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CHEMISTRY

Class 9th (KPK)

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Chapter # 01

Fundamentals of Chemistry
(TOPIC WISE QUESTIONS)

Q1: Discuss the History of Chemistry?

Ans: History of Chemistry:

The history of chemistry is as old as civilization it grew and flourished in the early civilization of the world. The Egyptians, The Greeks, the Romans and Muslims contributed too much, to the development of chemistry.

Derivation of word Chemistry:

The word chemistry is derived from the word "Kheem" which is the old name of Egypt, due to black colour of its soil. As the time passed the word "Keem" changed into Arabic word "Al-Kimiya" and then changed into English word "Chemistry".

Purpose of Chemisty:

The purpose of chemistry is to known about the matter, its properties and chemical changes which take place in it. In this regard men kept on learning about many things in the universe.

All these development were improved and achieved by trail and error basis and not on the basis of any systematic study.

Q2: Write a note on the Greek period.

Ans: Greek Period (500 B.C):

The Greek Philosopher were the first to develop ideas related to Chemistry. They introduce the concept of atoms, shape of atoms and chemical combination.

Belief of Greeks:

Greeks believed that all matters were derived from four elements.

i. Earth (Soil)
ii. Fire
iii. Water
iv. Air

According to them one thing or matter could be changed into another if these four elements are used in different properties.

Development of Chemistry in Greek Period:

The theories and the thoughts of the Greek philosopher prevailed upon science for longer time but chemistry could not developed during this period. Because the Greek believed in theoretical ideas not in experiments.

Q3: Write a note on Muslim Period?

Ans: The Muslims Period (600 – 1600 A.D)

The period from 600 to 1600 A.D in A.D in the history of chemistry is known as the Muslims period or Alchemist period.

This period created many talented and genius scientists who observed the matter and conduct experiments to test the observation.

Major aims of Alchemists:

The major aims of al-chemist were:

i. To change base metal into gold.
ii. To discover methods of prolong human life.

iii. To find physical evidence to support religious and philosophical belief.

Contributions:

i. The Muslim scientist discovered metals like arsenic, antimony and bismuth.
ii. They invent and performed different chemical process like sublimation, filtration, calcinations, distillation and fermentation etc.
iii. They also invent different instruments like beaker, funnels, crucibles, furnaces, retorts etc.
iv. They also describe the methods for preparation of chemicals and chemical compounds such as acid like hydrochloric acid (HCl), white lead and alcohols etc.
v. The Muslims also made drugs for various disease.
vi. They also developed methods for the extraction of metals and dying of clothes, leather and varnish making.

Hence in the view of above facts the period of practical chemistry is rightly called the period of Muslims alchemists.

Q4: Discuss the contributions of some prominent Al-Chemists in the development of Chemistry.

Ans: **Contribution of Al-Chemists:**

Muslims scientist (Al-chemist) contributed a lot of knowledge in the field of chemistry. The name and achievements of some of the prominent alchemist are given below.

JABIR IBN-E-HAYYAN (721 – 803 A.D)

Contributions:

1) Jabir ibn-e- Hayyan is generally known as the father of chemistry.
2) He was probably the first scientist who had a well-established chemical laboratory.
3) He invented experimental methods such as distillation, filtration, extraction of metals etc.
4) He prepared Hydrochloric acid, Nitric acid and white lead.

MUHAMMAD IBN-E-ZIKRIYA AL-RAZI (864 – 930 A.D)

Contributions:

1) He was a chemist, physician and philosopher.
2) He wrote 26 books but the most famous book was “Al-Asrar”. In this book, he discussed the different processes of chemistry.
3) He was the first chemist to divide the chemical compounds into four types and also divides the substances into living and non-living origin.
4) He prepared alcohol by fermentation.

AL-BERUNI (973 – 1048 A.D)

Contributions:

1) He had a sound knowledge of chemistry, chemical procedures and chemical combinations.
2) He determined the densities of different substances.
3) He also contributed in physics, mathematics, geography and history.

ABU-ALI -IBN-E-SEENA (980-1037 A.D):

Contributions:

1) He is known as the Aristotle of the Muslim World.
2) He is famous for the contribution in the field of medicines, medicinal chemistry, philosophy, mathematics and astronomy.
3) He was the first chemist who rejected the idea that any base metal could be changed into gold.

4) His books were taught in universities of Europe for centuries.

Q4: Define chemistry, state and explain the main branches of chemistry.

Ans: Chemistry:

Chemistry is the branch of science, which deals with the study of composition, structure, properties of matter, the changes occurring in matter and the laws and principles which governs these changes.

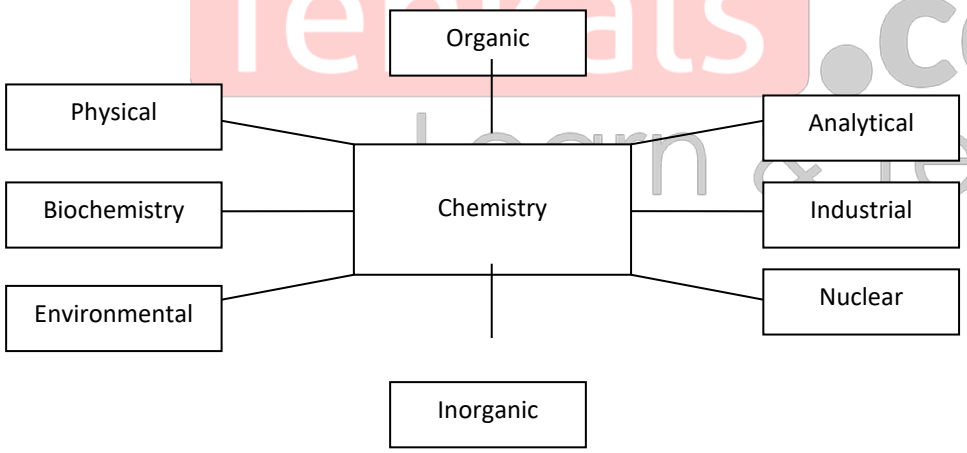
(Or)

The study of matter is called chemistry.

Branches of Chemistry:

Following are the main branches of chemistry:

i. Physical Chemistry
ii. Organic Chemistry
iii. Inorganic Chemistry
iv. Analytical Chemistry
v. Biochemistry
vi. Nuclear Chemistry
vii. Industrial Chemistry
viii. Environmental Chemistry.



i. Physical Chemistry:

The branch of chemistry which deals with the relation b/w physical properties structure, the forces and principles involved in the combination of atoms and molecules.

ii. Organic Chemistry:

The study of carbons and hydrogen containing compound called hydrocarbons and their derivative is called organic chemistry e.g. Methane, Alcohol, Petroleum products etc.

iii. Inorganic Chemistry:

The study of elements and their compound except the hydrocarbon and their derivatives is called inorganic chemistry. E.g. Fe, Cu, Zn, Pb, NaCl, $CaCo_3$ etc.

iv. Analytical Chemistry:

The study of methods and techniques used to determine the kind and quantity of various components in a given substance is called analytical chemistry.

v. Biochemistry:

The study of synthesis and decomposition of compounds and chemical reaction occurring in the living organisms, such as plants, animals and human beings is called biochemistry.

vi. Nuclear Chemistry:

The study of changes occurring in the nuclei of atoms accompanied by the emission or absorption of radiation is called nuclear chemisty.

vii. Industrial Chemistry:

The study of techniques and chemical processes used for the preparation of different industrial products like cement, glass, plastics, fertilizers etc is called industrial chemistry.

viii. Environmental Chemistry:

The study of interaction of chemical substances / processes with environment and their effects on it is called environmental chemistry. Air pollution and water pollution are the two main areas of environmental chemistry.

Q5: Define the following with examples.

(a) Element (b) Compound (c) Mixture

Ans: **Element:**

Element is a pure substance that cannot be broken down into simpler substance by ordinary physical and chemical method. An element is composed of atoms chemically and physically identical in size shape and all other properties.

Therefore element should retain their original properties. There are approximately 118 elements in which 92 are naturally occurring while the rest have been prepared artificially in laboratory.

Symbols of Elements:

In 1884, Berzelius suggested the system for representing elements symbols. The shortest name of an element is called symbol. In most cases, the first letter of name of an element is taken in capital letter as the symbol. In some cases, where the first has been already used, then the initial letters in capital together with a small any other letter is used.

Example:-

Name	**Symbol**
Boron	B
Calcium	Ca
Hydrogen	H
Magnesium	Mg

Some element's symbol starts with their Latin or Greek language name.

Examples:

1	Copper	Cuprum	Cu
2	Gold	Aurum	Au
3	Mercury	Hydragyrum	Hg
4	Tungsten	Wolfram	W

Compound:

Compounds are pure substance which is made up of two or more elements chemically combined together in a definite proportion by mass.

All the compounds which are formed as a result of chemical combination must have completely different physical and chemical properties from the elements. A compound is a pure substance and the components cannot be separated by physical method. Chemical process are necessary to separates its components and the product formed will lose its original shape and properties.

Fixed ratio by mass of a compound is basis component in compound. For example water (H_2O) is a compound. The ratio of hydrogen and Oxygen is always 2:1. Changing this ratio will give a different compound. For example add one more oxygen the ratio becomes 2:2 and the resulting is Hydrogen Peroxide (H_2O_2).

Formula of Compound:

The composition of a compound is represented by a chemical formula. A formula shows the symbols of the elements of which compound is made and their combining ratio to each other.

Example:

Water = H_2O

Benzene = C_6H_6

Sucrose = $C_{22}H_{22}O_{22}$

Mixture:

Mixture is an impure substance containing two or more than two elements or compounds physically combined together having no fixed ratio.

A mixture is obtained by mixing two or more elements or compounds in any ratio and the constituent of mixture retain their original properties. The constituent of mixture can easily be separated from each other by various physical methods e.g. filtration, distillation, sublimation, crystallization etc.

Example:

NaCL in water

Iron in Sulphur

Types of Mixture:

There are two types of mixture.

1. Homogenous mixture
2. Heterogeneous mixture

Homogenous Mixture:

Homo means “same” and generous mean “form” so mixture having uniform composition, throughout their mass is called homogenous mixture e.g. Air, Salt in water, Sugar in water. Etc.

Heterogeneous Mixture:

Hetero means “different” and generous means “form” so mixture having different and visible composition and the component can be seen with naked eyes is called heterogeneous mixture e.g. Ice-cream, cooking meal, muddy water etc.

Q6: Write note on the following.

a. Relative atomic mass b. Atomic mass unit c. Average atomic mass

Ans: a. Relative atomic mass:

Definition: The relative atomic masses of an element is the mass of an atom of an element relative to the mass $1/12^{th}$ mass of carbon-12.

Explanation:

Atom is extremely the smallest particle of matter. It is impossible and find out the accurate and exact mass of an atom of element by using a very sensitive or accurate balance. It is therefore preferable to measure the atomic masses of an atom by comparing masses of an atom with the mass of standard atom. The standard chosen for this purpose is the lightest isotope of carbon, which has a mass exactly 12 a.m.u.

Example:

One atom of H = 1.008 a.m.u
One atom of He = 4.00 a.m.u
One atom of Na = 23 a.m.u

b. Atomic mass unit:

The mass equal to $1/12^{th}$ of the mass of one carbon 12 atom is called atomic mass unit. The mass of 1 atom of C_{12} = 12 a.m.u.
1 mol of C_{12} = 12g
1 mol of C_{12} = 6.023×10^{23}
1 mol of C_{12} = 12g = 6.023×10^{23}
1/12 x mass of one atom of C_{12} taken exactly as 12 = 1 a.m.u
1 amu = 1/12 g mol / 6.023×10^{23} mol
1 amu = 1/12 x 1.99×10^{23} = 1.66×10^{24} g = 1.66×10^{-27} kg
The mass of one proton or one neutron is equal to one amu.

c. Average Atomic mass:

Average atomic mass is the weighted average of the atomic masses of the naturally occurring of the isotopes of an element.

The atomic masses are rarely found to be exactly whole numbers. This is because most elements are composed of two or more naturally occurring isotopes and the relative atomic mass takes into account the abundance of each isotope.

Average atomic mass = $\frac{atomic\ mass\ of\ 1st\ isotope\ x\ its\ \%\ abundace}{100} + \frac{atomic\ mass\ of\ 2nd\ isotope\ its\ \%age\ abundace}{100}$

Q7: Define (1) Formula unit (2) chemical species (3) ions (4) molecular ions (5) free radical.

Ans: 1. Formula Unit:

The simplest ratio between the ions of an ionic compound which are present in giant structure is
called formula unit. OR
Formula unit is the smallest repeating unit of an ionic compound showing the simple ratio between the ions.

For example. The simplest relation b/w Na and Cl ions in the whole crystal lattice of NaCl is 1:1 so the formula unit of sodium chloride is NaCl. Similarity KCl is the formula unit of potassium Chloride.

2. Chemical Species:

An atom or group of atoms which can take part in a chemical reaction is called chemical species. A chemical species may be neutral or it may carry a charge. Such chemical species are classified into ions, free radicals and molecular ions.

3. Ions:

Electrically charged particles are ions. (OR)

The particles that carries a positive or negative charge by the loss or gain of electrons is also called ions.

There are two types of ions.

i. Cation:

The positively charged ions that are formed by the gain of electrons is called cation. Positive ion always have less number of electrons than number of protons.

Examples:-

Na^+, K^+, Ca^{2+}, Mg^{2+} etc.

ii. Anion:

The negatively charged ions that are formed by the gain of electron is called anion. Negative ions have always have more number of electrons than number of protons.

Example:-

F^-, Cl^-, O2, etc.

4. Molecular Ions:

Electrically charged molecules formed by the lost or gain of electrons is called molecular ions. Positive molecular ions are formed by the loss of electrons from neutral molecules and negative molecular ions are formed by the gain of electrons from neutral molecules. Positive molecular ions are called molecular cation.

Example:-

O_2^+, CO^+, CH_4^+, C_2Hs^+, NH_4^+, H_3O^+ etc.

Negative molecular ions are called molecular anions.

Examples:-

SO_4^{-2}, CH_3COO^-, OH^-, CO_3^{-3} etc.

5. Free Radical:

An atom or molecule having single (an unpaired) electron in the outer shell with no charge is called a free radical.

Explanation:-

Free radicals are highly reactive species formed by the bond breaking (hemolytic fission) of stable molecules in such a manner that the resulting reactive specie get separated with unpaired electron. A free radical has no change and are represented by dot(.) which is written on the upper side of an atom or molecule. A free radical is reactive specie which does not exist independently E.g H **,** Cl, CH_3.

Example:- During the reaction b/w chlorine molecule (Cl_2) and methane (CH_4**)** in the presence of diffused sunlight the chlorine molecules first form chlorine free radical which then ultimately result in a chain reactions.

Cl_2 sunlight 2CL (Chlorine free radical)

The chlorine free radical (Cl) react with CH_4 to form methyl free radical

CH_4 + Cl ➔ CH_3 + (Methyl free radical) + cl

The CH_3 react with another Cl_2 molecule forms chloromethane and Cl

$CH_3 + Cl_2$ $CH_3 – CL + CL$

Q8: What is difference between an atom and ion?

Ans: Difference between an atom and ion:

ATOM	ION
An atom is the smallest particle of an element that can take part in a Chemical reaction.	The particle that carries a positive or negative charge by the loss or gain of electrons is also called ions.
It is a neutral. It has same number of protons and electrons.	It has a net charge (either negative or positive) on it. The number of protons is different than electrons.
It is the smallest particle of an element.	It is the smallest unit of ionic compound.
It can or cannot exist independently.	It cannot exist independently.
Example He, Na, Fe, Cl	Examples Na^+, Fe^{+2}, Cl

Q9: Define molecule and there types:

Ans: **Molecule:**

The smallest particle of an element or compound which can exist independently and do not take part in chemical reaction is called molecules.

A molecule may be Mono atomic and poly atomic.

Mono Atomic Molecules:

(Mono=one) This type of molecule is made up of only one atom, Examples of such molecules are the molecules of noble gases such as He, Ne, Ar, Kr, Xe, and Rn.

Polyatomic molecules (Poly=many_

The molecules made up of more than one atom are termed as poly atomic molecules. This may be diatomic which is made up of two atoms, triatomic made up of three atoms and tetra atomic made up of four atoms.

Examples:-

Di atomic = CO_2, CO

Tri atomic = CO_2, H_2O

Tetra atomic = NH_3

Penta Atomic = CH_4

Q10: Define gram atomic mass, gram molecular mass and gram formula mass of the element

and compounds give at least two examples in each case.

Ans: **Gram Atomic Mass:**

When atomic mass of an atom of element expressed in gram is called gram atomic mass. It is also called gram atomic mass.

Examples:

Gram atomic mass of H atom = 1.008 gram

Gram atomic mass of O atom = 16 gram
Gram atomic mass of C atom = 12 gram

Gram Molecular Mass:

When molecular mass of molecules of covalent compounds are expressed in grams is called gram molecular mass. It is also called gram molecules.

Examples:

Gram molecular mass of H_2O = 2 x 1 + 1 x 16 = 18 gram
Gram molecular mass of CO_2 = 1 x 12 + 16 x 2 = 44 gram
Gram molecular mass of CH_4 = 1 x 12 + 1 x 4 = 16 gram

Gram formula Mass:

When molecular mass of all the ionic compounds of all the ions present in a formula unit expressed in gram is called gram formula mass. It is also called gram formula.

Examples:

Gram formula mass of Nacl = 23 + 35.5 = 58.5 gram
Gram formula mass of $CaCl_2$ = 40 + 2 x 35.5 = 111 gram
Gram formula mass of KCL = 39 + 35.5 = 74.5 gram

Chapter # 01

Fundamentals of Chemistry

(LONG QUESTION ANSWER EXERCISE)

Q1. State and explain with examples.

a. The empirical formula of compound

b. The molecular formula of compound

Ans: **(a) The empirical formula of compound:**

The formula which shows the simplest ratio b/w the atoms of different elements present in one molecules of a compound is called empirical formula. It is also called simple formula.

Explanation:

Empirical formula does not tell us about actual numbers of atoms present in the compound.
E.g. Benzene has a formula C_6H_6 the simplest ratio b/w carbon and hydrogen is 1:1. Therefore the empirical formula of benzene is CH. Some other examples of empirical formula are as follows:

Name	FORMULA	EMPIRICAL FORMULA
Glucose	$C_6H_{12}O_6$	CH_2O
Acetic Acid	$C_2H_4O_2$	CH_2O
Hydrogen peroxide	H_2O_2	HO
Acetylene	C_2H_2	CH

Sometime different compounds have some empirical formula e.g. Benzene (C_6H_6) and acetylene (C_2H_2) have same empirical formula CH. Similarly all the ionic compounds are also represented by their empirical formula which shows the simplest ratio between them.

e.g. NaCl contain NA^+ and Cl^+ ion in a ratio of 1:1 $CaCl_2$ have a ratio 1:2.

(b) Molecular Formula:

The formula which shows the actual and exact number of atoms of different elements present in one molecule of a compound is called molecular formula e.g. molecular formula of a glucose is $C_6H_{12}O_6$, acetic acid is CH_3COOH.

Molecular formula of a compound can be find out by using the following formula.

Molecular formula = n x empirical formula

Where, $n = \frac{molecular\ mass}{emperical\ formula\ mass}$

Q2. What do you understand by the terms mole and Avogadro's number. Give examples.

Ans: **Mole:**

Atomic mass, molecular mass or formula mass of a substance expressed in grams is called the mole. (OR)

The quantity of a substance containing Avogadro's number of particles (atoms, ions or molecules) is called mole.

It is the basic SI unit of quantity of matter.

Examples:-

1 mole of NaCl = 58.5 gm
1 mole of Na = 23 gm
1 mole of O = 16 gm
1 mole of O_2 = 32 gm

Relation b/w number of moles and amount of substance:

If mass in grams of a substance and molecular mass is given, we can calculate the number of moles by the following formula:

Moles = $\frac{Mass\ in\ gm}{Atom\ /\ Molecular\ mass}$

Avogadro's number (N_A):

The number of particles (atoms, ions or molecules) present in one mole of a substance is called Avogadro's number. (OR)

The number of atoms, ions or molecules which correspond to atomic mass, molecular mass or formula mass of a substance is also known as Avogadro's number. It is a constant value and is equal to 6.023×10^{23}. This number was determined by an Italian Scientist, Amado Avogadro and its called Avogadro's number represented by N_A.

Examples:-

1 mole of H = 1.008 gm = 6.023×10^{23} atoms
1mole of Na = 23 gm = 6.023×10^{23} atoms
1 mole of H_2O = 18gm = 6.023×10^{23} molecules
1 mole of CO_2 = 44gm = 6.023×10^{23} molecules

Mathematically:

$N_A = \frac{No.of\ particles}{No.of\ moles}$

Q3(a) Compare and contrast a mixture and compound. Give examples of each of them.
(b) How will you classify molecules? Support your answer with at least two example of each.

Ans(a)

COMPOUND	**MIXTURE**
It is formed by chemical combination of atoms.	It is formed by physical combination of atoms.
The constituents lose their original properties.	The constituents retain their original properties.
Compounds always had fixed composition.	Mixture does not have fixed composition by mass.
The components of the compound cannot be separated by physical methods.	The component of the mixture can be separated by physical methods.
Every compound is represented by its chemical formula.	It consist of two or more components and does not have a chemical formula.
Compound have homogenous composition.	Mixture may be homogenous or heterogeneous in composition.
Compound has sharp and fixed melting point.	Mixture does not have sharp and fixed melting point.
Examples Sodium Chloride, Ethyl Alcohol, Hydrochloric acid, Distilled water	Examples Air, Rock, Ice Cream Muddy water, Mineral water, Solution

(b): Molecules:

The smallest particle of matter which can exist free in nature.

A molecule is formed by the chemical combination of atoms. It is the smallest unit of substance. It may be composed of like or unlike atoms. It show all the properties of that particle substances.

Example: H_2O_2, H_2O etc.

Types of molecules:

1. On the basis on number of atoms:

i. Monoatomic Molecule: (Mono = One)

Monoatomic molecule are those molecules which are made of only one atom.
For example, the inert gases He, Ne, Ar etc.
ii. Diatomic Molecule: (di = two)
Diatomic molecules are those molecules which are made of two atoms.
For example: H_2, O_2, HCl etc.
iii. Triatomic Molecule: (tri = three)
Triatomic molecule are those molecules which are made of three atoms.
Fro example: $H2_O$, CO_2, O_3 etc.
iv. Polyatomic Molecule: (poly = many)
Polyatomic molecule are those molecules which are made of three atoms.
For example: H_2SO_4, $C_{12}H_{22}O_{11}$, S_8 etc.
2. On the basis of type of atoms:

i. Homo-atomic Molecule: (Homo means same)

When a molecules which consists of same atoms of the element, it is called homo-atomic molecules. They are also called homo-nuclear molecule. The homo atomic molecules are diatomic and triatomic in nature:

Example:-

H_2, N_2, Fe_2, Cl_2, O_3, etc.

ii. Hetero-atomic Molecules: (Hetero means different)

When a molecules which consists of atoms of the different elements, it is called heteratomic molecules. They are also called hetero-nuclear molecule. The hetero atomic molecules may be triatomic or polyatomic in nature.

Example:- H_2O, CO_2, HNO_3, H_2SO_4, etc.

Q4. (a) What is molecular mass of a compound? How will you differentiate it from formula mass?

Ans. (a) Molecular Mass: The sum of the atomic masses of all the atoms of an element present in one molecule is called molecular mass. (OR)
The mass of a molecule of a compound relative to the mass of lightest isotopes of carbon taken as 12 a.m.u is also called molecular mass.

Example:
Molecular mass of O = 32 + 16 x 2 = 64 a.m.u
Molecular mass of CO_2 = 12 + 1 x 16 = 44 a.m.u
Molecular mass of H_2S = 1 x 2 + 32 = 34 a.m.u

Formula Mass: The sum of the masses of all the ions present in a formula unit of an ionic compound is called formula mass. (OR)
The mass of a formula unit of an ionic compound relative to the mass of lightest isotopes of carbon taken as 12 a.m.u is also called formula mass.

Example
Formula mass of NaCl = 23 + 35.5 = 58.5 a.m.u
Formula mass of $CaCl_2$ = 40 + 35.5 x 2 = 111 a.m.u

(b) Calculate the molecular mass or formula mass, as the case may be the following compounds in a.m.u.

Ans. **i. Benzene (C_6H_6):**

C = 6 x 12 = 72

$H = 6\ x\ 1 = 6$

78 $a.m.u$

ii. Ethane (C_2H_6):

C = 2 x 12 = 24

$H = 6\ x\ 1 = 6$

30 $a.m.u$

iii. Aluminium Chloride ($AlCl_3$):

Al = 1 x 27 = 27

Cl = 3 x 35.5 = 106.5

133.5 a.m.u

iv. Iron Oxide (Fe_2O_3):

Fe = 2 x 56 = 112

O = 3 x 16 = 48

160 a.m.u

Q5. (a) Find out the number of proton, electron and neutrons in the following elements.

Ag, Na, Fe, Ar, Pb, U

Ans: (a) As No. of P = No. of e.

No. of neutrons = A – Z

Element	No of e	No of P	Non of n^0 = A – Z
Ag	47	47	107 – 47 = 60
Na	11	11	22
Fe	26	26	30
Ar	18	18	22
Pb	82	82	125
O	92	92	146

Q5. (b) Complete the following table.

Ans. (b)

	Symbol	Atomic No.	Number of Protons	No. of electrons
a.	K	19	19	19
b.	O	8	8	8
c.	P	15	15	15
d.	Ca	20	20	20
f.	Cl	17	17	17

Chapter # 01

Fundamentals of Chemistry
(SHORT QUESTION ANSWER EXCERCISE)

Q1: How many electron are present in each of the following?

a. HF and Hf **b. Co and CO**

c. Si and SiO_2 **d. $PoCl_2$ and $POCl_3$**

Ans: a. HF = two elements (Hydrogen and Flourine). Hf = one element (Hafnium)

b. Co = one element (Cobalt) CO = Two elements (Carbon and Oxygen)

c. Si = One element (Silicon)

SiO_2 = Two element (one atom of Silicon and two atoms of Oxygen).

d. $PoCl_2$ = Two elements (one atom of Polonium and two atoms of Chlorine)

$POCl_3$ = Three elements (one atom of Phosphorus, one atom of oxygen and three atoms of chlorine.

Q2: Cm is the chemical symbol for Curium, named after the famous scientist Madam Curie.

Why Wasn't the symbol C, Cu or Cr used?

Ans: Curium is the radioactive element named after Madam Curie was discovered by T Glen Seaborg in 1945. Its symbol is Cm. Its atomic number is 96 and present in actinide series in periodic table. There are two reasons for using Cm symbol for curium istead of C, Cu or Cr.

Reason i:

These symbols were already used i.e. C for Carbon, Cu or Copper and Cr for Chromium.

Reason ii:

These element were discovered before Curium.

Q3: What is atomic number? How of an element does it differ from mass number?

Ans: Differences between atomic number and mass number:

Atomic Number	**Mass Number**
The total number of protons present in the nucleus of an atom is called atomic number. OR The number of electrons present in various shells of an atom is called atomic number.	The sum of protons and neutrons present in nucleus of an atom is called mass number.
It is also known as charge number.	It is also known as nucleon number.
It is represented by "Z".	It is represented by "A"
Atomic number = No. of Protons or number of Electrons.	Mass Number = No. of Protons + No. of Neutrons.
Example	Examples

Hydrogen = Z = 1	Hydrogen = A = 1
Carbon = Z = 6	Carbon = A = 12
Oxygen = Z = 8	Oxygen = A = 16

Q4: Student often mix up the following elements. Give the name for each element.

a. Mg and Mn **b. K and P** **c. Na and S** **d. Cu and Co**

Ans: a. Mg = Magnesium Mn = Manganese
b. K = Pottasium P = Phosphorus
c. Na = Sodium S = Sulphur
d. Cu = Copper Co = Cobalt

Q5 .a. Classify the following molecules as monoatomic, diatomic, triatomic and polyatomic molecules. N_2O, N_2, S_8, He, HCl, CO_2, Ar, H2, H_2SO_4, $C_6H_{12}O_6$.

Ans:

Monoatomic Molecule	**Diatomic Molecule**	**Triatomic Molecule**	**Poly atomic Molecule**
He	N_2	H_2O	S_8
Ar	HCl	CO_2	H_2SO_4
			$C_6 H_{12}O_6$

Q5 .b. Classify the following as cation, anion, molecular ion, free radical and molecule: CH^+, O^{-2}, CH_3, CO+, CO_2, Cl-, Mg^{+2}, $Co3^{-2}$, O_2, Na+, $C_2H_5O^{-1}$, H_2O, Cl_2.

Ans:

Cation	Anion	Molecular ion	Free Radical	Molecule
Mg^{+2}	O^{-2}	$C_2H_5O^{-1}$	CH_3	CO_2
Na^+	Cl-	CH^+		O_2
		CO^+		H_2O
		CO_3^{-2}		Cl_2

Q6. Calculate the number of moles of butane, C4H10 in 151g of butane (Atomic masses of
C = 12 amu and H=1 amu).

Ans: Given Data:
Mass in grams = 151g
Molecular mass of butane = C_4H_{10} = (12 x 4) + (1x10) = 48 + 10 = 58 amu
Required Data:
No. of moles = ?
According to formula:
No. of moles = $\frac{mass\ in grams}{molecular\ mass}$

$= \frac{151}{58}$

No. of moles = 2.63 mol

Q7. What is the mass of 5 moles of ice? (Atomic masses of H = 1 amu and O = 16 amu)

Ans: Given Data:

No. of moles = 5 mol

Molecular mass of ice (H_2O) = (2 x 1) + (1 x 16) = 2 + 16 = 18 amu

Required Data:

Mass in grams = ?

According to formula:

$$\text{No. of Moles} = \frac{mass\ in\ grams}{molecular\ mass}$$

Rearranging the Formula:

Mass in grams = No. of moles x molecular mass

5 mol x 18 amu

Mass in grams = 90g.

Q8: Calculate the number of molecules in 6.50 mol of CH_4 (Methane).

Ans: Given Data:

No. of moles = 6.5 mol

Avogadro's number = $N_A = 6.023 \times 10^{23}$

According to formula:

$$\text{No. of moles} = \frac{No.of\ molecules}{NA}$$

Rearranging the Formula:

No. of molecules = No. of moles x N_A

$= 6.50 \times 6.023 \times 10^{23}$

$= 39.14 \times 6.023 \times 10^{23}$

$= 3.914 \times 10^{23+1}$

No. of molecules = 3.914×10^{24} molecules

Q9. Calculate the average atomic mass of Lithium for following data.

Isotopes	Natural abundance	Relative atomic masses
^{6}Li	7.5%	6.0151
^{7}Li	92.5%	7.0160

Ans: Given Data:

Relative atomic mass of ^{5}Li = 6.0151

Natural abundance of ^{6}Li = 7.5%

Relative atomic mass of ^{7}Li = 7.0160

Natural abundance of ^{7}Li = 92.5%

Required Data

Average Atomic mass = ?

According to formula:

$$\text{Average atomic mass} = \frac{(R.At\ Mass\ 6Li\ x\ \%age) + (R.At\ Mass\ 7\ Li \times \%age}{100}$$

$= \frac{(6.0151 \times 7.51 + (7.0160 \times 92.5)}{100}$

$= \frac{(45.38) + (648.98)}{100}$

$= \frac{694.36}{100}$

= Average atomic mass of Lithium = 6.94 amu

Q10. Calculate the mass of 6.68 x 10^{23} molecule of PCL_3.

Ans: Given Data:

No. of molecules = 6.68 x 10^{23}

Avogadro's number = N_A = 6.023 x 10^{23}

Molecular mass of PCl_3 = (1x30.97) + (3x35.5)

= 30.97 + 106.5 = 137.47 amu

Required Data:

Mass in grams = ?

First calculate no. of moles by following formular

No. of moles = $\frac{No.of\ molecules}{N_A}$ = 6.68 x 10^{23} / 6.023 x 10^{23} No. of moles = 1.10 mol

Now calculate mass in grams by following formula: No. of moles = $\frac{mass\ in\ grams}{molecular\ mass}$

Rearranging the formula:

Mass in grams = No. of moles x molecular mass

1.109 x 137.47

Mass in grams = 151.62 g.