मौलिक अधिकार

SAFALTA CLASS™

An Initiative by अमर उजाला

MOLE CONCEPT

- Atomic Mass (परमाणु द्रव्यमान) N
- Molecular Mass (आणविक द्रव्यमान) N_2
- Molar mass (मोलर द्रव्यमान)
- Equivalent Weight (तुल्यांकी भार)
- Molarity (मोलरता)
- Molality (मोललता)
- Normality (नॉर्मलता)

Atomic mass / Molecular Mass

$_{Z}X^{A}$ → A → Atomic mass

Z ↓ Atomic NO.

$_{8}O^{16}$

O → 16u ⇒ Atomic mass ✓

⇒ O_2 ⇒ 32u ⇒ Molecular mass

⇒ H_2SO_4 ⇒ 2H + S + 4O ⇒ 2(1u) + 32u + 4(16)

⇒ 98 unit → molecular mass

* Molar mass :- 98 gm/mol ⇒ H_2SO_4 (molar mass)

Atomic Mass, Molecular Mass & Molar Mass

* $CaCl_2 \Rightarrow Ca + 2Cl$

$\Rightarrow$ 40 unit + 2 (35.5 unit)

$\Rightarrow$ 111 unit $\Rightarrow$ Molecular mass

111u

$\Rightarrow$ Molar mass $\Rightarrow$ 111 gm/mol

$\Rightarrow$ e.g.: $CH_3OH \Rightarrow C + 4H + O$

methanol

$\Rightarrow 12 + 4\times1 + 16$

$\Rightarrow$ 32 unit

Molar $\rightarrow$ 32 g/mol

H_2O ⇒

⇒ 18 unit ⇒ molecular mass H_2O

18 gm → molar mass H_2O

1 mole = 6.022×10^{23} ⇒ Avogadro's Number

① CO_2 ⇒ Molecular mass :-

⇒ C + 2O ⇒ 12 + 32

= 44 unit

⇒ Molar mass :- 44 gm

44 gm ⇒ molar mass of CO_2

| 1 mole ⇒ 6.022×10^{23} CO_2 |

44 gm → 1 mole

22 gm → $\frac{1}{2}$ mole

⇒ 22 gm CO_2

$\frac{1}{2}$ mole = 3.011×10^{23} CO_2

No. of moles

① $\Rightarrow n = \dfrac{\text{Given mass}}{\text{Molar mass}} = \dfrac{m}{M}$

② $\Rightarrow n = \dfrac{N}{N_0 \text{ or } N_A} = \dfrac{N}{N_0}$

N_0 or N_A → Avogadro No.

$\Rightarrow \quad \dfrac{N}{N_0} = \dfrac{m}{M} \Rightarrow$ ③ $N = N_0 \dfrac{m}{M}$

* H_2O (54gm)

$$n = \frac{m}{M}$$

$M = 2H + O$

$= 18\,gm$

$18\,gm \rightarrow 1\,mole$

$3\times$ ($54\,gm \rightarrow 3\,mole$) $\times 3$

$1\,mole = 6.022 \times 10^{23}$

$3\,mole = 18.066 \times 10^{23}$

$$n = \frac{54}{18} = 3$$

$$\Rightarrow N = n \times N_A = 3 \times 6.022 \times 10^{23}$$

$$\Rightarrow 18.066 \times 10^{23}$$

* H_2SO_4 (392 gm) ✓

$\eta = \frac{N}{N_0}$ ✓

$\Rightarrow \eta = 4$ ✓

$N = 4 \times 6.022 \times 10^{23}$

$\eta = \frac{m}{M}$ ✓ molar mass

$\Rightarrow \eta \; ? \; N$

$M = 2 \times 1 + 32 + 4 \times 16 \Rightarrow 2 \times 1 + 32 + 4 \times 16$

$\Rightarrow 98$ gm

$\eta = \frac{392}{98} = 4$

* 28gm N atom ⇒ no. of moles

$$n = \frac{28}{14} = 2$$

⇒ 88 gm CO_2 — no. of moles
\ no. of CO_2 molecules.

$$n = \frac{88}{44} = 2$$

⇒ $2 \times 6.022 \times 10^{23}$

N ⇒ 12.044×10^{23}

* NH_3 (68gm)

$$n = \frac{68}{17} = 4$$

$$= 4 \times 6.022 \times 10^{23}$$

Equivalent Weight: (तुल्यांकी भार):-

$$\text{Eq. Wt.} = \frac{\text{molecular wt}^{\sim}}{\text{X-(Factor)}}$$

X - factor (Number)

Acid	Base (क्षार)	Salt (लवण)
H^+ (no. of H^+ ions)	OH^- (no. of OH^- ion)	Total positive charge (cation)

* H_2SO_4 → Eq. wt = ?

molar mass = 98 gm

x-factor :- 2

$$eq.wt. = \frac{98}{2}$$

$$= 49$$

* HCl → H^+

M. mass = H + Cl

= 36.5 gm

x-factor ⇒ 1

eq. wt ⇒ 36.5

* eq. wt = ? Oxalic Acid ? $(COOH)_2 \cdot 2H_2O$

or

$C_2H_2O_4 \cdot 2H_2O$

$$\text{Eq. Wt.} = \frac{\text{Mol. Wt.}}{X}$$

$(COOH)_2$

(3)

Mol. Wt = 126 gm $= 2(C+2O+H)+2H+O = 126$ gm

X-factor $\Rightarrow$ 2

$$\text{eq. W.t} = \frac{126}{2} = 63$$

Base :- eq. wt → NaOH (OH^-)

mol. mass = 40 gm

x-factor ⇒ 1

eq. wt. = 40

⇒ $Ca(OH)_2$ ⇒ eq. wt = ?

mol. mass = 74

x-factor = 2 ⇒ $74/2 = 37$

$Ca(OH)_2 \Rightarrow Ca + 2(O+H)$

$\Rightarrow 40 + 2(16+1)$

$= 40 + 2(17)$

$= 40 + 34 = 74\,gm$

X-Factor = 2

$$\text{eq. wt} = \frac{74}{2} = 37$$

* Salt:

NaCl → eq. wt = ? (Na+) / Cl⁻

mol. mass = Na + Cl

= 23 + 35.5

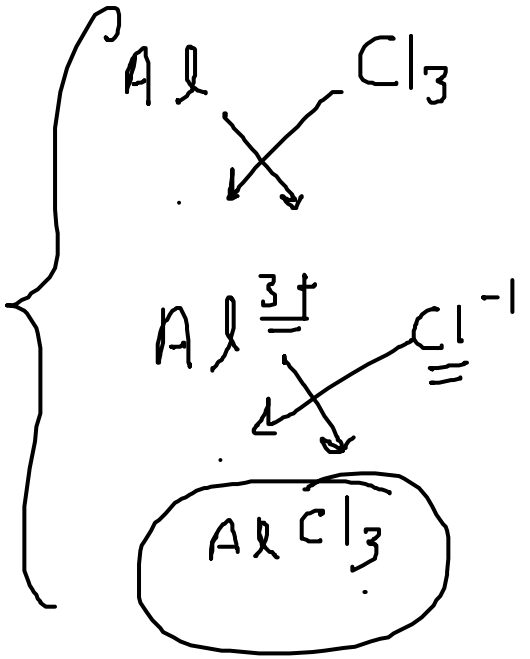
= 58.5 gm

x-factor → 1

eq. wt = $\frac{58.5}{1}$ = 58.5

* $AlCl_3$ का eq. wt. = ?

x-factor = 3



$$\text{eq. wt.} = \frac{M}{3}$$

$\Rightarrow Al_2(SO_4)_3 \checkmark \Rightarrow Al^{3+}$

$= +6 \Rightarrow$ x-Factor

$$H_2SO_4 + NaOH \longrightarrow NaHSO_4 + H_2O$$

H_2SO_4 ka eq. wt = ? $49X$

$NaHSO_4$ 98

$\Rightarrow$ Mol. mass = 98 gm

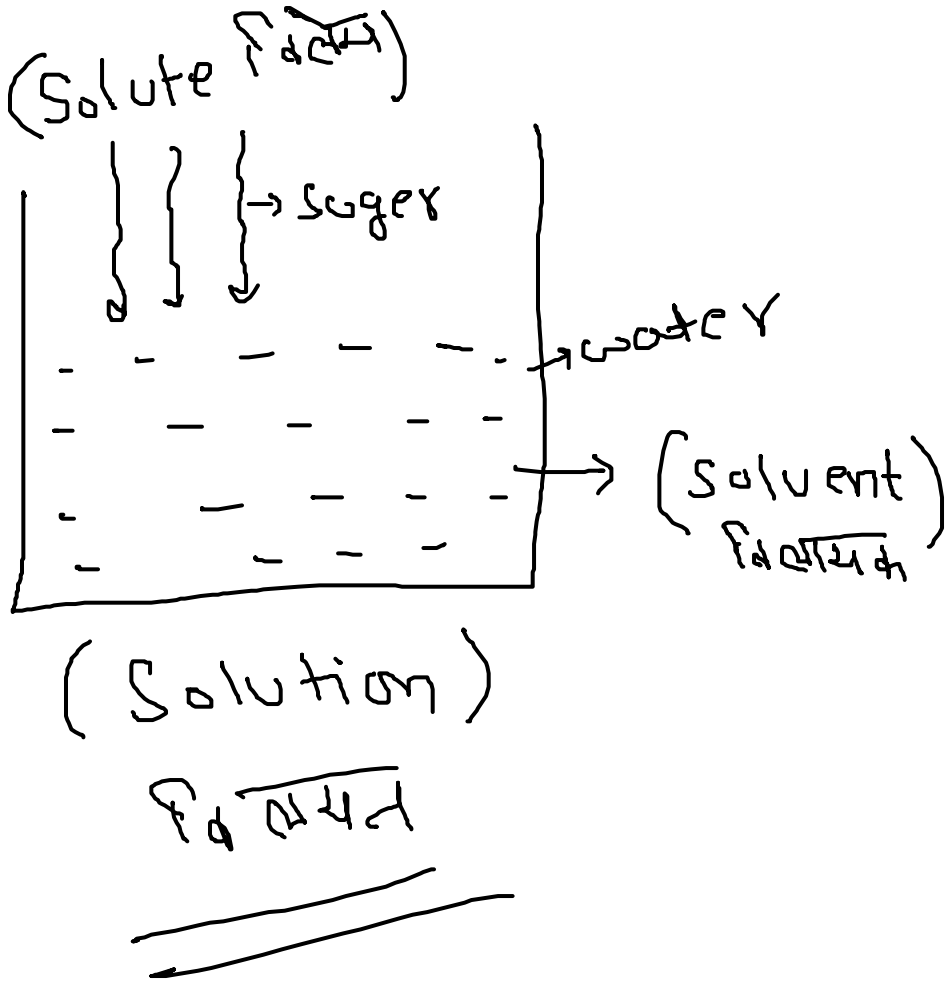
x-factor $\Rightarrow$ 2

$$\text{eq. wt} = \frac{98}{2}$$

$$= 49X$$

x-factor = 1

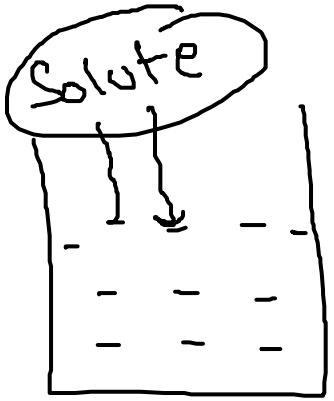
eq. wt = 98


(Solute विलेय)
Sugar
water
(Solvent विलायक)
(Solution)
विलयन

Molarity: (मोलरता)

M x

- No. of moles of solute in 1L solution.
- 1L विलयन में विलेय के मोलो की संख्या |



$$\Rightarrow M = \frac{\text{No. of moles of Solute}}{\text{Volume of Solution (in L)}} = \frac{\text{mol}}{\text{L}}$$

Solution

Unit (मोलरता)

① Find molarity of 40 gm of NaOH dissolved in 250 ml of solution?

$$M = \frac{n}{V(L)}$$

$$= \frac{1}{\frac{250}{1000}} = \frac{1000}{250}$$

$$M = 4 \text{ mol/L}$$

No. of moles in NaOH

$$n = \frac{m}{M} = \frac{40 \text{ gm}}{40} = 1$$

molecular mass

* 88gm CO_2 ⟶ 2.5 lt solution,

$$n = \frac{88}{44} = 2$$

$$M = \frac{20}{2.5} = \frac{20}{25} = \frac{4}{5}$$

$$= 0.8 \text{ mol/Lt}$$

Molality: (मोललता):-

- No. of moles of solute present in 1 kg of ~~solution~~ Solvent.
- 1 किलो ~~विलयन~~ Solvent में मौजूद विलेय के मोल की संख्या।

$$m = \frac{\text{No. of moles of Solute}}{\text{mass of Solvent (kg)}}$$

$$\boxed{m = \frac{n}{\text{mass (in kg)}}}$$

$\Rightarrow$ 20gm CO_2 $\rightarrow$ 100 gm Solution

Solute mass = 100 - 20

= 80 gm

* (1) 20 gm NaOH ⟶ 100 gm Solution?

molality = ?

$$n = \frac{20}{40} = \frac{1}{2}$$

mass of Solvent = 100 - 20

= 80 gm

$$m = \frac{1/2}{80/1000} = \frac{1000}{160} = 6.25 \text{ mol/kg}$$

No. of Gram equivalent : (ग्राम में तुल्यांक संख्या) :-

no. of gm equivalant $= \frac{\text{mass}}{\text{eq. wt}}$

no. of moles $= \frac{\text{mass}}{\text{Mol. mass}}$

e.g.: no. of equivalant present in 0.8 gm of NaOH

$$\text{eq. wt} = \frac{\text{mol. wt}}{X} = \frac{40}{1}$$

$$\text{eq. wt} = 40$$

$$\text{no. of gm eq.} = \frac{0.8}{40} = \frac{8}{400}$$

$$= 0.02$$

98 gm H_2SO_4 → no. of gm. eq. = ?

$$\Rightarrow \frac{98}{\text{eq. wt}}$$

$$\Rightarrow \frac{98}{49}$$

$$= 2$$

$$\Rightarrow \text{eq. wt} = \frac{\text{m. m}}{x}$$

$$= \frac{98}{2} = 49$$

Normality: (नार्मलता) :-

- No. of gram equivalent of solute present in 1L of solution.

1L विलयन में विलेय के ग्राम तुल्यांक संख्या

$$N = \frac{\text{no. of gm eq. of Solute}}{\text{Volume of Solution (in L)}}$$

* @ 1.96 gm H_2SO_4 ⟶ 500 ml Solution

Find normality of H_2SO_4 = ?

$\Rightarrow$ no. of gm equ. = $\frac{\text{mass}}{\text{eq. wt}} = \frac{1.96}{49.00} = \frac{4}{160} = \frac{1}{25}$

$= \frac{1/25}{1/2} =$

$= \frac{2}{25} = 0.08$

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