Mole Concept

MOLE CONCEPT

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

Atomic Mass, Molecular Mass & Molar Mass

$N \rightarrow$ Atom $\Rightarrow$ 14 unit $\longrightarrow$ 1 atom of N

$\Rightarrow$ 14 gm $\longrightarrow$ molar mass of nitrogen atom

$N_2 \rightarrow$ Molecule $\Rightarrow$ 28 unit $\longrightarrow$ 1 molecule of N_2

28 gm $\longrightarrow$ 1 mole of N_2 molecule

1 Dozen = 12

1 mole = 6.023×10^{23} atom | molecule

$\Rightarrow N_A$ = Avogadro number

* H_2O $\Rightarrow$ $2H + O$

$\Rightarrow$ $2 \times 1 + 16 = 18$ unit $\longrightarrow$ 1 molecule of H_2O

$\Rightarrow$ 18 gm = 1 mole of H_2O molecule

$= 6.022 \times 10^{23}$ H_2O molecules

Mole Concept

(मोल अवधारणा)

$\Rightarrow$ $n \rightarrow$ मोलों की संख्या (No. of moles)

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

2 $\rightarrow$ $n = \dfrac{N}{N_A} = \dfrac{\text{No. of molecules}}{\text{Avogadro no.}}$

$\Rightarrow \boxed{N = N_A \dfrac{m}{M}}$

(1) How many no. of moles are in 28 gm of N atom = ?

N ⇒ no. of moles (n) = ?

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

m = 28 gm

M = 14 gm

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

n = 2

no. of atoms

$$n = \frac{N}{N_A}$$

N = ?

$$N = n \times N_A$$

$$= 2 \times 6.023 \times 10^{23}$$

$$N = 12.046 \times 10^{23}$$

(2) 176 gm of CO_2 ⇒ (i) no. of moles? मोलों की संख्या = ? (n)

(ii) no. of CO_2 molecules?

⇒ CO_2 ⇒ C + 2O ⇒ 12 + 2×16 ⇒ 44 gm

$$n = \frac{176}{44} = 4$$

$$\boxed{n = 4}$$

$$N = 4 \times N_A$$

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

* HCl (73 gm) $\rightarrow n = ?$ $N = ?$

$n = ?$ $\quad n = \frac{m}{M} = \frac{73}{36.5} = 2$

$M \Rightarrow H + Cl$

$\Rightarrow 1 + 35.5$

$\Rightarrow 36.5$ gm

$n = 2$

$N = 2 \times 6.023 \times 10^{23}$

→ 2 unit → 2 gm

→ 1 unit → 1 gm

Equivalent Weight: (तुल्यांकी भार)

$$\text{Eq. wt} = \frac{\text{molecular weight}}{\text{X-factor}} = \frac{m}{X}$$

Acid
अम्ल
↓
H^+
आयन की संख्या
$X \Rightarrow$

Base
क्षार
↓
OH^-
आयन की संख्या

लवण (Salt) ↓
Total Positive charge on cation

e.g.: H_2SO_4 का Eq. Wt. (तुल्यांकी भार) = ?

अम्ल

$$\text{Eq. wt.} = \frac{\text{mol. wt}}{X}$$

$\Rightarrow$ Mol. W. $\Rightarrow 2H + S + 4O$

$\Rightarrow 2 \times 1 \text{ unit} + 32 \text{ unit} + 4 \times 16 \text{ unit}$

$\Rightarrow 2 + 32 + 64 \Rightarrow 98 \text{ unit}$

$\Rightarrow \boxed{X = 2}$

$$\text{Eq. Wt} = \frac{98}{2}$$

$= 49$

② HCl (अम्ल)

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

mol. mass / weight = H + Cl

= 1 + 35.5 = 36.5

$$HCl + H_2O \rightarrow H^+ + Cl^-$$

$X = 1$

Eq. Wt = 36.5

* Oxalic Acid :- $(COOH)_2 \cdot 2H_2O$ or $C_2H_2O_4 \cdot 2H_2^{x}O$

Eq. wt = ? $= \frac{\text{mol. mass}}{x}$

$H^+ + COO^-$

mol. mass = $2C + 2H + 4O + 2[2H + O]$

$= 24 + 2 + 64 + 2 + 2[18] = 126\ gm$

$x = 2$

Eq. Wt = $\frac{126}{2} = 63$

* $NaOH$ ✓

क्षार

Mol. mass = Na + O + H

= 23 + 16 + 1 = 40gm

$x = 1$

Eq. wt. = 40 ✓

* $Ca(OH)_2$ ⇒ Mol. mass = Ca + 2(O + H)

= 40 + 2(16 + 1) = 40 + 34

= 74

क्षार

$OH^- \rightarrow 2$

$x \rightarrow 1$

$\Rightarrow \frac{74}{x} = 37$

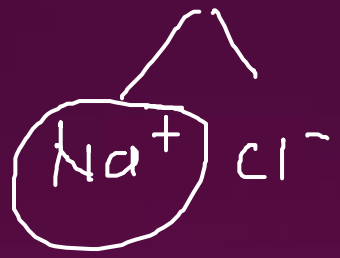
* NaCl → salt mole. mass = Na + Cl

= 23 + 35.5

= 58.5

X ⇒ 1

NaCl



Eq. wt = 58.5

⇒ $Al_2(SO_4)_3$ → x factor ⇒ 6

Al^{3+}

Eq. wt = ?

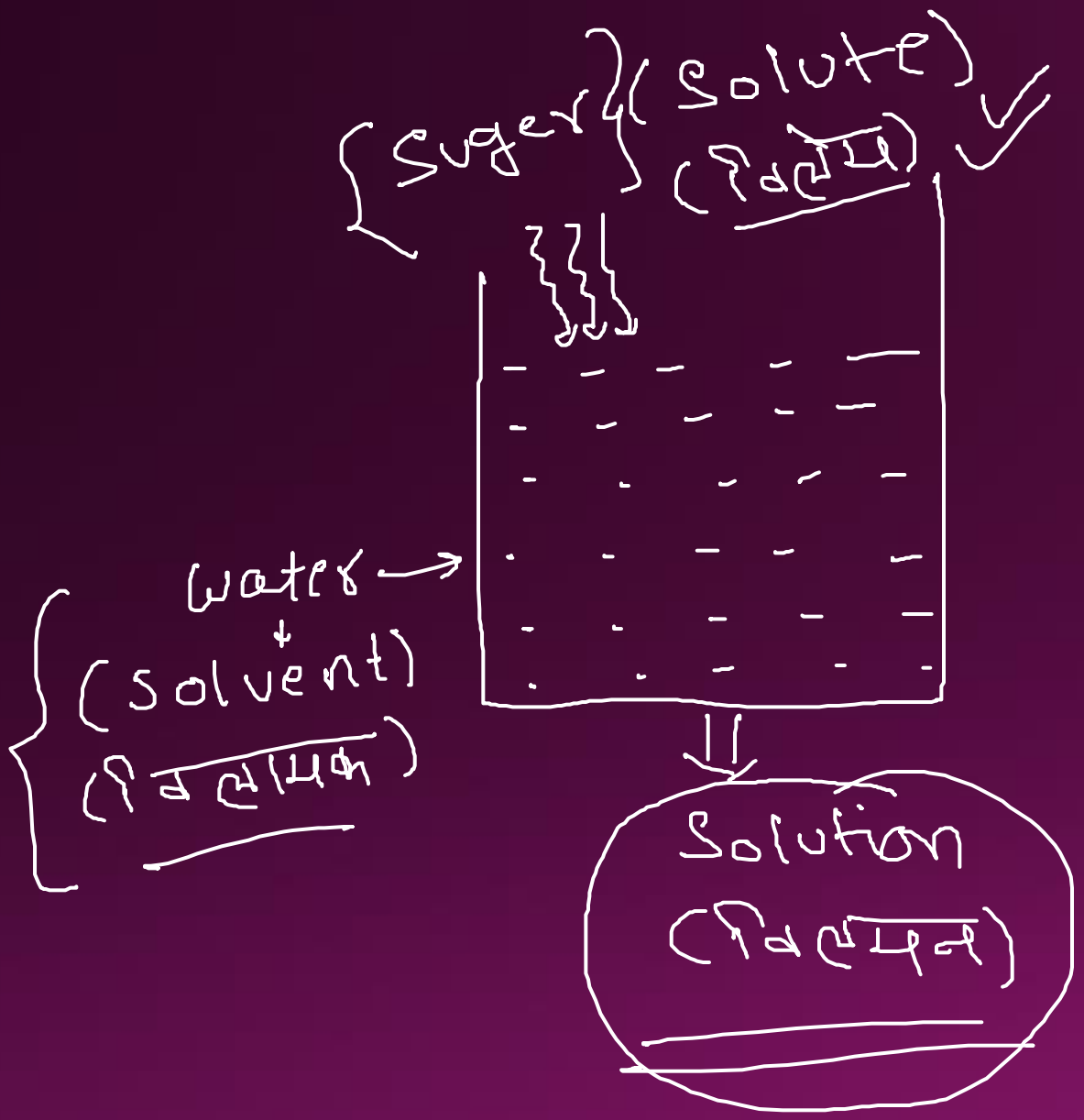
mol. mass = 2H + S + 4O

= 2 + 32 + 64

⇒ 98 gm

X factor :- 1

Eq. wt = 98


Sugar (Solute)
(विलेय)
Water
+
(Solvent)
(विलायक)
Solution
(विलयन)

Molarity: मोलरता

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

$$M = \frac{\text{विलेय में मोलों की संख्या}}{\text{विलयन का आ०(L)}}$$

$$M = \frac{mol}{L} \Rightarrow \boxed{m-L^{-1}}$$

m|L ⇒ Unit (मात्रक)

e.g: 40 gm NaOH मिलाया गया है → 500 ml solution ?
मोलरता (molarity) = ?

Sol: $M = \frac{n}{V(L)}$ $\quad 1L = 1000ml$

NaOH

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

$m = 40gm$

$M = Na + O + H$

$= 23 + 16 + 1 = 40$

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

$M = \frac{1}{\frac{500}{1000}} = \frac{1000}{500}$

$M = 2 \; m|L$

* 196 gm H_2SO_4 को मिलाया गया. ⟶ 250 ml Solution.

molarity (मोलरता) = ?

Sol:- $M = \frac{n}{V(l)}$

$n = \frac{m}{M} = \frac{196}{98} = 2$

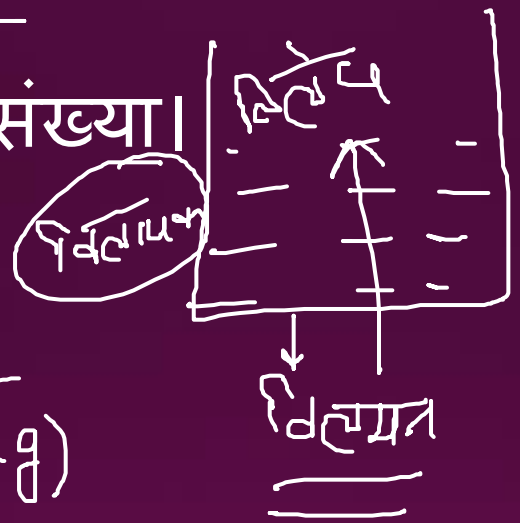
$M = 2H + S + 4O \Rightarrow 98$

$M = \frac{2}{\frac{250}{1000}} = \frac{2000}{250}$

$M = 8$ m|L

Molality: (मोलरता)

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



$$m = \frac{n}{\text{mass of Solvent (kg)}}$$

* 20gm NaOH dissolved in 200gm of Solution, Molality?

⇒ $n = \frac{m}{M} = \frac{20}{40} = \frac{1}{2}$

Mass of Solvent
= 200 − 20
= 180gm

→ $m = \frac{1/2 \times 1000}{180} = \frac{1000}{360} = \frac{25}{9}$

* 49 gm H_2SO_4 ⟶ 200 gm Solution

molality = ?

$$n = \frac{m}{M} = \frac{49}{98} = \frac{1}{2}$$

$$m = \frac{(n)}{\text{mass of Solvent (kg)}}$$

mass of Solvent = mass of Solution − mass of Solute

= 200 − 49 = 151 gm

$$m = \frac{1/2}{\frac{151}{1000}}$$

Normality

No. of Gram equivalent :

Normality:

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

SAFALTA CLASS™
An Initiative by अमर उजाला

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