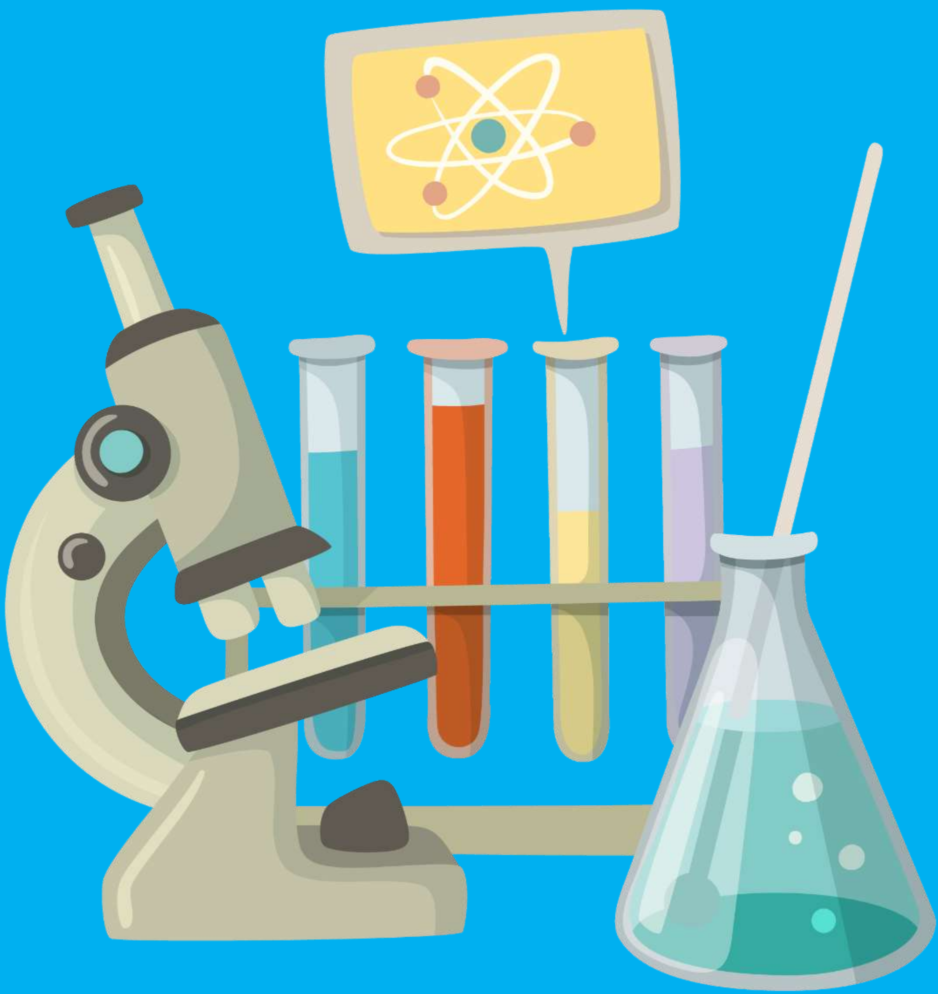
1. SOME BASIC CONCEPTS OF CHEMISTRY



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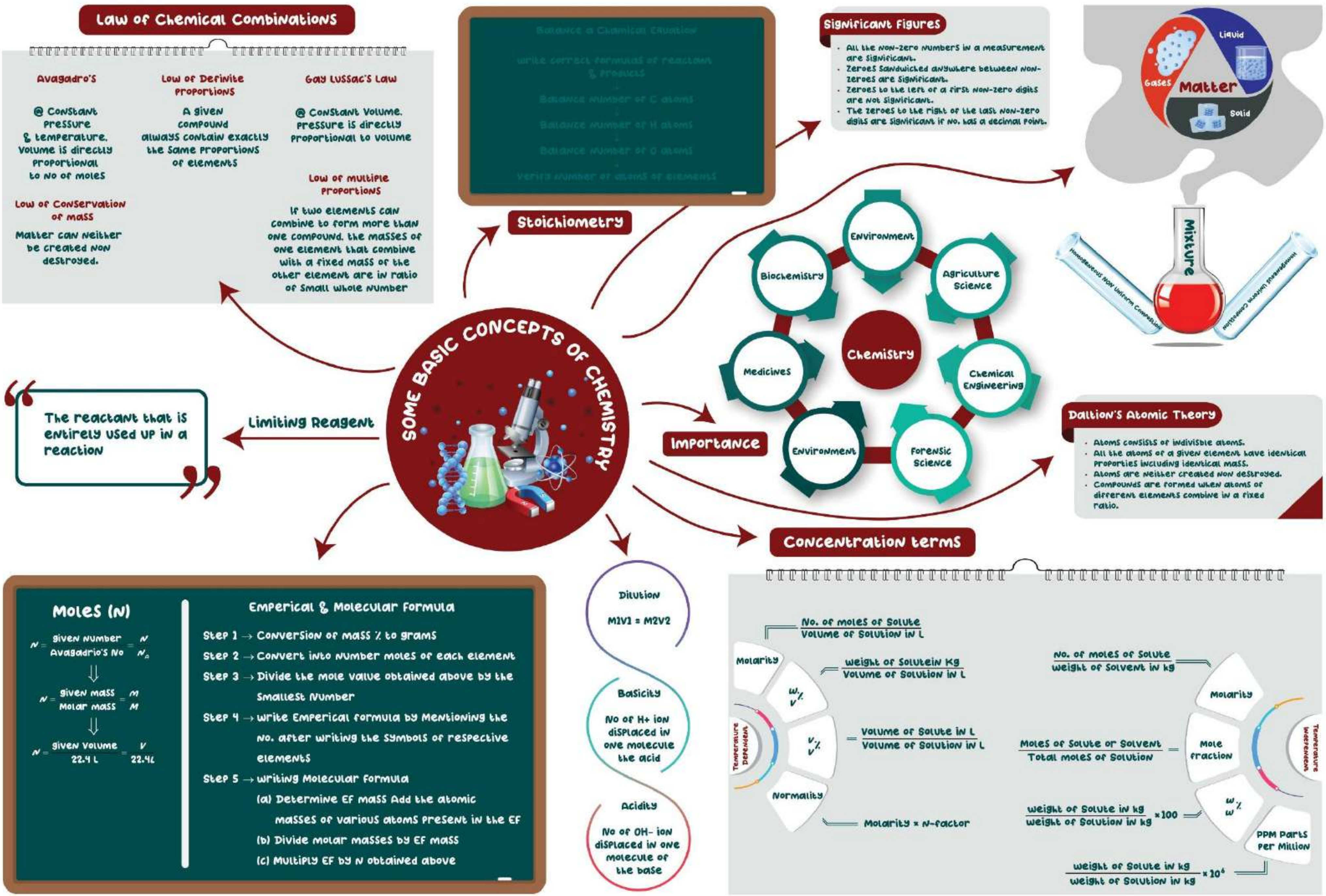


Introduction:

Chemistry is the science of molecules and their transformations which deals with the study of matter, its composition, the changes that matter undergoes and the relation between changes in composition and changes in energy. Chemistry plays an important role in meeting human needs for food, health care products.

Branches of Chemistry:

- **Organic Chemistry**- This branch deals with study of carbon compounds especially hydrocarbons and their derivatives.
- **Inorganic Chemistry**- This branch deals with the study of compounds of all other elements except carbon. It largely concerns itself with the study of minerals found in the Earth's crust.
- **Physical Chemistry**- The explanation of fundamental principles governing various chemical phenomena is the main concern of this branch. It is basically concerned with laws and theories of the different branches of chemistry.
- **Industrial Chemistry**- The chemistry involved in industrial processes is studied under this branch. Analytical Chemistry-This branch deals with the qualitative and quantitative analysis of various substances.
- **Biochemistry**- This branch deals with the chemical changes going on in the bodies of living organisms; plants and animals.
- **Nuclear Chemistry**- Nuclear reactions, such as nuclear fission, nuclear fusion, transmutation processes etc. are studied under this branch.

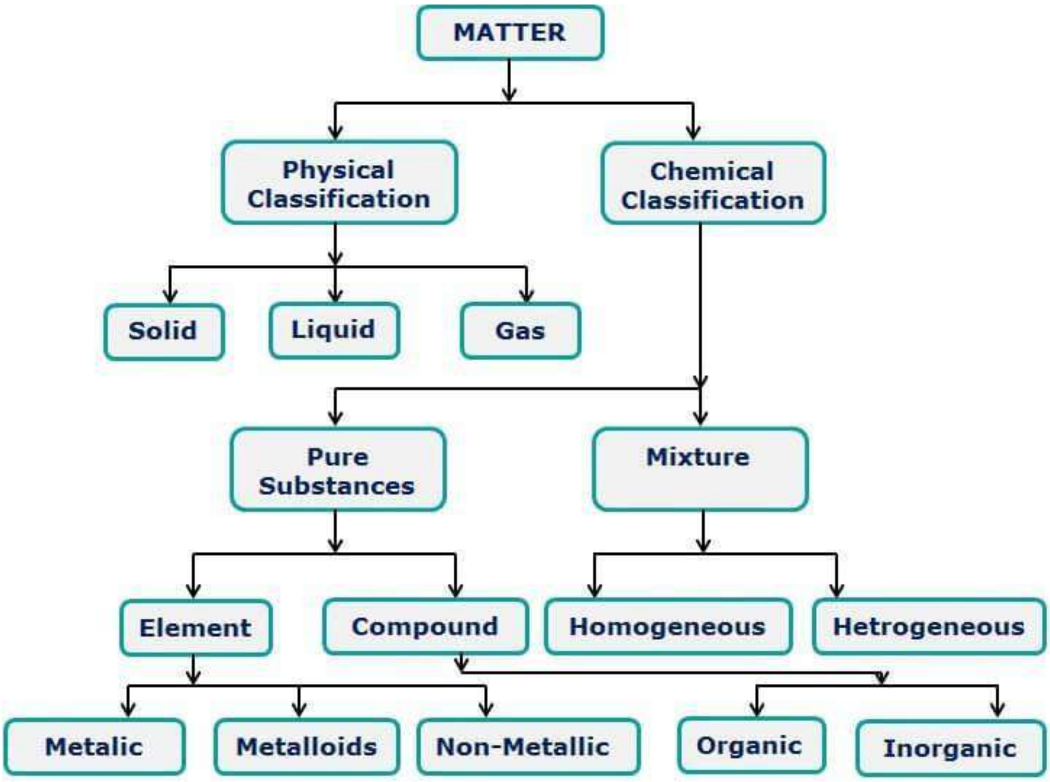
Importance of Chemistry:

Chemistry plays a central role in science and is often intertwined with other branches of science. Principles of chemistry are applicable in diverse areas, such as weather patterns, functioning of brain and operation of a computer, production in chemical industries, manufacturing fertilisers, alkalis, acids, salts, dyes, polymers, drugs, soaps, detergents, metals, alloys, etc., including new material.

Chemistry contributes in a big way to the national economy. It also plays an important role in meeting human needs for food, healthcare products and other material aimed at improving the quality of life.

Matter

Matter is any thing that occupies space, has mass, offer resistance and can be perceived of directly by our senses. For example, book, pen, pencil, water, air, all living beings, etc.



Element

Element is the purest form of matter. It is made up of only one type of atoms, ex.- carbon, iron, copper, oxygen etc.

Compound

Compound is the substance which is made up of two or more elements combined together in a fixed ratio by their weight e.g., carbon dioxide.

Mixture

Mixture is the substance which is made up of two or more substances in any ratio. e.g.,

Sugar + Water, Sodium Chloride + Water, Sand + Water

On the basis of composition, mixtures are of following type:

- **Homogeneous mixture**: The mixture which has uniform composition through out e.g., sugar solution.
- **Heterogeneous mixture**: The mixtures which do not have uniform composition through out. e.g. sand in water.

Atom

Atom is the smallest particle which may or may not exist free but takes part in chemical reaction. Atom word means not to be cut. Ex- H, Na, O etc.

International System of Units (S.I.)

The international system of units (in French Le Systeme International d' Unités - abbreviated as SI) was established in 1960 by the 11th general conference on weights and measures. SI system is a modification of metric system and has seven base units pertaining to the seven fundamental scientific quantities.

Base Physical Quantity	Symbol for Quantity	Name of SI Unit	Symbol for SI Unit
Length	l	metre	m
Mass	m	kilogram	kg
Time	t	second	s
Electric current	I	ampere	A
Thermodynamic temperature	T	kelvin	K
Amount of substance	n	mole	mol
Luminous intensity	I_v	candela	cd

Prefixes in SI system

Multiple	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-24}	yocto	y	10	deca	da
10^{-21}	zepto	z	10^{2}	hecto	h
10^{-18}	atto	a	10^{3}	kilo	k
10^{-15}	femto	f	10^{6}	mega	M
10^{-12}	pico	p	10^{9}	giga	G
10^{-9}	nano	n	10^{12}	tera	T
10^{-6}	micro	µ	10^{15}	peta	P
10^{-3}	milli	m	10^{18}	exa	E
10^{-2}	centi	c	10^{21}	zeta	Z
10^{-1}	deci	d	10^{24}	yotta	Y
10	deca	da			

Definition of SI Base Units

- **Metre**: The metre is the length of the path travelled by light in vacuum during a time interval of 1/(299792458) of a second.

- **Kilogram**: The kilogram is the unit of mass; it is equal to the mass of the international prototype of the kilogram.
- **Second**: The second is the duration of 9192631770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium-133 atom.
- **Ampere**: The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length.
- **Kelvin**: The kelvin, unit of thermodynamic temperature, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.
- **Mole**: The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12; its symbol is "mol".
- **Candela**: The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

Uncertainty in Measurement

All scientific measurements involve certain degree of error or uncertainty. Scientific notations, significant figures and dimensional analysis help us in many ways in presenting of data and theoretical calculations.

Scientific Notation

It is an exponential notation in which any number can be represented in the form $N \times 10^n$ where n is an exponent having positive or negative values and N can vary between 1 to 10. Thus, 232.508 can be written as 2.32508×10^2 in scientific notation.

Precision and Accuracy

Precision refers to the closeness of various measurements for the same quantity. However, accuracy is the agreement of a particular value to the true value of the result. Let the true value of a quantity is 3.9 and its measurements taken by two boys are 3.6 and 3.8. Here 3.8 is more accurate as it is closer to the true value. Similarly 3.85 is more precise than 3.9.

Significant Figures

i. The total number of digits in measuring of any physical quantity with certainty is called significant figures. There are certain rules for determining the number of significant figures.

ii. All digits are significant except zero in the beginning of a number. For example, in

285 cm, there are three significant figures.

iii. Zeros to the left of the first non-zero digit are not significant if such zeros follow the decimal point. For example, 0.03 has one significant figure.

iv. Zeros to the right of the decimal point are significant. For example, 0.200 g has three significant figures.

v. Zeros between two non-zero digits are significant. Thus, 2.005 has four significant figures.

vi. Counting the numbers of object, for example, 2 balls or 20 eggs, have infinite significant figures as these are exact numbers and can be represented by writing infinite number of zeroes after placing a decimal i.e., 2 = 2.000000 or 20 = 20.000000.

Notes: In additions or subtractions, the final result should be reported to the same number of decimal places as that of the term with the least number of decimal places.

Laws of Chemical Combination

All chemical reactions take place according to certain laws. These laws are known as laws of **chemical combination**.

i. **Law of conservation of mass**: This law was put forth by Antoine Lavoisier in 1789. According to this, "It states that the total mass of reactants is equal to the total mass of the products".

ii. **Law of constant composition:** This law was given by, a French chemist, Joseph Proust. This law states that a chemical compound is always found to be made of same elements combined together in fixed proportion by weight. CO_2 can be prepared by number of methods but always 12g carbon react with 32g of oxygen.

iii. **Law of multiple proportions**: This law was proposed by Dalton in 1803. According to this law, When two elements combine to form two or more chemical compounds, then weight of one of the element which combines with a fixed weight of the other, bears a simple whole number ratio to one another. This is called the law of multiple proportions.
For example, The ratio of masses of oxygen in CO and CO_2 for fixed mass of carbon (12) is 16 : 32 = 1 : 2.

iv. **Law of reciprocal proportions**: It states that the ratio of weights of two elements A and B, which combine separately with the fixed weight of a third element C is either same or some simple whole number of the ratio of weights in which A and B combine directly with each other.
For example, ratio of masses of carbon and sulphur which combine with the fixed mass (32 parts) of oxygen is 12 : 32 or 3 : 8.

v. **Gay Lussac's Law of Gaseous Volumes**: This law was given by **Gay Lussac** in 1808. He observed that when gases combine or are produced in a chemical reaction they do so in a simple ratio by volume, provided all gases are at the same temperature and pressure.

For example, One volume of hydrogen and one volume of chlorine always combine to form two volumes of HCl gas.

vi. **Avogadro's Law**: In 1811, Avogadro proposed that equal volumes of all gases at the same temperature and pressure should contain equal number of molecules.

Dalton's Atomic Theory

John Dalton in 1808 published "A New System of Chemical Philosophy" in which he proposed atomic theory of matter. The main points of Dalton's atomic theory are as follows:

i. Matter is made up of extremely small, indivisible particles called atoms.

ii. Atoms of a given element are identical in all respect, i.e., they possess same size, shape, mass, chemical properties etc.

iii. Atoms of different elements are different in all respects, i.e., they possess different sizes, shapes, masses, chemical properties etc.

iv. Atoms of different elements may combine with each other in a fixed, simple, whole number ratio to form compounds.

v. Atoms can neither be created nor destroyed in a chemical reaction. Dalton's theory could explain the laws of chemical combination.

Atomic Mass and Molecular Mass

a) Atomic Mass: Atomic mass can be defined as a mass of a single atom which is measured in **atomic mass unit** (amu) or **unified mass** (u) where,

1 a.m.u. = $\frac{1}{12}$ **th** of the mass of one C-12 atom

b) Molecular Mass: Molecular mass is the sum of atomic masses of the elements present in a molecule. It is obtained by multiplying the atomic mass of each element by the number of its atoms and adding them together. **Molecular mass** expressed in grams is known as gram molecular mass.

Molecular mass of methane,

$$(CH_4) = (12.011 \text{ u}) + 4\ (1.008 \text{ u}) = 16.043 \text{ u}$$

The Mole

One mole is the amount of substance that contains as many as entities as number of atoms in exactly 12.00g of C-12.

Number of carbon atoms in 12 g of C-12 = 6.022×10^{23}

Chemical Formulae

Symbolic representation of compound is called chemical formula. It is of following types:

a) **Empirical Formula**: An **empirical formula** represents the simplest whole number ratio of various atoms present in a compound.

b) **Molecular Formula**: The molecular formula shows the exact number of different types of atoms present in a molecule of a compound.

Relationship between Empirical and Molecular Formula

Molecular formula = (Empirical formula) × n

Measurement of Concentration

The concentration of a solution reflects the relative proportion of solute and solvent present in the solution. The various concentration terms are,

1. **Weight percent** (% w/W) = (Weight of solute / Weight of solution) × 100.
2. **Volume percent** (% V/V) = (Volume of solute / Volume of solution) × 100.
3. **Molality (m)** – It is defined as number of moles of solute present in 1kg of solvent.

   m = {Number of moles of solute/Mass of solvent (in kg)} × 100.
4. **Molarity (M)** – It is defined as number of moles of solute present in 1 L of solution.

   M = {Number of moles of solute/Volume of solution (in litre)} × 100
5. **Mole fraction** : Suppose, n is the moles of solute and N is the moles of solvent, then,

   (i). Mole fraction of solute (X_{solute}) $= \frac{n}{n+N}$

   (ii). Mole fraction of solvent ($X_{solvent}$) $= \frac{N}{n+N}$

   $X_{solute} + X_{solvent} = 1$
6. **Normality**: It is defined as gram equivalent of solute dissolved in one litre solution.

$$N = \frac{\text{Gram equivalent of solute}}{\text{Volume of solution (litre)} \times 100}$$

Limiting Reagent

Limiting reagent is the reactant which is completely consumed in a reaction. To estimate the amount of product, limiting reagent should be known.

$$N_2(\text{1 mole}) + 3H_2(\text{3 mole}) \longrightarrow 2NH_3(\text{2 mole})$$

It means 1 mole of N_2 react with 3 mole of H_2 to produce 2 mole of NH_3.

Summary-

1. **Matter**: Anything that occupies space and has mass.

2. **Element**: A pure substance which can neither be decomposed into nor built from simpler substances by any physical or chemical method. It contains only one kind of atoms.

3. **Compound**: A pure substance which can be decomposed into simpler substances by some suitable chemical method. It contains only one kind of molecules.

4. **Mixture**: A substance obtained by simple mixing of two or more pure substances.

5. **Law of Conservation of Mass**: During any physical or chemical change total mass of the products formed is equal to the total mass of the reactants consumed.

6. **Law of Constant Composition**: A chemical compound always contains same elements combined together in same proportion of mass.

7. **Law of Multiple Proportions**: When two elements combine with each other to form two or more than two compounds then the masses of one of the elements that combine with the fixed mass of the other, bear a simple whole number ratio to one another.

8. **Gay Lussac's law**: When gases react with each other they do so in volumes which bear a simple whole number ratio to one another and to the volumes of products, if there are also gases, provided all volumes are measured under similar conditions of temperature and pressure.

9. **Avogadro's Law**: Equal volume of all gases under similar conditions contain equal number of molecules.

10. **Atom**: The smallest particle of an element that takes part in chemical reactions.

11. **Molecule**: The smallest particle of a substance that has independent existence.

12. **Atomicity**: The number of atoms in a molecule of the elementary substance.

13. **Unified Mass (u)**: One-twelfth of the actual mass of an atom of carbon (C-12). It is equal to 1.66×10^{-27} kg.

14. **Atomic Mass**: The average relative mass of an atom of the element as compared with mass of a carbon atom (C-12) taken as 12 u.

15. **Molecular Mass**: The average relative mass of a molecule of the substance as compared with mass of an atom of carbon (C-12) taken as 12 u.

16. **Gram Atomic Mass**: The mass of 1 mole of atoms (6×10^{23}) in g is called gram atomic mass.

17. **Gram Molecular Mass**: The mass of 1 gram molecule of compound expressed in grams.

18. **Avogadro's Number (NA)**: 6.022×10^{23}.

19. **Mole**: 6.022×10^{23} specified particles.

20. **Molar Mass**: Mass of one mole particles of the substance.

21. **Gram Molecular Volume (G.M.V.)**: Volume occupied by one mole molecules of the gaseous substance. Its value is equal to 22.4 L and S.T.P.

22. **Empirical Formula**: The formula which gives the simplest whole number ratio of atoms of different elements present in the molecule of the compound. Molecular formula is whole number multiple of empirical formula.

23. **Molarity (M)**: Number of moles of solute per litre of solution. Expressed as moles per litre or moles per dm3 or Molar (M).

24. Molarity changes with change in temperature because volume of the solution changes with change in temperature.

25. $K = °C + 273.15$

26. $°F = \frac{9}{5}(°C) + 32$

NCERT LINE BY LINE QUESTIONS

(1.) How many moles of ethane are required to produce $22 g CO_2$ after combustion) **[Page: 20]**

(a.) 15 g
(b.) 30 g
(c.) 7.5 g
(d.) 21 g

(2.) The number of moles of oxygen present in 1 L of air under standard condition is (air contains 21%oxygen) **[Page: 23]**

(a.) 9.3 L
(b.) 0.0093 L
(c.) 0.021 L
(d.) 2.21 L

(3.) A bivalent metal has an atomic mass of 28. The molecular mass of its chloride is **[Page: 17]**

(a.) 127
(b.) 63.5
(c.) 99
(d.) 91.5

(4.) Higher the number of moles, higher will be number of molecules as 1 mole contains 6.023×10^{23} number of molecules. What is the number of moles of carbon atoms in 2.2 g of CO_2 . **[Page: 18]**

(a.) 0.6
(b.) 0.2
(c.) 0.05
(d.) 0.02

(5.) If the density of a solution is $1.27 g / mL$, the mass of $2.5 mL$ solution in significant figures is **[NCERT Exemplar Modified, Page: 14]**

(a.) 3.175g
(b.) $3175 \times 10^{-3} g$
(c.) 3.2g
(d.) 31.75g

(6.) Which of the following is a mixture). **[Page: 5]**

(a.) Gasoline
(b.) Distilled water
(c.) Bronze
(d.) Both (a) a (c)

(7.) Consider the following statements: **[Page: 18]**
(I) Mass of 0.25 moles of H_2SO_4 is 24.5 g.(II) The order of number of molecules in 100mL each is $H_2 < NH_3 < CO_2$.
(III) The volume occupied by 1 mole atom of a diatomic gas at STP is 11.2 mL.
Correct statements are

(a.) Only I
(b.) Only I a II
(c.) Only I & III
(d.) All of these

(8.) Two students performed the same experiment separately and each one of them recorded two readings of mass which are given below. Correct reading of mass is 3.0 g. On the basis of given data, mark the correct option out of the following statements. **[Page: 13]**

Student	Readings	
A	3.01	2.99
B	3.05	2.95

(a.) Results of both the students are neither accurate nor precise.
(b.) Result of student A is both precise and accurate.
(c.) Result of student B is precise but not accurate.
(d.) Result of student B is both precise and accurate.

(9.) Two elements *P* and *Q* combine to form a compound *X*. Atomic mass of *P* is 14 and *Q* is 1. Percentage of *P* in the compound is 82.35%. What will be the empirical formula of the compound *X*? **[Page: 19]**

(a.) PQ
(b.) P_2Q
(c.) PQ_2
(d.) PQ_3

(10.) Which of the following reactions is not correct according to the law of conservation of mass?**[NCERT Exemplar Modified, Page: 14]**

(a.) $H_2(g)+\frac{1}{2}O_2(g) \rightarrow H_2O(1)$
(b.) $C_3H_8(g)+O_2(g) \rightarrow CO_2(g)+H_2O(g)$
(c.) $SO_2(g)+\frac{1}{2}O_2(g) \rightarrow SO_3(g)$
(d.) $CH_4(g)+2O_2(g) \rightarrow CO_2(g)+2H_2O(g)$

(11.) Specific heat of metal is 0.30 and its chloride contains 83% of chlorine. What is exact atomic weight of the metal) **[page: l7]**

(a.) 21.8l
(b.) 23.4l
(c.) 22.08
(d.) 21.08

(12.) Match the following **[Page: ls]**

(Column - I)	(Column - II)
P. One g - atom of nitrogen	(i) $23/N_A g$
Q. One mole of water	(ii) $98/N_A g$
R. One atom of sodium	(iii) 18 *g*
S. One molecule of H_2SO_4	(iv) 14 *g*

(a.) P- iii, Q-i, R-ii, S- iv
(b.) P- iv, Q-iii, R- i, S - ii
(c.) P- iv, Q- iii, S- ii, R-i
(d.) P- i, Q-ii, R- iv, S- iii

(13.) The density of a given object is $8.96 g / cm^3$. The volume of this object weighing 179.2 g in L is **[Page: 10]**

(a.) 20 L
(b.) 10 L
(c.) 0.02 L
(d.) 0.01 L

(14.) Number of grams of oxygen in 16.l g of $Na_2SO_4 \cdot 10H_2O$ is **[Page: 17]**

(a.) 20.8 g
(b.) 22.4 g
(c.) 11.2 g
(d.) 12 g

(15.) An alkaloid contains 17.28% nitrogen and its molecular mass is 162. The nitrogen atoms present in one molecule of alkaloid is **[Page: 19]**

(a.) 5
(b.) 4
(c.) 3
(d.) 2

(16.) The number of atoms present in one mole of an element is equal to Avogadro number. Which of the following element contains the greatest number of atoms)**[NCERT Exemplar Modified, Page: 18]**

(a.) 4 g *C*
(b.) 46 g Na
(c.) 0.40 g Ca
(d.) 12 g He

(17.) The relative abundance of various isotopes of silicon is as $Si^{28} = 92.23\%, Si^{29} = 4.67$ and $Si^{30} = 3.10\%$ The average atomic mass of silicon is**[Page: 17]**

(a.) 29.l
(b.) 28. 1
(c.) 28.5
(d.) 31.2

(18.) When $2.112 g$ of $KClO_3$ was heated, 1.212 g of KC1 and $0.9 g O_2$ were produced. The results illustrate: **[Page: l4]**

(a.) The law of multiple proportion
(b.) The law of definite proportion
(c.) The law of conservation of mass
(d.) All of these

(19.) Which of the following is not a chemical property?**[Page: 6]**

(a.) Acidity
(b.) Flammability
(c.) Basic nature
(d.) Boiling point

(20.) Which statements are correct for Dalton's atomic Theory? **[QR code, Page: 16]**
(I) Matter consists of indivisible atoms.
(II) Compounds are formed when atoms of different elements combine in different ratio.
(III) Chemical reactions involve reorganisation of atoms.

(a.) I only
(b.) I & II only
(c.) I a III only
(d.) All of these

(21.) The number of atoms in 27 m*g* of water in terms of Avogadro number (N_A) is **[Page: 18]**

(a.) $4.5N_A$
(b.) $4.5\times10^{-3}N_A$
(c.) $1.5\times10^{-3}N_A$
(d.) $1.5N_A$

(22.) An organic compound has molecular weight 194. If this compound contains $36.08^{o}\%_{0}N$, then number of nitrogen molecules in this compound is **[Page: 19]**

(a.) 4
(b.) 5
(c.) 6
(d.) 3

(23.) Two elements A and B have atomic weights 12 and 16. They form four compounds W, X, Y and Z in which A is present in same amount while element B is present in the ratio 1:2:3:4. If compound W has 24 paris by weight of A and 32 parts of B, then compound X has 24 parts by weight of A and **[Page: 15]**

(a.) 64 parts of B
(b.) 32 parts of B
(c.) 14 parts of B
(d.) 56 parts of B

(24.) Match the following: **[NCERT Exemplar Modified, Page: 18]**

(i)	$88g\,CO_2$	(a)	$0.25\,mol$
(ii)	6.022×10^{23} molecules of H_2O	(b)	2 mol
(iii)	5.6 L of at STP	(c)	1 mol
(iv)	$96g\,O_2$	(d)	3 mol

(a.) i-A, ii-D, iii-C, iv-B
(b.) i-B, ii-C, iii-A, iv-D
(c.) i- A, ii-C, iii-D, iv-B
(d.) i-B, ii-D, iii-A, iv-C

(25.) The crystalline salt $Na_2SO_4\cdot xH_2O$ on heating loses 55.9% of its weight. The formula of the salt is**[Page: 2O]**

(a.) $Na_2SO_4\cdot7H_2O$
(b.) $Na_2SO_4\cdot5H_2O$
(c.) $Na_2SO_4\cdot10H_2O$
(d.) $Na_2SO_4\cdot H_2O$

(26.) The density of a gas x is four times that of gas *y*. The ratio of these molecular masses $\left(M_x : M_y\right)$ will be **[Page: 1O]**

(a.) 4: 1
(b.) 1:4
(c.) 2: 1
(d.) 1:2

(27.) What is the molarity of H_2SO_4 solution that has density $1.84g/mL$ and 89% by weight? **[Page: 23]**

(a.) 17.14 M
(b.) 16.7 M
(c.) 18.4 M
(d.) 8.9 M

(28.) $1cc.N_2O$ at NTP contains **[Page: l8]**

(a.) $\frac{1.32}{224}\times10^{23}$ electrons
(b.) $\frac{1.8}{224}\times10^{22}$ atoms
(c.) $\frac{6.02}{22400}\times10^{23}$ molecules
(d.) All of these

(29.) 1 volume of hydrogen always combines with 1 volume of chloride to form 2 volumes of HC1. This statement illustrates **[Page: 16]**

(a.) Law of Definite Proportion
(b.) Law of Conservation of Mass
(c.) Gay-Lussac's Law
(d.) None of these

(30.) Four students weigh a sample of 2 g twice, which of the following is most accurate? The observations are given in the table. **[Page: 13]**

Student	Measurement	
A	1.95	1.95
B	1.98	2.00
C	2.01	1.99
D	2.05	2.04

(a.) A
(b.) B
(c.) C
(d.) D

(31.) The percentage of mass of Al in $KAl(SO_4)_2 \cdot 12H_2O$ is **[Page: 19]**

(a.) 4.74%
(b.) 12.59%
(c.) 5.69%
(d.) 11.21%

(32.) Consider the following statements: **[Page: 16]**

(I) Atoms of H, O, N and C have identical properties but different mass.
(II) Matter is divisible into atoms which are further indivisible.
(III) Dalton's atomic theory supports law of conservation of mass.
Which are correct according to Dalton's atomic theory?

(a.) (i) & (ii)
(b.) (ii) & (iii)
(c.) (i), (ii) & (iii)
(d.) None of these

(33.) Match Column I with Column II. **[Page: 5]**

Column I	Column II
A Heterogeneous Mixture	(i) Camphor
B Homogenous Mixture	(ii) Mercury
C Element	(iii) Rain
D Compound	(iv) Soil

(a.) A-(iii), B-(ii), *C*-(i), D-(iv)
(b.) A-(iv), B-(iii), C-(ii), D-(i)
(c.) A-(i), B-(iv)2 *C*-(ii), D-(iii)
(d.) A- (ii), B-(i), C- (iii), D- (iv)

(34.) Which of the following has maximum number of molecules? **[Page: 18]**

(a.) $10gH_2$
(b.) $22gCO_2$
(c.) $5gH_2O$
(d.) $18gC_6H_{12}O_6$

(35.) A compound contains 4.07% hydrogen, 24.27% C and 71.65% C1. Its molar mass is 98.96 g. The molecular formula is **[Page: 19]**

(a.) CH_2Cl (b.) $C_2H_4Cl_2$
(c.) $C_2H_2Cl_2$ (d.) CH_3Cl

(36.) A solution is prepared by adding 2.5 g of a substance in 47.5 g of water. The mass percent ofsolute is **[Page: 23]**

(a.) 2.5% (b.) 2.15%
(c.) 5% (d.) 7.25%

(37.) The density (in g/mL) of a 3.60 M sulphuric acid solution that is $29\%H_2SO_4$ by mass will be**[Page: 23]**

(a.) 1.45 (b.) 1.64
(c.) 1.88 (d.) 1.22

(38.) How many grams of a dibasic acid with molecular weight 200 should be present in 200 mL of solution with 0.2 N) **[Page: 23]**

(a.) 1 g (b.) 2 g
(c.) 3 g (d.) 4 g

(39.) Consider the following statements: **[Page: 23]** (I) Molarity is defined in mol/L.(II) Molarity is the number of moles of solute present in 1 kg of solution.(III) For making 0.2 M solution we require 0.2moles of NaOH dissolved in 1 L solution. Which of these are incorrect)

(a.) I & III only (b.) II only
(c.) I & II only (d.) All of these

(40.) A chemist wants to prepare 500 mL of 1 mole solution of H_2SO_4. Density of H_2SO_4 is $1.075 g/cm^3$. The quantity of H_2SO_4 needed to prepare is**[Page: 23]**

(a.) 47.97 (b.) 52.67
(c.) 58.9 (d.) 62. 1

(41.) If 500 mL of 95 M solution is diluted to 2,500 mL, what will be the molarity of the solution obtained)**[NCERT Exemplar Modified]**

(a.) 1.5 M (b.) 1.66 M
(c.) 1 M (d.) 1.59 M

(42.) If the concentration of glucose $(C_6H_{12}O_6)$ in blood is $0.6 g/L$, what will be the molarity of glucose in blood ? **[NCERT Exemplar Modified, Page: 23]**

(a.) 3.3 M (b.) 0.0033 M
(c.) 0.005 M (d.) 0.5 M

(43.) Match the following: **[Page: 23]**

(i)	58.5g $NaCl$ in 1 L solution	(a)	1% w / w
(ii)	58.5g $NaCl$ in 1 kg water	(b)	1 m
(iii)	1g $NaCl$ in 99 g water	(c)	1 M
(iv)	1g $NaCl$ in 100 mL solution	(d)	1% w / v

(44.) Which of the following is dependent on temperature ? **[NEET-2017, Page: 23]**

(a.) Molality (b.) Molarity

(c.) Mole fraction (d.) Weight percentage

(45.) What is the mass percentage of C in carbon monoxide ? **[NCERT Exemplar Modified, Page: 23]**

(a.) 0.044% (b.) 27.27%

(c.) 3.4% (d.) 42.85%

(46.) The density of 3 molar solution of NaOH is $1.1109/\text{mL}$. The molarity of the solution is**[Page: 23]**

(a.) 3.21 M (b.) 2.97 M

(c.) 2 M (d.) 1.1 M

(47.) A H_2SO_4 solution has a molarity of 11.24 and molality of 94. Calculate the density of solution.**[Page: 24]**

(a.) 1.22 (b.) 1.124

(c.) 0.94 (d.) 1.115

(48.) What will be the molality of the solution containing 9.125 g of HCl in 500 g of water).**[NCERT Exemplar Modified, Page: 24]**

(a.) 0.1 m (b.) 1 m

(c.) 0.5 m (d.) 1 m

(49.) The density of 2 M aqueous solution of NaOH is $1.28\text{g}/\text{cm}^3$. The molality of solution is (Given that molecular mass of NaOH $=40\text{gmol}^{-1}$)**[Odisha NEET-2019, Page: 24]**

(a.) 1.32 m (b.) 1.20 m

(c.) 1.56 m (d.) 1.67 m

(50.) Answer the following with correct significant figure. **[Page: 13]**

$10.10+11.231+8.01+2.3$

(a.) 31.641 (b.) 31.6

(c.) 31.5 (d.) 31.64

Topic wise Practice Questions

TOPIC 1: Measurement, Significant Figures and Laws of Chemical Combination

1. Which has highest weight?

   1) 1 m^3 of water 2) A normal adult man 3) 10 litre of Hg 4) All have same weight

2. Arrange the numbers in increasing no. of significant figures. 0.002600, 2.6000, 2.6, 0.260

   1) 2.6 < 0.260 < 0.002600 < 2.6000 2) 2.6000 < 2.6 < 0.002600 < 0.260

3) $0.260 < 2.6 < 0.002600 < 2.6000$ 4) $0.002600 < 0.260 < 2.6 < 2.6000$

3. In which of the following number all zeros are significant?
1) 0.0005 2) 0.0500 3) 50.000 4) 0.0050
4. Which of the following is the best example of law of conservation of mass?
1) 12 g of carbon combines with 32 g of oxygen to form 44 g of CO_2.
2) When 12 g of carbon is heated in a vacuum there is no change in mass.
3) A sample of air increases in volume when heated at constant pressure but its mass remains unaltered.
4) The weight of a piece of platinum is the same before and after heating in air.
5. The percentage of copper and oxygen in samples of CuO obtained by different methods were found to be the same. This illustrates the law of
1) constant proportions 2) conservation of mass 3) multiple proportions 4) reciprocal proportions
6. One of the following combination which illustrates the law of reciprocal proportions?
1) N_2O_3, N_2O_4, N_2O_5 2) NaCl, NaBr, NaI 3) CS_2, CO_2, SO_2 4) PH_3, P_2O_3, P_2O_5
7. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At 15°C and 150 mm Hg pressure, one litre of O_2 contains 'N' molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be :
1) N/2 2) 1 N 3) 2 N 4) 4 N
8. 10 dm^3 of N_2 gas and 10 dm^3 of gas X at the same temperature contain the same number of molecules, the gas X is
1) CO_2 2) CO 3) H_2 4) NO

TOPIC 2: Mole Concept

9. What is the mass of 1 molecule of CO?
1) 2.325×10^{-23} 2) 4.65×10^{-23} 3) 3.732×10^{-23} 4) 2.895×10^{-23}
10. How many atoms are contained in one mole of sucrose ($C_{12}H_{22}O_{11}$)?
1) $20 \times 6.02 \times 10^{23}$ atoms/mol 2) $45 \times 6.02 \times 10^{23}$ atoms/mol
3) $5 \times 6.02 \times 10^{23}$ atoms/mol 4) None of these
11. Molecular mass is defined as the
1) mass of one atom compared with the mass of one molecule
2) mass of one atom compared with the mass of one atom of hydrogen
3) mass of one molecule of any substance compared with the mass of one atom of C-12
4) None of the above
12. Two containers P and Q of equal volume (1 litre each) contain 6 g of O_2 and SO_2 respectively at 300 K and 1 atmosphere, then
1) number of molecules in P is less than that in Q.
2) number of molecules in P and Q is same.
3) number of molecules in Q is less than that in P.
4) either 1) or 2).
13. A sample of AlF_3 contains 3.0×10^{24} F^- ions. The number of formula unit of this sample are
1) 9×10^{24} 2) 3×10^{24} 3) 0.75×10^{24} 4) 1.0×10^{24}
14. Which one of the following is the lightest?
1) 0.2 mole of hydrogen gas
2) 6.023×10^{22} molecules of nitrogen
3) 0.1 g of silver
4) 0.1 mole of oxygen gas
15. The average atomic mass of neon based on following data is:

Isotope	Relative abundance
^{20}Ne	0.9051
^{21}Ne	0.0027
^{22}Ne	0.0922

1) 0.33 u 2) 20.187 u 3) 6.729 u 4) 18.058 u
16. The ratio of number of oxygen atoms (O) in 16.0 g ozone (O_3), 28.0 g carbon monoxide (CO) and 16.0 oxygen (O_2) is (Atomic mass : C = 12, O = 16 and Avogadro's constant NA = 6.023×10^{23} mol^{-1})

1) 3 : 1 : 2 2) 1 : 1 : 2 3) 3 : 1 : 1 4) 1 : 1 : 1

17. A mixture of CH_4, N_2 and O_2 is enclosed in a container of 1 litre capacity at 0°C. Total pressure of gaseous mixture is 2660 mm Hg. If the ratio of partial pressures of the gases is 1 : 4 : 2 respectively, the number of moles of oxygen present in the vessel is:
1)1/ 22.4 2) 1.0 3) 0.1 4) none of these

18. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is
1) 10 g molecules 2) 5 g molecules 3) 1 g molecules 4) 0.5 g molelcules

19. The number of molecules in 16 g of methane is
1) 3.0×10^{23} 2) $\frac{16}{6.02}\times10^{23}$ 3) 6.023×10^{23} 4) $\frac{16}{3.0}\times10^{23}$

20. 25.4 g of I_2 and 14.2 g of Cl_2 are made to react completely to yield a mixture of ICl and ICl_3. Calculate moles of ICl and ICl_3 formed
1) 0.1, 0.1 2) 0.2, 0.2 3) 0.1, 0.2 4) 0.2, 0.1

21. If we consider that 1/6, in place of 1/12, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will
1) decrease twice 2) increase two fold
3) remain unchanged 4) be a function of the molecular mass of the substance

22. Number of moles of MnO^{4-} required to oxidize one mole of ferrous oxalate completely in acidic medium will be
1) 0.6 moles 2) 0.4 moles 3) 7.5 moles 4) 0.2 moles

23. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions are
1) 0.0093 mole 2) 0.21 mole 3) 2.10 mole 4) 0.186 mole

24. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (at. wt. of Fe is 56) present in one molecule of haemoglobin are
1) 1 2) 6 3) 4 4) 2

25. How many moles of P_4O_6 and P_4O_{10} will be produced by the combustion of 12.4 g of phosphorous (atomic mass 31) in 12.8 g of oxygen, leaving no P_4 or O_2?
1) 0.1 and 0.3 mol 2) 0.15 mol and 0.25 mol 3) 0.05 mol each 4) 0.1 mol each

TOPIC 3: Atomic, Molecular Masses, Equivalent Masses and Expression of Concentration

26. Number of atoms in 558.5g Fe (at. wt. of Fe = 55.85 g mol^{-1}) is
1) twice that in 60 g carbon 2) 6.023×10^{22}
3) half that in 8 g He 4) $558.5 \times 6.023 \times 10^{23}$

27. The percentage weight of Zn in white vitriol [$ZnSO_4.7H_2O$] is approximately equal to (Zn = 65, S = 32, O = 16and H = 1)
1) 33.65 % 2) 32.56 % 3) 23.65 % 4) 22.65 %

28. The vapour density of a mixture containing NO_2 and N_2O_4 is 27.6 . Mole fraction of NO_2 in the mixture is
1) 0.2 2) 0.4 3) 0.6 4) 0.8

29. The number of molecules in 8.96 litre of a gas at 0° C and 1 atm. pressure is approximately
1) 6.023×10^{23} 2) 12.04×10^{23} 3) 18.06×10^{23} 4) 24.08×10^{22}

30. Suppose two elements X and Y combine to form two compounds XY_2 and X_3Y_2 when 0.1 mole of former weighs 10 g while 0.05 mol of the latter weights 9 g. The atomic masses of X and Y are respectively
1) 60 & 40 2) 30 & 40 3) 40 & 30 4) 40 & 60

31. 4 g of a hydrated crystal of formula $A.xH_2O$ has 0.8 g of water. If the molar mass of the anhydrous crystal 1) is 144 g mol^{-1}, The value of x is
1) 4 2) 1 3) 2 4) 3

32. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is
1) 0.01 M 2) 0.001 M 3) 0.1 M 4) 0.02 M

33. A metallic chloride contain 47.22% metal. Calculate the equivalent weight of metal.
1) 39.68 2) 31.76 3) 36.35 4) 33.46

34. Sulphur forms the chlorides S_2Cl_2 and SCl_2. The equivalent mass of sulphur in SCl_2 is
1) 8 g/mol 2) 16 g/mol 3) 64.8 g/mol 4) 32 g/mol

35. If 0.20 g chloride of a certain metal, when dissolved in water and treated with excess of $AgNO_3$, yields 0.50 g of AgCl, the equivalent mass of the metal is (Ag = 108, Cl = 35.5)
1) 21.90 2) 20.04 3) 40.08 4) 43.80

36. Equivalent mass of a metal *M* is 2.5 times that of oxygen. The minimum molecular mass of its oxide is
1) 28 2) 42 3) 56 4) 112

37. The same amount of a metal combines with 0.100 g of oxygen and with 1.000 g of a halogen. Hence, the equivalent mass of halogen is
1) 9 2) 35.5 3) 80 4) 127

38. In the reaction $NaOH + Al(OH)_3 \rightarrow NaAlO_2 + H_2O$ The equivalent mass of $Al(OH)_3$ is
1) 78 2) 26 3) 52 4) unpredictable

39. On reduction 1.644 g of hot iron oxide give 1.15 g of iron. Evaluate the equivalent weight of iron.
1) 18.62 2) 19.13 3) 18.95 4) 12.95

40. If a pure compound is composed of X_2Y_3 molecules and consists of 60% of X by weight, the atomic weight of Y is
1) 2.25 times atomic weight of X 2) 44% of atomic weight of X
3) 4.0 times the atomic weight of X 4) 25% of the atomic weight of X

41. Oxalic acid $H_2C_2O_4$ reacts with permanganate ion according to the balanced equation below. How many mL of 0.0154 $KMnO_4$ solution are required to react with 25.0 mL of 0.0208 M $H_2C_2O_4$ solution? $5H_2C_2O_4(aq) + 2MnO_4^-(aq) + 6H^+(aq) \rightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(1)$
1) 13.5 mL (2) 18.5 mL (3) 33.8 mL (4) 84.4 mL

42. Percentage of Se in peroxidase anhydrase enzyme is 0.5% by weight (at. wt. of Se = 78.4) then minimum molecular weight of peroxidase anhydrase enzyme is
1) 1.568×10^3 2) 15.68 3) 2.136×10^4 4) 1.568×10^4

43. Liquid benzene (C_6H_6) burns in oxygen according to the equation

$$2C_6H_6(1) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(g)$$

How many litres of O_2 at STP are needed to complete the combustion of 39 g of liquid benzene?(Mol. wt. of O_2 = 32, C_6H_6 = 78)
1) 74 L 2) 11.2 L 3) 22.4 L 4) 84 L

44. The mass of $BaCO_3$ produced when excess CO2 is bubbled through a solution of 0.205 mol $Ba(OH)_2$ is
1) 81 g 2) 40.5 g 3) 20.25 g 4) 162 g

45. 12 L of H_2 and 11.2 L of Cl_2 are mixed and exploded. Find the composition by volume of mixture.
1) 11.2, 11.2, 22.4 2) 0.8, 0, 22.4 3) 0.8, 0.8, 22.4 4) 0.8, 11.2, 22.4

46. 10 moles SO_2 and 15 moles O_2 were allowed to react over a suitable catalyst. 8 moles of SO_3 were formed. The remaining moles of SO_2 and O_2 respectively are -
1) 2 moles, 11 moles 2) 2 moles, 8 moles 3) 4 moles, 5 moles 4) 8 moles, 2 moles

47. How many moles of KI are required to produce 0.4 moles of K_2HgI_4 ?
1) 0.4 2) 0.8 3) 3.2 4) 1.6

48. Under similar conditions of pressure and temperature, 40 mL of slightly moist hydrogen chloride gas is mixed with 20mL of ammonia gas, the final volume of gas at the same temperature and pressure will be
1) 100 mL 2) 20 mL 3) 40 mL 4) 60 mL

49. What is the volume of CO_2 liberated (in litres) at 1 atmosphere and 0°C when 10 g of 100% pure calcium carbonate is treated with excess dilute sulphuric acid?
(Atomic mass Ca : 40, C : 12, O : 16)
1) 0.224 2) 2.24 3) 22.4 4) 224

50. The volume of 0.1 N dibasic acid sufficient to neutralize 1 g of a base that furnishes 0.04 mole of OH– in aqueous solution is :
1) 400 mL 2) 600 mL 3) 200 mL 4) 800 mL

51. The density of 3M solution of sodium chloride is 1.252 g mL^{-1}. The molality of the solution will be : (molar mass, NaCl = 58.5 g mol^{-1})
1) 260 m 2) 2.18 m 3) 2.79 m 4) 3.00 m

52. The amount of $BaSO_4$ formed upon mixing 100 mL of 20.8% $BaCl_2$ solution with 50 mL of 9.8% H_2SO_4 solution with 50 mL of 9.8% H_2SO_4 solution will be:
(Ba = 137, Cl = 35.5, S = 32, H = 1 and O = 16)
1) 23.3 g 2) 11.65 g 3) 30.6 g 4) 33.2 g

53. The formula of an acid is HXO_2. The mass of 0.0242 moles of the acid is 1.657 g. What is the atomic mass of X?
1) 35.5 2) 28.1 3) 128 4) 19.0

54. A portable hydrogen generator utilizes the reaction between calcium hydride and water to produce hydrogen. What mass of hydrogen can be produced by 70 g cartridge of calcium hydride ?
1) 6.7 g 2) 3.5 g 3) 4.5 g 4) 5.5 g

55. If $1\frac{1}{2}$ moles of oxygen combine with Al to form Al_2O_3 the weight of Al used in the reaction is (Al = 27)
1) 27 g 2) 54 g 3) 49.5 g 4) 31 g

56. O_2, N_2 are present in the ratio of 1 : 4 by weight. The ratio of number of molecules is :
1) 7 : 32 2) 1 : 4 3) 2 : 1 4) 4 : 1

57. 6.8 g H_2O_2 present in 100 mL of its solution. What is the molarity of solution?
1) 1 M 2) 2 M 3) 3 M 4) 0.5 M

58. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?
1) 1.25×10^{-2} 2) 2.5×10^{-2} 3) 0.02 4) 3.125×10^{-2}

59. How many moles of $Al_2(SO_4)_3$ would be in 50 g of the substance ?
1) 0.083 mole 2) 0.952 mole 3) 0.481 mole 4) 0.140 mole

60. 25mL of a solution of barium hydroxide on titration with a 0.1 molar solution of hydrochloric acid gave a litre value of 35mL. The molarity of barium hydroxide solution was
1) 0.14 2) 0.28 3) 0.35 4) 0.07

TOPIC 4: Empirical Formula, Molecular Formula and Chemical Stoichiometry

61. The empirical formula of a compound is CH_2. One mole of this compound has a mass of 42 grams. Its molecular formula is :
1) C_3H_6 2) C_3H_8 3) CH_2 4) C_2H_2

62. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be :
1) CH_3O 2) CH_2O 3) CHO 4) CH_4O

63. In a compound C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108. Molecular formula of compound is
1) $C_2H_6N_2$ 2) C_3H_4N 3) $C_6H_8N_2$ 4) $C_9H_{12}N_3$

64. A chloride of a metal (*M*) contains 65.5% of chlorine. 100 mL of vapour of the chloride of metal at STP weighs 0.72 g. The molecular formula of the metal chloride is :
1) MCl 2) MCl_2 3) MCl_3 4) MCl_4

65. In the reaction $4NH_3(g) + 5\,O_2(g) \rightarrow 4\,NO(g) + 6H_2O(l)$ When 1 mole of ammonia and 1 mole of O2 are made to react to completion,
1) 1.0 mole of H_2O is produced 2) 1.0 mole of NO will be produced
3) all the oxygen will be consumed 4) all the ammonia will be consumed

66. If potassium chlorate is 80% pure, then 48 g of oxygen would be produced from (atomic mass of K =39)
1) 153.12 g of $KClO_3$ 2) 122.5 g of $KClO_3$

3) 245 g of $KClO_3$ 4) 98 g of $KClO_3$

67. The empirical formula of an acid is CH_2O_2, the probable molecular formula of acid may be :
1) $C3H_6O_4$ 2) CH_2O 3) CH_2O_2 4) $C_2H_4O_2$

68. Which of the following is the correct empirical and molecular formulae of a compound, if the molecular mass of a compound is 80 and compound contains 60% of C, 5% of H and 35% of N ?
1) $C2H_2N$; $C_4H_4N_2$ 2) $C_3H_4N_2$; $C_6H_8N_4$
3) $C_2H_4N_2$; $C_4H_8N_4$ 4) C_2H_2N ; C_2H_2N

69. 12 gm of Mg (atomic mass 24) will react completely with hydrochloric acid to give
1) One mol of H_2 2) 1/2 mol of H_2 3) 2/3 mol of O_2 4) both 1/2 mol of H_2 and 1/2 mol of O_2

70. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is
1) 3 2) 4 3) 5 4) 6

NEET PREVIOUS YEARS QUESTIONS

1. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be **[2018]**
1) 1.4 2) 3.0 3) 4.4 4) 2.8

2. In which case is number of molecules of water maximum? **[2018]**
1) 18 mL of water 2) 0.18 g of water
3) 10^{-3} mol of water 4) 0.00224 L of water vapours at 1 atm and 273 K

3. Which of the following is dependent on temperature? **[2017]**
1) Molarity 2) Mole fraction
3) Weight percentage 4) Molality

4. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample? **[2015]**
1) 75 2) 96 3) 60 4) 84

5. The number of water molecules is maximum in : **[2015]**
1) 18 molecules of water 2) 1.8 gram of water
3) 18 gram of water 4) 18 moles of water

6. What is the mole fraction of the solute in a 1.00 m aqueous solution? **[2015]**
1) 0.177 2) 1.770 3) 0.0354 4) 0.0177

7. If Avogadro number NA, is changed from 6.022×10^{23} mol^{-1} to 6.022×10^{20} mol^{-1} this would change : **[2015]**
1) the definition of mass in units of grams
2) the mass of one mole of carbon
3) the ratio of chemical species to each other in a balanced equation.
4) the ratio of elements to each other in a compound

8. What is the mass of precipitate formed when 50 mL of 16.9% solution of AgNO3 is mixed with 50 mL of 5.8% NaCl solution?
(Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5) **[2015]**
1) 28 g 2) 3.5 g 3) 7 g 4) 14 g

9. Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gases $H_2 : O_2$: methane would be : **[2014]**
1) 8 : 16 : 1 2) 16 : 8 : 1 3) 16 : 1 : 2 4) 8 : 1 : 2

10. When 22.4 litres of $H_2(g)$ is mixed with 11.2 litres of $Cl_2(g)$, each at S.T.P., the moles of HCl(g) formed is equal to:- **[2014]**
1) 1 mol of HCl(g) 2) 2 mol of HCl(g) 3) 0.5 mol of HCl(g) 4) 1.5 mol of HCl(g)

11. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much? **[2014]**

(At. wt. Mg = 24 ; O = 16)

1) Mg, 0.16 g 2) O2, 0.16 g 3) Mg, 0.44 g 4) O2, 0.28 g

12. One mole of carbon atom weighs 12 g, the number of atoms in it is equal to, (Mass of carbon –12 is 1.9926 × 10–23 g) **[NEET-2020 covid-19]**

(1) 1.2 × 1023 (2) 6.022 × 1022 (3) 12 × 1022 (4) 6.022 × 1023

13. An organic compound contains 78% (by wt) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is : [Atomic wt of C is 12, H is 1) **[NEET-2021]**

1) CH_2 2) CH_3 3) CH_4 4) CH

14. What mass of 95% pure CaCO3 will be required to neutralize 50 mL of 0.5M HCl solution according to the following reaction? **[NEET-2022]**

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2_{(g)}} + 2H_2O_{(1)}$$

[Calculate upto second place of decimal point]

1) 1.25g 2) 1.32g 3) 3.65g 4) 9.50g

NCERT LINE BY LINE QUESTIONS – ANSWERS

(1.)	c	**(2.)**	b	**(3.)**	c	**(4.)**	c	**(5.)**	a
(6.)	d	**(7.)**	c	**(8.)**	b	**(9.)**	d	**(10.)**	b
(11.)	a	**(12.)**	b	**(13.)**	c	**(14.)**	c	**(15.)**	d
(16.)	d	**(17.)**	b	**(18.)**	c	**(19.)**	d	**(20.)**	c
(21.)	b	**(22.)**	b	**(23.)**	a	**(24.)**	b	**(25.)**	c
(26.)	a	**(27.)**	b	**(28.)**	d	**(29.)**	c	**(30.)**	c
(31.)	c	**(32.)**	b	**(33.)**	b	**(34.)**	a	**(35.)**	b
(36.)	c	**(37.)**	d	**(38.)**	d	**(39.)**	b	**(40.)**	a
(41.)	c	**(42.)**	b	**(43.)**	b	**(44.)**	b	**(45.)**	d
(46.)	b	**(47.)**	a	**(48.)**	c	**(49.)**	d	**(50.)**	b

TOPIC WISE PRACTICE QUESTIONS-ANSWERS

1) 1	2) 1	3) 3	4) 1	5) 1	6) 3	7) 3	8) 2	9) 2	10) 2
11) 3	12) 3	13) 4	14) 3	15) 2	16) 2	17) 1	18) 2	19) 3	20) 1
21) 1	22) 2	23) 1	24) 3	25) 3	26) 1	27) 4	28) 4	29) 4	30) 3
31) 3	32) 1	33) 2	34) 2	35) 1	36) 3	37) 3	38) 2	39) 1	40) 2
41) 1	42) 4	43) 4	44) 2	45) 2	46) 1	47) 2	48) 2	49) 2	50) 1
51) 3	52) 1	53) 1	54) 1	55) 2	56) 1	57) 2	58) 4	59) 4	60) 4
61) 1	62) 1	63) 3	64) 3	65) 3	66) 1	67) 3	68) 1	69) 2	70) 4

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1) 4	2) 1	3) 1	4) 4	5) 4	6) 4	7) 2	8) 3	9) 3	10) 1
11) 4	12) 2	13) 2							

NCERT LINE BY LINE QUESTIONS-EXPLANATIONS

(1.) (c) $C_2H_6+\frac{7}{2}O_2 \rightarrow 2CO_2+3H_2O$

1 mole (*i.e.* 30 g) C_2H_6 gives 2 moles (i.*e*. 88 g) CO_2

So 22 g will be produced by $=\frac{30}{88}\times 22=7.5g$

(2.) (b) Volume of oxygen i n1Lair $=\frac{21}{100}L$

Number of moles $=\frac{21}{100}\times\frac{1}{22.4}=0.0093$

(3.) (c) 

formula: MCl_2

$\text{Mass}=\text{Atomic mass of M}+2\times\text{Atomic mass of Cl}$
$=28+2\times 35.5=28+71=99$

(4.) (c) Mass of $CO_2=12+16\times 2=44$

Mass of C in $44gCO_2=12\boldsymbol{g}$

Mass of C in $2.2gCO_2=\frac{12}{44}\times 2.2=0.6\boldsymbol{g}$

Moles of carbon $=\frac{0.6}{12}=0.05$

(5.) (a) Density $=\frac{\text{Mass}}{\text{Volume}}$

Mass $=$ Density $\times$ Volume$=1.27\times 2.5=3.175$

In multiplication and divisions, the result must be reported with no more signification figures as in the measurement with the few significant figures. Thus, the answer is (a).

(6.) (d) Gasoline is a mixture of small hydrocarbons and bronze is a mixture of copper and tin. Distilled water is a pure substance.

(7.) (c) Equal volume of all gases at STP contain equal number of molecules, hence II is incorrect.

(8.) (b) Because readings of student A are close to the actual reading(accuracy) and both measurements are close to each other also (precise).

(9.) (d)

Element	Percentage	Moles	Mole ratio	Simplest Ratio
P	82.35	$82.35/14=5.88$	$\frac{5.88}{5.88}=1$	1
Q	17.65	$17.65/1=17.65$	$\frac{17.65}{5.88}=3$	3

Thus, the empirical formula $=PQ_3$

(10.) (b) As in $C_3H_8(g)+O_2(g)\rightarrow CO_2(g)+H_2O(g)$ reaction number of elements are not same, so mass of reactants is not equal to mass of products. Hence, it does not follow law of conservation of mass.

(11.) (a) Percentage of chlorine $=83\%$

Percentage of metal $=100-83=17\%$

Exact weight $=\dfrac{17\times35.5}{83}=7.27$

Specific heat of metal $=0.30$

Approximate atomic weight $=\dfrac{6.4}{0.30}=21.33$

Valency $=\dfrac{21.33}{7.27}=2.93=3$

Atomic weight of metal $=3\times7.27=21.81$

(12.) P. One g -atom of nitrogen means 14 g of nitrogen, i.e., $.P\rightarrow(iv)$

Q. One mole of water $(H_2O)=2\times1+16=18g$

$Q\rightarrow(iii)$

R. One mole of sodium, i.e. $23g=\mathrm{N}_A$ atoms thus mass of 1 atom of sodium $=23/\mathrm{N}_A g$

$R\rightarrow$ (i)

S. One mole of $H_2SO_4=2\times1+32+16\times4=98\mathrm{g}=\mathrm{N}_A$ molecules

Thus, mass of 1 molecule $=98/\mathrm{N}_A$

$S\rightarrow$ (ii)

(13.) (c) Density $=\dfrac{\text{Mass}}{\text{Volume}}$

Volume $=\dfrac{\text{Mass}}{\text{Density}}$

Volume $=\dfrac{179.2\mathrm{g}}{8.96\mathrm{g}/\mathrm{cm}^3}=20\mathrm{cm}^3=0\cdot02\mathrm{L}$

(14.) (c) The molecular mass of $Na_2SO_4\cdot10H_2O$ is $=322g$

In 322 g, mass of oxygen is $=16\times(4+10)=224g$

In $16.1\mathrm{g}$, mass of oxygen will be $\dfrac{224}{322}\times16.1=224\times0.05=11.2g$

(15.) (d) Weight oof N in alkaloid $=\dfrac{17.28\times162}{100}=27.9$

Number of N atoms $=\dfrac{27.9}{14}=2$

Assertion-Reason Type Questions

(16.) (d) Number of mole in $\mathrm{C}=\dfrac{4}{12}=0.33$

Number of mole in $\mathrm{Na}=\dfrac{46}{23}=2$

Number of mole in $\mathrm{Ca}=\dfrac{0.40}{40}=0.01$

Number of mole in He $=\dfrac{12}{4}=3$

Higher the number of moles, higher will be number of molecules (atoms).

(17.) (b) Average Atomic Mass

$$= \frac{\text{At.Mass}_1 \times \text{Abundance}_1 + \text{At.Mass}_2 \times \text{Abundance}_2 + \text{At.Mass}_3 + \text{Abundance}_3}{\text{Abundance}_1 + \text{Abundance}_2 + \text{Abundance}_3}$$

$$= \frac{28 \times 92.23 + 29 \times 4.67 + 30 \times 3.10}{92.23 + 4.67 + 3.10}$$

$$= \frac{2582.44 + 135.43 + 93}{100} = \frac{2810.87}{100} = 28.1$$

(18.) (c) As $KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2}O_2$

Mass of reactant $=$ Mass of products

$2.112\ \text{g} = (1.212 + 0.9)\text{g}$

Thus, it illustrates the law of conservation of mass.

(19.) (d) Boiling point is a physical property as it does not require any chemical change.

(20.) (c) Compounds are formed when atoms of different elements combine in same ratio.

(21.) (b) Moles $= \frac{27 \times 10^{-3}}{18} = 1.5 \times 10^{-3}$

Number of molecules $= 1.5 \times 10^{-3} \boldsymbol{N}_A$

Number of atoms $= 1.5 \times 10^{-3} \boldsymbol{N}_A \times 3 = 4.5 \times 10^{-3} \boldsymbol{N}_A$

(22.) (b) Mass o N in the compound $= \frac{36.08}{100} \times 194 = 70\ \text{amu} = 5$ N atoms

(23.) (a)

In	W	A : B	1 : 1
In	X	A : B	1 : 2
In	Y	A : B	1 : 3
In	Z	A : B	1 : 4

In compound W 24g of A combines with 32 g of *B*. Then in X 24g of A will combine with 64 g of B.

(24.) (i) $\rightarrow$ (B)

$88\text{g}\, CO_2 = \frac{88}{44} = 2\text{mol}$

(ii) $\rightarrow$ (C)

6.022×10^3 molecules of any compound $=$ 1 mol

(iii) $\rightarrow$ (A)

$5.6\text{L of } 0_2 = \frac{5.6}{22.4} = \frac{1}{4} = 0.25$ mol

(iv) $\rightarrow$ (D)

$96\text{g}O_2 = \frac{96}{32} = 3$ mol

(25.) (c) $Na_2SO_4 \cdot xH_2O \xrightarrow{\Delta} Na_2SO_4 + xH_2O$

Suppose the weight of the compound is (*a*)

$\boldsymbol{a} - \frac{55.9}{100} \times \boldsymbol{a} = 142$

$100\boldsymbol{a} - 55.9\boldsymbol{a} = 14200$

$44.1\boldsymbol{a} = 14200$

$\boldsymbol{a} = \frac{14200}{44.1} = 322$

$142+18x=322 \Rightarrow 18x=180$, $x=10$

(26.) (a) $\frac{M_x}{M_y}=\frac{d_x}{d_y}$

$d_x=4d_y \Rightarrow \frac{M_x}{M_y}=\frac{4d_y}{d_y}=4:1$

(27.) (b) Mass of solute $=89$ g

Mass of solution $=100$ g

Volume of solution

$=\frac{\text{Mass}}{\text{Density}}=\frac{1.00}{184}=54.34\text{mL}$

Molarity $=\frac{89}{98}\times\frac{1000}{54.34}=16.7\text{M}$

(28.) (d) As 22.4 L at STP contain 1 mole, or 6.023×10^{23} molecules

Thus, 1 cc i.e. 1 mL contain $=\frac{6.023\times10^{23}}{22400}$ molecules

1 molecule of N_2O contains 3 atoms, thus

Number of atoms in $1cc=\frac{3\times6.023\times10^{23}}{22400}$

i.e. $\frac{1.8\times10^{22}}{224}$ atoms Electrons in 1 molecule of $N_2O=7+7+8=22$

Thus, electrons in 1 cc of N_2O

$=\frac{22\times6.023\times10^{23}}{22400}=\frac{1.32\times10^{23}}{224}$

(29.) (c) According to Gay-Lussac's law gases combined or produced in a chemical reaction. They do so in a simple ratio by volume.

(30.) (c) C is most accurate because his values are closer to the actual value.

(31.) (c) Molar mass of $KAl(SO_4)_2\cdot12H_2O=$

$39+27+32\times2+16\times8+12\times18=474\text{g/mol}$

Percentage by mass of $Al=\frac{27}{474}\times100=5.69\%$

(32.) (b) Atoms of H, O, N and C have different properties and different masses.

(33.) (b)

(34.) (a) Moles of $H_2=\frac{10}{2}=5$

Moles of $CO_2=\frac{22}{44}=0.5$

Moles of $H_2O=\frac{5}{18}=0.278$

Moles of $C_6H_{12}O_6=\frac{18}{180}=0.1$

Higher the number of moles, higher will be the number of molecules.

(35.) (b)

Element	% Composition	Number of moles	Simplest molar ratio	Simplest whole number
C	24.27	$24.27/12 = 2.02$	$\frac{2.02}{2.02}=1$	1
H	4.07	$4.07/1 = 4.07$	$\frac{4.07}{2.02}=2$	2
Cl	71.65	$71.65/35.5 = 2.02$	$\frac{2..02}{202}=1$	1

Thus, empirical formula $= CH_2Cl$

Empirical formula mass $=12+2+35.5=49.5$

Molar mass of compound $=98.96$

$$n=\frac{\text{Molar mass}}{\text{Empirical formula mass}}=\frac{98.96}{49.5}=2$$

Thus, Molecular formula $=(CH_2Cl)_2=C_2H_4Cl_2$

(36.) (c) $\text{Mass percent}=\frac{\text{Mass of solute}}{\text{Mass of sotution}}\times 100$

$$=\frac{2.5}{47.5+2.5}\times 100=\frac{2.5}{50}\times 100=5\%$$

(37.) (d) 3.60 M means 3.6 moles present in 1000 mL.

Mass of 3.6 moles of $H_2SO_4=3.6\times 98g=352.8g$

Given that 29 g of H_2SO_4 is present in 100 g of solution.

352.8 g of H_2SO_4 present in $\frac{100}{29}\times 352.89=1216g$ of solution

Density $=\frac{\text{Mass}}{\text{Volume}}=\frac{1216}{1000}=1.216g/mL$

(38.) (d) Equivalent weight $=\frac{200}{2}=100$

If x g acid is required

$$0.2=\frac{x}{100}\times\frac{1000}{200}$$

$$\Rightarrow x=\frac{100\times 200\times 0.2}{1000}=4g$$

(39.) (b) Molarity is the number of moles of solute present in l litre of solution.

(40.) (a) $\text{Molaliry}=\frac{\text{Mass / Molarmass}}{\text{Mass of solvent}(g)}\times 1000$

$$1=\frac{\text{Mass}/98}{\text{Volume}\times\text{Density}}\times 1000$$

Suppose the mass of solute is x.

$$1=\frac{x}{98\times(500\times 1.075-x)}\times 1000$$

$$1=\frac{1000x}{52{,}675-98x}$$

$$52675=1098x$$

$$x=\frac{52675}{1098}=47.97g$$

(41.) (c) $M_1V_1 = M_2V_2$

$500 \times 5 = M_2 \times 2500$

$M_2 = \frac{500 \times 5}{2500} = 1M$

(42.) (b) 1 Litre of blood contains 0.6 g of glucose

Moles of glucose $= 0.6/180 = 0.0033 mol$

Thus, molarity $= \frac{0.0033}{1} = 0.0033 mol/L$

(43.) (ii)$\rightarrow$(b)

1 mole present in lkg water $= l$

Molar solution (1 m)

(iii)$\rightarrow$(a)

1 g solute dissolved in 99 g water Mass of solute $=$ 1 g

Mass of solution $= 1 + 99 = 100\boldsymbol{g}$

% of solute $= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100 = \frac{1}{100} \times 100 = 1\%$

(iv)$\rightarrow$(d)

Mass of solute $=$ 1

Mass of solution $=$ 100 mL

$w/v\% = \frac{1}{100} \times 100 = 1\%$

(44.) (b) Molarity depends on temperature as it contains volume which is temperature dependent.

(45.) (d) 12g$\boldsymbol{C}$ is present in $CO_2 (12 + 16 = 28)$

$0\%_0 = \frac{\text{amount of C}}{\text{amount of CO}} \times 100 = \frac{12}{28} \times 100$

$= 42.85\%$

(46.) (b) 3 molar solution means 3 moles of NaOH in 1 kg solvent.

3 moles of $NaOH = 3 \times 40 = 120g$

Mass of solution $=$ 1000 $+$ 120 $=$ 1120 g

Molarity $= \frac{3}{1120/1.110} \times 1000 = 2.97M$

(47.) (a) Molarity $= \frac{\text{gram moles of } H_2SO_4}{\text{volume of solution}}$

$11.24 = \frac{\text{moles of } H_2SO_4}{1}$

Moles of $H_2SO_4 = 11.24$ moles

Amount of $H_2SO_4 = 11.24 \times 98 =$ 1.10l kg

Molality $= \frac{\text{moles of } H_2SO_4}{\text{kg of solvent}}$

Amount of solvent $= \frac{11.24}{94} = 0.1195kg$

Amount of solution $= 1.101 + 0.1195 = 1.2205kg$

Density of solution $= \frac{1.2205}{1} = 1.22$

(48.) (c) Moles of $HCl = \frac{9.125}{36.5} = 0.25$ mole

$$\text{Molality} = \frac{\text{Moles of solute}}{\text{Mass of solvent}} \times 1000$$

$$= \frac{0.25}{500} \times 1000 = 0.5\text{m}$$

(49.) (d) $\frac{1}{m} = \frac{d}{M} - \frac{M_B}{1000}$

$$= \frac{1.28}{2} - \frac{40}{1000} = 0.64 - 0.04 = 0.60$$

$$m = \frac{1}{0.6} = \frac{10}{6} = 1.67\text{m}$$

Assertion-Reason Type questions

(50.) (b) $10. + 11.231 + 8.01 + 2.3 = 31.641$

As the result cannot have more digits to the right of the decimal point than either of the original numbers.

Thus, the answer should be reported as 31.6.

TOPIC WISE PRACTICE QUESTIONS - SOLUTIONS

1. 1) $1\text{m}^3 \text{of water} = 10^6 \text{cm}^3 \text{of water}$

$\therefore$ Mass of $10^6 \text{cm}^3 \text{water} = 10^6 \text{cm}^3 \times 1\text{g cm}^3 \left(\because \text{density of } H_2O\right) = 1\text{g cm}^3) =$

$10^6 \text{g} = \frac{10^6}{10^3} \text{kg} = 10^3 \text{kg} = 1000\text{kg}$

b) Weight of normal adult man = 65 kg

$\therefore$ weightof1m^3 of water is highest.

c) Density of Hg = 13.6g cm^{-3}

Volume of Hg = 10 L = $10 \times 1000 = 10^4 \text{cm}^3$

$\therefore$ Weight of $\text{Hg} = 13.6 \times 10^4 = 136000\text{g} = 136\text{kg}$

2. 1) 2.6 has two significant figures.
0.260 has three significant figures.
0.002600 has four significant figures.
2.6000 has five significant figures.
3. 3) If zero is used to locate the decimal point it is considered as a significant figure. In 50.000 all zero are significant.
4. 1)
5. 1) According to law of constant proportions a pure chemical compound always contains same elements combined together in the same definite proportion of weight.
6. 3) In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that ratio S and O when combine with C is 2 : 1. Ratio of S and O is SO_2 is 1 : 1
7. (3) According to Avogadro's law "equal volumes of all gases contain equal number of molecules under similar conditions of temperature and pressure". Thus if 1 L of one gas contains N molecules, 2 L of any other gas under the same conditions of temperature and pressure will contain 2N molecules.
8. (2) The number of molecules of N_2 and X are same. Hence they must have the same molecular weights. $\therefore$ X is CO.
9. (2) Gram molecular weight of CO = 12 + 16 = 28 g

6.023×10^{23} molecules of CO weight 28 g 1 molecule of CO weighs $= \frac{28}{6.02 \times 10^{23}} = 4.65 \times 10^{-23}\text{g}$

10. 2) Total atoms in 1 molecule of $C_{12}H_{22}O_{11} = 12 + 22 + 11 = 45$

$\therefore$ total atoms in 1 mole of $C_{12}H_{22}O_{11} = 45 \times 6.02 \times 10^{23}$ atoms/mol

11. 3)

12. 3) 6g of O_2 contains $\frac{6}{32} \times N_A$ molecules whereas 6g of SO_2 contains $\frac{6}{64} \times N_A$ molecules.

13. 4) In, AlF_3 the number of F is 3 for one AlF_3 molecule

$3F^- = 1$ formula unit of AlF3

$3.0 \times 10^{24} F^- \equiv 1 \times 10^{24} AlF_3 \text{units} = 1.0 \times 10^{24}$

14. 3) a) Weight of H2 = mole × molecular wt. = 0.2 × 2 = 0.4 g

b) $6.023 \times 10^{23} = 1\text{mole}$

Thus $6.023 \times 10^{22} = 0.1$ mole

weight of N_2 = 0.1x28=2.8g

c) Weight of silver = 0.1 g

d) Weight of oxygen = 32 × 0.1 = 3.2 g

15. 2) Average atomic mass of neon = $20 \times 0.9051 + 21 \times 0.0027 + 22 \times 0.0922 = 20.187u$

16. 2)

17. 1) Partial pressure of $O_2 = \frac{2}{7} \times 2660 = 760\text{mm Hg}$

At STP one mol of a gas occupies a volume of 22.4 L.

Hence, number of moles of O_2 in 1L = 1/22.4

18. 2) 6.02×10^{23} molecules of CO =1mole of CO

6.02×10^{24} CO molecules = 10 moles CO

= 10 g atoms of O = 5 g molecules of O2

19. (3) 16 g CH_4 is 1 mol. Hence number of molecules = Avogadro number = 6.023×10^{23}

20. 1) Initial mole of $I_2 = \frac{25.4}{257} = 0.1\text{mole}$

Initial mole of $Cl_2 = \frac{14.2}{71} = 0.2\text{mole}$

$I_2 + 2Cl_2 \rightarrow ICI + ICI_3$

Initially 0 0

After reaction 0.1 0.1

21. 1) Relative atomic mass

$$= \frac{\text{Mass of one atom of the element}}{1/12^{th} \text{part of the mass of one atom of Carbon} - 12} \text{ or } \frac{\text{Mass of one atom of the element}}{\text{mass of one atom of the C} - 12} \times 12$$

Now if we use 1/6 in place of 1/12 the formula becomes

Relative atomic mass = Mass of one atom of element /Mass of one atom of carbon $\times 6$

$\therefore$ Relative atomic mass decrease twice

22. 2)

$$5\begin{matrix} COO^- \\ | \\ COO^- \end{matrix} + 2\,MnO_4^- + 16\,H^+ \rightarrow$$

oxalate ion

$$2\,Mn^{2+} + 10CO_2 + 8H_2O$$

From above equation 2 moles MnO_4^- required to oxidise 5 moles of oxalate.

Thus number of moles of MnO_4 required to oxidise one mole of oxalate = 2/5 = 0.4

23. 1) 21% of 1 litre is $\Rightarrow 0.21$ litre.

22.4 litres = 1 mole at STP

$\therefore 0.21\text{litre} = \frac{0.21}{22.4} = 0.0093\text{mol}$

24. 3) Mass of iron in 100 g haemoglobin = 0.334 g.

$\therefore$ In 67200g haemoglobin, mass of iron = $\frac{842}{6.023\times10^{23}} = 1.4\times10^{-21}$ g

$\therefore$ The number of Fe atoms in one molecule of haemoglobin

$= \frac{672\times0.334}{56} = 4$

25. 3) Moles of $P_4 = \frac{12.4}{4\times31} = 0.1$

Moles of $O_2 = \frac{12.8}{32} = 0.4$

Let x moles of P_4 form P_4O_6

Then, moles of O_2 required= $x\times3+(0.1-x)\times5 = 0.4$

(given) $\Rightarrow x = 0.05$

26. 1) Fe (number of moles) = $\frac{558.5}{55.85} = 10\text{moles} = 10N_A\text{atoms}$

No. of moles in 60 g of C = 60/12 = 5 moles = $5N_A$atoms

27. 4) Molecular weight of $ZnSO_4, 7H_2O = 65+32+(4\times16)+7(2\times1+16) = 287$

$\therefore$ percentage mass of zinc (Zn) = $\frac{65}{287}\times100 = 22.65\%$

28. 4) $(V.D)_{mix} = X_{NO2}\times(V.D)_{NO_2} + X_{N_2O_4}\times(V.D)_{N_2O_4}$

$27.6 = x\times23+(1-x)\times46\,(x = \text{mole fraction of } NO_2) \Rightarrow x = 0.8$

29. 4) At S.T.P. 22.4 litre of gas contains 6.023×10^{23} molecules

$\therefore$ molecules in 8.96 litre of gas = $\frac{6.023\times10^{23}\times8.96}{22.4} = 24.08\times10^{22}$

30. 3) Molecular weight of $XY_2 = \frac{wt}{moles} = \frac{10}{0.1} = 100$

Molecular weight of $X_3Y_2 = \frac{9}{0.05} = 180$

Let a and b be the atomic masses of X and Y respectively.
Then a + 2b = 100
3a + 2b = 180
$\therefore$ a = 40 and b = 30

31. 3) Q Given weight of hydrated crystal = 4 g
Weight of water = 0.8
$\therefore$ Weight of anhydrous salt = 4 – 0.8 = 3.2
Q 3.2 g anhydrous salt = 0.8 g of water

$\therefore$ 144 g anhydrous salt = $= \frac{0.8}{3.2}\times144 = 36$ g of water

$\therefore x = \frac{36}{18} = 2$

32. 1) $M = \frac{6.02\times10^{20}\times1000}{100\times6.023\times10^{23}} = \frac{6.02\times10^{21}}{6.02\times10^{23}} = 0.01M$

33. 2)Suppose weight of metallic chloride = 100 g
Then weight of metal = 47.22 g
Weight of chlorine = 100 – 47.22 = 52.78 g

$\therefore$ Equivalent weight of metal= $\left(\frac{\text{Mass of Metal}}{\text{Mass of chloride}}\right)\times35.5 = \frac{47.22}{52.78}\times35.5 = 31.76$

34. 2) The atomic weight of sulphur = 32

In SCl_2 valency of sulphur = 2

So equivalent mass of sulphur = $\frac{32}{2} = 16 g/mol$

35. 1) $\frac{E + \text{Eq.mass of } Cl^-}{\text{Eq.mass of } Ag + \text{Eq.mass of } Cl^{-1}} = \frac{E + 35.5}{108 + 35.5} = \frac{0.2}{0.5} \Rightarrow E = 21.90$

36. 3) Equivalent mass of oxygen = 8;

Equivalent mass of metal = 2.5 × 8 = 20

For mininum molecular mass, the oxide must contain one mol atom of oxygen i.e., 16 g or two equivalents.

Mass of two equivalents of metal = 2 × 20 = 40 g.

Hence, molar mass of the metal oxide = 40 + 16 = 56 g

37. 3) 0.1 g of oxygen ≡ 1 g of halogen.

Hence equivalent mass of halogen = $= \frac{1}{0.1} \times 8 = 80$

(Equivalent mass of O = 8)

38. 2) 1equivalent of NaOH ≡ 1 equivalent of $Al(OH)_3$

$\therefore 40g \text{ of } NaOH \equiv \frac{78}{3} g \text{ of } Al(OH)_3$

39. Weight of iron oxide = 1.644 g

Weight of iron after reduction = 1.15 g

weight of displaced oxygen = 1.644 – 1.15 = 0.494 g

$\therefore$ Equivalent weight of iron = $\frac{1.15}{0.494} \times 8 = 18.62$

Thus equivalent weight of metal is = 18.62.

40. 2) Mol of X in 60 g = $\frac{60}{M_x}$ and mol of Y in 40g = $\frac{40}{M_Y}$

Also, $\frac{n_x}{n_y} = \frac{2}{3} = \frac{60}{M_x}\frac{M_y}{40} \Rightarrow Mg = \frac{4}{9} M_x = 44\%$ of atomic weight of x

41. 1) mmol of $H_2C_2O_4 = 25 \times 0.0208 = 0.52 \Rightarrow$ mmol of $KMnO_4$ required $= \frac{2}{5} \times 0.52 = 0.208$

$\Rightarrow$ volume of $KMnO_4$ required $= \frac{0.208}{0.0154} = 13.5 mL$

42. 4) 0.5 g of Se = 100 g enzyme

78.4 g of Se = $\frac{100}{0.5} \times 78.4 = 1.568 \times 10^4 g$ enzyme

43. 4)

44. 2)

$$\underset{n\,\text{mol}}{Ba(OH)_2} + CO_2 \longrightarrow \underset{n\,\text{mol}}{BaCO_3} + H_2O$$

n mol $Ba(OH)_2 = n$ mol $BaCO_3$

$\therefore$ 0.205 mol $Ba(OH)_2 \equiv 0.205$ mol $BaCO_3$

Wt. of substance = No. of moles × Molecular mass

$= 0.205 \times 197.3 = 40.5 g$

45. 2)

$$\begin{array}{ccc} H_2 + & Cl_2 \rightarrow & 2HCl \\ 1L & 1L & 2L \\ 11.2\,L & 11.2\,L & 22.4L \end{array}$$

Volume of $H_2 = [12 - 11.2] = 0.8\,L$,
Volume of Cl_2 = Zero, Volume of HCl = 22.4 L

46. 1)

$$\begin{array}{cccc} 2SO_2 + & O_2 & \longrightarrow & 2SO_3 \\ 10 & 15 & & 0 \\ 10-2x & 15-x & & 2x \\ \because 2x = 8 & x = 4 & & \end{array}$$

Hence, remaining, $SO_2 = 10 - 8 = 2$ moles,
$O_2 = 15 - 4 = 11$ moles

47. 2) $2KI + HgI_2 \rightarrow K_2HgI_4$
Moles of KI required to produce 0.4 moles of $K_2HgI_4 = 2 \times 0.4 = 0.8$

48. 2)

$$\begin{array}{lccc} & NH_3(g) + & HCl(g) \rightarrow & NH_4Cl(g) \\ t=0 & 20mL & 40mL & 0 \\ t=t & 0 & 20mL & solid \end{array}$$

Final volume = 20 mL

49. 2)

50. 1) Applying law of equivalence
Equivalence of acid = Equivalence of base
$0.1 \times v = 0.04 \times 1$
$v = 0.4L = 0.4 \times 1000 = 400mL$

51. 3) The relation between molarity (M) and molality (m) is
$d = M\left(\frac{1}{m} + \frac{M_2}{1000}\right)$, M_2 = Mol. mass of solute On putting value
$1.252 = 3\left(\frac{1}{m} + \frac{58.5}{1000}\right)$
on solving m = 2.79

52. 1)

$$\begin{array}{ccccccc} BaCl_2 & + & H_2SO_4 & \longrightarrow & BaSO_4 & + & 2HCl \\ 1\text{ mole} & & 1\text{ mole} & & 1\text{ mole} & & 1\text{ mole} \\ 208\text{ g} & & 98\text{ g} & & 233\text{ g} & & 73\text{ g} \\ 20.8\text{ g} & & 9.8\text{ g} & & 23.3\text{ g} & & 7.3\text{ g} \end{array}$$

53. 1) $n = \frac{\text{Mass}}{\text{Molar mass}}$
$0.0242 = \frac{1.657}{M} \Rightarrow M = 68.47$
$1 + X + 32 = 68.47$
X = 35.5

54. 1) $CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$

Mass of $H_2 = \frac{2 \times 2 \times 70}{42} = 6.67g$

(Molar mass of $CaH_2 = 42g$)

55. 2) $2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3$

According to equation 3/2mole of O_2 combines with 2 moleAl.
2 mole AI = 54g

56. 1) Let mass of $O_2 = 1g$

$\therefore$ Mass of $N_2 = 4g$

No. of molecules of O_2 = $\frac{1}{32}$

No. of molecules of N_2 = $\frac{4}{28}$

Ratio of no. of molecules = $\frac{1}{32} : \frac{4}{28} : \frac{1}{32} : \frac{1}{7} = 7 : 32$

57. 2) Weight of H_2O_2 in 100mL of H_2O_2 solution = 6.8g

$\therefore$ Weight of H_2O_2 in 1000mL of its solution = $6.8 \times 10 = 68g$

Molecular weight of H_2O_2 = 34

Then, Molarity = $\frac{68}{34} = 2M$

58. 4) 1 Mole of $Mg_3(PO_4)_2$ contains 8 mole of oxygen atoms

$\therefore$ 8 mole of oxygen atoms $\equiv$ 1 mole of $Mg_3(PO_4)_2$

0.25 mole of oxygen atom $\equiv \frac{1}{8} \times 0.25$mole of $Mg_3(PO_4)_2 = 3.125 \times 10^{-2}$mole of $Mg_3(PO_4)_2$

59. 4)Number of moles = $\frac{\text{weight}}{\text{mol.wt}} = \frac{50}{342} = 0.14\text{mole}$

60. 4) $25 \times N = 0.1 \times 35; N = 0.14$

$Ba(OH)_2$ is diacid base

Hence N = $M \times 2$ or $M = \frac{N}{2}$

M = 0.07M

61. 1) Empirical formula of compound = CH_2
Molecular mass of the compound = 42
$\therefore n = 42/14 = 3$
$\therefore$ Hence molecular formula = C_3H_6

62. 1)

Element	Percentage	Atomic weight	Atomic ratio	Simple ratio
C	38.71	12	$\frac{38.71}{12}=3.23$	$\frac{3.23}{3.23}=1$
H	9.67	1	$\frac{9.67}{1}=9.67$	$\frac{9.67}{3.23}=3$
O	$100-(38.71+9.67)=51.62$	16	$\frac{51.62}{16}=3.23$	$\frac{3.23}{3.23}=1$

Thus empirical formula is CH_3O

63. 3)

	Percentage	R.N.A	Simplest ratio
C	9	$\frac{9}{12}=\frac{3}{4}$	3
H	1	$\frac{1}{1}=1$	4
N	3.5	$\frac{3.5}{14}=\frac{1}{4}$	1

Empirical formula $= C_3H_4N$

$(C_3H_4N)_n = 108$

$(12\times 3+4\times 1+14)_n = 108$

$(54)_n = 108$

$n=\frac{108}{54}=2$

$\therefore$ molecular formula $= C_6H_8N_2$

64. 3) Molecular mass of metal chloride $=\frac{0.72\times 22400}{100}=161.28$

Mass of chlorine in molar mass of chloride

$=\frac{65.5\times 161.28}{100}=105.64g$

Mole atoms of chlorine in one mole of chloride

$=\frac{105.64}{35.5}=3$

65. 3) According to stoichiometry they should react as follow

$4NH_3+5O_2\rightarrow 4NO+6H_2O$

4 mole of NH_3 requires 5 mole of O_2

1 mole of NH_3 requires = $\frac{5}{4}=1.25$ mole of O_2

Hence O_2 is consumed completely

66. 1)

$$\underset{\substack{2\times122.5\text{ g}\\245}}{2KClO_3} \xrightarrow{\text{heat}} 2KCl + \underset{\substack{3\times32\text{ g}\\96}}{3O_2}$$

48 g of oxygen will be produced from 122.5 g of $KClO_3$

$\therefore$ Amount of 80% $KClO_3$ needed

$$= \frac{100}{80}\times122.5 = 153.12\ \text{g}$$

67. 3) The acid with empirical formula CH_2O_2 is formic acid, HCOOH.

68. 1) Let 100 g of compound be there

Number of moles of Nitrogen $= \frac{35}{14} = 2.5$

Number of moles of Hydrogen $= \frac{5}{1.008} = 4.9$

Since 2.5 is the smallest value division by it give ratio

N : H : C

1 : 1.96 : 1.96

= 1 : 2 : 2

Empirical formula = C_2H_2N

Empirical formula weight = $2\times12+2+14=40$

Molecular mass = 80

Molecular formulae = $n(C_2H_2N) = 2(C_2H_2N)\left(n=\frac{80}{40}\right) = C_4H_4N_2$

69. 2)

$$Mg + 2HCl \rightarrow MgCl_2 + H_2\uparrow$$

1 mole — 1 mole

$\frac{1}{2}$ mole — $\frac{1}{2}$mole (12g of Mg $=\frac{1}{2}$ mol)

70. 4) The following reaction occurs:

$$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

From the above equation, we find that Mohr's salt

$(FeSO_4.(NH_2)_2SO_4.6H_2O)$ and dichromate reacts in 6 : 1 molar ratio.

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (d) $HCOOH \xrightarrow[\text{Dehydrating agent}]{H_2SO_4} CO + H_2O$ [H_2O absorbed by H_2SO_4]

At start (moles) $= \frac{2.3}{46} = \frac{1}{20}$ 0   0

Final moles 0 $\frac{1}{20}$ $\frac{1}{20}$

$H_2C_2O_4 \xrightarrow{H_2SO_4} CO + CO_2 + H_2O$ [H_2O absorbed by H_2SO_4]

At start (moles) $= \frac{4.5}{90} = \frac{1}{20}$ 0   0   0

Final moles 0 $\frac{1}{20}$ $\frac{1}{20}$ $\frac{1}{20}$

CO_2 is absorbed by KOH.
So the remaning product is only CO.
Moles of CO formed from both reactions

$$= \frac{1}{20} + \frac{1}{20} = \frac{1}{10}$$

Left mass of CO $=$ moles $\times$ molar mass

$$= \frac{1}{10} \times 28 = 2.8 \text{ g}$$

2. **1) a)** Mass of water = $18 \times 1 = 18\text{g}$

Molecules of water = mole $\times N_A = \frac{18}{18} N_A = N_A$

b) Molecules of water = mole $\times N_A = \frac{0.18}{18} N_A = 10^{-2} N_A$

c) Molecules of water = mole $\times N_A = 10^{-3} N_A$

d) Molecules of water = mole $\times N_A = 10^{-4} N_A$

3. 1) Molarity depends on the volume of a solution which can be changed with change in temperature.

4. 4) $MgCO_3 \rightarrow MgO + CO_2$

84g of $MgCO_3$ form 40g of MgO

$\therefore$ 20g of $MgCO_3$ form $\frac{40 \times 20}{84}$ g of Mg $= 9.52$g of MgO

Since 8.0 g of MgO is formed

Purity of sample = $\frac{8}{9.52} \times 100 = 84.0\%$

5. **(4)** No. of moles of water
In 1.8 g of H_2O = 0.1 moles
In 18 g of H_2O = 1 moles
1 mole contain 6.022 × 1023 molecules of water
therefore maximum number of molecules is in 18 moles of water.

6. 4) Molality = $\frac{w}{M} \times \frac{1}{V(kg)} = \frac{n}{V(kg)}$ (where $n_{solute} = w/M$)

$1.00m = \frac{n}{V(kg)}$ i.e.,1mole in 1 kg of water

Moles of 1 kg H_2O $= \frac{1000g}{18g/mol} = 55.55mole$

Moles of solute = 1

Mole fraction

$= = \frac{n_{solute}}{n_{solute} + n_{water}} = \frac{1}{(1+55.55)} = 0.01768 = 0.0177$

7. 2) If 6.022×10^{23} changes to 6.022×10^{20} /mol than this would change mass of one mole of carbon.

8. 3)

(c) 50 mL of 16.9% solution of $AgNO_3$

$$\left(\frac{16.9}{100}\times 50\right) = 8.45 \text{ g of } AgNO_3$$

$$n_{mole} = \frac{8.45g}{(107.8+14+16\times3)\ g/mol}$$

$$= \left(\frac{8.45\ g}{169.8g/mol}\right) = 0.0497 \text{ moles}$$

50 mL of 5.8% solution of NaCl contain

$$NaCl = \left(\frac{5.8}{100}\times 50\right) = 2.9\ g$$

$$n_{NaCl} = \frac{2.9\ g}{(23+35.5)\ g/mol} = 0.0495 \text{ moles}$$

$AgNO_3 +$	$NaCl$	$\rightarrow$	$AgCl\downarrow + Na^+ + Cl^-$
1 mole	1 mole		1 mole
0.049 mole	0.049 mole		0.049 mole of AgCl

$$n = \frac{w}{M} \rightarrow w = (n_{AgCl}) \times \text{Molecular Mass}$$

$$= (0.049)\times(107.8+35.5)$$

$$= 7.02\ g$$

9. 3) According to Avogadro's law "At same temperature and pressure Volume $\propto$ no. of moles"

$n_{H_2} = \frac{w}{2}; n_{o_2} = \frac{w}{32}; n_{CH_4} = \frac{w}{16}$

$\because V_{H_2} : V_{O_2} : V_{CH_4} = n_{H_2} : n_{O_2} : n_{CH_4} = \frac{w}{2} : \frac{w}{32} : \frac{w}{16} = 16:1:2$

10. 1)

	H_2 +	Cl_2	$\longrightarrow$	$2HCl$
t = 0	22.4 lit	11.2 lit		0
t = 0 or	1 mole	0.5 mole		0
at time t	(1 – 0.5) = 0.5			0.5 × 2 = 1 mole

11. 1)

$$\text{Initially } \underset{1g}{Mg} + \underset{0.56}{\frac{1}{2}O_2} \longrightarrow MgO$$

$$\text{or} \quad \frac{1}{24}\text{mole} \quad \frac{0.56}{32}\text{ mole}$$

$$0.0416\,\text{mole} \quad 0.0175\,\text{mole}$$

$$(0.0416 - 2 \times 0.0175)(2 \times 0.0175)\,\text{mole}$$

$$= 0.0066\,\text{mole}$$

$$\therefore \quad \text{Mass of Mg} = 0.0066 \times 24$$

$$= 0.158 \approx 0.16g$$

12. 4) 1 mole of carbon = 6.022×10^{23} atoms
13. 2)

%C	%H
78	22
78/12	22/1
6.5	22
6.5/6.5	22/6.5
1	3.38

14 $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + 2H_2O$

1 : 2

0.5 M HCl, 50 ml $\Rightarrow$0.025 moles

1 $CaCO_3$ – 2 HCl

? - 0 .025

0.025/2 = 0.0125 moles

For 95% pure 100/95x1.25 = 1.32gms