Solutions → Concentration Terms

(1) Concentration Terms → Molarity / Molality --- class 11th
(2) Vapour Pressure →
(3) Colligative properties → Relative lowering in V.P.
Elevation in B.P
Depression in F.P
Osmotic Pressure
(4) Vant Hoff Factor
(5) Solubility of Gases

Today, Basics of Concentration Terms (in short)
For detail see class 11 lectures from Youtube channel Physicswallah.

Start

Solution → Homogeneous mixture of 2 or more substances in which individual components will loose their identity and cannot be separated in pure form by simple Methods

Solution

Solute (smaller Amount) — Solvent (larger Amount)

40% ethanol ⇒ Solute = 40% ethanol
Solvent = 60% water

60% ethanol Solute → water Solvent → ethanol
But not hard & fast Rule

Another Defination: Solution Jiski final physical state lega wahi Solvent Hoga

ex: Sugar + water → Solution
solid liquid liquid
↓so solvent liquid
↓
water

Concentration Terms

Volume Related (Temperature Dependent)
i) % by volume
ii) % wt by volume
iii) Molarity
iv) Normality

Mass Related (Temperature Independent)
i) % by mass
ii) mole fraction
iii) molality
iv) Parts per million/billion

density se Relate Hogi Apas Me

Date

1) [wt by wt %] Most imp

Ex A solution of NaCl in water is 5%.
⇒ (wt by wt) 5g NaCl is present in 100g solution.

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

Q 10g sucrose is dissolved in 100g water. Find wt by wt

Here solute + solvent = solution = 110g

$= \frac{10}{110} \times 100 = \frac{100}{11} = 9.09\%$

Q 10g of NaCl is present in 100ml of solution. Find wt by wt %. If density of solution is 1.2g/ml.

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

$= \frac{10}{120} \times 100 = \frac{2.5}{3} = 8.33\%$

Page
Date

Mass of solution = P × V

$= 1.2\text{g} \times 100\text{ml}$

$= 120\text{g}$

2) [V by V %]

Ex A HCl (aq) solution is 7% (V by V)
⇒ 7ml HCl is present in 100ml solution

V by V % = $\frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$

3) [wt by V %] Most imp

Ex A sugar solution is 3% (wt by vol)
⇒ 3g of sugar is present in 100ml solution

wt by V % = $\frac{\text{Mass of solute}}{\text{volume of solution}} \times 100$

Date

log kaaru

eg ⇒ A sugar solution is 10% (w/v). Find (w/w %) if density of solution is 1.25 g/ml

⇒

log sugar → 100ml solution	w/w% = Mass of solute / Mass of solution
Mass of solution = ρ × vol. of solution = 1.25g × 100ml / 1ml = 125 g	= 10g × 100 / 125g = 8%

log kaaru

eg ⇒ A sugar solution is 10% (w/w). Find (w/v %) if density of solution is 1.2 g/ml

log sugar → 100g solution	w/v% = Mass of solute × 100 / vol. of solution
ρ = M/V ⇒ V = M/ρ = 100/1.2	= 10g × 100 / 100ml / 1.2 = 12%

Page
Date

eg A solution of HNO_3 is 5% (w/w). Find the mass of HNO_3 present in 100ml of solution. (density of solution = 1.4 g/ml)

⇒

w/w = Mass of solute / Mass of solution × 100	Mass of solution = ρ × V
5 = x / 140 × 100	= 1.4 × 100 = 140 g
x = 7g Ans	

4) Mole Fraction

eg

no. of moles	A	B
	1	3

Mole fraction of A = no. of mole A / no. of mole 1

= 1/4 , 3/4

eg ⇒ A B C

nA nB nC

Mole fraction of A = nA / (nA + nB + nC)

Note = Here Mole Fraction = χ ⇒ zeta

or

ζ = eta

So, $\chi_C = \frac{n_C}{n_A + n_B + n_C}$

Q-1) 40g NaOH + 54g H_2O

Na = 23
O = 16
H = 1

$\chi_{NaOH} = \frac{1}{4} = 0.25$

$\chi_{H_2O} = \frac{3}{4} = 0.75$

$\chi_{NaOH} + \chi_{H_2O} = 1$

$n_{NaOH} = \frac{\text{Mass}}{\text{Molar Mass}} = \frac{40}{40} = 1$ Mole

$n_{H_2O} = \frac{54}{18} = 3$ Mole

Note A B C

$\chi_A + \chi_B + \chi_C = 1$ always

C = 12
O = 16
H = 1

Q-2) A solution has 46% (w/w) ethyl alcohol in water. Find Mole fraction of ethyl alcohol

Ethyl alcohol = C_2H_5OH in H_2O

⇒ 46g of ethyl alcohol in 100g of solution

Sol^n	C_2H_5OH	H_2O
100g	46g	54g

$C_2H_5OH = 24 + 6 + 16 = 46$

$H_2O = 2 + 16 = 18$

No. of moles = Mass / Molar Ma

$C_2H_5OH = \frac{46}{46} = 1$ mol

$H_2O = \frac{54}{18} = 3$ mol

$\chi_{\text{ethyl alcohol}} = \frac{1}{4} = 0.25$

$\chi_{water} = 1 - 0.25 = 0.75$

* PPM → parts per Million $= 10^6$ = 10 lakh

ex sugar 2PPM in solution

2g sugar → 10^6 g of solution

⇒ no. of PPM = $\frac{\text{Mass of Solute}}{\text{Mass of solution}} \times 10^6$

Q) O_2 is dissolved in water as 8×10^{-4} g O_2 in 100g water, Find concentration of O_2 in PPM

$= \frac{8 \times 10^{-4} g}{100 g} \times 10^6 = 8 \times 10^{-4} \times 10^4$

$= 8 \times 10^0 = 8$ PPM

Q) Sea water contains 53 PPM of sodium carbonate (Na_2CO_3). Find Mass of (Na_2CO_3) present in a glass of water

⇒ if glass ml is not given than consider as 250 ml.

⇒

250ml 1 g/ml

250 g

no. of PPM = $\frac{\text{Mass of Solute}}{\text{Mass of solution}} \times 10^6$

$53 = \frac{x}{250} \times 10^{6.5}$

$53 = \frac{x}{25} \times 100000$

$25 \times 53 = x \times 100000$

$\frac{1325}{10000} = x = 0.01325$ Ans

Date

* PPB :- Parts Per Billion = $1 in 10^9$

NaCl → 5 PPB

5 g NaCl → 10^9 g solution

no. of PPB = $\frac{\text{Mass of Solute}}{\text{Mass of Solution}} \times 10^9$

Page
Date

* Molarity :- no. of moles of solute which are present in 1 L solution

It is denoted by (M)

eg I Molarity of Sugar (aq) solution is 2M → 2 moles of sugar are present in 1 L solution

eg II Molarity of H^+ ions is 3 M → 3 moles of H^+ ions are present in 1 L of solution

formula :- $\frac{\text{no. of moles of solute}}{\text{Vol. of solution (L)}}$

unit = $\frac{\text{Moles}}{\text{Litre}}$ denoted (M)

Q1) Find Molarity of

i) 4g NaOH dissolved in 250ml solution

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

$= \frac{4}{\frac{250}{1000}}$

$= \frac{40}{\frac{1}{4}} = \frac{1}{\frac{1}{4}} = 4M$

Na = 23
O = 16
H = 1

Molecular Mass of NaOH = 23 + 16 + 1 = 40

ii) 4.9g H_2SO_4 present in 500ml solution

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

$= \frac{4.9}{\frac{98}{\frac{500}{1000}}} = \frac{49}{\frac{98}{\frac{1}{2}}} = \frac{1}{\frac{2}{1}} = \frac{1}{2} \times \frac{2}{1} = \frac{1}{1} = 1M$

H = 1
S = 32
O = 16

Molecular Mass of H_2SO_4 = 2 + 32 + 64 = 98

iii) Find the Mass of Na_2CO_3 present in 100ml of 3M solution

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

$3 = \frac{n}{\frac{100}{1000}} \Rightarrow 3 = 10n$

$n = \frac{3}{10} = 0.3$

$Na_2CO_3 = 0.3$ Moles

No. of Moles $= \frac{Mass}{Molar\ Mass}$

$0.3 = \frac{x}{106}$

$31.8 = x$

$Mass = \frac{31.8}{1}$

Na = 23
C = 12
O = 16

Na_2CO_3

46 + 12 + 48 = 106

(iv) 10% (wt/wt) aq soln of H_2SO_4. If density of soln is 1.1 g/ml find Molarity

=> 1g solute present in 100g soln

i.e. 10g H_2SO_4 present in 100g soln

$M = \frac{n}{V(L)} = \frac{\frac{10}{98}}{V(in\ L)}$

H_2SO_4

$= 2+32+64$

$= 98$

So, Mass of soln = solvent + solute

= 100g solution

density of soln = 1.1 g/ml

Vol. of soln $= \frac{m}{d} = \frac{100}{1.1}$ ml

So, $\frac{\frac{10}{98}\ \text{moles}}{\frac{100}{1.1\times1000}\ L} = 1.111\ M$

v) Find Molarity of

If 120g urea (CN_2CONH_2) is dissolved in 1000g water find Molarity of soln If density of solution is 1.12 g/ml

$M = \frac{n}{V(in\ L)} = \frac{120}{60} = \frac{120}{60} = \frac{2}{1}$

$\frac{1000}{1000}$ 1(L)

N = 14
C = 12
O = 16
H = 1

= 2 M

NH_2CONH_2

= 60 Molar mass

Mass of soln = Solute + Solvent

= 120 + 1000

= 1120g

Volume = $\frac{\text{Mass}}{\text{density}}$

$= \frac{120}{1.12} = 1000$ ml

vi) Most imp question

* Find molarity of water (density = 1 g/mL, 1 kg/L)

so Ans is always 55.5555

remember this

Ans = Let us consider 100mL of water

mass of water = 100g

$$M = \frac{n}{V(\text{in } L)} = \frac{\frac{100}{18}}{\frac{100}{1000}} = \frac{1000}{18} = 55.5555$$

H_2O

$= 2 + 16 = 18$

This trick only applicable if the density is normal

* so, if density is not normal

then see sum after V9 →

Page Date

* water (density = 0.9 g/mL, 1 kg/L)

=> let us consider 100mL of water

Mass of water = density × Volume = 90g

$$M = \frac{n}{V(\text{in } L)} = \frac{\frac{90}{18}}{0.1} = \frac{5}{0.1} = 50$$

Molar →	M = 1	1M
Bi Molar →	M = 2	2M
semi Molar →	M = 1/2	M/2
Deci Molar →	M = 1/10	M/10
centi Molar →	M = 1/100	M/100

Q) Find mass of potassium hydroxide (KOH) present in $150\ cm^3$ of semiMolar aq. soln.

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

$\frac{1}{2} = \frac{n}{\frac{150}{1000}}$

$n = \frac{1 \times 150}{2\ \ 1000}$

$n = \frac{3}{40}$

$n = \frac{mass}{molar\ mass}$

$\frac{3}{40} = \frac{x}{56}$

$x = \frac{56 \times 3}{40}$

$x = 4.2g$

K = 39
O = 16
H = 1

KOH
= 39 + 16 + 1
= 56

Molarity of ions

Q) If 53g Na_2CO_3 is dissolved in 500 mL solution. Find Molarity of

1) Sodium carbonate (Na_2CO_3)
2) Sodium ion (Na^{+1})
3) Carbonate ion (CO_3^{2-})

Na = 23
C = 12
O = 16

i) $M = \frac{n}{V(in\ L)} = \frac{\frac{53}{106}}{\frac{500}{1000}} = \frac{\frac{1}{2}}{\frac{1}{2}} = 1M$

Na_2CO_3 = 46 + 12 + 48 = 106

ii), iii)

$Na_2CO_3 \rightleftharpoons 2Na^{\oplus} + CO_3^{-2}$

1 Mole — 2 Mole — 1 Mole

1 L — 2 L — 1 L

Ans = $2Na^+ = 2$ Mole
$CO_3^{-2} = 1$ Mole.

Page
Date

a) Find Molarity of H^{+} ions if 49g H_2SO_4 is dissolved in 250ml solution

=)

$$M = \frac{n}{V(L)} = \frac{49}{98} = \frac{0.5}{0.25} = 2$$

$$250 \quad 1000$$

H_2SO_4

$= 2+32+64$
$= 98$

$H_2SO_4 \longrightarrow 2H^{+} + SO_4^{2-}$

2 mole 4 mole 2 mole

1 L 1 L 1 L

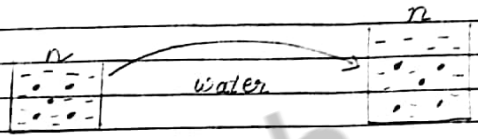
$H_2SO_4 = 2$ mole

$2H^{+} = 4$ mole

$SO_4^{2-} = 2$ mole

Page
Date

note :- volume increase, molarity decrease



M_1, V_1 $M_2 V_2$

$M_1 = \frac{n}{V_1}$ $M_2 = \frac{n}{V_2}$

$M_1V_1 = M_2V_2$

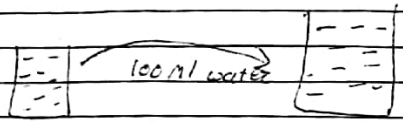
here, no. of moles of solute initial = no. of moles of solute final

no. of moles $= M.V$

$ni = nf$

$M_1V_1 = M_2V_2$

Q. 0.2 M, 100ml HNO_3 solution is diluted with 100 ml water. Find new Molarity



$M_1 = 0.2$ $M_2 = ?$

$V_1 = 100\,ml$ $V_2 = 200\,ml$

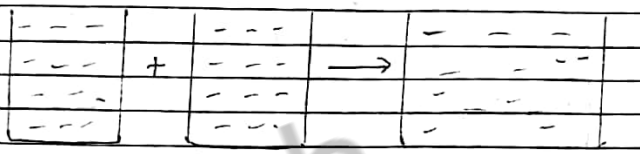
$M_1V_1 = M_2V_2$

$0.2 \times 100 = M_2 \times 200$

$M_2 = 0.1$ (= new Molarity)

Molarity of mixture :- (solute - same)

$$M = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$



M_1V_1 M_2V_2 $(V_1+V_2), M$

Q. If 0.2 M, 100 ml HCl solution is mixed with 0.1 M, 300 ml HCl solution. Find Molarity of Mixture.

$$M = \frac{M_1V_1 + M_2V_2}{V_1 + V_2} = \frac{0.2 \times 100 + 0.1 \times 300}{100 + 300}$$

$$= 0.125$$

Molality

(Mass)	(Volume)
Molality → (m) no. of moles of solute present in 1 kg solvent	Molarity → (M) no. of moles of solute present in 1 L solution
$m = \frac{\text{no. of moles of solute}}{\text{Mass of solvent in kg}}$	$M = \frac{\text{no. of moles of solute}}{\text{V° in sol}^n \text{ (L)}}$

Eg: Molality of HCl is 3m

⇒ 3 moles of HCl are present in 1kg water

1 kg = 1000 g

Q: Find molality of

i) 20g NaOH dissolved in 100g sol^n

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

$= \frac{20}{40} = \frac{0.5}{0.08} = 6.25\,m$

$\frac{80}{1000}$

Here, 100g solution − 20g solute NaOH = 80g Solvent

Na = 23
O = 16
H = 1

NaOH = 23+16+1 = 40

a) If 0.85 g of NH_3 is dissolved in 100 ml of water. Density of solution is 1.2 g/ml. Calculate molality, molarity, mole fraction of solute & solvent.

b) $m = \frac{\text{moles of solute}}{\text{mass of solvent}} = \frac{0.85}{17}$

$N = 14$
$H = 1$
$14 + 3 = 17$

Mass of sol^n = density × volume of sol^n
= 1.2 × 100
Mass of solution = 120 g

Mass of solute = 0.85 g

Mass of solvent = 100 − 0.85
= 119.15 g

$= \frac{0.85}{17} = \frac{0.05}{0.11915} = 0.4196$

$\frac{119.15}{1000}$

Normality

Page
Date

Normality = no. of gm equivalents of solute which are present in 1L solution

gm eq / L → N

$N = \frac{\text{no. of gm equivalents of solute}}{\text{volume of solution (in L)}}$

So, for normality, we have to study Equivalent weight & Gram Equivalent

* **Equivalent Mass**

Eq Mass = $\frac{\text{Molecular Mass}}{X}$ ← Valency factor

⇒ Acids → X = Basicity (H⊕)

H_2SO_4

here H = 2 so X = 2

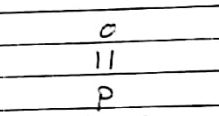
∴ Eq mass = $\frac{\text{Molecular Mass}}{2}$

⇒ HCl

Here, H = 1 so $x = 1$

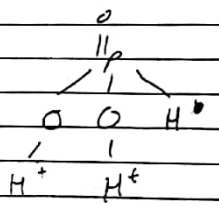
Eq Mass = $\frac{\text{Molecular Mass}}{1}$

⇒ i) H_3PO_4



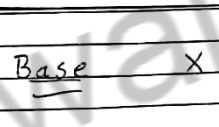
so, $x = 3$

ii) H_3PO_3



so, $x = 2$

iii) H_3PO_2



so, $x = 1$

* Base x = Acidity (:- $OH^{\ominus}$)

⇒ $Ca(OH)_2$

$x = 2$ so, Eq Mass = Molecular M
2

⇒ $Al(OH)_3$

$x = 3$

⇒ $NaOH$

$x = 1$

Date

* Salt x = total +ve charge on cation

* ⇒ Na_2CO_3

⇒ $2Na^{(+1)}$

So, x = 2

⇒ Eq Mass = $\frac{Mol\ wt}{2}$

* ⇒ $AlCl_3$

⇒ $Al^{3(+)}$ here value of Al = 3 always

So, x = 3

* ⇒ $Al_2(SO_4)_3$

⇒ $2Al^{3+}$ $x = 3 \times 2 = 6$

Page
Date

* $MgSO_4$

Mg^{2+} value of Mg is 2 always

$x = 2$

Q. Find Eq wt of H_2SO_4, NaOH, Na_2CO_3

⇒ Eq wt = $\frac{Mol\ wt}{x}$

H = 1
S = 32
O = 16
N = 23
C = 12

$H_2SO_4 = \frac{2+32+64}{2} = \frac{98}{2} = 49g$

$NaOH = \frac{23+16+1}{1} = 40g$

$Na_2CO_3 = \frac{23+12+48}{2} = \frac{83}{2}\ g$

Note :- The Eq mass/wt also depends on chemical reaction.

for eg :- $H_2SO_4 + NaOH \rightarrow NaHSO_4 + H_2O$

Here Eq wt of H_2SO_4 = Not 2 = x

because, after reaction it gives only $1\ H^{\oplus}$ so,

$\boxed{x = 1}$

So, if reaction is given then specify or understand the reaction before Answer

if reaction is not given then apply the previous acid, base or salt rule.

Number of gram equivalent

formula = $\frac{\text{Mass}}{\text{Eq wt}}$

Q= Find no. of gm eq present in
i) 0.4g of NaOH

Na = 23
O = 16
H = 1

ii) no. of gm eq = $\frac{\text{Mass}}{\text{Eq wt}}$

Eq wt = $\frac{\text{Mol wt}}{x} = \frac{23+16+1}{1} = 40$

= $\frac{\text{Mass}}{\text{Eq wt}} = \frac{0.4}{40} = 0.01$

no. of gm eq = 0.01

Q) Find no. of gm eq present in
(i) 0.98g H_2SO_4

H = 1
S = 32
O = 16

⇒ no. of gm eq = $\frac{\text{Mass}}{\text{Eq Mass}}$

Eq Mass = $\frac{\text{mol. wt}}{x} = \frac{2+32+16\times4}{2} = 49$ g

$\frac{\text{Mass}}{\text{Eq Mass}} = \frac{0.98}{49} = 0.02$

no. of moles = 0.02

Q) Find no. of gm eq present in
53g Na_2CO_3

Na = 23
C = 12
O = 16

⇒ no. of gm eq = $\frac{\text{Mass}}{\text{Eq Mass}}$

Eq Mass = $\frac{\text{mol wt}}{x} = \frac{46+12+48}{2} = \frac{106}{2} = 53$ g

$\therefore (x = 2Na^{\oplus} = 2)$

$\frac{\text{Mass}}{\text{Eq Mass}} = \frac{53}{53} = 1$ g

imp

Q) Find no. of gm eq present in 3 moles of H_2SO_4

⇒ no. of gm equivalent = $\frac{\text{Mass}}{\text{Eq Mass}}$

$= \frac{\text{Mass}}{\frac{\text{mol. wt}}{x}} = \frac{\text{Mass}}{\text{Mol. wt}} \times x$

no. of gm eq = no. of moles × X ← imp formula

no. of gm eq = 3 × 2 = 6 g

Q) $AlCl_3$ → 3 mole

⇒ no. of gm eq = no. of moles × X

$= AlCl_3 = 1Al^{3+} = x = 3$

no. of gm eq = 3 × 3 = 9

Date

* No. of gm eq = No. of moles $\times$ X

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

1 mole 2 mole
X = 2 X = 1

= 2gm eq = 2gm eq

* $NaCl + HNO_3 \longrightarrow HCl + NaNO_3$

1 mole 1 mole
$x = Na^+ = 1$ $x = H = 1$

= 1gm eq = 1gm eq

3 1
* $H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$

1 mole 3 mole
x = 3 x = 1

3gm eq 3 gm eq

Page
Date

Note :- No. of gm equivalent is always same in chemical reaction

Normality

Q) If 0.98g of H_2SO_4 are present in 500ml solution. Find normality (∴ H=1, S=32, O=16)

$N = \frac{\text{no. of gm eq of solute}}{\text{vol. of solution in (L)}} = \frac{\text{mass}}{\text{Eq mass} \times V(in\ L)}$

Eq Mass = $\frac{\text{Mol. Mass}}{X} = \frac{2+32+64}{2} = 49g$ of H_2SO_4

$\frac{\text{Mass}}{\text{Eq Mass} \times V(in\ L)} = \frac{0.98}{\frac{49}{1000} \times \frac{500}{1}} = \frac{2}{1} = 0.04N$

some imp Note

Semi Normal → $N = \frac{1}{2} = \frac{N}{2}$

Bi Normal → $N = 2 = 2N$

Centi Normal → $N = \frac{1}{100} = \frac{N}{100}$

Deci Normal → $N = \frac{1}{10} = \frac{N}{10}$

Q) Find mass of NaOH present in 250 ml of semi normal solution. (C_{NaOH} = base)

=> $N = \frac{1}{2}$, $V = 250\ ml$

$N = \frac{\text{no. of gm eq of solute}}{\text{V of solution (in L)}}$

$\frac{1}{2} = \frac{\text{Mass}}{\text{Eq mass} \times V(in\ l)}$ (Eq mass = $\frac{23+16+1}{1}$ = 40)

$\frac{1}{2} = \frac{\text{Mass}}{40 \times \frac{250}{1000}}$ = 0.04 Ans

Most imp

* Relationship between Normality & Molarity

Q- Find Molarity of 0.2N H_2SO_4 solution

=> $N = \frac{\text{no. of gm eq of solute}}{\text{Vol. in (L)}}$ | $M = \frac{\text{no. of moles of sol}}{\text{vol. in (L)}}$

$\frac{N}{M} = \frac{\text{no. of gm eq of solute}}{\text{no. of moles of solute}}$

$\frac{N}{M} = \frac{\text{Mass}}{\text{Eq mass}} = \frac{\text{Mass}}{\text{Molecular mass}} = \frac{\text{Molecular mass}}{\text{Eq mass}}$

$\frac{N}{M} = \frac{\text{Molecular mass}}{\text{Eq mass}} = \frac{\text{Molecular Mass}}{\text{Molecular Mass}} \times X$

$\frac{N}{M} = X$ → $N = M \times X$

most imp formula

So, $0.2 = M \times 2$

$M = \frac{0.2}{2} = 0.1$ Ans

Q) Find Normality of 0.4M H_3PO_4 solution

⇒ $M = 0.4$

$N = ?$

H_3PO_4

$x = 3$

$N = M \times X$

$N = 0.4 \times 3$

$N = 1.2$

* **Normality of mixture**

Acid + Acid / Base + Base

N_1 N_2 $V_1 + V_2$

V_1 V_2 N

$$N = \frac{N_1V_1 + N_2V_2}{V_1 + V_2}$$

Q- 0.2N, 200ml HCl is mixed with 0.3N, 300ml HCl. Find N of mixture

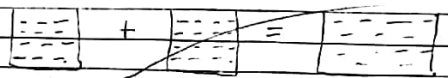
⇒ $N = \frac{N_1V_1 + N_2V_2}{V_1 + V_2} = \frac{0.2 \times 200 + 0.3 \times 300}{200 + 300}$

$= 0.26$ Ans

* **Acid + Base** most most most imp

Normality of mixture

⇒ Acid + Base



N_a N_b $V_1 + V_2$

V_a V_b

Check Resuting solution

$N_aV_a > N_bV_b$ ⟶ Acidic

$N_aV_a < N_bV_b$ ⟶ Basic

2) * If $N_aV_a > N_bV_b$ then

$$N_{acid} \text{ of } H^+ = \frac{N_aV_a - N_bV_b}{V_a + V_b}$$

3) * If $N_aV_a < N_bV_b$ then

$$N_{Basic} \text{ of } OH^- = \frac{N_bV_b - N_aV_a}{V_a + V_b}$$

3) * If $N_aV_a = N_bV_b$ then

this solution is neutral

6) 0.2N, 100 ml HCl + 0.3 N, 200 ml NaOH
H^+ or OH^- ?

$N_aV_a = 0.2 \times 100 = 20$ (H^+)

$N_bV_b = 0.3 \times 200 = 60$ (OH^-)

Basic $N_{OH^-} = \frac{60 - 20}{300} = \frac{40}{300}$ N

Q * If 0.4 N 500 ml HCl neutralised 300 ml of NaOH completely. Find N of NaOH solution

$N_aV_a = N_bV_b$

$0.4 \times 500 = N \times 300$

$\frac{200}{300} = N$

$N = 0.67$