtylalcohol and water is heated in distillation flask fitted with a fractionating column. When the mixture is heated both ehtylcohol and water form vapour and water point approach. The ehtylalcohol vapour and water vapour rise up in the fractionating column. The upper part of the fractionating column is cooler, so as the hot



Fractional distillation

vapours rise up in the column, the get cooled, condense

and trickle back into the distillation flask. As the experiment goes on, the fractionating column warms up by the heat released by the condensed vapours. After some time, a temperature at the top of column being much less then at is bottom. When the temperature the top of the fractionating column reaches 78^{o}C, then ehytlalcohol vapour passes into the condenser, gets cooled and collects in a beaker kept at the end of the condenser. The ehtylalcohol water mixture is kept boiling at such a rate that the thermometer shows the boiling of ehtylalcohol (78^{o}C). In this way, all the ehtylalcohol distills and gest separated.

Separation of gases of the air :

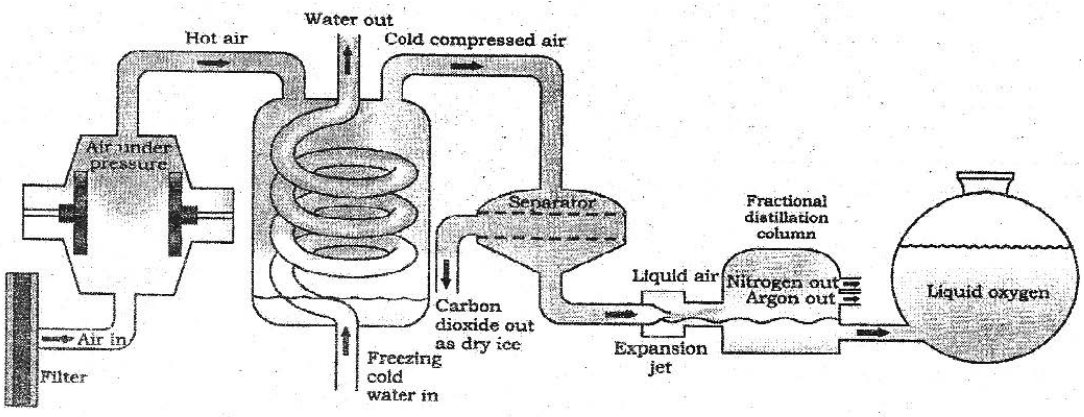
Air is mixture of gases like nitrogen, oxygen, argon, carbon dioxide, helium, neon etc. The major component of air is nitrogen (78.03%). The second major component of air is oxygen (20.99%) and the third major component of air is argon (0.93%)

All these gases are obtained from air on a large scale. This is because are is cheapest source of these gases.

Air is homogeneous mixture and can be separated into its components by fractional distillation of liquid air.

Methods :

- The air is first filtered to remove dust, then water vapour and carbon are removed. It water vapour and carbon dioxide are not removed, they would become solid in the cooling process and block the pipers.
- Air is compressed to a high pressure and then cooled. This cooled air is then allowed to expend quickly into a chamber through a jet. This expansion cools the air even more.
- The process of compression. cooling and rapid expansion of air is repeated again and again makes the air more and more cool. Ultimately the air gats so cooled that it turn into a liquid. In this liquid air is obtained.



Separation of components of air

- The liquid air is fed into a tall fractional distillation column from near is bottom and warmed up slowly.
  (a) Liquid nitrogen which present in air. has the lowest boiling point. of, - 196^{o}C. So, on warming, liquid nitrogen boils off first to form nitrogen gas.
  (b) Liquid argon which present in liquid are has a slightly higher boiling point of – 186^{o}C so liquid argon boils off next and collected as argon gas in the middle part of the fractional distillation column.
  (c) Liquid oxygen also present in liquid air has a still higher boiling point of. – 183^{o}C so., liquid oxygen boils off lest and collected as oxygen gas from the bottom of the fractional distillation column.

Separation of pure copper sulphate from impure sample :

The process involved in obtaining pure copper sulphate from its impure sample, is crystallisation.

Crystallisation : The process of cooling that separates a pure solid in the form of its crystal

Methods :

- We take about 10 grams of impure copper sulphate and dissolve it in minimum amount of water in a china dish to make copper sulphate solution.
- Filter the copper sulphate solution to remove insoluble impurities.]
- Heat the copper sulphate solution gently on a water bath of evaporate water and obtain a Saturated solution. This can be tested by dipping a glass rod in hot solution from time. When small srystals form on the glass rod, the solution is saturated. Then stop heating
- Allow the hot, saturated solution of copper sulphate to cool slowly.
- Crystals of pure copper sulphated are formed, impurities remains behind in the solution.
- Separate the copper sulphate crystals from solution by filtration and dry.
- Crystallisation is a better technique then evaporation to dryness because of following reasons.
  (i) Some solids decompose or get charred on heating to dryness during evaporation

  (ii) The soluble impurities do not removed in the process of evaporation. But such impurities get removed in crystallization

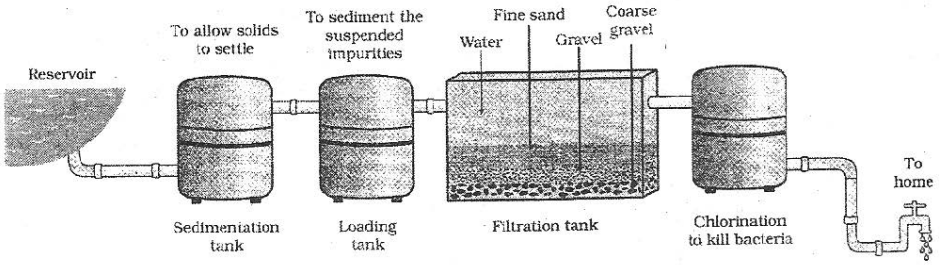
Application :

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

Supply of drinking water in a city :

In cities, drinking water is supplied from water works, the methods like sedimentation, decantation. loading, filtration and chlorination etc are used it remove undesirable materials from water. The source of water supply in a city is either a nearly river or a lake called reservoir. The river water and take water usually contain suspended solid substance and some germs. so , before this ware can be supplied to homes, it must be purified to remove suspended impurities as wall as germs.

The purification of river water or lake water is done in the following steps.



Water purification system in water works

(1) **Sedimentation :** The water is allowed to stand in big tanks, where heavier suspended impurities settle down. To increase the rate of sedimentation, alum is added to it, the impurities settle at the bottem.

(2) **Filtration :** The semi-clear water is allowed to pas through beds of send. Charcoal and gravel to remove suspended impurities.

(3) **Removal of harmful – organism or sterilization :** The harmful bacteria in filtered water can cause very serious diseases such as typhoid, cholera etc. Thus, to the filtered water bleaching powder or chlorine gas is added. This kills the micro-organism and hence the water becomes fit for dirking. This water is directly pumped into overhead tanks for supply to a city.

Ques . How will you separate a mixture containing kerosene and petrol (difference in their boiling point is more then 25^{o} C, which are miscible with each other ?) **[NCERT]**

Ques . Name the technique to separate **[NCERT]**
(i) butter from curd,
(ii) Salt from sea-water,
(iii) Camphor from salt

Que. What type of mixture are separated by the techniques cystalistion ? **[NCERT]**

Que. Name the apparatus you would use to separate oil from water.

Que. You are given a mixture of water, groundnut oil and common salt. How will you separate grounut oil and common salt from it ?

Que. Name the property of one of the constituents which can be used to separala mixture of salt and camphor.

Physical and chemical change :
There are some changes during which not new substance are formed. On the other hand, there some other changes during which new substance are formed. So, on the basis of whether new substance are formed or not, we can classify all the changes into two groups. Physical and chemical changes.

Physical properties : The properties the can be observed and specified like colour, hardness, rigidity, fiuidity. density melting point etc. are the physical properties.

Physical changes : Those change in which no new substances are formed, are called physical changes. In a density, melting point, substances involved do not change their identity. They can be easily returned to their original form by some physical process. This means that physical change can be easily reversed to form the original substance. The change in physical state. size and shape of a substance are called physical change .

Example : When ice is heated it melts to form water. Though is ice and water look different, they are both med of water molecules. Thus no new chemical substance is form during the melting of ice. So, the melting of ice to form water is a physical change. When water is also a physical change. Some other physical changes are : Boiling of water, condensation of steam. ringing of and electric bell and breaking of a glass.

Chemical changes : Those changes in which new substance are formed, are called chemical changes. A chemical change is also called a chemical reaction. In a chemical change the substance involved, change their identity. They get converted into entirely new substance. The new substance usually cannot be returned to their original form. This means that chemical changes are usually irreversible.

Example : When a magnesium wire is heated it burns in are to form a white powder called 'magnesium oxide'. This magnesium oxide is an entirely new substance. Thus a new chemical substance is formed during the burning of a magnesium wire is a chemical change. Some other example change are : Burning of candle, Burning of character, and burning of hydrogen in oxygen to form water.

Differences between Physical can chemical Change :

	Physical Change		**Chemical Change**
1.	New substance are not formed	1.	New substance are formed
2.	A physical change is a temporary changes	2.	A chemical changes is a permanent change
3.	A physical change is easily reversible	3.	A chemical change is usually irreversible
4.	The mass of substance does not alter in a physical	4.	The mass of substance does alter in a chemical change

Types of pure substance :

On the basis of their chemical composition, substance can be classified either are element or compounds.

Elements :
Rodert Boyle was the first scientist of use the term element is 1661. Element is are the basic building block of matter, every substance on the earth from one or more elements. There are 115 elements discovered far, amongst these elements, 92 elements occur in nature, whereas 23 have been made in nuclear laboratories, majority of element are solid. Eleven elements are in gaseous at room temperature of . Two elements are liquid at room temperature- mercury and bromine. Antoine Laurent Lavoiser (1734-94). A french chemical defined an element as a basic form of matter that can be defined as a substance made up of the atoms with same atomic number.
Example :

Elements can be classified as metals, non-metals and metalloids. eg. hydrogen, oxygen, nitrogen, zinc, mercury etc. Metals usually show one or all of the following properties.

Properties of metals :

1. They have generally silver gray colour, However some metal or their alloys have golden yellow colour. Exceretion is copper. which is reddish in colour.
2. Metals have a lusture, the freshly cut surface has a shine on it.
3. They easily conduct heat and electricity.
4. They are malleable i.e. they can be beaten into sheets.
6. They are sonorous.

eg. Gold, silver, copper, iron, sodium, potassium etc. Mercury is the only metal the is liquid at room temperature. Non-metal usually show soma or all of the following properties.

Properties of non-metals

1. They exist in solid, liquid and gaseous state.

2. They display variety of colour.

3. They are generally nether malleable nor ductile.

4. They are poor conductor is heat and electricity

5. The are not sonorous.
   eg. Hydrogen, oxygen, iodine, carbon etc.

Metalloid : Some element have intermediate properties of the metal and non-metals. The elements which exhibit the properties of metals as wall as non-metals**,** are called metalloids.

Example : Boron, Silicon, Germanium etc.

Compounds : A pure substance, which is composed two or more element's combined chemical in a definite retio, such that it can be broke into elements only by chemical means, is compound.

The tow or more elements present in a compound. are called constituent or components of the compound, for example, water is a compound of hydrogen and oxygen. Combine together in the ratio of 1 : 8 by weight . The water can be broke into its consitituenst only by electro-chemical method i.e by electric current through it. The compounds can be further classified as acids, bass and salts.

The product formed by mixing 1 g of sulphur powder and 2g of iron filings/turnings called a mixture.

- The constituent of product i.e. iron fillings and yellow particles of sulphur can be seen with naked eye, which is the property of a mixture.
- The iron fillings can be separated by dissolving the mixture in carbon disulphide, sulphurdissolves, but not the iron, As the constituent scan be separated by physical means therefore the product is a mixture.
- The constituents iron and sulphur are not evenly spread. At some places iron filings are more then sulphur.

- No energy is absorbed when the suplhur powder is mixed iron filings.
- The particles of iron and sulphur retains individual chemical and physical properties.

The product of formed on hating 1g of sulphur powder and 2g of iron turnings called a compound.

- The product formed of is iron suphide the yellow particles of sulphur and fillings of iron are no longer visible.
- The iron or suplhur cannot be separated from the iron sulphid by any physical means.
- The composition of iron sulphide is same throughout.
- Heat energy is evolved when the iron reacts with suplhur. The product continues glowing with red dull colour, even when the heating is stopped.
- The properties of the product (iron sulphide) are entirely different from the properties of and Sulpure

Difference between mixtures and compounds :

	Mixtures		**Compounds**
1.	Elements or compounds just mix together to form a mixture and no new compound is formed	1.	Elements react to form new compounds.
2.	A mixture has variable composition.	2.	The composition of each new substance is always fixed.
3.	A mixture shows the proposition constituent substance.	3.	The new substance has totally different properties.
4.	The constituents can be separated fairly easily by physical methods	4.	The constituents can be separated only by chemical electrochemical methods.

Ques. Classify the following as chemical or physical change :

- cutting of trees.
- melting of butter in pan.
- rusting of almirah.
- boiling of water to form stean.
- 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 fruit and
- burning of paper and wood.

Ques. Classify the following into element, compound and mixture :

(i) Coal (ii) methane (iii) copper (iv) carbon dioxide (v)steam (vi) honey (vii) granite. (viii) blood (ix) sugar (x)germanium

Ques. What type of mixture are separated by the technique of crystallization ? Explain one.

EXERCISE

(A) OBJECTEVE TYPE QUESTIONS :

1. Which of the following is not a compound
(A) Common salt (B) Water (C) Iron fillings (D) Copper sulphate

2. Which of the following is not a mixture

3. Brass contains
(A) Gold and copper (B) Air (C) Steam (D) Milk

4. Which of the following is not a chemical change
(A) Electrolysis of water
(B) Boiling of water
(C) Digestion of food
(D) Burning of magnesium ribbon in oxygen to form magnesium oxide.

5. Which of the following is liquid metal.
(A) Copper (B) Mercury (C) Bromine (D) Silver

6. Which of the following can be not a pure substance
(A) Mercury (B) Sugar (C) Blood (D) Salt

7. Which of the following can be classified as a Substance
(A) Milk (B) Sea – Water (C) Ice (D) Cast iron

8. Which of the following given a ture solution in water
(A) Starch (B) Sugar (C) Chalk powder (D) Egg albumin

9. Which of the following statements is not correct –
(A) A compound is a pure substance
(B) Compound is homogeneous in nature.
(C) Compound always contains two or more elements
(D) Compound can be separated into constituent elements by some physical process.

10. Which of the following statements is not true.
(A) True solution are homogeneous in nature
(B) Suspension are heterogeneous in nature.
(C) Solute particle in a colloidal solution can be separated by filtration
(D) True solution are transparent to light

11. Which of the following is the second most abundant metal in the earth's crust ?
(A) Copper (B) Aluminum (C) Iron (D) Zinc

12. Which of the following will show Tyndall effect
(A) Starch solution (B) Sodium chloride solution
(B) Copper sulphate solution (D) Suger solution

13. When a beam of light is passed through a true solution it gets
(A) Reflected (B) Absorbed (C) Scatted (D) Zinc

14. Camphor can be purified by :
(A) Distillation (B) Filtration (C) Scattered (D)Path of light does not visible

15. Carbon burn in oxygen to form carbon dioxide. The properties of carbon dioxide are-
(A) Similar to oxygen (B) Similar or carbon
(C) Totally different form both carbon and oxygen (D) Much similar to both carbon and oxygen

16. A mixture of common salt and water can be separated by
(A) Sublimation (B) Evaporation (C) Separating funnel (D) Filtration

17. The process of cooling a hot, concentrated of a substance to obtain crystal is called
(A) Fractional distillation (B) Distillation (C) Crystallisation (D) Chormatography

18. A solution in which more quantity of solute can be dissolved without rasising its temperature is called
(A) Unsaturated solution (B) Saturated solution
(C) Super saturated solution (D) Concentrate solution

19. Colloidal particle can be normally seen by
(A) Ordinary microscope (B) Naked eye
(B) Electron microscope (D) Telescope

20. A mixture of alcohol and water can be separated by
(A) Separating funnel (B) Fractional distillation (C) Distillation (D) Crystallisation

(B) FILL IN THE BLAKS :

1. Compound is a……substance
2. Wood is a……
3. Electrolysis of water is a……..change.
4. Digestion of food is a…….change
5. …….is a metal which exists as liquid
6. Gases can be separated from, air by……method.
7. ……show tyndall effect
8. Brass is a mixture of……..and ……
9. 10 % by mass of a solution means……g of solute are present in 50gm of solution.
10. Air is a……

(C) WRITE T FOR TRUE FOR FALSE STATEMENT :

1. Steam is a compound.

2. Mercury is a liquid non-metal.

3. Mass percentage of solution containing 10 g of solute in 100 g of water is 100%

4. Mixture of salt and ammonium chloride can be separated by cyrstallisaion process.

5. Constituents of a mixture can be separated by physical methods.

6. Milk, coffee and brass are example of mixture

7. Digestion of food is a physical change

8. Solution cannot be separated by process of filtration.

9. Fog is an example of liquid dispersed in gas.

(D) VERY SHORT ANSWER QUESTION :

1. Is steam is element, a compound or a mixture ?

2. Name the two steps used of saparation f gases form air.

3. By which method will you separate m mixture of oil and water ?

4. Arrange true solution, suspension and colloid and decreasing order of size of the particles.

5. What type of mixture are separated by the technique of crystallization.

6. Name of the technique to separate,.
(i) butt from and curd
(ii) salt from sea water
(iii) camphor from salt

7. How would you confirm that a colouress liquid given to you is water ?

8. Classify each of the following as a homogenous or heterogenous mixture. Soda water, wool, air, vinegar, Filtered tea.

9. Identity the solution among the following mixtures.
(a) soil (b) sea water (c) air (d) coal (e) soda water

10. What is meant by pure substance ?

(E) LOGN TYPE QUESTIONS :

1. What is a mixture ? Name two type of mixture and give two examples of each.

2. What is a solution ? Give is three properties.

3. Whet is suspension ? Given is three properties.

4. Explain the method to separate cream from milk.

5. How can we obtain coloured component from blue/black in k ? explain.

6. Explain the method to separate a mixture of salt and ammonium chloride.

7. Discuss the method to separate a mixture of :

(i) two miscible liquid,
(ii) What immisicible liquids.

8. What are physical and chemical changes ? Give two example of each.

9. Define element, compound and mixture. Give two example of each.

10. Give difference between compounds and mixture

11. Write a brief notes on :

(i) Tyndall effect (ii) Solubility

12. What type of mixture are separated by the technique of cyrstallsation ? Explain one.

13. A mixture contains water, kerosens and sand, How will you separated this mixture ?

14. Explain the difference between :

(i) Homogeneous mixture and heterogeneous mixture
(ii) physical and chemical change

15. Define the following terms
(i) Saturated solution
(ii) Solvent

IS MATTER AROUD US PURE

ANSWER KEY

- **Objective type questions**

1.C **2.** C **3.** B **4.**B **5.**B **6.**C **7**.C **8.**B **9.**D **10.**C

11.C **12.**A **13.** D **14.** D **15.** C **16.**B **17.**C **18.**A **19.**C **20.**D

- **True or False :** **1.** F **2.** F **3.** F **4.** F **5.** T **6.** T **7.** T **8.** T

9. T

- **Fill in the blanks**

1. Pure **2.** Mixture **3.** Chemical

4. Chemical **5**. Mercury **6.** Fraction distillation

7. Colloids **8.** Copper and zinc **9.** 5g

10. Mixture

MATTER IN OUR SURROUNDING

1. INTRODUCTION

Early Indian philosophers and ancient Greek philosophers classified matter in the from of five basic elements "Panch Tatva" - air, earth, fire, sky and water. All living and non living things are made of these five basic elements.

In our surroundings, we see a large variety of things with different shapes, size and textures, Everything in this universe is made up of material which scientists have named "Matter" for example air, food, stones, clouds, stats, plants and animals, even a small drop of water or a sand particle are matter. The perception of joy, love, hate, thought, cold, hot, pain does no constitute matter while we perceive.

DEFINITION

Material :- The term used to describe a particular kind of matter, is called material e.g. – wood, water and marble.

Type of material :-

(a) Homogeneous material :- A material which has same composition and same properties throughout, is called homogeneous material .

(b) Heterogeneous material :- A material which has different composition and different properties in different parts is, called heterogeneous material. For e.g. – In marble, presence of grey and red grains of other materials.

Matter : - Anything which occupies space and has mass is called matter, so everything in the universe is "matter" Some examples of matter are, water, air, metals, plants, animals etc. The matter can be classified into different categories depending upon its physical or chemical nature

(a) Matter is categorized as a gas, a liquid and a solid on the basis of physical state. For e.g. – Air, water, and the earth. Change of state are also matters of everyday experience for example, ice melts and water freezes, water changes into steam on heating and steam condenses to liquid water on cooling .

(b) On the basis of chemical nature matter is classified as an element compound or mixture. Elements and compounds are pure substances whereas a mixture contains two or more pure substances.

Physical nature of matter :-

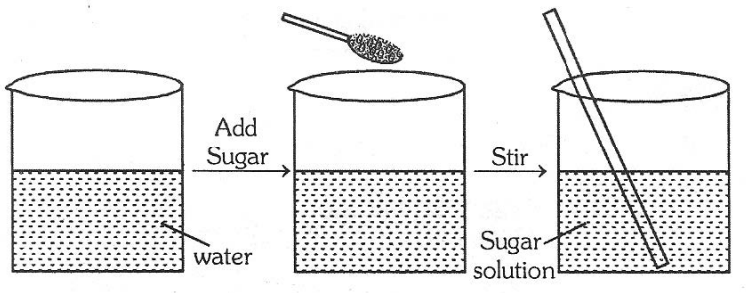
(1) Matter is made up of particles :- The particle nature of matter can be demonstrated by a simple activity

(a) Take about 50 ml water in 100 ml beaker.

(b) Mark the level of water.

(c) Add some sugar to the beaker and sir with the help of a glass rod.

(d) Observe the change in water level.



Dissolution of sugar in water. In solution particles of sugar are present in spaces between particles of water

Conclusion : - It is observed that crystals of sugar disappear. The level of water remains unchanged. These observations can be explained by assuming that matter is made up of small particles. On dissolution, the particles of sugar get distributed into the spaces between particles of water

(2) The constituent particles of matter are extremely small in size :- The following activity demonstrates that the constituent particles of matter are very small.

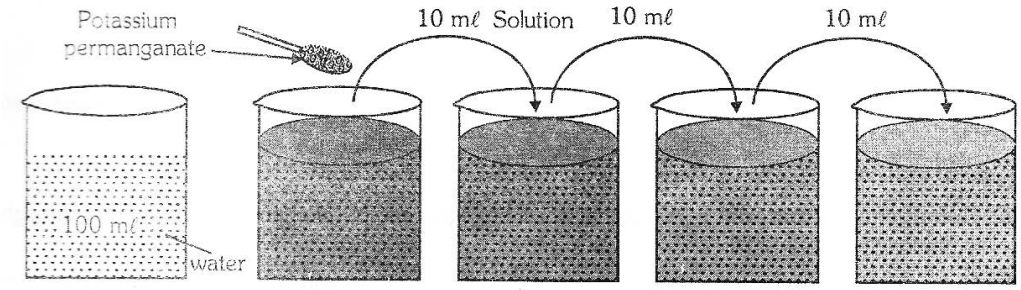
(i) Take a 250 beaker and add 100 ml water to it.

(ii) Now add 2 – 3 crystals of potassium permanganate ($KMnO_4$) and stir with a glass rod in order to dissolve the crystals

(iii) Take 10 ml of this solution and add to 100 ml of water taken in another beaker.

(iv) Take 10 ml of this diluted solution and put into 100 ml of water taken in still another beaker.

(v) Repeat this process 10 times observe the colour of the solution in the last beaker.



Decrease in colour of potassium permanganate solution

Conclusion :- (i) It is observed that the water in the last beaker is still coloured but the intensity of colour becomes light. It indicates that potassium permanganate ($KMnO_4$) crystal contains millions of tiny particles, some of which are still present even in the last beaker after so much dilution

(ii) This experiment can be done by copper soleplate $CuSO_45H_2O$ crystals, (for colours)

(iii) Dettol (for smell)

Characteristics of particles of matter :-

(i) **Particles of matter have space between them :- Activity –** When sugar is dissolved in water, the volume of the liquid remains unchanged. During dissolution, the particles of sugar get into the spaces between the particles of water. As a result, they get evenly distributed and there is no noticeable change in volume, similarly, when potassium permanganate is dissolved in water, its particle get evenly distributed throughout the bulk of water. This is indicated by uniform colour of the solution. This indicates that there are spaces between particles of matter. The particles of potassium permanganate get uniformly distributed in the spaces between water molecules.

Similarly when we prepare tea, coffee or lemonade (nimbu pani) we observe that particles of one type of matter get into the spaces between particles of other.

(ii) Particles of matter are continuously moving :-

Activity – (a) If an incense stick (Agarbatti) is lighted and placed in one corner of a room, its pleasant small spreads in the whole room quickly. It demonstrates that the particles of matter possess motion. A burning incense stick produces some gases (vapour) having pleasant small. The particles of these gases due to motion spread in the entire room and their presence can be felt by sensing the smell.

(b) **Activity :-** To demonstrate that kinetic Energy of particles increases with increase in temperature.

Note :- Kinetic energy :- Kinetic energy is energy of motion and is usually defined defined as the work that will be done by the body possessing the energy when it is brought to rest.

For a body of mass m having a speed v, the kinetic energy is $= \frac{1}{2}mv^2$

(i) Take two beakers. To one beaker add 100 ml of cold water and to the other beaker add 100 ml of hot water.
(ii) Now add a crystal of potassium permanganate to both the beakers
Conclusion :- It is observed that purple colour of potassium permanganate starts spreading and after sometime the entire solution become purple. The rate of mixing is faster in case of hot water. This experiment demonstrates that the particle of matter possess motion and that the kinetic energy of the particles increase with increase in temperature.

Form these activities it is observed that when two different forms of matter are brought in contact, they intermix spontaneously. This intermixing is possible due to motion of the particles of matter and also due to the spaces between them. The intermixing takes place due to movement of particles of one form into the spaces between the particles of the other form of matter.
"This spontaneous intermixing of particles of two different types of matter is called diffusion"
The rate of diffusion becomes faster with increase in temperature because at higher temperature, the particles have more energy and hence move faster.
(iii) Particles of matter attract each other :- There are some forces of attraction between the particles of matter which bind them together. The force of attraction between the particles of the same substance is known as cohesion. The force of attraction (or cohesion) is different in the particles of different kinetic of matter .

The following activity may be carried out to demonstrate the attractive forces between particles of matter
(a) Take a piece of iron wire, a piece of chalk and a rubber band.
(b) Try to break them by hammering, cutting or stretching. It is observed that the piece of iron wire is most difficult to break. This indicates that particles in iron wire are held by stronger force of attraction as compared to particles in piece of chalk or rubber band.

Conclusion :- Since energy is required to break crystals of matter into particles. It indicates that particles in matter are held by some attractive forces, the strength of these attractive forces varies from on matter to anther.

Q. We can get smell perfume sitting several meters away, why ?
Ans. This is because perfumes contain volatile solvent which carries pleasant smelling vapours. They diffuse quite fast and can reach to people sitting several meters away.

STATES OF MATTER
Matter can be classified into 3 states on the basis of physical state-solids, liquids and gases.
Properties of solids :-
(1) Solid state :-
(a) A solid possesses a fixed volume and a definite shape, distinct boundaries and a definite mass.
(b) Solids are rigid and almost incompressible.
(c) Solids may break under force but it is difficult to change their shape.
(d) Solids generally possess high densities
(e) Solids do not exhibit diffusion.

Note:- Density : - The mass of a substance per unit of volume .
Formula – $\boxed{\text{density} = \frac{mass}{volume} = \frac{kg}{m^3}}$ **orkgm^{-3}**
InSI it is measured in kgm^{-3}.

(f) In solids intermolecular forces of attraction is more strong.
Example – Table, chair, common salt, silver, ice, diamond, stone, sugar etc.

Volume :- All solids occupy a volume the shape occupied by a substance is called volume .
The unit of volume is m^3 (cubic meter) . The common unit of volume is litre. (L)
$1m^3 = 1000\ dm^3 = 1000$ L
1 L = 1 dm^3
1L = 1000 ml = 1000 cm3

Example of solid state :-
(i) A wooden block should be called a solid .
Explanation – A wooden block has a fixed shape and is rigid. Hence, it should be called solid .
(ii) A rubber band undergoes a change in shape on stretching, still we call it a solid.
Explanation – A rubber band is called a solid because although it undergoes a changes in shape on stretching yet it regains the same shape when the force is removed.
Solids generally do not exhibit diffusion :- Due to smaller interparticle spaces and absence of translatory motion
Some example in solids which shown diffusion –
(a) If we write something with chalk on a black-board and leave it as such for a few days, it becomes difficult to clean. This is due to diffusion of chalk particles into the surface of the black-board.
(b) If two metal blocks are bound tightly together and left undisturbed for a long time, it is observed that some particles of one metal diffuse into the surface of the other metal.
(2) Liquid state : Properties of Liquids :-
(a) The matter in liquid state possesses a definite volume, a definite mass, but no definite shape.
(b) Liquids are also almost incompressible but are not rigid. In fact, can flow from a higher to a lower level. Liquids have a property of fluidity and acquire the shape of the container in which they are kept.
(c) Liquids can undergo diffusion.
(d) Liquids also have high densities but less than that of solids.
(e) In liquids intermolecular force of attraction is weaker than solid.
Examples : -Water, alcohol, milk, diesel, petrol, kerosene oil, vegetable oil, fruit juices etc.
Solids, liquids as well as gases can diffuse into liquids This is due to the fact that interparticle spaces in liquids are larger and the particles in liquid state move freely.
Example :- (i) Add few crystals of sugar to water they intermix (dissolve) with water spontaneously.
(ii) When we add few drops of ink to water, the colour of the ink gets dispersed evenly in the entire liquid.
The gases also diffuse into liquids – (i) Aqueous solution of ammonia contains ammonia diffused in water.
(ii) The gases from the atmosphere diffuse and dissolve in water especially O_2, CO_2 are essential for the survival of aquatic animals and plants.
(iii) The fish and other aquatic animals can utilize the dissolved oxygen for producing energy form food.
(3) Gaseous state :-
Properties of Gases
(a) The matter in gaseous state has neither definite volume nor definite shape gut it has definite mass. It acquires the shape and volume of the container.

(b) Gases are highly compressible.

e.g.. (i) CNG (compressed Natural gas) is used as fuel in internal combustion engines.

(ii) Oxygen in compressed form is supplied to hospitals for serious patients in cylinders.

(iii) LPG (Liquefied petroleum gas) which is used in home for cooking .

(c) The gases exhibit the property of diffusing very fast into other gases.

Examples of diffusion in gases

(i) The smell (aroma) of perfumes of any thing is mix with the particles of air and reaches in seconds to very much distance.

(ii) It is commonly observed that if a bottle of ammonia is opened in one corner of the laboratory, its smell can be felt in the other corner of the laboratory after some time.

(iii) The smell of hot sizzling food reaches you several metres away. but to get the smell from cold food you have to go close.

Explanation :- The smell of hot sizzling food reaches us more quickly as compared to smell of cold food. This is because rate of diffusion is faster at higher temperature than at lower temperature. The rate of diffusion of not sizzling food is more and hence reaches you even several metres away. On the hand, rate of diffusion of cold food is less and therefore, you have to go quite close to it in order to get its smell.

(d) Gases exerts pressure on the walls of the container in which they are stored .

Note :- Pressure :- In the gaseous state the particle move about randomly at high speed. Due to their random movement , the particles hit each other and also the walls of the container. The pressure exerted by the gas is because of this force exerted by gas particles per unit area on the walls of the container.

The atmospheric pressure at sea level is 1 atm, and is taken as the normal atmospheric pressure.

$\boxed{P = \frac{F}{A}}$ **P = Pressure, F = Force, A = Area**

It is measured in "pascals" (Pa) in SI units and other unit is atm. These two units are related as

1 atm = 10.1×10^5 pa

1 bar = 1×10^5 pa

1 bar = 1.01 atm.

(e) Gases can flow easily in all directions.

(f) Gases have very low densities as compared to solids and liquids.

Example of gaseous state :- Air, hydrogen (H_2), carbondioxide (CO_2), hydrogen sulphide (H_2S), ammonia (NH_3), oxygen (O_2), Nitrogen (N_2) etc.

Q. We can easily move our hand in the air but to do the same through a solid block of wood we need a karate expert.

Ans. In air the intepatricle attractive forces are negligible and hence, it is easy to separate the particles in air and we can easily move our hand through it. In a solid block of wood, the interparticle forces are very strong and hence, it is not easy to separate the particles. Therefore it is not easy to move our hand through a solid block of wood (only a karate expert can do it). Dut to this property large volume of a gas can be compressed into a small cylinder and transported easily .

STUDY OF COMPRESSIBILITY OF GASES AND LIQUIDS

Activity – (i) Take three 100 ml syringes and close their nozzles by inserting them in a rubber cork. Remove the pistons from all the syringes.

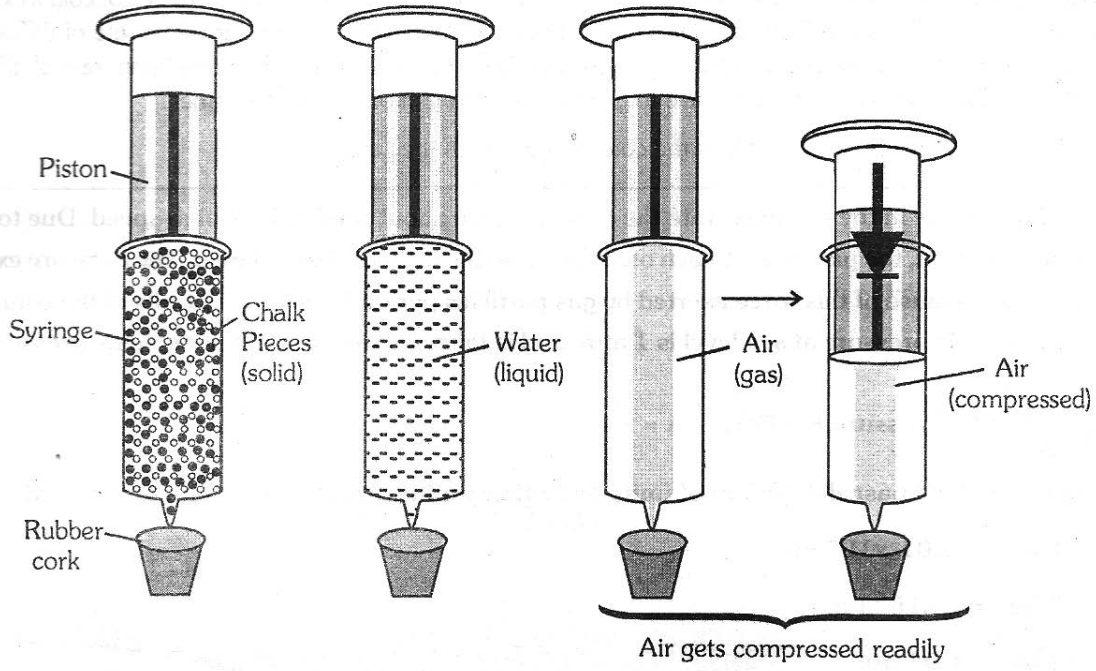
(ii) Fill chalk chalk pieces in the first, water in the second and leave third syringe as such. It already contains air

(iii) Insert the pistons back into the syringes

(iv) Compress all the syringes by pushing the pistons.

It is observed that when the syringe constraining air, is compressed by applying pressure, the piston can move downward easily and it can be compressed to a larger extent. But when the second syringe containing water is compressed, it is compressed not easily and it can be compressed to much lesser extent than that of air. The first syringe containing chalk pieces (solid) is compressed with most difficulty.

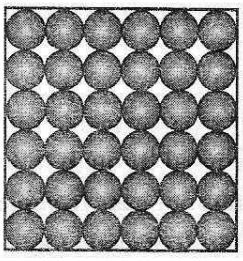
Conclusion : - This shown that gases are more compressible than liquids.



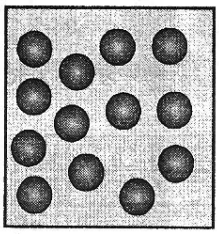
Study the compressibility of solid, liquid and gas.

EXPLANATION OF SOLID, LIQUID AND GAS STATE ON THE BASIS OF MOLECULAR STRUCTURE

In case of solids :- the intermolecular spaces are very small and intermolecular forces are very large. Thus, the molecules in a solid can vibrate about their mean positions, but cannot change their positions. It is on account of this molecular arrangement, that solids have definite shape and definite volume. Further more, they are incompressible.

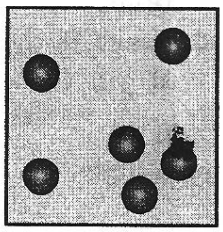


In case of liquids, the intermolecular spaces are some what large and intermolecular forces fairly small as compared to the solids. Further more, the molecules of the liquid have large kinetic energy. It is on account of the larger kinetic energy and large intermolecular spaces that the molecules can interchange their position. It is on account of this reason that liquids take the shape of containing vessel and flow from higher to lower level . However, the intermolecular forces in the liquids are sufficient to hold the molecules together and therefore, they have fixed volume. They are incompressible.



Arrangement of molecules in a liquid

In gas the intermolecular spaces are 1000 times or more than the liquids. This in turn weakens the intermolecular force to almost negligible magnitude. The molecules of a gas are free to move about in any direction. This accounts for the fact that gases have no definite shape or volume and occupy all the available apace. Due to large intermolecular space, they are easily compressible



Arrangement of molecules in a gas

Example – (i) Cooking gas used in homes is liquefied petroleum gas (LPG) which is obtained by compressing petroleum gas into steel cylinders. **(ii)** Compressed natural gas (CNG) is used as automobile fuel because the natural gas (methane) can be easily compressed **(iii)** The industrial gases such as ammonia (NH_3), chlorine (Cl_2), oxygen (O_2) etc. are compressed and transported to various places.

Q. Arrange the following substances in increasing order of forces of attraction between the particles – water, sugar , oxygen.

Ans. Oxygen < water < Sugar

Q. Give two reasons to justify -

(a) Water at room temperature is a liquid.

(b) An iron almirah is solid at room temperature.

Ans. (a) (i) Intermolecular forces are less.

(ii) Intermolecular spaces and kinetic energy is more.

Thus, the molecule of water can interchange their spaces and hence water is in liquid state at room temperature (b) (i) Intermolecular forces are very large.

(ii) Intermolecular spaces, as well as, kinetic energy are very small.

Thus, the molecules are held very, very tightly, with the result, the iron almirah has a definite shape and definite volume, and hence , is a solid

The diver is able to cut through water in a swimming pool.

Explanation : - The diver is able to cut through water in the swimming pool because matter is not continuous, but it is made up of particles which have vacant spaces between them moreover, the attractive forces between molecules of water are not very strong. The diver can easily cut through water by applying force to displace water and occupy its place.

Comparision of characteristic properties of solids, liquids and gases :-

S.No.	Property	Solids	Liquids	Gases
1	Shape	Definite	Take the shape of the container, but do not necessarily occupy all of it	Take the shape of the container by occupying whole of the space available to them.
2	Volume	Definite	Definite	Take the volume of the container.
3	Compressibility	Almost nil	very very less	Very large
4	Fluidity of Rigidity	Rigid	Fluid	Fluid
5	Density	High	Low	Very low
6	Diffusion	Generally do no diffuse	Diffuse slowly	Diffuse rapidly
7	Free surfaces.	Any number of free surfaces.	Only one free surface	No free surface.

Chang of state of matter :- A substance may exist in three states of matter i.e., solid, liquid or gas, depending puon the conditions of temperature and pressure. By changing the conditions of temperature and pressure, all three states could be obtained (solid, liquid, gas). On heating a solid changes into a liquid which on further heating changes into gas.

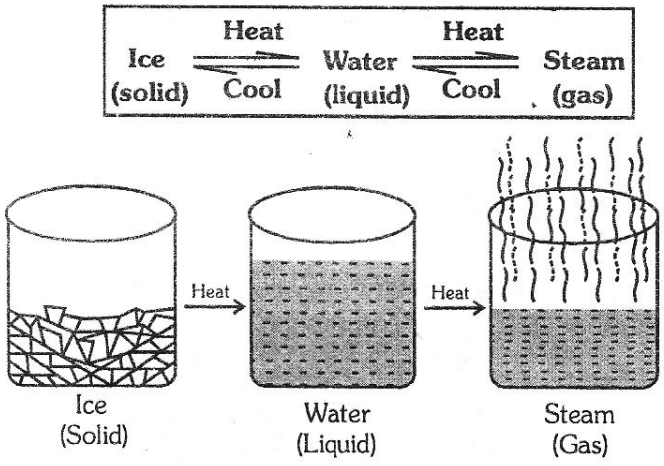
Example – Water exists in all the three states.

Solid : ice

Liquid : water.

Gas : water vapour

Ice is a solid state and may be melted to form water (liquid) which on further heating changes into steam (gas). These changes can also be reverse on cooling .



Change in three states of matter

Q. Why ice floats on water ?

Ans. Solids generally have higher density than the liquids but ice due to its specific structure has larger interparticle spaces and hence has lower density than liquid water. As a result ice floats on water.

Quantity	Unit	Symbol
Mass	**Kilogram**	**Kg**
Length	**Meter**	**m**
Temperature	**Kelvin**	**K**
Weight/force	**Newton**	**N**
Volume	**Cubic meter**	**m^3**
Density	**Kilogram/Cubic meter**	**Kg/m^3**
Pressure	**Pascal**	**Pa**

Some Important Relations
1kg = 1000g
1m = 100 cm
$1m^3 = 10^6 cm^3$ or 10^3 L (litre)
103 cm^3 = 1 L

Temperature and pressure are the two factors which decide whether a given substance would be in a solid, liquid or gaseous state.

(1) Effect of change of temperature :- The effect of temperature on three states of matter could be seen by performing the following activity

Activity :-

(i) Take a piece of about 10 – 150g of ice in a beaker.

(ii) Hang a thermometer in it so that its bulb is in contact with ice.

(iii) Start heating the beaker slowly on a low flame.

(iv) Note down the temperature when ice starts changing of water & ice has been converted to water.

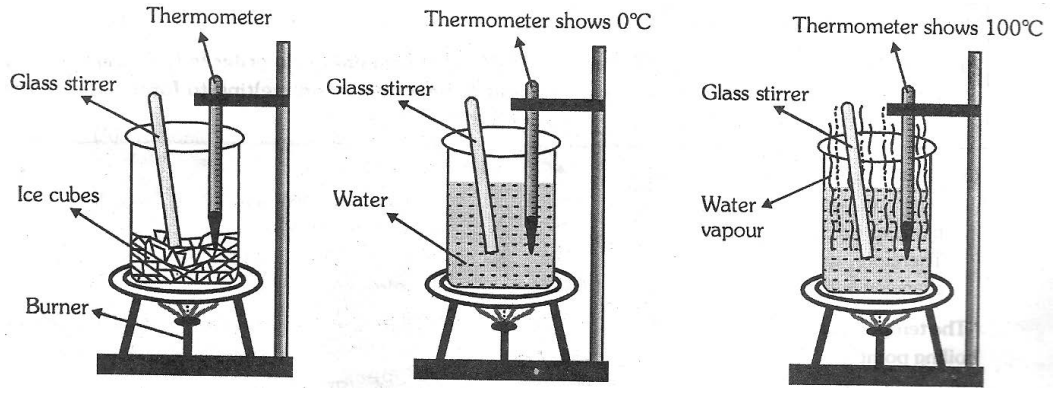
(v) Record all observations for the conversion of solid ice into liquid water.

(vi) Now, place a glass rod in the beaker and slowly heat the beaker with constant stirring with help of a glass rod.

(vii) Note the temperature when water starts changing into water vapours.

(viii) Record all observations for the conversion of water in the liquid state to vapour state.

It is observed that as temperature increases, the ice starts changing into water. This change is called **"Melting"** The temperature remains same till all the ice changes into water. The thermometer shown 0^0C until all the ice has melted. On further heating, the temperature stats rising. At 373 K (or 100^0C), water starts boiling. As the water continue boiling the temperature remains almost constant.



Conversion of ice to water and water to water vapour

Explanation about interconversion of different three state of matter :-

(i) Solid to liquid change (melting) : - Ice is a solid. In solid, the particles are tightly packed together. When we heat a solid, its particles become more energetic and kinetic energy of the particles increase. Dut to the increase in kinetic energy, the particles start vibrating more strongly with grater speed. The energy supplied by heat overcomes the intermolecular forces of attraction between the particles. As a result, the particles leave their mean position and break away from each other. After this solid melts and a liquid is formed.

"The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point". The process of melting is also called "Fusion". The melting point of ice is 0^0C. It may also be written as 273.16 K or 273 K.

NOTE :- The temperature is represented in celsius scale as ^{0}C. Now a days it is expressed on kelvin scale (K).

Conversion of temperature on celsius scale to kelvin scale:

For example :- 0^0C = 0 + 273 = 273 K

100_0C = 100 + 273 = 373

Conversion of temperature on kelvin scale to scelsius scale :

For example :- 373 K = 373 – 273 = 100^0C

Q.	**Convert the following temperatures to the celsius scale.**	
	(a) 300 K	**(b) 573 K**
Ans.	**(a) 300 – 273 = 27^0C**	**(b) 573 – 273 300^0C**
Q.	**Convert the following temperature to the kelvin scale.**	
	(a) 25^0C	**(b) 373^0C**
Ans.	**(a) 25 + 273 = 298 K**	**(b) 373 + 273 = 646 K**

It is observed that the temperature of the system does not change after melting point is achieved till the ice melts, though we continue to heat the beaker. This is happen because the heat supplied is used up in changing the state by breaking the intermolecular forces of attraction which hold them in solid state. As a result, there is no change in temperature till all the ice melts. This energy required to change solid into liquid is called **"latent heat"**. The word "latent" means **"hidden"** because this energy is hidden into the contents of the beaker.

Latent heat is of two types :- (a) Latent heat of fusion (b) Latent heat of vaporization.

(a) Latent heat of fusion : - Latent heat of fusionis defined as the amount of heat energy required to change 1 kg of a solid into a liquid at atmospheric pressure without any change in temperature at its melting point". The latent heat of fusion of ice is 3.34×10^5 J/Kg

Q. Ice is at 273 K more effective in cooling, than water at the same temperature, why ?

Ans. One kilogram of ice at 273 K, needs 3, 36000 J of heat energy in order to from water at 273 K. As the ice can extract out large amount of heat energy on melting to form water at the same temperature, therefore, it is more effective in cooling.

(ii) Liquid to gas change (Boiling or vaporizations) :- In a liquid most of the particles are close together. When we supply heat energy to the liquid, the particles of water start vibrating even faster. Some of the particles become so energetic that they can overcome the attractive forces of the particles around them. Therefore, they become free to move and escape from the liquid. Thus the liquid evaporates i.e., starts changing into gas.

"The temperature at which a liquid changes into a gas or vapour at the atmospheric pressure is called its boiling point".

"Boiling" is a bulk phenomenon.

Example – For water, the boiling point is 100^0C or 373 K. The particles in steam i.e., water vapour at 373 K have more energy than water at the same temperature.

Reason :- This is because the particle in steam have absorbed extra energy in the form of latent heat of vaporization.

(b) Latent heat of vaporization :- The latent heat of vaporization of a liquid is the quantity of heat in joule required to convert 1 kilogram of the liquid (at its boiling point) to vapour or gas, without any change in temperature. The latent heat of vaporization of water is 22.5×10^5 joules per kilogram (or $22.5 \times 10_5$ J/kg)

Q. What produces more severe burns, boiling water or stem ?

Ans. Steam will produce more severe burns than boiling water. It is because, 1 g of steam at 373 K (100^0C) contains 2260 J of energy more in the form of latent heat of vaporization as compared to water at 373 K (100^0). Thus steam produces more severe burns.

The boiling point of a liquid also indicates the strength of intermolecular force of attraction between particles. Volatile liquids such as alcohol, petrol and acetone have very weak intermolecular forces. Therefore, they boil at low temperature. On the other hand, water has stronger intermolecular forces of attraction and therefore, it boils at higher temperature. When steam is cooled, it condenses to water & when water is cooled, it changes to ice.

Stem $\xrightarrow[\text{Condensation}]{\text{Cool below } 100^0C}$ **Condenses to water** $\xrightarrow[\text{Solidification}]{\text{Cool below } 0^0C}$ **Frozen or solidifies to Ice**

Solid state $\underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}}$ **Liquid state** $\underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}}$ **Gaseous state**

NOTE :- Condensing is opposite to evaporating and freezing is opposite to melting.

Q. What is the physical state of water at -
(a) 25^0C (b) 0^0C (c) 100^0C

Ans. (a) 25^0C – Water is in liquid state.
(b) 0^0C – Water is in solid state.
(c) 100^0C – Water is in gaseous state.

Sublimation

The process due to which a solid directly changes into gaseous state on heating, without changing first into liquid state and the gaseous state, directly change into solid state on cooling, is known as "Sublimation"

Example :- Ammonium chloride, camphor, iodine, naphthalene, solid carbon dioxide or (dry Ice), anthreacene.

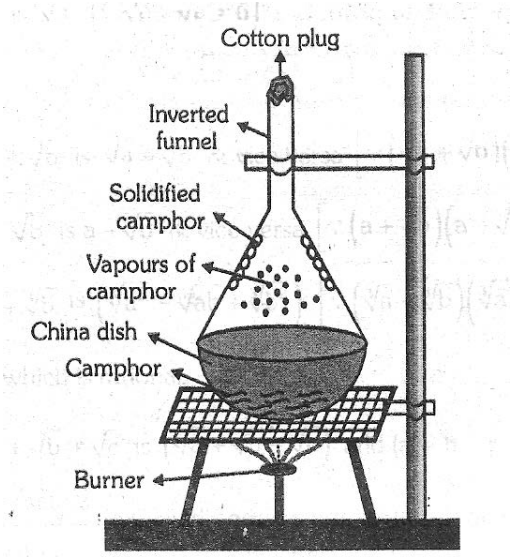
Sublime :- A gaseous form, directly formed from a solid on heating , is known as sublime.

Sublimate :- A solid state of matter formed directly from its gaseous state on cooling, is called sublimate.

To understand sublimation process we can do an activity :-

1. Take some camphor or ammonium chloride.
2. Power it and put in a china dish.
3. lace an inverted funnel over the china dish.
4. Heat the china dish slowly.

We observe that solid camphor on heating gets converted into vapour which gets condensed on the funnel. Solid state is directly converted in to gaseous state. This experiment shows sublimation process.



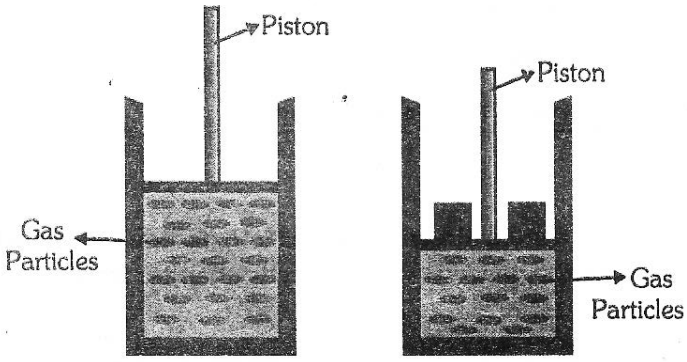
Sublimation process

Q.	**Naphthalene balls disappear with time without leaving any solid why ?**
Ans.	**Naphthalene is volatile solid and has a tendency to sublime, therefore, it changes into vapours completely which disappear into the air and no solid is left**

(2) Effect of change of pressure :- Gases are compressible because on applying pressure, the space between the gaseous particles decreases. Therefore gases can be compressed readily.

By applying pressure and reducing temperature, the gases can be converted into liquids i.e. gases will be liquefied.

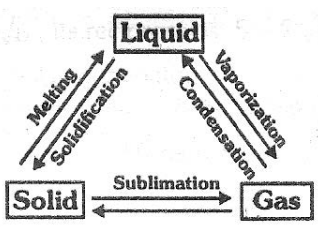
"This process of conversion of a gas into a liquid by increasing pressure or decreasing temperature is called liquefaction.



By applying pressure particles of matter can be brought close together

Thus, we can conclude that temperature and pressure determine the state of a substance ; solid, liquid or gaseous.
NOTE :- Solid carbondioxide is also called dry ice, Solid CO_2 gets converted into gaseous state directly on

<u>Interchange between different states</u>



Three conditions of temperature and pressure which decide the state of matter :-

- If the melting point of a substance is above the room temperature at the atmospheric pressure, it is called **solid**.
- If the boiling point of a substance is above room temperature under atmospheric pressure, it is classified as **liquid**.
- If the boiling point of the substance is below the room temperature at the atmospheric pressure, it is called **gas**.

EVAPORATION

"The process of a liquid changing into vapour (or gas) even below its boiling point is called evaporation ".

Evaporation of a liquid can take place even at room temperature, though it is faster at higher temperatures. It is **surface phenomenon** because it occurs at surface of a liquid only.

Whatever be the temperature at which evaporation takes place, the latent heat of vaporizations must be supplied whenever a liquid changes into vapour (or gas).

Explanation about Evaporation :- Some particles in a liquid always have more kinetic energy than the others. So even when a liquid is well below its boiling point, some of its particles have enough energy to break the force of attraction between the particles and escape from the surface of the liquid in the form of vapour (or gas). Thus, the fast moving particles (or molecule) of a liquid are constantly escaping from the liquid to from vapour (or gas)

Examples :- (i) Water in ponds changes from liquid to vapour without reaching the boiling point.
(ii) Water when left uncovered slowly changes into vapour.
(iii) When we put wet clothes for drying, the water from the clothes goes to the atmosphere.

Differences between evaporation and boiling.

	Evaporation	**Boiling**
1	Evaporation process takes place spontaneously at all temperatures.	Boiling takes place only at definite temperature (boiling point) at which the vapour pressure of the liquid is equal to atmospheric pressure.
2	Evaporation takes place only at the surface of the liquid	Boiling takes place even below the surface of the liquid in the form of bubbles.

Factors Affecting Evaporation

There are five factors which affects the rate of evaporations:

(i) **Nature of liquid :-** Different liquids have different rates of evaporation. A liquid having weaker interparticle attractive forces evaporates at faster rate because less energy is required to overcome the attractive forces.
Example – Acetone evaporates faster than water.

(ii) **Surface area of the liquid :-** The evaporation depends upon the surface area. If the surface area is increased, the rate of evaporation increases because the high energy particles from liquid can go into gas phase only through surface.

Example :- (a) The rate of evaporation increases when we put kerosene or petrol in an open china dish than in a test tube.
(b) Clothes dry faster when they are well spread because the surface area for evaporation increases.

(iii) **Temperature:-** Rate of evaporation increases with increase in temperature. This is because with the increase in temperature more number of particles get enough kinetic energy to go into the vapour state (or gaseous state) Example – Clothes dry faster in summers than in winters.

(iv) Humidity in the air:- The air around us contains water vapour or moisture. The amount of water present in the air is referred to as humidity. The air cannor hold more than a definite amount of water vapour at a given temperature. If the humidity is more, the rate of vaporization decreases. The rate of evaporation is more if the air is dry.

Example :- Clothes do not dry easily during rainy season because the rate of evaporation is less due to high moisture content (humidity) in the air.

(v) Wind speed:- The rate of evaporation also increases with increase in speed of the wind. This is because with increase in speed of wind, the particles of water vapour move away with wind resulting decrease in the amount of vapour in the atmosphere.

Example:- (i) Clothes dry faster on a windy day.

(ii) In a desert cooler an exhaust fan sucks the moist air from the cooler chamber which results in greater are of evaporation of water an hence greater cooling.

Evaporation causes cooling:- During evaporation, cooling is always caused. This is because evaporation is a phenomenon in which only the high energy particles leave the liquid surface. As a result, the particles having low energy are left behind. Therefore, the average molecular energy of the remaining particles left in the liquid state is lowered. As a result, there is decrease in temperature on the part of the liquid that is left. Thus evaporation causes cooling.

Example:- (i) When we pour some acetone on our palm, we feel cold. This is because the particles gain energy from our palm or surroundings and leave the palm feeling cool.

(ii) We sprinkle water on the root or open ground after a sunny hot day. This cools the roof or open ground. This is because the large latent heat of vaporization of water. helps to cool the hot surface.

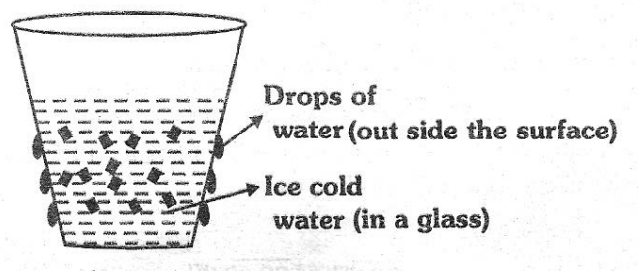
Some other examples of evaporation:-

(i) **We should wear cotton clothes in hot summer days to keep cool and comfortable.**

This can be explained as follow. We get a lot of sweat on our body in hot summer days. Cotton is a good absorber of water, so it absorbs the sweat from our body and exposes it to the air for evaporation. The evaporation of this sweat cools our body. The synthetic clothes (made of polyester etc) do not absorb much of sweat, so they fail to keep our body cool in summer.

(ii) **We see water droplets on the outer surface of a glass containing ice-cold water**

Take some ice-cold water in a glass. Soon we will see water droplets on the outer surface of the glass. The water vapour present in air, on coming in contact with the cold glass of water loses energy and gets converted to liquid state, which we see as water droplets.



Droplets formed on the surface of

the glass containing ice cold water

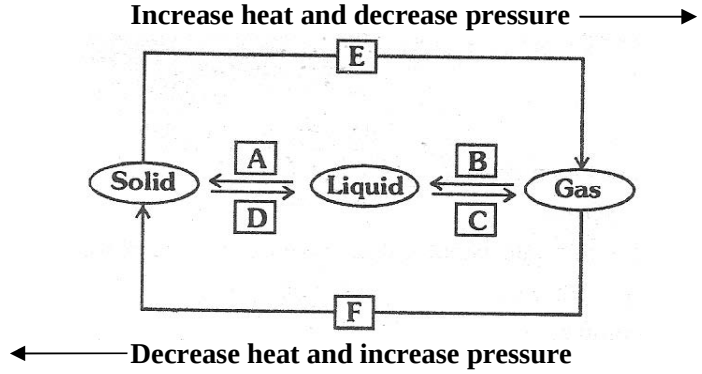
(iii) **Water keeps cool in the earthen pot (matki) during summer:-** When the water oozes out of the pores of an earthen pot, during hot summer, it evaporates rapidly. As the cooling is caused by evaporation, therefore, the temperature of water within the pot falls and hence it become cool.

(iv) **Rapid cooling of hot tea:-** If tea is too hot to sip, we pour it in the saucer. In doing so, we increase the surface are and the rate of evaporation. This, in turn, causes cooling and the tea attains a desired temperature for sipping.

(v) A wet handkerchief is placed on the fore head of a person suffering from high fever. The logic behind placing wet cloth is that as the water from the wet cloth evaporates, it takes heat from the skull and the brain within it. This, in turn, lowers the temperature of brain and protects it from any damage due to high temperature.

(iv) We often sprinkle water on the road in summer. The water evaporates rapidly from the hot surface of the road, there by taking heat away from it. Thus, the road become cool.

Q. Name A, B, C, D, E and F in the following diagram showing change in its state.



Ans A : Fusion
B : Vaporization
C : Condensation
D : Solidification
E &F : Sublimation

PLASMA

(i) Plasma is a mixture of free electrons and ions.

(ii) Plasma is considered the fourth state of matter.

(iii) Plasma occurs naturally in the stars (including the sun). Inside the stars, the temperature is so high that the atoms break up. Some of the electrons break away from the atoms converting the rest of atoms into electrically charged particles called ions. This mixture of free electrons and ions is a star is called plasma.

(iv) The sun and other stars glow because of the presence of plasma in them.

(v) Plasma can also be made on the earth by passing "electricity through gases at very low pressure taken in a glass tube (called discharge tube).

(vi) Plasma makes a fluorescent tube (or neon sign bulb) to glow.

BOSE-EINSTEIN CONDENSATE (BEC)

In 1920, and Indian scientist **"Satyendra Nath Bose"** did some calculation for the fifth state of matter. On the basis of these calculations, Albert Einstein predicted the existence of a new state of matter called Bose-Einstein condensate (BEC). The fifth state of matter called Bose-Einstein condensate was finally achieved by three scientists, **Cornell, Ketterle and Wieman** of USA by cooling a gas of extremely low density (about one hundred thousandth the density of normal air) to super low temperatures.

EXERCISE

(A) OBJECTIVE TYPE QUESTIONS:-

1. Which of the following has the strongest interparticle force a the room temperature?
   (A) Nitrogen (B) Mercury (C) Iron (D) Chalk
2. What is volume of gases?
   (A) Definite (B) Almost Nil
   (C) Large (D) Take the volume of container
3. The change of state from solid to liquid known as-
   (A) Fusion (B) Boiling (C) Melting (D) None of these
4. Dry ice is -
   (A) Water in solid state (B) Water in gaseous state
   (C) CO_2 in liquid state (D) CO_2 in solid state
5. The boiling point of water on kelvin scale is -
   (A) 573 K (B) 273 K (C) 373 K (D) 100 K
6. The process of change of a liquid into vapour at any temperature is called –
   (A Diffusion (B) Evaporation (C) Cooling (D) Heating
7. Which factor affecting Evaporation -
   (A) Temperature (B) Surface area (C) Both (A) & (B) (D) None of these
8. On increasing the temperature of the liquid the rate of evaporation is -
   (A) Increase (B) Decreases (C) No Change (D) None of these
9. Fluids are -
   (A) Liquids and gases (B) Solids and gases (C) Liquids and solids (D) Only solids
10. Which substance undergo sublimation process -
    (A) Naphthalene (B) CO_2 (C) Ice (D) N_2
11. Condensation Process is -
    (A) Change of state from gas to liquid (B) Change of state from liquid to gas
    (C) Change of state from gas to solid (D) Change of state from solid to liquid
12. The temperature at which liquid starts boiling at atmospheric pressure known as-
    (A) Melting point (B) Boiling point (C) Latent heat (D) Condensation
13. The melting point of ice is -
    (A) 0^0C (B) 4^0C (C) 5^0C (D) None of these
14. The physical state of matter which can be easily compressed -
    (A) Liquid (B) Gas (C) Solid (D) None of these
15. Name the process by which a drop of ink spreads in a beaker of water -
    (A) Diffusion (B) Vaporization (C) Condensation (D) Sublimation
16. The temperature at which a solid changes into liquid at atmospheric pressure is called-
    (A) Melting point (B) Boiling point (C) Diffusion (D) Evaporation
17. Convert the temperature of 373^0C to the kelvin scale?
    (A) 646 K (B) 546 K (C) 300 K (D) 500 K
18. Convert the temperature of 270K to the celsius scale -
    (A) -3^0C (B) -4^0C (C) 2^0C (D) 5^0C
19. Plasma is the …… state of matter -
    (A) First (B) Second (C) Third (D) Fourth

20. The process for the change of a solid directly into its vapour is called - \
(A) Evaporation (B) Ebullition (C) Condensation (D) Sublimation

(B) FILL IN THE BLANKS :-

1. Density is measured in ……..
2. The change of a liquid into vapour is called …….
3. The matter in our surrounding exists in three states …….. and ……
4. Matter is made up of very small ……
5. The change of a solid directly into gas is called ……..
6. Smell of cooked food reaches us in seconds due to the process known as ……..
7. Intermolecular space in solids is …… than that of liquids.
8. …… have definite volume but not definite shape.
9. Rapid evaporation depends on the …….are exposed to atmosphere.
10. Intermolecular forces of attraction are …… in solids,…….. in liquids and …….. In gases.
11. Boiling point of water is ……... K and melting point of ice is ……. K.
12. 1 atm is equal to …….
13. Change of vapour state to liquid state is called ……..
14. The best evidence that the particles of matter are constantly moving comes from the studies of …….. and ……..and …….
15. Plasma is a mixture of ……..and …….

(C) WRITE T FOR TRUE AND F FOR FALSE STATEMENT :-

1. Air, water, chair, table and smell are examples of matter.
2. Gases have highest rate of diffustoin among all the three states of matter.
3. Evaporation causes heating.
4. Camphor changes to gaseous state without changing into liquid.
5. Water has boiling point equal to 100^0C.
6. Evaporation is a bulk phenomenon.
7. Intermolecular foreces are maximum in solids and minimum in gases.
8. Condensing is opposite to evaporation and freezing is opposite to melting.
9. The large in humidity is out of the factor which increases the rate of evaporation.

(D) VERY SHORT ANSWER QUESTIONS:-

1. Name the physical state of matter which can be easily compressed ?

Ans. Gaseous.

2. Will increase or decrease of pressure help to liquefy a gas?

Ans. Increase of pressure.

3. Which of the following are matter? Chair, Air, Love, Smell, Hate, Almonds, Thought, cold-drink, smell of perfume?

Ans. Chair, air, almonds, cold, drink, and smell of perfume are matter.

4. A substance has a definite volume but no definite shape state whether this substance is a solid a liquid or a gas.

Ans. Liquid.

5. Define :- (a) Boiling point (b) Melting point

Ans. (a) Boiling point: - Boiling point is the temperature at which a liquid changes into gas or vapour.

(b) Melting point:- Melting point is the temperature at which a solid melts to become a liquid.

6. Define:- (a) Latent heat of fusion (b) Latent heat of vaporization.

Ans. (a) Latent heat of fusion :- The amount of heat energy that is required to change 1 kg of a solid into liquid at atmospheric pressure without any change of temperature is called latent heat of fusion.

(b) Latent heat of vaporization:- The amount of heat energy that is required to change 1 kg of a liquid into vapour at atmospheric pressure without any change of temperature is called latent heat of vaporization.

7. What is sublimation?

Ans. Sublimation is the change of gaseous state directly to solid state on cooling, without going through liquid state and vice versa.

8. Give reasons-

(a)A gas fills completely the vessel in which it is kept.

(b)A gas exerts pressure on the walls of the container.

Ans. (a) In gases, the particles are very loosely packed and the attractive forces between the particles are negligibly small. As a result, the particles of gases, move randomly in all direction and therefore, fill the vessels completely.

(b) The molecules of a gas are free to move randomly in all direction. During their motion, they collide with one another and also with the walls of the container. The constant bombardment of the molecules on the walls of the container exerts a steady force. The force acting per unit area on the walls of the container is called pressure. Thus, gases exert pressure.

9. What are the characteristics of the particles of matter?

Ans. The Characteristics of the particles of matter?

(i) All matter consist of very small particles.

(ii) The particles of matter have vacant spaces between them.

(iii) The particles of matter are continuously moving and possess kinetic energy.

(iv) The particles of matter attract each other with a force called intermolecular force of attraction. The intermolecular forces of attraction are maximum in solids and least in gases, Liquids have intermolecular force in between solids and gases.

(v) Particles of matter mix with each other on their own and get into the spaces between particles of each other.

10. What is plasma?

Ans. Plasma is fourth state of matter which consists of super energetic and super excited particles in the form of ionized gases.

11. What are full forms of CNG and LPG? And write their uses?

Ans. CNG is compressed natural gas which is being used in vehicles as a fuel. LPG is liquefied petroleum gas which is used for cooking and also for vehicles as a fuel.

12. Change the following celsius temperature to kelvin scale- **(KVS 2005)**

(i) -273^0C (ii) -100^0C (iii) -40^0C (iv) $+30^0C$

Ans. In kelvin scale -

(i) $-273^0C + 273 = 0$ K

(ii) $-100 + 273 = 173$ K

(iii) $-40 + 273 = 233$ K

(iv) $+30^0C + 273 = 303$ K

13. Convert (a) 300 K (b) 573 K into celsius scale- **(NCERT)**

Ans. (a) 300 K in celsius scale = $300 - 273 = 27^0C$.

(b) 573 K in celsius scale = $573 - 273 = 300^0C$.

14. Why does our plam feel cold, when we put some acetone petrol as perfume on it ?

Ans. The particles of acetone, petrol, perfume gain energy from our plam and evaporate causing the plam to feel cold.

15. Have you ever thought how do aquatic plants and animal survive ? from where do they get oxygen ?

Ans. The aquatic plants and animals survive because the gases from the atmosphere diffuse and dissolve in water. These gases mainly contain carbondioxide and oxygen are therefore, taken by the plants and animals respectively for their survival .

16. The mass per unit volume of a substance is called density (density = mass /volume). Arrange the following in order of increasing density – air , exhaust from chimneys, honey, water, chalk, cotton and iron.

Ans. The order of increasing density is : - air < exhaust from chimney < cotton < water < honey < iron.

(E) LONG TYPE QUESTIONS :-

1. Write comparative properties of solids, liquids and gases. **[Refer Page No. – 8]**

2. How many type of matter can be classified ? Explain both of these. **[Refer Page No. - 3, 4, 5]**

3. Write an example which shows the effect of change of temperature on solid . **[Refer Page No. - 9]**

4. What is evaporation ? Explain about the factors affection Evaporation ? **[Refer Page No. – 13, 14]**

5. What is sublimation process ? Give an example to define it. **[Refer Page No. – 11, 12]**

6. What is the difference between evaporation and boiling ? **[Refer Page No. - 13]**

7. Give some example of evaporation. **[Refer Page No.14, 15]**

8. Define about :- (a) Plasma (b) Bose Einstein condensate. **[Refer Page No. - 15]**

9. Explain molecular structure of solid, liquid and gaseous state ? **[Refer Page No. – 6, 7]**

10. What is diffusion ? Give some example of it.

[Definition of diffusion on Pg. No. – 3, Ex. Of diffusion on Pg. No. 5]

11. What are the characteristics of particles of matter ? **[Refer Page No. - 2, 3]**

12. Why do we see water droplets on the outer surface of a glass containing ice cold water ? **[Refer Page No. - 14]**

13. Give one simple activity /experiment to show

(ii) Particles of matter are very small **[Refer Page No. - 2]**

(ii) Ammonium chloride sublimes. **[Refer Page No. – 11, 12]**

14. What is matter ? write three states of water in which it exists.

[Definition of matter on Pg. No. – 1, States of water on Pg. No. 8]

15. Convert the following :

(i) 375 K to celsius scale. **[Hint :- 357 – 273 convert into ^{0}C]**

(ii) 27^0C to kelvin scale . **[Hint :- 27 + 273 convert into K]**

(iii) 1.01×10^5 Pa to atmosphere. **[Hint :- 1 atm = 1.01×10^5 Pa]**

16. Write an activity which shows the compressibility of gases & liquids. **[Refer Page No. - 6]**

17. Define about :-

(i) Pressure & its unit **[Refer Page No. - 5]**

(ii) Density **[Refer Page No. - 3]**

(iii)Volume **[Refer Page No. - 4]**

(iv) Kinetic energy **[Refer Page No. - 2]**

MATTER IN OUR SURROUNDING ANSWER KEY EXERCISE

- **Objective type question**

1. C **2.** D **3.** C **4.** D **5.** C **6.** B **7.** C **8.** A **9.** A **10.** A

11. A **12**. B **13.** A **14.** B **15.** A **16.** A **17.** A **18.** A **19.** D **20.** D

- **Fill in the blanks**

1. Kilogram per cubic meter 2. Vaporization 3. Solid, liquid and gas
4. Particles 5. Sublimation 6. Diffusion
7. Less 8. Liquids 9. Surface
10. Maximum, intermediate, minimum 11. 373, 273
12. 1.01×10^6Pa 13. Condensation 14. Diffusion, brownian, motion
15. Free electrons and ions.

- **True (T). False (F)**

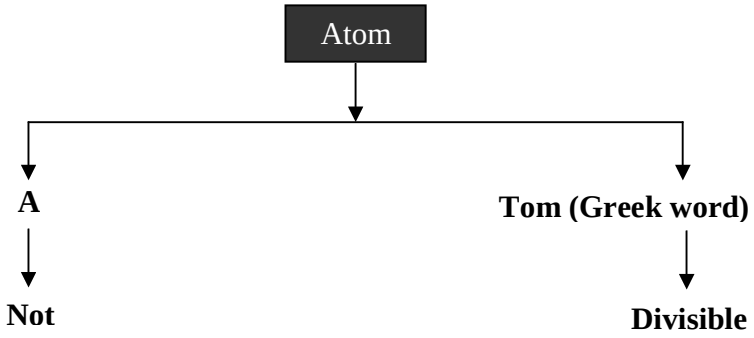
1.F 2.F 3.F 4.T 5.T 6.F 7.T 8.T 9.T 10.F

STRUCTURE OF ATOM

1. INTRODUCTION :

According to john Dalton : A mater was composed of mass particle called atom.

Atom is a Greek word and is meaning Indivisible i.e. an ultimate particle which cannot be further subdivided.



According to Dalton's theory –

(1) Atom is the smaller indivisible part of matter which taken part in chemical reaction.
(2) Atom is neither be crated nor be destroyed.
(3) Atom of the same element are similar in size. mass and characteristics ; however. atoms of different elements have different size. mass and characteristics.

- **An atom is made up of three subatomic particle electron, proton & neutrons. These three particle are called fundamental particle of matter.**

Particles	Scientist	Charge	Mass
Electron (e^-)	J.J Thomson	-ve	9.1×10^{-31} kg (1/1837 = 0.0000599 amu)
Proton (p)	E. Goldstein	+ve	1.67×10^{-27} kg
Neutron (n)	Chadwick	Zero	1.67×10^{-27} kg

DO YOU KNOW : Mass of proton is 200 times more then electron

Atomic structure : There are two parts of atom :

(i) Nucleus (ii) Outer part

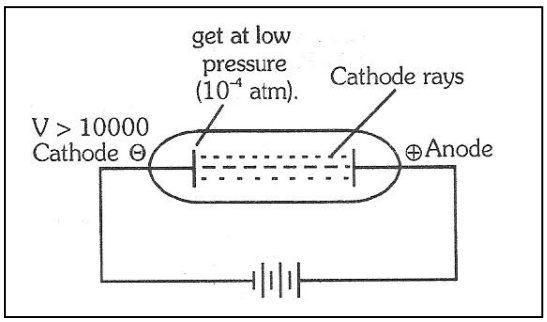
Nucleus : The size of nucleus of atom is very small in which neutron and are preset so the almost entire mass of the atom is situated in nucleus. Protons & neutrons present in the nucleus are collectively termed an nucleus. Number of neutrons is called mass number element. Size of the nucleus in the atom is 10^{-15} m.

Mass number(A) = Number of proton's in the nucleus (P) + Number of Neutrons (n).

Outer part : In the outerpart, electrons moves around the nucleus in fixed orbits. These orbits called energy levels.

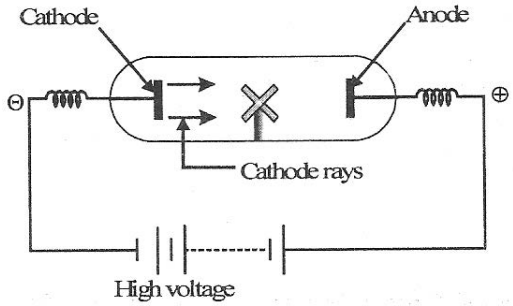
Cathode rays : (Discovery of e^-)

In 1859 " Julius Plucker" started the study of conduction on electricity through gases at low pressure in a discharge tube. When a high voltage of 10,000 volts or more was impressed across the electrodes, some of inversible rays moved form the negative electrodes to the positive electrode . Since negative electrons is referred to as cathode. These rays called cathode rays.



Properties of cathode rays :

- These rays in straight line away from cathode with vary high velocity from 10^7 to 10^9 m/sec.
- A shadow of metallic object placed in the path is cast on the wall opposite to cathode.
- Cathode rays cause green fluorescence on glass surface, i.e. the glasss surface on which the cathode rays strike show a coloured shine



Cathode ray particle strike the blades of the paddle wheel, and set it into motion

- These rays are deflected by the electric of magnetic fields when the rays are passed between two Electrical charged plates, these deflected towards the positively charged plates. It shows that cathode rays car negative charge. These particle carrying negative charge. These particles carrying negative charge we called negatrons by Thomson. The name negatron was changed "Electron by Strong"

- These rays produced heat energy when they collide with the matter. It shows that cathode rays possess energy which is coverted into heat energy when stopped by matter.

- These rays effect the photographic plate.

- Cathode rays can penetrate the thin of solid materials
- Cathode rays canthode rays independent of
- The nature of cathode rays independent of

(a) The nature of cathode
(b) The gas in discharge tube

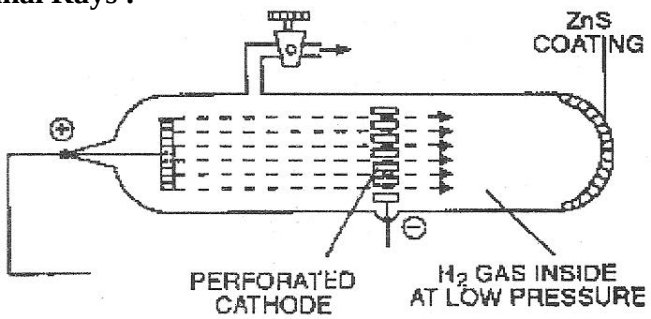
Ques. What are cathode rays ? **[NCERT]**

Measurement of e/m for electron :

In 1887 J.J Thomson determine the e/m value. Charge/mass of the electron of by studying the deflection of cathode rays in electric & magnetic fields.

The value of e/m has been found to be -1.7588×10^8 coulomb/unit. The absolute value of the charge in an e^- was measured by R.A Milikan 1909 by the Milikan's oil drops experiment.

Anode Ray of Canal Rays :



It has been established that electron is a negatively charged particle in all the atoms. As an atom is electrically neutral, there must be some positively charged particle present in the atoms to neutralize the negative charge of the electrons. It has been confirmed by experiment "Goldstein" in 1886 discovered the existence of a new type of rays in discharge tube. He carried out experiment in discharge tube containing perforated cathode. These rays moved towards cathode and passed through the perforation in the cathode.

- Initially these ray ware called canal rays because they pass through the canals or holes of the cathode.
- These rays are also called anode rays since they originate from the anode side.
- Anode rays are positively charged, therefore these were named positive ray b Sir J.J. Thomson.

Characteristics of anode rays.

- Anode rays travel in straight lines. These rays rotate the light paddle wheel placed in their path. Anode rays are deflected by magnetic or electric field towards negatively charged plate. This indicates that these rays are positively charged.
- The anode rays affect photographic plate.
- The nature of anode rays depends upon the type of gas used. The charge (e) to mass (m) ratio (e/m) to anode rays particle is different or different gases. The value of e/m is maximum for hydrogen gas.
- The positive rays obtained from hydrogen are made up the same type of positive particles. These particles are known as protons.

In the discharge tube the atom gas lose negatively charged electrons. These atoms, thus acquire a positive charge. The positively charge particle produced from hydrogen gas were called " protons."

$$H \xrightarrow{e^-} H^+ \text{ (Proton)}$$

Characteristics of proton :

A proton is a fundamental particle of atom carrying one unit positive charge of having mass nearly equal to the mass of an atom of hydrogen . The protons are present in the nucleus of atom.

Charge of proton : Proton is a positively charged particle. The charge on a proton is equal but opposite to that on an electron. Thus the magnitude of charge on a proton is $+ 1.6032 \times 10^{-19}$ coulomb/ unit. The mass of proton in equal to the mass of hydrogen atom.

Que. If an atom contains one electron and one proton, will it carry any charge or not ? **[NCERT]**

Thomson Model of Atom :

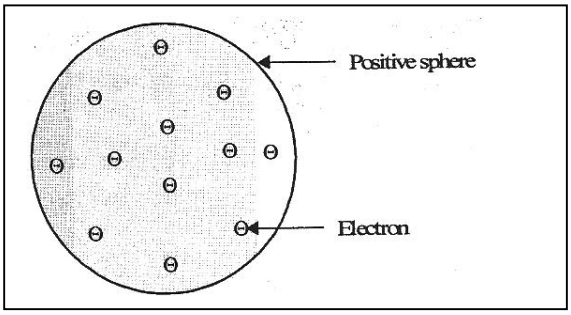


Fig. Thomson's model of the Atom

- Detailed model of the atom was first of all proposed by sir J.J. Thomson.
- Thomson proposed that an atom consist of a uniform sphere of positive charge in which the electrons are distributed more or less uniformly.
- Thomson proposed the model f atom to be similar to that of a Christmas budding. The electrons, in a sphere of positive charge. Were like current (dry fruits) in a spherical Christmas pudding. We can also think of the watermelon, while the electron are sudden in the positively charge sphere, like the seeds in the watermelon.

Ques. On the basis of Thomson's model of an atom, explain how the atom is neutral as a whole. **[NCERT]**

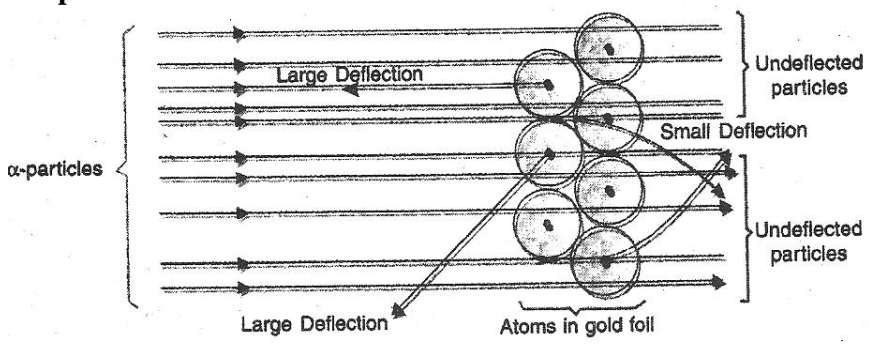
Drawback of the Thomson Model :

- An important drawback of this model is that the mass of the atoms is considered to be evenly spread over the atom.
- It is static model. It does not explain at movement of electron.
- It could not explain the stability of a atom.

Rutherford's Model of the atom (Discover of Nucleus)

In 1911, scientist "Ernest Rutherford" gave a new picture for the structure of atom by his α-particle scattering experiment & proposed the structure of atom. α particle are charged particle having 2 unit of positive charge and 4 units of mass, that is α- particle (2^{He2}) are doubly charged helium atom (He^{+2})

Rutherford Experiment :



- When fast moving alpha particle strike very thin gold foil in vaccum, it is found that :
  Most of the fast moving α- particles passed straight through the gold foil, Without any deflection from their original part.

- Some of the α-particle were deflected by the foil by small and few are deflected through large angles.
- A very few alpha particle completely rebound on hitting the gold foil and turn back their path.

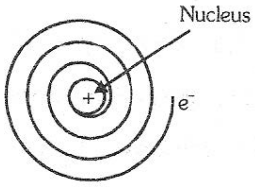
Conclusion of Rutherford experiment :
Rutherford concluded form the α-particle scattering experiment that

- Most of the space inside the atom is empty because most of the α - particle passed through the gold foil without getting deflected.
- Very few particle ware deflected from their path, indicating that the positive charge of the atom occupies very little space.
  A vary small fraction of α-particle ware deflected by 180^o, indicating all the positive charge and mass of the gold atom ware concentrated in a vary small volume within the atom.
  On the basis of his experiment, Rutherford put forward the nuclear model of an atom, which has the following features .
- There is a positively charged center in an atom called the Nearly all the mass of the an atom resides in the nucleus.
- The electron revolve around the nucleus in well-defined orbit.
- The size of nucleus is very small as compared to the size of the atom.

Ques. On the basis of Rutherford's model of an atom, which subatomic particle is present it the nucleus of an atom ? **[NCERT]**

DO YOU KNOW : Radius of nucleus is 10^{-15}m radius of atom is 10^{-10}m.

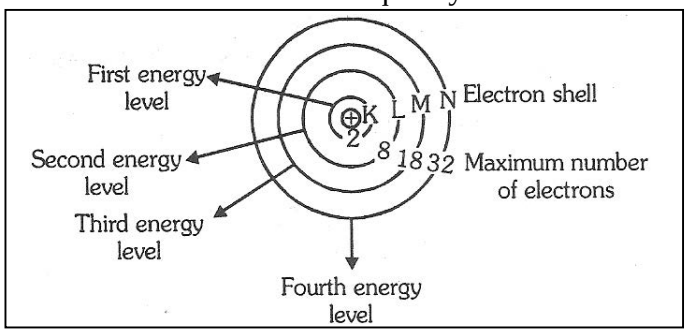
Drawback of the Rutherford Experiment :
According to Maxwell. if an electrically charged particle revolves around circular path, then it always radiate out enery Thus. If an electron moves around the nucleus, it must continuously radiate out enery and hence, gradually more towards nucleus in a spiral path, till it collide with nucleus,

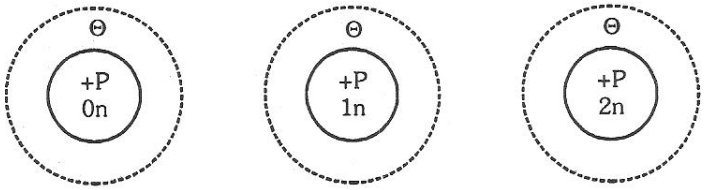


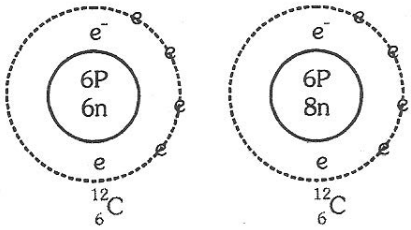
Bohr Model of an atom: Rutherford's Model of the atom was unable to explain certain observations with regard to the atom that is stability of the atom and the occurrence of the atomic spectra.
Neil bohr accepted Rutherford's idea that the positive charge and most of the mass is concentrated in its nucleus with the electrons present at some distance away. It is a quantum mechanical model. This model was based on quantum thory of radiation or plank theory and classical law of physics.
According to Bhr's Theory:

- Electrons revolve around the nucleus in well defined orbits or shells each having a definite amount of energy associated with the electrons in it. Therefore these shells are also called energy levels.
- The energy associated with the electrons in and orbit increase as the radius of the orbit increase. These shell also known as K,L,M,N…….starting from the one closestto the nucleus.
- An electron in a shell can move to a higher or lower energy shell by absorbing or releasing a fixed amount of energy.

- The amount of energy or emitted is given by differences energies with the two levels. Thus
  Energy absorbed $\Delta E = E_2 - E_1 = h\nu$
  Energy emitted $\Delta E = E_2 - E_1 = h\nu$
  where h is plank's constant and v is the frequency of the radiation.







Ques. Draw a sketch of Bohr's model of an atom with three shells. **[NCERT]**

Discovery of Neutron :

In 1932, "Chadwick" bombarded beryllium with a stream of α - particle. He observed that penerating radiation were produced which were not effected by electric & magnetic. field. These radiations consists of neutral particle which were called neutron. The nuclear nuclear reaction can be show as as :

$${}^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{6}_{12}C + {}_{0}n^{1}$$

(Berylium) (α-particle) (carbon) (Neutron)

In this equation the subscript stand of number of protons and the superscript of mass number. It is now clear that the neutron is fundamental consitituent of atom and is located in nucleus.

Characteristics of a neutron :

Mass : The relative mass of neutron is almost equal to that of proton. In fact relative mass of neuron is 1.0087 (1.008) amu and that of proton is 1.0073 (1.008) amu.

Charge : Neutron is electrically neutral has no electric charge with the discovery of neutrons. we can explain why the atomic mass of helium is 4 amu. Atomic mass = of proton + Mass of neutron.

VERY SHORT TYPES QUASTION :

1. What is the fundamental particle of matter ?
2. Which experiment was performed by J.J. Thomson ?
3. Which experiment was performed by Rutherford ?
4. Name the scientist who gave the theory of atom ?
5. Who discovered electron ?
6. Who discovered proton ?
7. What are electron ?

FILL IN THE BLANKS :

1. The mass of proton is ……..times that of on electron.
2. The mass of a neutron is…….to that of a proton.
3. Nucleus of an atom was discovered by……
4. The charge/mass (e/m) ratio of an electron is ……..
5. The voltage used to pass a current through a discharge tube is……..
6. The elementary particle not present in a hydrogen atom is……..
7. …….are double charged helium ions.
8. The proton of charge is…….coulombs/limit
9. The……..and…….rays affect the photographic plate
10. Mass of the atom is mainly due to…….and…….

TRUM/FALSE :

1. Anode rays consist of positively charge particle ?
2. The mass of proton is 1840 times that of an electron.
3. Cathode rays consists of beam of fast moving proton.
4. The charge of electron and protons are of equal magnitude.
5. Radius of nucleus is of the order of 10^{-15} m.
6. Central part of the atom where neutrons and protons are held together is know as nucleus.
7. e/m ratio for electron is about 1000 time that of a proton.
8. J.J. Thomson proposed that the nucleus of an atom contains only neutron.
9. Neuron were discovered by James chadwick.
10. The value of e/m is maximum of for hydrogen gas.

NCERTQUESTIONS :

1. What is Tomson's model of atom ? Why was it rejected ?
2. Describes the Rutherford's model of an atom ?
3. Compare the properties of electrons. protons and neutrons.
4. Helium atom has an atomic mass of 4-amu two protons is its nucleus. How may neutrons does it have ?
5. What do you think would be the observation if the α-particle scattering experiment is carried out using a foil of a metal after than gold ?

Valency : An atom of each element has definite combining capacity in outershell is called is valency. The number of electron (e^-) gained, dost or shard by the atom of an element of complete octet stable : Ex $_2He^4$, Ne^{20}

Valence electron : The electron in the outer most shall are called valence electron.

Ex. Na^+ and N^-

Ques. How will you find the valency of chlorine sulphur and magnesium **[NCERT]**

Atomic number and mass number.

Atomic number (Z) :
Protons are presents in the nucleus of an atom, it is the number of protons of an atom, which determines its atomic number. It is denoted by 'Z'. Thus atomic = No. of protons = No. of electron for hydrogen Z = 1 because in hydrogen atom only one proton is present in the nucleus.
Therefore the atomic number is defined as the total number or protons present in the nucleus of an atom. for eg. $_6C$ means atomic no. of carbon is 6 Nucleus of carbon has 6 protons. Nucleus of carbon has 6 unit positive charge. There are 6 electrons, revolving round the nucleus of carbon.

Ex : $^{24}_{12}Mg$

The mass number of magnesium is 12. The total number of protons and neutrons in the nucleus of magnesium is 24 number of neutrons is = 24 – 12 = 12.
Mass Number (A) : The mass number of an atom is defined as the sun of the total number or protons are neutron present in the nucleus of an atom. For example, mass of carbon is 12u because it has 6 proton and neutron that is 6u + 6u = 12u.
Mass number : Number of protons + number of neutron for eg.
The notation for an atom be the atomic number, mass number and symbol of the element are be written an follows .

Symbol of element : $_Z\mathbf{X}^A$

$X \Rightarrow$ elements

$A \Rightarrow$ Mass No.

$Z \Rightarrow$ Atomic No.

Symbol	A	z = p	n
Li	6	3	3
C	12	6	6
N	14	7	7
O	16	8	8
Mg	24	12	12

For example Nitrogen is written as $^{14}_{7}N$

Ques. If number of electrons an atom is 8 and number of protons is also 8, then (i) what is atomic Number of atom (ii) what is the change of the atom ? **[NCERT]**

Ques. Find out the mass number oxygen and sulphur atom. **[NCERT]**

Isotopes : Isotopes are atoms of the same element, having the same atomic number but different mass number. For example isotopes of hydrogen atom, namely protium ($_1H^1$) deuterium ($_1H^2$) tritium ($_1H^3$)

Exampe of lsotopes :

Isotopes of carbon $^{12}_{6}C$ and $^{14}_{6}C$

Carbon Isotopes	$^{12}_{6}C$	$^{14}_{6}C$
Atomic number	6	6
No. of proton	6	6
No. of electron	6	6
No. of neutron	6	8
Mass number	12	14

Applications of Isotopes :

Since of chemical properties of all isotopes of an element are the same the but isotopes nave special properties which find them useful in various fields. Some of them are:

- Uranium $\left(^{238}_{92}U\right)$ used as a fuel in nuclear reaction.
- Cobalt $\left(^{60}_{27}Co\right)$ is used in the treatment of cancer.
- Iodine $\left(^{128}_{53}i\right)$ is used in the treatment of goitre.
- Sodium $\left(^{24}_{11}Na\right)$ is used for differentiating cancerous tissues from the normal tissues.
- Carbon $^{14}_{6}C$ is used in of fossil samples.

How to calculate the atomic mass of element from the mass number of its isotopes.

The atomic mass of an element is the weighted arithmetic mean of the atomic masses of its isotopes resent in the sample of the element.

$$\textbf{Atomic mass of the element X} = \frac{\%\text{of}X_1 \times \text{Mass number of}\ \%\text{of}\ X_2 \times \text{Mass number of}\ X_2}{100}$$

Ex. This method is illustrated by taking the case of chlorine. The two isotopes of chlorine, $^{35}_{17}Cl$ and $^{37}_{17}Cl$ occur in the ratio 3 : 1. Then,

Atomic mass of chlorine : = $\frac{(35u \times 3)+(37u \times 1)}{3+1}$ = $\frac{105u+37u}{4}$ = $\frac{142u}{4}$ = 35.5u

Ques. If bromine occurs is in the form of say two isotopes $^{79}_{35}Br$ (49.7%) and $^{81}_{35}Br$ (50.3%), then calculate the atomic mass of bromine atom.

Isobars : Atoms of different element with different atomic number which have the same mass number, are know as isobars.

For example : Calculate and argon

$_{20}Ca^{40}$ $_{18}Ar^{40}$

The atomic number of argon is 18, calcium is 20 but the mass number of these element of same.

(2) $^{14}_{6}C$ and $^{14}_{7}N$

Isotopes	$^{12}_{6}C$	$^{14}_{7}N$
Atomic number	6	7
No. of proton	6	7
No. of electron	6	7
No. of neutron	6	7
Mass number	14	14

Ques. Write the electronic configuration of any pair of isotopes and isobars. **[NCERT]**

QUESTION

Very short types question :

1. What is the atomic number ?
2. What is the atomic mass ?
3. What is the valency electron?
4. What is the isotopes ?

Fill in the blanks :

1. Isotopes of an element have……. number of……
2. Magnesium has 2 valence electron in the……shell
3. The valency of Neon is…….
4. Number of valency electronic is Cl^+ ion are…….
5. An atom has atomic mass number 23 and atomic number…….the atom has…….electron.

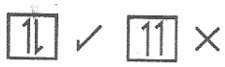
Order of filling of electron in orbitals :

There are different rules for filling electrons in subshells. They are described as follows.

- Pauli's exclusion principle
- Aufban principle.
- (n + *l*) rule
- Hund's maximum multiplicity rule.

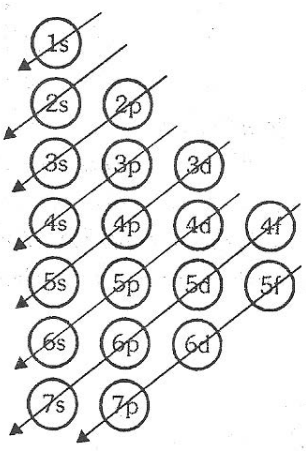
Pauli's Exclusion Principle :

- According to Pauli's exclusion principle an orbital cannot accommodate more then two electron. These two electron should have opposite spine eg.



Anfban Principle :
Aufban is German word and its meaning **building up.** Aufban principle given a sequence in which various subshell are filled up depending on the relative order of energy of various subshell. The subshell with minimum energy is filled up first, when this subshell obtained maximum on. of e^- of capacity of electron then the next sushell of higher energy starts fillings.

Simmon's Array :



Hund's Maximum Multiplicity Rule :

According to hund's rule electron are distribute among the orbital or subshell in such a way to give maximum number of unpaired of electron with parallel spin i.e. in a subshell of electrons will not start unit and unless all the orbitald of that substance will get one electron each with same spin.

For example :

$_7N$ $1s^2$ $2s^2$ $2p^3$

$_8O$ $1s^2$ $2s^2$ $2p^4$

(n + *l*) Rule: According to it the sequence is which various subshells are filled up an also be determined with the help of (n + *l*) value of a given subshell. The subshell with lowest in (n + *l*) value is filled up first when two of more subshells have same (n + *l*) value then the subshell with lowest value n is filled up first.

Sub shell	n	l	n + l	
1s	1	0	1	
2s	2	0	2	
2p	2	1	3	(1)
3s	3	0	3	(2)
3p	3	1	4	(1)
4s	4	0	4	(2)
3d	3	2	5	(1)
4p	4	1	5	(2)
5s	5	0	5	(3)
4d	4	2	6	(1)
5p	5	1	6	(2)
6s	6	0	6	(3)

Electron distribution in different orbit (shell) :

The distribution of electron into different orbits of an atom was suggested by Bohr and Bury. The following for writing the number of electron in different of energy level or shell. The maximum number of electron present in a shell is given by the formula $\mathbf{2n^2}$ Where 'n' is the orbit number or energy level index 1,2,3 Hence the maximum number of electron in different shells are as follows.

First orbit (K – shell)

$2 \times 1^2 = 2$

Second orbit (L - shell) = $2 \times 2^2 = 8$

Third orbit (M - shell) = $2 \times 3^2 = 18$

Fourth orbit (N – shell) = $2 \times 4^2 = 32$

The maximum number of electron that can be accommodated in the outermost orbit is 8.

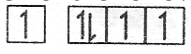
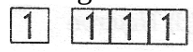
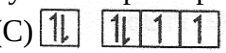
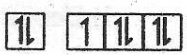
- Electron are not accommodated in a given shell. unless the inner shell filled. The is, the shell are filled in step-wise manner.

Orbitals : The three dimensional area around the nucleus of an atom where the probability of finding moving electron is maximum is called orbital.

EXERCISE

STRUCTURE FO ATOM

(A) OBJECTIVE TYPE QUESTIONS :

1. The first of quantum theory to explain in the structure of atom was made by –
   (A) Heisenberg (B) Bohr (C) Plank (D) Einstein
2. Plum-Pulding model is know as –
   (A) Rutherford Model (B) Thomson's model (C) Bohr Model (D) All the above
3. Nucleous consiste of –
   (A) Proton and electron (B) Proton and neutron (C) Neutron and electron
   (D) only neutron
4. The number of valance electron in Na is –
   (A) 1 (B) 2 (C) 3 (D) 4
5. Mass number of electron is -
   (A) Number of protons in its nucleus (B) Number of electron and protons in the atom
   (C) Number of neutrons and protons ins the nucleus (D) Number of neutrons in the nucleus
6. Electron, proton and neutron are found in atom
   (A) Electrons, proton and neutron are found in atom
   (B) Atom is inidivisible
   (C) Atom of various element have same properties
   (D) Atoms are destroyed in the chemical reaction
7. Neutron is a fundamental particle which have –
   (A) + 1 unit charge and mass (B) No charge and 1 unit mass
   (C) Have no charge and mass (D) Have – 1 unit charge and 1 unit mass
8. No. of unpaired electron in $1s^2. 2s^2.2p^4$
   (A) 4 (B) 2 (C) 0 (D) 1
9. The electron should be filled in the orbital in accordance with the increasing order of their energy. This statement is related with –
   (A) Affbau principle (B) Pauli principle (C) Hund's principle (D) Planke's rules
10. Which species does not contain neutron –
    (A) H (B) Li^{+2} (C) C (D) 0
11. Which of the following electronic configuration does not obey aufbau principle –
    (A)  2s 2p (B)  2s 2p (C)  2s 2p (D)  2s 2p
12. Atomic number of any electron –
    (A) Atomic weight divided by two (B) Number of neutron in nucleus
    (C) Nucleus weight (D) Nuclear charge
13. Lighest particle is –
    (A) Neutron (B) Electron (C) Proton (D) None of these

14. Fundamental particle of atomic nucleus is
(A) p, e^- (B) p, n, e (C) p, n (D) n,e

15. The atomic size is nearly –
(A) 10^{-10} cm (B) 10^{-6} (C) 10^{-7} m (D) 10^{-10} m

16. An atom which has a mass number of 14 or 8 neutron is –
(A) Isotope of oxygen (B) Isotope of oxygen (C) Isotope of carbon (D) Isobar of carbon

17. Electron configuration of a p in ground state is –
(A) $1s^2 2s^2 2p^6$ (B) $1s^2 2s^2 2p^6 3s^2 3p^3$ (C) $1s^2 2s^2 2p^6 3s^2 3p^2 3d^1$ (D) $1s^2 2s^2 2p^6 3s^2$

18. When a gas at reduced pressure is subjected to an electric discharge. the rays originating from the negative electrode ary –
(A) Anode rays (B) Cathode rays (C) x – rays (D) Radiation ray.

19. The maximum number of electrons that can be accommodate in the n^{th} level is –
(A) n^2 (B) $2n^2$ (C) $4n^2$ (D) n

20. Isotopes of an element are the atom which have –
(A) The same number of neutrons in their nuclei (B) The same mass number
(C) Different number of electron in their orbit (D) The same number of proton in their nuclei

21. Number of valence electron in Ar are –
(A) 8 (B) 18 (C) 19 (D) 20

22. Rutherford's alpha – particle Scattering experiment was responsible for the discovery of –
(A) Proton (B) Electron (C) Neutron (D) Atomic nucleus

23. Isotopes of element have –
(A) different chemical properties (B) different atomic
(C) The same physical properties (D) Different number of neutrons

24. Which one of the following is a correct electric configuration of calcium –
(A) 2, 8, 8, 1 (B) 2, 6, 8, 2 (C) 2, 8, 8, 2 (D) 2, 8, 2, 8,

25. Which one of the following is a correct electronic configuration of cromium-
(A) 2, 8, 8, 6 (B) 2, 8, 8, 2, 4 (C) 2, 8, 8, 1,5 (D) 2, 8, 8, 8,2,5

26. $^{35}_{17}Cl$ and $^{37}_{17}Cl$ have the same number of
(1) Electron (2) Proton (3) Neutron (4) A & C

27. $^{40}_{18}Ar$ and $^{40}_{20}Ca$ have the same number of
(1) Electron (2) Proton (3) Nucleons (4) A & C

28. The total number of neutron is zinc (z = 30) with mass number 70 is –
(1) 40 (2) 20 (3) 36 (4) 38

29. The sun of number of neutron and protons in one of the isotopes of hydrogen is –
(1) 3 (2) 2 (3) 5 (4) 6

30. Deflection back of a few particles one hitting thin foil of gold shows that –
(1) Nucleus in heavy
(2) Nucleus in small
(3) Both (1) and (2)
(4) Electron create hinderance in the movement of α - particle.

31. The number of electron is the M-shell of the element with atomic number 24 is –
(1) 24 (2) Pauli's rule (3) 13 (4) 8

32. Electronic configuration  violated

(1) Hund's rule (2) Pauli's rule (3) Aufbau rule (4) All to above

33. Number of unpaired electron in $1s^2 2s^2 2p^4$
(1) 4 (2) 2 (3) 0 (4) 1

34. Electronic configuration of Cr is –
(1) (Ne) $3s^2\ 3p^6\ 3d^4\ 4s^2$ (2) (Ne) $3s^2\ 3p^6\ 3d^5\ 4s^1$
(3) (Ne) $3s^2\ 3p^6\ 3d^3\ 4p^1$ (4) (Ne) $3s^2\ 3p^6\ 4s^1\ 4p^3$

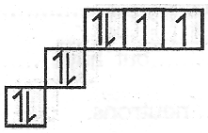
35. Which electronic configuration is most stabl
(1) $3d^2\ 45^o$ (2) $3d^o\ 4s^1$ (3) $3d^1\ 4s^0$ (4) $3d^5\ 4s^1$

36. Which rule is not followed by configuration 

(1) Hunds rule (2) Aufbau rues (3) n + *l* rules (4)All of the above

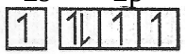
37. Difference between Cl a ato and Cl^- ion of
(1) Proton (2) Electron (3) Neutron (4)Proton and electron

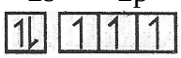
38. Which element is represented by the following electronic configuration ?

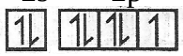


(1) Nitrogen (2) Oxygen (3) Flourine (4) Neon

39. Which of the following electronic configuration does not obey aufbau principal .

(1) 

(2) 

(3) 

(4) 

40. $18^{Ar^{40}}$, $19^{K^{40}}$, $20^{Ca^{40}}$
(A) Isotopes (2) Isobars (3) A & B both (4) None

41. Electronic configuration of Fe^{+2} is
(1) (Ar) $4s^2\ 3d^6$ (2) (Ar) $3d^6$ (3) (Ar) $4s^2 3d^4$ (4) (Ar) $4s^2\ 3d^0$

42. The charge and mass of the proton present in then nucleus of helium are respectively –
(1) +2, 4u (2) + 1, 1u (3) + 2 , 1u (4) +2, 2u

43. Which of the following is not correct observation/conclusion form Rutherford scattering experiment
(1) Nucleus is small but heavy
(2) Nucleus always carriers positive charge
(3) Atom is nearly 10^5 times greater then the size of the nucleus
(4) The number of α-particle hiting the nucleus is very large.

44. Neutron a is present in all atom except
(1) Protium (2) Deuterium (3) Tritium (4) Helium

45. A monovalent anions has 10 electron and 10 neutrons. The atomic number and mass number of the element of respectively –
(1) 10, 20 (2) 9, 18 (3) 10, 20 (4) 9, 19

46. A trivalent cation of an element contains 10 electrons. The atomic number of the element of is –
(1) 10 (2) 7 (3) 13 (4) None of these

47. Which of the following isotope is used in the treatment of blood cancer
(1) P – 32 (2) I-131 (3) Co – 60 (4) Any one of these

48. Which isotope is generally used as a nuclear fuel –
(1) U – 235 (2) Co – 60 (3) P-32 (4) lodine

49. Which isotopes is used in treatment of cancer ?
(1) Co – 60 (2) U – 235 (3) P – 32 (4) lodine

(B) FILL IN THE BLANKS :

1. Electron are……charged particle
2. The scientist who who discovered the nucleus is……
3. Neutron have mass equal to……but have……..electric charge.
4. $^{12}_{6}C$ contain……..protons and…….neurons.
5. The atomic number is equal to the number of…….protons.
6. An element has mass number 23, its atomic number is 11, the number of neutrons will equal to……..
7. Isotopes have same…….
8. Isobars have same number of……
9. The charge on the atom containing 17 protons, 18 neutron and 18 electrons is……..
10. Neutrons are not present in……..?
11. $_{17}Cl^{35}$ and $_{17}Cl^{37}$ are……..?
12. The maximum number of electron that can be present in the outermost shell an atom a is.
13. The total number of protons and neutron in the nucleus of atom is called its……

14. The fundamental particles of an tom are……and……
15. Protons were discovered by……and electron….....and neutron by…….
16. What is the velency of fluorine……..
17. Alph-particle scattering experiment was responsible for discovery of…….

(C) TRUE OF FALSE :

1. Element having electron arrangement 2, 8, 8,1,9 is Cu.
2. Element having of electronic arrangement 2, 8, 8, 1,5 in cromium.
3. In Na^+ number of e^- are more then the number of protons.
4. Isotopes of iodine is used for making tincture of iodine n medicine.
5. Neutron is sun of proton plus electron and therefore, it is neutral.
6. Isobar of and element different in the number of neutron.
7. Neutron were discovered by Hency Becquerel.
8. Helium does not neuron.
9. Hydrogen does not have neutron.
10. The valency of potassium is 2.
11. J.J. Thomson proposed that the nucleus of an atom contain only nucleons.
12. A neutron is formed by an electron and a proton combining together. There, it is neutral.
13. The mass of an electron by an electron is about $\frac{1}{2000}$ times that of proton.
14. An isotoops of iodine is used for making tincture iodine, Which is used as a medicine.

(D) MATCH THE COLUMN:

1. Match the desctription in column B with the term/statement in column A.

Column – A	**Column – B**
(a) Isobars	(1) Shell in an atom
(b) Isobars	(2) Number of + ve charge on the nucleus.
(c) Valence electron	(3) Electron present in outer most shell.
(d) Electron	(4) Negative charged particle having in elements.
(e) K, L, M, N	(5) Atoms having same atomic number but different mass number
(f) Atomic mass	(6) Same measurement but different atomic number
(g) Atomic number	(7) The number of protons and neutrons in the nucleus.

(E) VERY SHORT TYPES QUESTION :

1. How many times a proton is heavier then an electron.
2. Who was the first of discover neturons ?
3. Who was the first of composition of ${}_{8}C^{18}$
4. Give the number and atomic number of an element is 23 and 11 respectively. What is the number of nucleons present of it ?
5. Out of 0-16 and 0-18 isotopes, which has mor number of neutrons ? s
6. What determines the number of positive charge on the nucleus ?
7. Give the nuclear composition of ${}^{18}_{8}O$
8. An element has atomic number 19 and mass number 39. How many electron and protons are present in tis unipositive ion ?
9. How many electrons at the maximum can be present in the first shell.
10. The electronic configuration of Neon is ?

MATTER IN OUR SURROUDING | **ANSWER KEY**

- ***Objective type questions***

1.B	**2.**B	**3.**B	**4.**A	**5.** C	**6.**B	**7.**B	**8.**B	**9.**A	**10.**A
11.A	**12.**A	**13.**B	**14.**C	**15.** D	**16.** C	**17.** B	**18.** A	**19.** B	**20.** D
21. A	**22.** D	**23**. D	**24.** C	**25.** C	**26.** C	**27.** D	**28.** A	**29.** D	**30.** C
31. C	**32.** D	**33.** D	**34.** B	**35.** D	**36.** C	**37.** D	**38.** C	**39.** A	**40.** A
41. B	**42.** B	**43.** D	**44.** A	**45**. D	**46.** C	**47.** A	**48.** A	**49.** A	

- ***Fil in the blanks***

1. –ve	**2.** Rutherford	**3.** Proton, No	**4.** 6, 6
5. Proton	**6.** 12	7. Atomic number	**8.** Atomic mass
9.-ve	**10.** Hydrogen	**11.** Isotopes	**12.** 8 Electron
13. Atomic mass	**14.** e.p. and n	**15.** Goldstein, JJ Thomson, Chaduoick	
16. 7	**17.** Nucleus		

- ***Ture (T) False(F)***

1. F	**2.** T	**3.** F	**4.** F	**5.** T	**6.** T	**7.** F	**8.** F	**9.** T	**10.** F
11. F	**12**. T	**13.** T	**14.** F						

- ***Objective type questions***

1. (1) → e, (2) →g, (3) → c, (4) →d, (5) →b, (6) → a, (7) → f