

Class - IX

Normality, Molality and Mole Fraction

Teaching Task

Q1) Ans:- D.

Solution:-

A) 8.0 g of KOH / 100 ml of solution.

$$N = \frac{8}{56} \times \frac{1000}{100} = \frac{80}{56} = 1.4 N.$$

B) 0.5 molar H_2SO_4 . $\rightarrow N = \text{Molarity} \times \text{Basicity}.$

$$N = M \times 2.$$
$$= 0.5 \times 2 = 1 N.$$

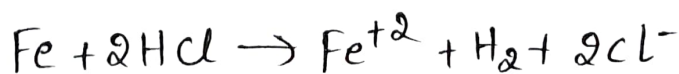
C) 1 N H_3PO_4

D) 6 g of NaOH / 100 g of water.

$$N = \frac{6}{23+16+1} \times \frac{1000}{100}$$
$$= \frac{60}{40} = 1.5 N$$

Q2) Ans:- B.

Solution:- No. of moles of H_2O , $n = 4M \times 0.05L = 0.2$ moles.



2 moles of HCl is required to convert Fe to Fe^{+2} .

No. of moles of

$$Fe^{+2} = \frac{1}{2} \times 0.2 = 0.1 \text{ moles.}$$

Q3) Ans:- B.

Solution:-

A) 0.3% H_3PO_4

$$\text{Molar mass} = 3 + 3 \times 1 + 16 \times 4 = 98$$

$$0.3\% \text{ in } 98 \text{ gms} = 0.294 \text{ gms.}$$

B) 0.3M H_3PO_4 , for 1 litre

$$M = \frac{w}{\text{GMW}} \times \frac{1000}{V_{\text{mL}}}$$

$$0.3 = \frac{w}{98} \times \frac{1}{1}$$

$$w = 29.4 \text{ gms/in 1 litre}$$

c) 0.3m H_3PO_4

$$m = \frac{w}{\text{GMW}} \times \frac{1}{w_{\text{kg}}}$$

$$0.3 = \frac{w}{98} \times \frac{1}{1}$$

$$w = 29.4 \text{ gms present in 1 kg}$$

d). 0.3N H_3PO_4

$$N = \frac{w}{\text{G.EW}} \times \frac{1000}{V_{\text{mL}}} = \frac{w}{49} \times \frac{1000}{1000}$$

$$0.3 \times 49 = w$$

$$w = 14.7 \text{ gms in 1000 mL.}$$

0.3M is more concentrated because 29.4gms present in 1000 mL

Q4)

Ans: D.

Solution: Given

5ml of N HCl.

$$M_1 = 1 \times 5 = 5M.$$

20ml of $N/2$ H_2SO_4 .

$$M_2 = \frac{1}{2} \times 20 = 10M.$$

30ml of $N/3$ HNO_3 .

$$M_3 = \frac{1}{3} \times 30 = 10M.$$

$$M_{eq} = M_1 + M_2 + M_3 = 5 + 10 + 10 = 25M.$$

Volume = 1000mL.

$$M_{eq} = N \times V.$$

$$25 = N \times 1000$$

$$N = \frac{25}{\frac{1000}{40}} = \frac{1}{40}.$$

Normality of solution would be $\frac{N}{40}$.

Q5)

Ans: B.



For 1 mole of H_2SO_4 , 2 moles of KOH required.

Given 100 ml of 0.1M H_2SO_4 .

$$n = \text{Molarity} \times V_{\text{lit}} = 0.1 \times 0.1 = 0.01 \text{ moles.}$$

100 ml of 0.1M KOH .

$$n = 0.1 \times 0.1 = 0.01 \text{ moles.}$$

For 0.01 moles of H_2SO_4 , 0.02 moles of KOH required, but we have only 0.01 moles of KOH .
So KOH is limiting reagent, For 0.01 moles of KOH , 0.005 moles of H_2SO_4 is used.

$$\text{Remaining } \text{H}_2\text{SO}_4 = 0.01 - 0.005 = 0.005 \text{ moles.}$$

$$N = \frac{w}{\text{GEW}} \times \frac{1000}{V_{\text{ml}}}.$$

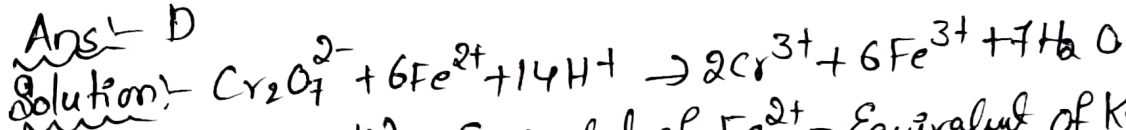
$$\text{GEW} = \frac{\text{GMW}}{n} \Rightarrow N = \frac{nw}{\text{GMW}} \times \frac{1000}{V_{\text{ml}}}.$$

Given $V = 2 \text{ litres} = 2000 \text{ mL}$.

$$N = \frac{0.005 \times 2 \text{ equivalents/mole}}{2 \text{ L}}$$

$$= 0.005 = 5 \times 10^{-3} \text{ N.}$$

Q6). Ans: D



$n = 1$ (Mohr's salt), Equivalent of $\text{Fe}^{2+} = \text{Equivalent of } \text{K}_2\text{Cr}_2\text{O}_7$.
 $= 500 \times 10^{-3} \times 6 \times 1 = 3.0$.

Mole percent of Mohr's salt of 5 moles = $\frac{3}{5} \times 100$
 $= 60$.

Q7)

Ans:- A.Solution:- The valency factor for $K_2Cr_2O_7$ is 6.

$$N_1 V_1 = N_2 V_2$$

$$0.2 \times 56 = N_2 \times 40$$

$$N_2 = \frac{1}{4}$$

$$N_2 = \frac{w}{M.wt} \times \text{eq. factor} \times \frac{1}{V.l.t.}$$

$$\frac{1}{4} = \frac{w}{56} \times 1 \times 1.$$

$$w = \frac{56}{4} = 14g.$$

Q8)

Ans:- D.Solution:- Mole fraction of water = $1 - 0.6 = 0.4$.No. of moles of water in solution = n .

$$\text{Moles of alcohol} = \frac{\text{Given mass}}{\text{Molecular mass}} = \frac{69}{46} = \frac{3}{2}$$

$$\text{Mole fraction of water} = \frac{n}{n + \frac{3}{2}}$$

$$\frac{n}{n + \frac{3}{2}} = 0.4.$$

$$\frac{2n}{2n+3} = 0.4 \Rightarrow 2n = 0.4(2n+3)$$

$$2n = 0.8n + 1.2$$

$$2n - 0.8n = 1.2$$

$$1.2n = 1.2 \Rightarrow n = 1.$$

For 1 mole water, $GMW = 18 \text{ gms.}$

Q9) Ans: B

Solution:- $M = \frac{n}{V \text{ in litres.}}$

Given volume = 500ml = $\frac{500}{1000}$

$$M = \frac{\frac{n}{\frac{500}{1000}}}{\frac{500}{1000}} = 2n \rightarrow \text{Molarity} = 2 \times \text{moles of Solute.}$$

$$\text{No. of moles} = \frac{\text{weight}}{\text{molar mass}} = \frac{\text{Molarity}}{2}$$

$$\text{weight} = \frac{\text{Molarity}}{2} \times \text{molar mass.}$$

$$\text{Equivalent weight} = \frac{\text{molar mass}}{\text{basicity}} = \frac{\text{Molar mass}}{2}$$

Weight of acid present in solution =

$$\text{Molarity} \times \frac{\text{molar mass of dibasic acid}}{2}$$

$$\text{Amount of acid} = \text{Molarity} \times \text{Equivalent weight} \\ = M \times E.$$

Q10) Ans: B.

Solution:- Moles of Solute present in 500ml of solution = $\frac{6}{60} = 0.1$.

$$\text{Weight of solution} = 500 \times 1.05 = 525 \text{ gm.}$$

$$\text{weight of solvent} = 525 - 6 = 519 \text{ gms.}$$

$$m = \frac{0.1 \times 1000}{\frac{519}{\text{(weight of solvent)}}} = 0.19$$

(moles of solute)

Q11)

Ans: B.

Solution: No. of moles of solute (n) = $\frac{16}{32} = \frac{1}{2} = 0.5 \text{ moles}$

$$\text{Weight of solution} = d \times v \\ = 0.96 \times 100 = 96.$$

$$\text{Molality} = \frac{\text{no. of moles of solute}}{\text{weight of solvent}} \times \frac{1000}{\text{weight of solvent}}$$

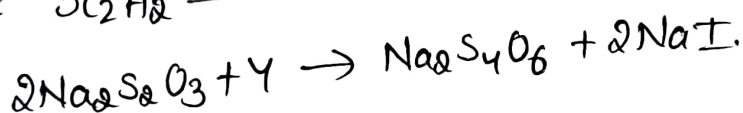
$$\text{weight of solvent} = \text{Wt. Solution} - \text{Wt. of Solute} \\ = 96 - 16 = 80$$

$$m = 0.5 \times \frac{1000}{80} = \frac{50}{8} = 6.25 \text{ m.}$$

Q12)

Ans: A.

Solution: $3\text{C}_2\text{H}_2$ ~~red hot tube~~ X.



$$\text{Y} = \text{I}_2, \quad \text{X} = \text{C}_6\text{H}_6.$$

$$\text{Mole fraction of Y} = 0.2.$$

$$\text{Total mole fraction of X \& Y} = 1.$$

$$\text{mole fraction of X} = 1 - \text{Y} = 1 - 0.2 = 0.8.$$

$$\text{Molality} = \frac{0.2}{0.8 \times 78} \times 1000 = \frac{200}{62.4} = 3.2 \text{ m.}$$

Q13)

Ans: C, D.

Solution: Mole fraction, molality & % wt are independent of temperatures.

Q14) Ans:- B, C.

Solution:-

$$M_{\text{Na}_2\text{CO}_3} = \frac{5.3}{106} \times \frac{1000}{100} = \frac{1}{2} = 0.5 \text{ M}$$

$$N_{\text{Na}_2\text{CO}_3} = 0.5 \times 2 = 1.0 \text{ N}$$

$$M_{\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}} = \frac{6.3}{126} \times \frac{1000}{100} = \frac{1}{2} = 0.5 \text{ M}$$

$$N_{\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}} = 0.5 \times 2 = 1 \text{ N}$$

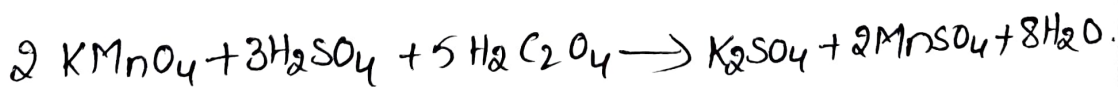
For Both solutions Molarity & Normality are same

Q15) Ans:- A.

Solution:- The quantities of the solute & solvent are expressed in weights, the molality does not change with the change in temperature.

Q16) Ans:- D

Solution:- Equivalent weight = $\frac{\text{Molar mass}}{\text{valency factor}}$



Oxidation number of Mn in KMnO_4 .

$$1 + \text{Mn} + 4(-2) = 0$$

$$\text{Mn} = 7$$

$$\text{In } \text{MnSO}_4 \rightarrow \text{Mn} + 6 + 4(-2) = 0$$

$$\text{Mn} = 2$$

Oxidation state of Mn changes from 7 to 2,

So valency factor = 5

$$\text{Equivalent weight} = \frac{M}{5}$$

Q17) Ans:- C.

Solution:- Relation b/w molarity & molality

$$m = \frac{1000 \times M}{(1000 \times d) - (M \times G.M.W.)}$$
$$= \frac{1000 M}{1000 - M M'}$$

Q18) Ans:- B

Solution:- Molecular weight of $H_2O_2 = 2 + 32 = 34$.

20% aqueous H_2O_2 means 20gms of H_2O_2 in 100gm of solution.

$$\text{Mass of water} = 100 - 20 = 80.$$

$$\text{Mole fraction of water} = \frac{n_{\text{water}}}{n_{\text{water}} + n_{H_2O_2}}$$

$$n_{\text{water}} = \frac{80}{18}, \quad n_{H_2O_2} = \frac{20}{34}$$

$$X_{\text{water}} = \frac{\frac{80}{18}}{\frac{80}{18} + \frac{20}{34}} = \frac{\frac{80}{18}}{\frac{(34 \times 80) + 18(20)}{18 \times 34}}$$
$$= \frac{80 \times 34}{2720 + 360}$$
$$= \frac{2720}{3080} = 0.883$$
$$= \frac{68}{77} = 0.883$$

Matrix Matching

Q19) Ans:- A) A-4, B-1, C-2, D-3

Solution:-

- A) Molality $\rightarrow$ 4) $\text{g mol} \cdot \text{kg}^{-1}$.
B) Mole fraction $\rightarrow$ 1) No units.
C) Normality $\rightarrow$ 2) $\text{g} \cdot \text{eq} \cdot \text{dm}^{-3}$.
D) Molarity $\rightarrow$ 3) $\text{mol} \cdot \text{dm}^{-3}$.

Q20) Ans:- A) P B) P C) q, s D) q, R, S.

Solution:-

- A) Normality $\rightarrow$ p) Vary with temperature.
B) Molarity $\rightarrow$ p) Vary with temperature.
C) Molality $\rightarrow$ q) Independent of temperature
D) Mole fraction $\rightarrow$ q) Independent of temperature.
s) ^{variation} Involves weight.
r) Involves ratio.
s) Involves weight.

Learner's Task

Q1) Ans:- C.

Solution:- Units of Normality are Gram equivalents/litre.

Q2) Ans:- C

Solution:- Units of molality are moles/kg.

Q3) Ans:- C.

Solution:- Relation b/w molarity & molality

$$m = \frac{1000 \times M}{(1000 \times d) - (M \times \text{GMW})}$$

$$\text{GMW} = M^1$$

$$m = \frac{1000 \times M}{1000 \times d - M M^1}$$

Q4) Ans:- A.

No. of moles of urea (n) = 0.1 gram mol.

W_{solvent} = 100g.

Mass of solvent = 0.1 kg.

$$\text{Molality} = \frac{\text{Moles (solute)}}{\text{Mass (solvent in kg)}}$$

$$= \frac{0.1}{0.1} = 1 \text{ molal.}$$

Q5) Ans:- C

Solution:- Urea $\text{CH}_4\text{N}_2\text{O} = 12 + 4 + 28 + 16 = 60$.

Given 6gm of urea $\rightarrow n = \frac{6}{60} = 0.1$.

90 gms. of water $\rightarrow n = \frac{90}{18} = 5 \text{ moles.}$

$$X_{\text{urea}} = \frac{0.1}{0.1 + 5} = \frac{0.1}{5.1} = 0.019$$

$$= \frac{1}{51}$$

Q6) Ans:- B.

Solution:- $X_A + X_B + X_C + X_D = 1.$

$$X_B = 0.5$$

$$X_A + X_C + X_D = 1 - 0.5 = 0.5$$

X_A is less than 0.5.

Q7) Ans:- A.

Solution:-

$$m = \frac{X_A \times 1000}{(1 - X_A) (\text{GMW})_B}$$

$$X_S = \frac{m}{m + \frac{1000}{\text{MW of Solvent}}}$$

Given $m = 0.1$, for water $\text{MW} = 18$.

$$X_S = \frac{0.1}{0.1 + \frac{1000}{18}} = \frac{0.1}{1.8 + 1000}$$

$$= \frac{0.1 \times 18}{1001.8} = 0.00179.$$

$$\begin{aligned} \text{Molefraction of Solvent} &= 1 - X_S \\ &= 1 - 0.00179 = 0.99821 \end{aligned}$$

Q8) Ans:- D.

Solution:- Given, $m = 1$, $M' = 40$, $d = 1.02 \text{ g/ml}$.

$$m = \frac{1000 \times M}{1000d - M M'} \Rightarrow 1 = \frac{1000 M}{1000(1.02) - 40 M}$$

$$1000 M = 1020 - 40 M$$

$$1000 M + 40 M = 1020$$

$$1040 M = 1020$$

$$M = \frac{1020}{1040} \Rightarrow M = 0.98$$

Q9)

Ans:- B.Solution:- Concentration of NaOH = 10% w/w.

Let 100gms of solution, mass of NaOH = 10gms.

$$n_{\text{NaOH}} = \frac{10}{40} = 0.25 \text{ moles.}$$

$$\text{Mass of water} = 100 - 10 = 90.$$

$$n_{\text{water}} = \frac{90}{18} = 5 \text{ moles.}$$

$$X_{\text{NaOH}} = \frac{n_{\text{NaOH}}}{n_{\text{NaOH}} + n_{\text{water}}} = \frac{0.25}{0.25 + 5} = \frac{0.25}{5.25} = 0.0476$$

Q10)

Ans:- C.Solution:- Specific gravity = 1.54.

$$\text{H}_3\text{PO}_4 = 3 + 31 + 64 = 98.$$

$$\text{weight \%} = 70\%.$$

$$N = \frac{10 \times \text{specific gravity} \times \text{weight \%}}{\text{G.E.W.}}$$

$$= \frac{10 \times 1.54 \times 70}{\frac{98}{3}} = \frac{1078 \times 3}{98} = 33N.$$

JEE Main Level Questions

Q1)

Ans:- D.Solution:- 1 Mole of acid dissolved in one litre water will give 1N solution only if the acid having basicity 1.→ HCl, HClO₄ & HNO₃ are all mono basic.→ H₃PO₄ has basicity value 3, so it won't give 1N solution.

Q2)

Ans:- C.

Solution:-

A) 20 ml of 0.1M H_2SO_4 + 20 ml of 0.3M NaOH .

$$\text{No. of moles of } \text{H}_2\text{SO}_4 = 0.1\text{M} \times 0.020\text{L}$$

$$= 0.002 \text{ moles.}$$

$$\text{Moles of } \text{H}^+ = 2 \times 0.002 = 0.004 \text{ moles}$$

$$\text{No. of moles of } \text{NaOH} = 0.3\text{M} \times 0.02\text{L.}$$

$$= 0.006 \text{ moles}$$

$$\text{OH}^- = 0.006 \text{ moles}$$

$\text{OH}^- > \text{H}^+ \rightarrow$ It is basic.

B) 10 ml of 0.1M H_2SO_4 + 20 ml of 0.2M NaOH .

$$n \text{ of } \text{H}_2\text{SO}_4 = 0.1 \times 0.01 = 0.001$$

$$n \text{ of } \text{H}^+ = 2 \times 0.001 = 0.002$$

$$n \text{ of } \text{NaOH} = 0.2 \times 0.02 = 0.004 \text{ moles}$$

$$\text{OH}^- = 0.004 \text{ moles.}$$

It is also basic.

C) 10 ml of 0.1M H_2SO_4 + 10 ml of 0.1M NaOH .

$$n \text{ of } \text{H}_2\text{SO}_4 = 0.1 \times 0.01 = 0.001.$$

$$[\text{H}^+] = 2 \times 0.001 = 0.002$$

$$n \text{ of } \text{NaOH} = 0.1 \times 0.01 = 0.001$$

$$\text{OH}^- = 0.001$$

$\text{H}^+ > \text{OH}^-$ So it is acidic.

D) 20 ml of 0.1M H_2SO_4 + 40 ml of 0.1M NaOH .

$$n \text{ of } \text{H}_2\text{SO}_4 = 0.1 \times 0.02 = 0.002$$

$$[\text{H}^+] = 2 \times 0.002 = 0.004.$$

$$n \text{ of } \text{NaOH} = 0.04 \times 0.1 = 0.004.$$

$[\text{H}^+] = [\text{OH}^-] \rightarrow$ It is neutral.

Q3)

Ans:- D.

Solution:- $N = \frac{w}{\text{GEW}} \times \frac{1000}{V_{\text{in}}}$

I) 1000mL of 0.3N

$$0.3 = \frac{w}{\text{GEW}} \times \frac{1000}{1000}$$

$$\frac{w}{\text{GEW}} = 0.3.$$

II) 2000mL of 0.15N.

$$0.15 = \frac{w}{\text{GEW}} \times \frac{1000}{2000}$$

$$\frac{w}{\text{GEW}} = 2 \times 0.15 = 0.3.$$

III) 2500mL of 0.2N solution.

$$\frac{w}{\text{GEW}} = 0.2 \times \frac{2500}{1000} = \frac{5}{10} = 0.5.$$

IV). 3000mL of 0.1N solution.

$$0.1 = \frac{w}{\text{GEW}} \times \frac{1000}{3000}$$

$$\frac{w}{\text{GEW}} = 0.1 \times 3 = 0.3.$$

I, II & IV are same.

Q4) Ans:- B.

Solution:- $N_{\text{HCl}} = \frac{\text{weight} \times 1000}{\text{GEW} \times V} = \frac{0.04 \times 1000}{36.5 \times 1} = 1.095$

$$N_{\text{NaOH}} = N_{\text{HCl}}$$

$$N_{\text{NaOH}} = \frac{w_B \times 1000}{40 \times 1} \Rightarrow \frac{1.095 \times 40}{1000} = w.$$

$$w_B = 0.0438 \text{ g/mL}.$$

Q5) Ans:- B.

Solution:-
$$N = \frac{N_1 V_1 + N_2 V_2}{V_1 + V_2}$$

Valency factor of HCl is 1.

$$N = 5$$

$$5 = \frac{N \times 1.5 + 2 \times 2.5}{1.5 + 2.5}$$

$$5 = \frac{1.5N + 5}{4}$$

$$1.5N + 5 = 20$$

$$1.5N = 20 - 5$$

$$N = \frac{15}{1.5} = 10$$

Q6) Ans:- B.

Solution:- Equivalent mass of $\text{KMnO}_4 = \frac{\text{Molecular weight}}{\text{No. of Electrons gained by MnO}_4}$

In KMnO_4 , $\text{Mn} = 7$, In $\text{MnO}_4 \Rightarrow \text{Mn} = 8$.

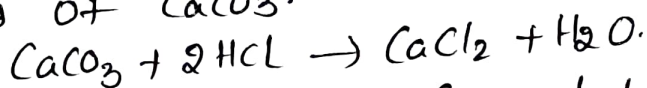
Electrons gained = 1.

$$\text{E.M of } \text{KMnO}_4 = \frac{158}{1} = 158.$$

Q7) Ans:- B.

Solution:- Solvay process, 'X' is CaCO_3 & Y is HCl.

Let V be the volume of HCl that neutralise 25gms of CaCO_3 .

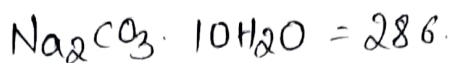


Equivalent of X = Equivalent of Y.

$$2 \times \frac{25}{100} = V \times 1 \Rightarrow V = \frac{50}{1000} = 0.05 \text{ l} = 50 \text{ ml}$$

Q8). Ans: A.

Solution: Molecular mass of



$$\text{Equivalent Mass} = \frac{286}{2} = 143.$$

100ml solution of sodium carbonate contains 1g

1000ml solution of sodium carbonate = 10g.

$$N = \frac{10}{143}.$$

Applying formula,

Normality of acid $\times$ its volume =

Normality of sodium carbonate $\times$ its volume

$$\text{Normality of acid} = \frac{10 \times 42.9}{143 \times 30} = 0.1.$$

Let V ml be the volume of H_2SO_4 .

$$8 \times 5 + 4.8 \times 5 + 34 \times V = 0.1 \times 2000.$$

$$V = 4 \text{ mL}.$$

Amount of

$$\begin{aligned} \text{SO}_4^{2-} &= \frac{\text{Normality} \times \text{Eq. mass} \times \text{volume}}{1000} \\ &= \frac{34 \times 48 \times 4}{1000} \\ &= 6.528 \text{ g.} \end{aligned}$$

Q9) Ans:- C.

Solution:- 0.25 mole of urea are present in 1 kg of water

Moles of urea = 0.25 mole

Mass of solvent (water) = 1 kg = 1000 g

Mol. mass of urea (NH_2CONH_2) = 60 g/mol

$$0.25 \text{ moles of urea} = 0.25 \times 60 \text{ g} \\ = 15 \text{ g}$$

$$\text{Total mass of solution} = 1000 + 15 = 1015 \text{ g} \\ = 1.015 \text{ kg}$$

1.015 kg of solution contains urea =

15 g x 2.5 kg of solution will require urea

$$\text{Mass of urea} = \frac{15 \text{ g} \times 2.5 \text{ kg}}{1.015 \text{ kg}} = 37 \text{ g}$$

Q10) Ans:- A.

Solution:- Mass of sugar = 34.2 g

$$\text{No. of moles of sugar} = \frac{34.2}{\text{Mol. mass}} = \frac{34.2}{342} = 0.1$$

$$\text{Mass of water} = 214.2 - 34.2 = 180 \text{ g} = 0.18 \text{ kg}$$

$$\text{No. of moles of water} = \frac{180}{18} = 10 \text{ moles}$$

$$\rightarrow \text{Molality} = \frac{\text{No. of moles of sugar}}{\text{Mass of water in kg}} = \frac{0.1}{0.18} = 0.555 \text{ M}$$

$$\rightarrow \text{Total no. of moles} = 10 + 0.1 = 10.1$$

$$\text{Mole fraction of Sugar} = \frac{0.1}{10.1} = 0.0099$$

Q11) Ans:- B.

Solution:- 10% means 10g of glucose in 100gms solution.

$$\text{water} = 100 - 10 = 90 \text{ gms.}$$

Molar mass

$$\text{C}_6\text{H}_{12}\text{O}_6 = 6 \times 12 + 12 \times 1 + 6 \times 16 = 180 \text{ g/mol.}$$

$$\text{no. of moles of glucose} = \frac{10}{180} = 0.056 \text{ mol.}$$

X_w = mole fraction of A.

$$\text{Molality of solution} = \frac{0.056}{0.09 \text{ kg}} = 0.62 \text{ m.}$$

$$\text{No. of moles of water} = \frac{90}{18} = 5 \text{ moles.}$$

$$X_g = \frac{0.056}{0.056 + 5} = 0.011.$$

$$\text{mole fraction of water } X_w = 1 - X_g = 1 - 0.011 = 0.989.$$

Q12) Ans:- C.

Solution:- A $\rightarrow$ Solute, B $\rightarrow$ Solvent

$$m = \frac{X_A}{(1 - X_A) \cdot m_B} \times 1000$$

$$= \frac{1 - 0.849}{0.849 \times 18} \times 1000$$

$$= \frac{0.151}{15.282} \times 1000$$

$$= \frac{151}{15.282} = 9.8809$$

Q13). Ans:- A, B, C.

Solution:- Molality $m = \frac{n_2}{w_2}$

$$n_2 = m w_1$$

$$x_2 = \frac{n_2}{n_1 + n_2} = \frac{m w_1}{\frac{w_1}{M_1} + m w_1} = \frac{m M_1}{1 + m M_1}$$

$$\rightarrow m = \frac{1000 \cdot M}{1000\rho - (M \times \text{GMW})}$$

$$m = \frac{M}{\rho - M M_2}$$

$$\rightarrow x_2 = \frac{m M_1}{1 + m M_1}$$

Q14) Ans:- A

Solution:- 1 M solution means 1 mole solute in 1000 mL.

1m solution means 1 mole solute in 1000 gram of solvent.

So concentration of molar aqueous solution is more

Q15). Ans:- D.

Solution:- $E = \frac{\text{Molecular weight}}{\text{change in oxidation state.}}$

Oxidation number of Mn in $\text{KMnO}_4 = 7$

In $\text{MnO}_4 = 2$

$$\text{Change} = 7 - 2 = 5$$

$$E = \frac{M}{5} = M/5$$

Q15) Ans: c.

Solution: $m = \frac{M \times 1000}{1000d - M M'}$

Integer Type

Q16) Ans: 3.

Solution: H_3PO_4 is tribasic.

$$N = 3M \\ = 3 \times 1 = \underline{3}.$$

Q17) Ans: 3.

Solution: n-factor of $H_3PO_4 = 3$.

$$\text{mass of } H_3PO_4 = 4.9 \text{ g/mol.}$$

$$\text{molar mass of } H_3PO_4 = 3 + 31 + 64 = 98.$$

$$\text{no. of moles} = \frac{4.9}{98} = 0.05 \text{ mol.}$$

$$\text{Molarity} = \frac{\text{no. of moles of } H_3PO_4}{\text{volume of solution in Litre}} = \frac{0.05}{0.5} \\ = 0.1 M.$$

$$\text{Normality} = n \times \text{Molarity} = 3 \times 0.1 \\ = 0.3 \Rightarrow 3 \times 10^{-1} \\ x = 3.$$

Q18) Ans: 2.

Solution:

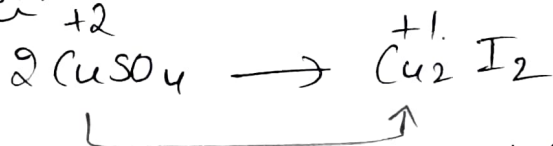
$$m = \frac{x}{\text{GMW}} \times \frac{1000}{100 - 2}$$

$$= \frac{2}{58.5} \times \frac{1000}{100 - 2} = \frac{2000}{58.5 \times 98} = \frac{2000}{5733}$$

$$= 0.3488 \\ \approx 0.35 \\ = 35 \times 10^{-2}$$

Q19) Ans:- 1.

Solution:-



charge in oxidation state = 1.

$$\text{Equivalent weight of CuSO}_4 = \frac{M_{\text{CuSO}_4}}{n} \\ = \frac{M}{1}$$

Q20) Ans:- 50.

Solution:- $n_{\text{O}_2} = \frac{0.8}{32} = 0.025$

$$n_{\text{N}_2} = \frac{0.7}{28} = 0.025$$

$$\text{mole percent of O}_2 = \frac{0.025}{0.025 + 0.025} \times 100 \\ = \frac{2.5}{0.05} = \underline{\underline{50}}$$

Additional Practise Questions

Q1) Ans:- A

Solution:- Equivalent weight equal to molecular weight divided by n-factor.

$$E.W = \frac{M.W}{n\text{-factor}}$$

n-factor in case of $\text{H}_3\text{PO}_2 = 1$.

$$E.W = \frac{M.W}{1}$$

Q2) Ans:- B.

Solution:- Molality = No. of moles of solute.

Molality $\propto$ no. of moles of solute.

Molality $\propto \frac{1}{\text{weight of solvent}}$.

To reduce molality one half, double the weight of solvent.

Q3) Ans:- B.

Solution:- $N = \frac{10g}{\text{GEW.}}$

$$y = 0.98\% \quad \text{GEW} = \frac{\text{GMW}}{2} = \frac{98}{2} = 46.$$

(H_2SO_4)

$$N = \frac{10 \times 0.98}{46} = \frac{9.8}{46} = 0.2 \text{ N.}$$

Q4) Ans:- C

<u>Solution:-</u>	FeSO_4	$\text{K}_2\text{Cr}_2\text{O}_7$
	0.1 N.	x gms
	100 mL	GMW = 294.

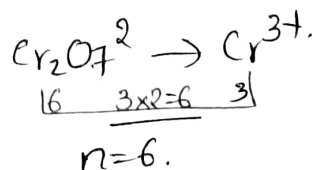
no. of GEW of FeSO_4 = no. of GEW of $\text{K}_2\text{Cr}_2\text{O}_7$.

$$0.1 \times 100 \times 10^{-3} = \frac{w}{\text{GEW.}}$$

$$10^{-2} = \frac{w}{\text{GMW}/6} \Rightarrow \frac{6.w}{294}$$

$$w = \frac{10^{-2} \times 294}{6}$$

$$= 0.49.$$



5. Normality, Molality and Mole Fraction KEY

	TEACHING TASK									
	1	2	3	4	5	6	7	8	9	10
D	B	B	D	B	D	A	D	B	B	
	11	12	13	14	15	16	17	18	19	20
B	A	C,D	B,C	A	D	C	B	A	A	

LEARNERS TASK

CUQ'S

	1	2	3	4	5	6	7	8	9	10
C	C	C	A	C	B	A	D	B	C	

JEE MAIN&ADVANCED LEVEL QUESTION

	1	2	3	4	5	6	7	8	9	10
D	C	D	B	B	B	B	A	C	A	
	11	12	13	14	15	15	16	17	18	19
B	C	A,B,C	A	D	C		3	3	2	1

20-50

ADDITIONAL PRACTISE QUESTIONS FOR STUDENTS

	1	2	3	4
A	B	B	C	