Chemistry

Class 11th and 12th

JEE/NEET/ CET/

State board

All chapters

Handwritten notes

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Basic

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* **Ionisation :⟹**
Formation of ions.

$$NaCl \xrightarrow{H_2O} Na^{\oplus} + Cl^{\ominus}$$

− tv = Anion.
+ tv = Cation.

e^-	11	17	−10	−18
p+	11	17	11	17
	(2, 8, 1)	(2, 8, 7)	+1	−1

S^{-2} = Sulphide.
Fe^{2+} = Ferrous.
Fe^{3+} = Ferric.
Cu^{2+} = cupric.
Cu^{+} = cuprous.
SO^{-2} = sulphate.
CO_3^{-2} = carbonate.
HO^{3} = nitrate.
$-OH$ = Hydroxyl.
NO_2 = Nitride.

higher = ic.
Lower = ous.

* **RCC** = Reenforce Cement Concrate

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* **Chemistry :**
It is defined as the study of composition structure and properties of matter and reactions by which one form of atom may be converted into another form.

* **Matter :**
Any thing which has mass and which can occupies space is known as matter.

* **Energy :**
It is capacity to do work.

* Matter and energy are inconvertible.
$E = mc^2$

Matter.

- Pure substance
  - elements
    - Carbon
    - Iron
    - ↓
    - Smallest Particals
    - ↓
    - atom
  - compounds
    - H_2O
    - sugar
    - ↓
    - Smallest Particals
    - ↓
    - Molecules.
- Mixture.
  - Homogenous
    - air, salt solution
    - ↓
    - Particales size 0.1 to 1mm
    - ↓
    - Only one phase.
  - Hetrogenous
    - collidal dispersion
    - ↓
    - 1 - 1000 nm.
    - coarse dispersion
    - ↓
    - greater than 1000 nm

Q. Write short notes on :

(A) Phlogiston Theory

Ans :⟹ ① This theory states that any substance that can undergoes combustion consists of two mysterious matter known as phlogiston and clax.

② When substance undergoes combustions phlogiston gets evoporated in atmosphere and clax remain behind as a ash

Phlogiston + clax

↓

Ash

③ When candle burns in close container the space in the container gets filled with phlogiston

④ No more phlogiston can be accomodated Hence candle gets extingushed.

* Hydrogen = Hydra + genesis = Water forming gas.

* Oxygen = Oxy + genesis = Acid forming gas.

* Elements :

It is defined as a substance that cannot be decomposed by simple chemical process. In two or more different substances.

e.g. carbon, Iron, sodium, Nitrogen etc.

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100 (Naturally)

18 (Artificial) (manmade).

* **Compounds :**

Compounds are defined as a substance of definite compositions which can be decomposed into two or more substances by simple chemical process.

e.g. ⇒ Water (H_2O), sugar, Alcohol, CO_2 etc.

* **Units :**

The standard used for measurment of physical quantity is called as unit.

It should be universally accepted and easily avail

- **Seven Fundamental SI units.**

Fundamental quantity	SI unit	Symbol
Length	Meter	m
Mass	Kilometer	Kg
Time	secound	s
Temperature	Kelvin	K
Amount of substance	Mole	mol
Electric current	Ampere	A
Luminous intensity.	Candela.	cd.

- **Derived units**

NO.	Physical quantity.	Relationship with Fundamental units.	symbol
	Area	Length squared	m^2

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Volume	length cubed.	m^3
Density	Mass per unit volume	$Kg\ m^{-3}$
Velocity	Distance travelled in unit time.	$m\ s^{-1}$
Acceleration	velocity change per unit time	ms^{-2}
Force	Mass x Acceleration	$Kg\ ms^{-2}$ (newton N)
Pressure	Force per unit area.	$Kg\ m^{-1}\ s^{-2}$
Electric charge Electric P.D. or potential diffrec	current x time energy per unit charge.	As (columb, c) $Kg\ m^{-2} s^{-2} A^{-1}$ / $JA^{-1}s^{-1}$ volt / JC
Energy (work or heat)	force x distance travelled.	$Kg\ m^2 s^{-2}$ or Joule s^{-1}
Concentration.	mole per cubic meter	$mol\ m^{-3}$
Electrochemical equivalent	$Z = E/F$	Kg/coulmb or $Kg\ c^{-1}$
Heat Capacity	$C_p = dH/dT$, $C_v = dE/dT$.	$JK^{-1}\ mol^{-1}$

* Laws of chemical combination :

(A) Law of conservation of mass

This law states that the mass is neither created nor destroyed during chemical combination of matter.

It means the total mass of reactants is exactly equal to the total mass of products.

Consider following reactions.

① Carbon + Oxygen ⟶ Carbon dioxide

$C_{(s)} + O_{2\,(g)} \longrightarrow CO_{2\,(g)}$

12 + 32 = 44 ; 12 + 32 = 44

② $CaCO_{3\,(s)} \xrightarrow[\Delta]{1200\ K} CaO_{(s)} + CO_{2\,(g)}\uparrow$

40 + 12 + 48 = 100 ; (40 + 16) (44) = 100

(B) Law of definite composition :

The law states that any pure chemical compound always contains same elements in definite proportion by weight irrespective of its source or method of preparation.

This is also known as Law of definite proportio

e.g. sample of water can be collected from anywhere or it can prepared in laboratory but it always contains 88.89 % oxygen and 11.11 % hydrogen by mass.

$\therefore H_2O$ molar mass = 16+2 = 18 gm/mol

% of oxygen = $\frac{16}{18} \times 100 = 88.89$ %

% of hydrogen = $\frac{2}{18} \times 100 = 11.11$ %

* **Law of multiple proportion:**

The law states that if two elements chemically combine with each other forming two or more compounds with different compositions by mass then the ratio of masses of interacting elements are in simple whole no.'s

e.g. When carbon & oxygen chemically combine with each other they can form carbon dioxide (non, poisoneous, ex fireextinguisher) or carbon monoxide. (Poisonous, combustible).

For carbon dioxide: $\Longrightarrow$

$$\frac{2.66 \text{ grams of oxygen}}{1.0 \text{ grams of carbon}} = 2.66$$

for carbon monoxide: $\Longrightarrow$

$$\frac{1.33 \text{ grams of Oxygen}}{1.0 \text{ grams of carbon}} = 1.33$$

Ratio of masses of Oxygen in CO_2 & CO

$$\frac{2.66}{1.33} = 2:1$$

* **Gay Lussacs law of combining volume of gases.**

This law states that when gases react together to produce gaseous products the volume of reactant & product gases bear a simple whole no. ratio provided that volumes are measured at constant temperature and pressure.

e.g

$$\underset{1L}{H_2} + \underset{1L}{Cl_2} \longrightarrow \underset{2L}{2HCl}$$

volume ratio 1 : 1 : 2

$$\underset{1L}{N_2} + \underset{3L}{3H_2} \longrightarrow \underset{2L}{2NH_3}$$

volume ratio 1 : 3 : 2

- **Note :⇒** Volume of the gases is not additive.

Q. Give the postulates of Daltan's atomic theory.

Ans :⇒ ① All matters are made up of tiny indivisible and indestructeble Uniqtet particles called atoms.

* Atomic mass = $\frac{\text{Mass of element}}{\frac{1}{12}\text{th mass of C-12 atom}}$

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Atom is the smallest particle of element while molecule is smallest particle of compound.

② Atoms of the same element are similar with respect to size, shape and mass while atoms of different elements are dissimilar.

③ Compounds are formed when atomes of the different elements combines with each other in simple whole no. ratio.

④ A chemical reaction involves only seperation combination or rearrangement of integer no. of atoms.
During chemical reaction atom is neither created nor destroyed.

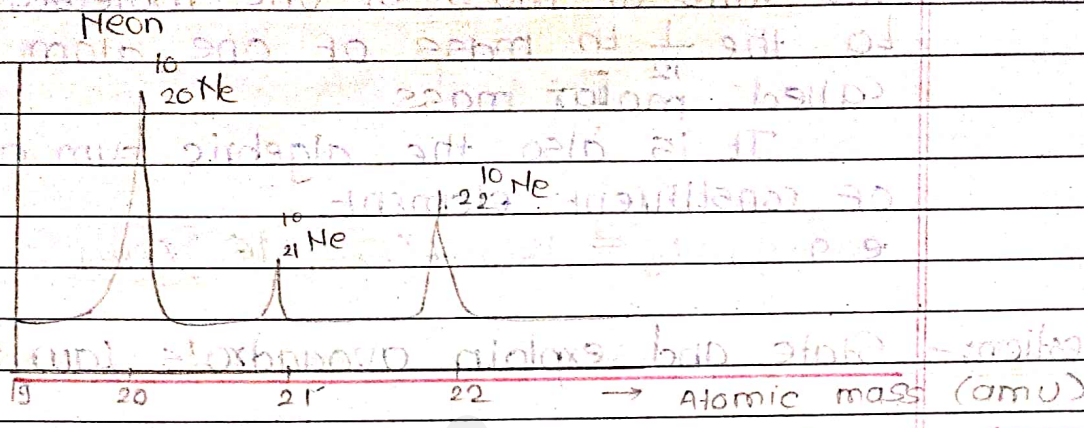
* Atomic Mass :-
Single atom of any element is too small to weigh directly. atomic mass of the element is the ratio of mass of that element to $\frac{1}{12}$th mass of C-12 atom.

C-12 atom = w $\quad \therefore \frac{w}{12} = 1.66 \times 10^{-24}$ gm
$= 1$ amu / unified mass.

H - 1 amu

O - 16	Ca - 40
C - 12	S - 32
H - 24	P - 31
Na - 23	Cl - 35.5

* **Isotopes :-**



question: What is need of turn average atomic mass ?

→ Isotopes are the atoms of same element having same atomic no. but different atomic mass no. In nature different elements exist in different isotopes forms. with each form having different natural abandance and hence average atomic mass must be calculated.

e.g. chlorine exist in two isotopic form namely $^{35}_{17}Cl$ and $^{37}_{17}Cl$ with natural abendance 75 % and 25 % respectively.

$$\left(\text{Average atomic mass}\right) = \left(\text{Atomic mass} \times \frac{\%}{\text{abandance}}\right) + \left(\text{atomic mass} \times \frac{\%}{\text{abandance}}\right)$$

$$= \frac{(35 \times 75) + (37 \times 25)}{100} = 35.5 \text{ Amu}$$

* **Molecular mass / Molar mass :-**

The molar mass of a substance is defined as

T = temperature , P = Pressure

the ratio of mass of one molecual of substance to the $\frac{1}{12}$ th mass of one atom of C-12 is called molar mass.

It is also the algebric sum of atomic masse of constituent element

e.g. $CH_4 = 12 + 4(1) = 16$ Amu

Question:- State and explain avogadro's law :

⟹ Avogadro's law states that equal volume of al gases under identical conditions of temperature and pressure contain equal no. of molecules.

Avogadro's law can also be stated as at constant temperature and pressure, volume of gas is directly proportional to its no. of molecules

Mathematically :—

$V \propto$ No. of molecules (at constant T, P)

$V \propto$ No. of moles

$V \propto n$ (at constant T, P)

$\frac{V}{n} =$ Constant

$\therefore n = \frac{\text{Weight}}{\text{Molecular mass}}$

* STP = Standard Temprature Pressure.

at STP $\left(\frac{V}{n}\right)$ can be calculated according to ideal gas eqn $PV = nRT$

$\frac{V}{n} = \frac{RT}{P}$ at STP.

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$P = 1$ atm.

$T = 273$ K

$R = 0.0821$ L. atm mol^{-1} K^{-1}

$\therefore$ (Molecular gas constant)

$$\frac{V}{n} = \frac{0.0821 \text{ L. atm. mol}^{-1} \text{ k}^{-1} \times 273 \text{ K}}{1 \text{ atm}}$$

$\therefore \frac{V}{n} = 22.414$ L. mol^{-1} if $n = 1$

$\therefore V = 22.414$ L.

Is called Avagadro's molecular volume.

* **Mole concept :—**

The quantity of a substance equal to its atomic mass or molar mass and grams is refered as one mole of that substance.

One mole of substance is defined as the amount of substance that contains no. of particles, atoms, molecules, ions or electrons as present in 0.012 kg of Carbon-12 This no. is 6.022×10^{23}. and is known as avogadro's no. (N_A).

This no. of electrons makes an electrical charge one Farady.

One more of any gas at STP occupies 22.414 Litters.

formula :—

$$\text{No. of moles} = \frac{\text{Weight of substance}}{\text{Molar mass}}.$$

$$\text{No. of moles} = \frac{\text{Volume of given gas at STP}}{22.414}$$

$$\text{No. of moles} = \frac{\text{No. of particles}}{\text{Avagadro's No.}}$$

e.g. (1)

Nitrogen:—

One atom of N = 14 Amu.

1 atom of N $= 14 \times 1.66 \times 10^{-24}$ gm

$= 23.24 \times 10^{-24}$ gm.

Weight of 1 mole of N atom $= (23.24 \times 10^{-24})(6.022 \times 10^{23})$

$= 23.24 \times 6.022 \times 10^{-1}$

$= 2.324 \times 6.022 = 14$ gm

(2) **Oxygen:—**

$(_8^{16}O)$

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Atomacity - NO. of atoms in compound

Q.1 How many atoms and molecules are present in 8 grams of methane?

soln :- Weight of CH_4 = 8 grams.

NO. OF molecules & atoms = ?

Molar mass = C + 4(H) = 12 + 4(1) = 16 grams.

$$n = \frac{\text{Weight}}{\text{Molar mass}} = \frac{8}{16} = \frac{1}{2}$$

NO. of molecules = $\frac{1}{2} \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$

NO. of atoms = NO. of molecules × Atomatity

$= 3.011 \times 10^{23} \times 5 = 15.055 \times 10^{23}$.

Question 2 Calculate no. of atoms and molecules present in 11 gram CO_2.

soln :- Given :-

Weight of CO_2 = 11 grams

NO. of atoms and molecules = ?

Molar mass = C + 2(O) = 12 + 2 × 16 = 44 grams.

$$n = \frac{\text{Weight}}{\text{Molar mass}} = \frac{11}{44} = \frac{1}{4}$$

NO. of molecules = $\frac{1}{4} \times 6.022 \times 10^{23} = 1.50505 \times 10^{23}$

NO. of atoms :- NO. OF molecules × Atomaticy

$= 1.50505 \times 10^{23} \times 3$

$= 4.51515 \times 10^{23}$.

Question: Calculate the mass of single molecule atom of water molecule.

Soln:— Given :-

Weight = ?

Molar mass = $H_2O = 2(1) + 16 = 18$ grams.

1 mole H_2O = 18 gm.

6.022×10^{23} molecules = 18 gm.

1 molecules = ?

Wt of 1 molecules of $= \frac{18}{6.022 \times 10^{23}} = 3 \times 10^{-23}$ gm

2nd method:

1 molecule of H_2O = 18 Amu

$= 18 \times 1.66 \times 10^{-24}$

$= 3 \times 10^{-23}$ grams / Amu.

Q Calculate the no. of atoms and molecules present in molecules

(i) 1.1×10^{-4} kg. of CO_2

(ii) 5.6 decimeter $(dm)^3$ of NH_3. at STP.

Soln:— Given.

Weight $= 1.1 \times 10^{-4} = \frac{1.1}{1000} \times 10^{-4} = 0.11$ gram.

(for kg → gram)

Molar mass = $CO_2 = 12 + (16) \times 2 = 12 + 32 = 44$

$n = \frac{\text{Weight}}{\text{Molar mass}} = \frac{1.1}{1000} \times \frac{1}{44}$

$= \frac{0.011}{44} = \frac{0.01}{4} = \frac{1}{40} = 0.025$

or

$\frac{1}{4} \times 10^{-2}$

No. of Molecules $= \frac{1}{4} \times 10^{-2} \times 6.022 \times 10^{23}$

$= 1.505 \times 10^{21}$

No. of atoms $= 1.505 \times 3 = 4.51515 \times 10^{23}$

Volume of $NH_3 = 5.6\ dm^3$

$\therefore n = \frac{\text{Volume of gas at STP}}{22.414} = \frac{5.6}{22.414} = \frac{1}{4} = 0.25$

No. of Particles $= n \times N_A = \frac{1}{4} \times 6.022 \times 10^{23}$

$= 1.505 \times 10^{23}$

No. of atoms $= 1.505 \times 4 = 6.02 \times 10^{23}$

* Percentage Composition :—

e.g. C_2H_5OH / C_2H_6O

Molar mass $= 2(12) + 6(1) + 16 = 24 + 16 + 6 = 46\ gm/mol$

% of Carbon $= \frac{24}{46} \times 100 = \frac{1200}{23} = 52.17\ \%$

% of Hydrogen $= \frac{6}{46} \times 100 = \frac{300}{23} = 13.05\ \%$

% of 'O' $= \frac{16}{46} \times 100 = \frac{800}{23} = 34.78\ \%$

Question Calculate the mass percentage of each element in sulphuric acid (H_2SO_4)

→ Molar mass = (H) x 2 + S(1) + O(4)
= (1)2 + 32(1) + 16(4) = 2 + 32 + 64
= 98 grams/m

% of H = $\frac{2}{98} \times 100 = \frac{100}{49} = 2.$

% of S = $\frac{32}{98} \times 100 = \frac{1600}{49} = 32.$

% of O = $\frac{64}{98} \times 100 = \frac{3200}{49} = 64.$

* Molecular formula :—
It is the chemical formula which gives the exa no. and type of element in the given molecu

* Emperical
It is the chemical formula that gives the relative no. of atoms in a simplest ratio.

Molecular formula = n x Emperical formula.

Question:- Write a note on chemical stoichiometry :—
Stoichiometry is the process of making calculation base on the formula and balanced eqn.
In stiochomatrically balanced eqn total mass of reactant is always equal to mass of product.
To balanced chemical eqn some no.s are used they are known as Stoichiometric coefficient
e.g.

$$2H_2 + O_2 \longrightarrow 2H_2O$$
(g) (g) (l)

2(2) 32 2(18)

36 grams 36 grams.

Total mass of reactant = Total mass of Product.

e.g.

$$C_{(s)} + \frac{1}{2} O_{2(g)} \longrightarrow CO_{(g)}$$

$$2C_{(s)} + O_2 \longrightarrow 2CO_{(g)}$$

Limiting reagent :—

The reactant that is taken in andaquate quantity is called limiting reactant.

It is the reactant that reacts completly & Stop the further progress of reactant. (reaction)

Excess reagent :-

It is the reactant which is taken in excess quantity.

After the completion of reaction. Some quantity of these substance remains unreacted.

Question:- How many years would it take to spend one Avadronumber Rs. at a rate of 10,00,000 Rs. at per secounds.

⟹ 10 Lakh rupees per secound.

Rupees spend in one year $= 10^6 \times 60 \times 60 \times 24 \times 365$

$10^6 \times 3600 \times 24 \times 365$ rupees = 1 year

6.022×10^{23} rupees $= x$

$$\therefore x = \frac{6.022 \times 10^{23}}{36 \times 10^8 \times 24 \times 365} = \frac{6.022 \times 10^{15}}{36 \times 24 \times 365}$$

$$= \frac{60220 \times 10^{11}}{36 \times 24 \times 365}$$

$= 1.2809 = 0.1909 \times 10^{11}$ years

$= 19.09 \times 10^9$ years.

Question:- What is the mass of 3.01×10^{22} molecules of Ammonia (NH_3)

Soln. —

Molar mass = $NH_3 = 14 + (1) \times 3$

$= 14 + 3 = 20$ grams.

1 mole = 20 grams.

1 mole = 6.022×10^{23}

$\therefore \quad \therefore$

$6.022 \times 10^{23} = 17$ gram

$3.01 \times 10^{22} = x$