Absolute

JEE ADVANCED

2500+ Questions

CHEMISTRY

This Book Consists of Advanced Level Questions with 3 Mock Test

- Single Correct Choice Questions
- Integer / Numerical type Questions
- One or Multiple Correct Choice Question
- Comprehension type Questions
- Matrix match/List type Questions

CONTENTS

CHAPTER 1

Stoichiometry & Redox Reactions

Solved Examples

1. A mixture of pure $K_2Cr_2O_7$ and pure $KMnO_4$ weighing 0.561 g. was treated with excess of KI in acidic medium. Iodine liberated required 100 ml of 0.15 M of sodium thiosulphate solution for exact oxidation. What is the % of each in the mixture?

Sol. $K_2Cr_2O_7 + KMnO_4 = 0.561 g$

If $K_2Cr_2O_7 = x$ g

Then $KMnO_4 = (0.561 - x)$ gm

Meq. of $K_2Cr_2O_7$ + Meq. of $KMnO_4$ = Meq. of $Na_2S_2O_3$

$$\left[\frac{x}{49}+\frac{(0.561-x)}{31.6}\right] \times 1000 = 100 \times 0.15$$

x = 0.245

$K_2Cr_2O_7 = 0.245$ g

$KMnO_4 = 0.316$ gms

$$\% \text{ of } K_2Cr_2O_7 = \frac{0.245}{0.561}\times 100 = 43.67\ \%$$

$$\% \text{ of } KMnO_4 = \frac{0.316}{0.561}\times 100 = 56.33\%$$

2. A solution contains a mixture of Na_2CO_3 and NaOH. Using phenolphthalein as indicator, 25 mL of mixture required 19.5 mL of 0.995 N HCl for the end point. With methyl orange, 25 mL of solution required 25 mL of the same HCl for the end point. The grams per litre of Na_2CO_3 in the mixture is

(*a*) 23.2 (*b*) 18.5 (*c*) 19.9 (*d*) 12.8

Sol. (*a*) Let the moles of Na_2CO_3 and NaOH in 25 mL mixture be x and y respectively.

Case-I: When HPh is used as indicator.

$$\underset{x}{NaOH} + \underset{x}{HCl} \rightarrow NaCl + H_2O$$

$$\underset{y}{Na_2CO_3} + \underset{y}{HCl} \rightarrow NaHCO_3 + NaCl$$

So, $x + y = 19.5 \times 10^{-3} \times (0.995 \times 1)$ …(*i*)

Case-II: When methyl orange is used as indicator.

$$\underset{x}{NaOH} + \underset{x}{HCl} \rightarrow NaCl + H_2O$$

$$\underset{y}{Na_2CO_3} + \underset{2y}{2HCl} \rightarrow 2NaCl + H_2O + CO_2$$ …(*ii*)

$x + 2y = 25 \times 10^{-3} \times 0.995 \times 1$

On solving eqs. (*i*) and (*ii*), we get,

$x = 13.93 \times 10^{-3}$ mol and $y = 5.4725 \times 10^{-3}$ mol

Now, weight of NaOH in 25 mL mixture

$= 13.93 \times 10^{-3} \times 40 = 557.2 \times 10^{-3}$ g

Weight of Na_2CO_3 in 25 mL mixture

$= 5.4725 \times 10^{-3} \times 106 = 580.085 \times 10^{-3}$ g

∴ Weight of NaOH per litre

$$= \frac{557.2\times10^{-3}\times1000}{25} = 22.288\ g/L$$

Weight of Na_2CO_3 per litre

$$= \frac{580.085\times10^{-3}\times1000}{25} = 23.2034\ g/L$$

3. What weight of inorganic rubber phosphonitrile dichloride can be obtained if the synthesis begins with 1.4 g N_2, 5.6 Lit of H_2 at S.T.P., 80 g of PCl_3 and large excess of S_2Cl_2 and HCl.

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

$$NH_3 + HCl \longrightarrow NH_4Cl$$

$$3PCl_3 + S_2Cl_2 \longrightarrow 2PSCl_3 + PCl_5$$

$$nPCl_5 + nNH_4Cl \xrightarrow[120°C]{\Delta} (PNCl_2)_n + n\,HCl$$

Sol. $N_2 + 3H_2 \longrightarrow 2NH_3$

Before reaction $\frac{1.4}{28}$ mole $\frac{5.6}{22.4}$ mole

After reaction 0.5 mole 0.25 mole 1 mole

$NH_3 + HCl \longrightarrow NH_4Cl$

0.1 mole 0.1 mole

$3PCl_3 + S_2Cl_2 \longrightarrow 2PSCl_3 + PCl_5$

$\frac{80}{137.5}$ mole

0.58 mole $\frac{0.58}{3} = 0.193$ mole

$nPCl_5 + nNH_4Cl \longrightarrow (PNCl_2)_n + nHCl$

0.198 mole 0.1 mole 0.1 mole

0.1 mole $(PNCl_2)_n = 11.6$ g

4. One gram of an alloy of aluminium and magnesium when heated with excess of dil. HCl forms magnesium chloride, aluminum chloride and hydrogen. The evolved hydrogen collected over mercury at 0°C has a volume of 1.2 litres at 0.92 atm. pressure. Calculate the composition of the alloy.

Sol. $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

$2Al + 6\,HCl \longrightarrow 2AlCl_3 + 3\,H_2$

Suppose Mg = x g

And Al = (1–x)g

$P_1V_1 = P_2V_2$

$0.92 \times 1.2 = 1 \times V_2$

$V_2 = 1.104$ litre

$$\frac{22.4x}{24} + \frac{3 \times 22.4(1-x)}{2 \times 27} = 1.104$$

x = 0.4514

Mg = 0.4514 g

Al = 0.5486 g

5. A 2.18g sample containing a mixture of XO and X_2O_3. It takes 0.015 mole of $K_2Cr_2O_7$ to oxidise the sample completely to form XO_4^- and Cr^{3+}. If 0.0187 mole of XO_4^- is formed, what is the atomic mass of X?

Sol. $XO + K_2Cr_2O_7 \longrightarrow Cr^{+3} + XO_4^-$

$X_2O_3 + K_2Cr_2O_7 \longrightarrow Cr^{+3} + XO_4^-$

Let wt of XO in the mixture be x g

Equivalent of $K_2Cr_2O_7$ consumed by the mixture $= 0.015 \times 6$

Equivalents of XO $= \frac{x}{x+16} \times 5$

Equivalents of $X_2O_3 = \frac{2.18-x}{2x+48} \times 8$

$$\therefore \frac{x}{x+16} \times 5 + \frac{2.18-x}{2x-148} \times 8 = 0.015 \times 6$$

Since 1 mole of XO gives 1 mole XO_4^- and 1 moles of X_2O_3 gives 2 moles of XO_4^-,

$$\therefore \frac{x}{x+16} + \frac{2x(2.18-x)}{2x+48} = 0.0187$$

Solving this x = 99

6. A solution contains a mixture of sulphuric acid and oxalic acid, 25 ml of the solution requires 35.54 ml. of 0.1 M NaOH for neutralization and 23.45 ml. of 0.02 M $KMnO_4$ for oxidation. Calculate the molarity of solution with respect to sulphuric acid and oxalic acid.

Sol. Meq. of H_2SO_4 + Meq. of $H_2C_2O_4$ = Meq. of NaOH = 35.54 ×0.1

Meq. of $H_2C_2O_4$ = Meq. of $KMnO_4$

$\frac{w}{63} \times 1000 = 23.45 \times 0.02 \times 5$

w = 0.1477 g

Meq. of $H_2SO_4 = (35.54 \times 0.1) - (23.45 \times 0.02 \times 5)$

Thus, w = 0.0592 g

Molarity of $H_2SO_4 = \frac{0.0592}{98 \times 0.025} = 0.0241$ M

Molarity of $H_2C_2O_4 = \frac{0.1477}{126 \times 0.025} = 0.0469$ M

7. 0.532 g of the chloroplatinate of a diacidic base on ignition left 0.195 g of residue of Pt. Calculate molecular weight of the base (Pt = 195)

Sol. Suppose the diacid base is B.

$$\underset{\text{Diacid base}}{B} + \underset{\text{Acid}}{H_2PtCl_6} \rightarrow \underset{\text{Chloroplatinate } 0.532g}{BH_2PtCl_6} \rightarrow \underset{0.195g}{Pt}$$

Since Pt atoms are conserved, applying POAC for Pt atoms, moles of Pt atoms in BH_2PtCl_6 = Moles of Pt atoms in the product

1 × moles of BH_2PtCl_6 = moles of Pt in the product

$$\frac{0.532}{\text{Mo. wt. of } BH_2PtCl_6} = \frac{0.195}{195}$$

$\therefore$ Mol. wt. of $BH_2PtCl_6 = 532$
From the formula $BH_2PtCl_6 = 532$
From the formula BH_2PtCl_6, we get
Mol. wt. of B
= mol. wt. of $BH_2 PtCl_6$ – mol. wt. of H_2PtCl_6
= 532 – 410 = 122

8. A 62% by mass of an aqueous solution of acid has specific gravity 1.8. This solution is diluted such that the specific gravity of solution became 1.2. Find the % by wt of acid in new solution.

Sol. $\text{Density} = \dfrac{\text{Mass}}{\text{Volume}}$

$$1.8 = \frac{100}{\text{Volume of Sol}^n}$$

$\Rightarrow$ Volume of solution $= \dfrac{100}{1.8}$

Let x gm water is added in solution

Then, $d = \dfrac{\text{mass}}{\text{volume}}$

$$1.2 = \frac{100 + x}{\frac{100}{1.8} + x}$$

$$1.2 \times \frac{100}{1.8} + 1.2x = 100 + x$$

$$\frac{200}{3} + 1.2x = 100 + x$$

$$0.2x = 100 - \frac{200}{3} = \frac{100}{3}$$

$$x = \frac{100}{3 \times 0.2} = \frac{1000}{6} = \frac{500}{3} = 166.67$$

Mass of new solution = 100 + 166.67 = 266.67
266.67 gm solution contains 62 gm of acid

$$\% \text{ by mass} = \frac{62}{266.67} \times 100 = 23.25\%$$

9. 20 g. of a sample of $Ba(OH)_2$ is dissolved in 50 ml of 0.1 N HCl solution. The excess of HCl was titrated with 0.1 N NaOH. The volume of NaOH used was 20 cc. Calculate the percentage of $Ba(OH)_2$ in the sample.

Sol. Milli eq. of HCl initially = 50 × 0.1 = 5
Milli eq. of NaOH consumed = Milli eq. of HCl in excess = 20 × 0.1 = 2
$\therefore$ Milli eq. of HCl consumed
= Milli eq. of $Ba(OH)_2 = 5 - 2 = 3$
$\therefore$ eq. of $Ba(OH)_2 = 3/1000 = 3 \times 10^{-3}$
Mass of $Ba(OH)_2 = 3 \times 10^{-3} \times (171/2) = 0.2565$ g.
% $Ba(OH)_2 = (0.2565/20) \times 100 = 1.28\%$

10. A solution contains Na_2CO_3 and $NaHCO_3$. 10 mL of the solution requires 2.5 mL of 0.1 M H_2SO_4 for neutralization using phenolphthalein as an indicator. Methyl orange is added when a further 2.5 mL of 0.2 M H_2SO_4 was required. Calculate the amount of Na_2CO_3 and $NaHCO_3$ in one litre of the solution.

Sol.

	Na_2CO_3	$NaHCO_3$
Let	a mmol	b mmol

When HPh is used indicator

Then $\dfrac{1}{2}$ mmol of Na_2CO_3 = mmol of H_2SO_4

$$\frac{a}{2} = 2.5 \times 0.1 \Rightarrow a = 0.5$$

Methyl orange is added after the first end point the solution
Contains $NaHCO_3$ original & $NaHCO_3$ produced.
meq. of H_2SO_4 = meq. of $NaHCO_3$ original + meq. of $NaHCO_3$ produced
2.5 × 0.2 × 2 = b + mmol of Na_2CO_3 = b + a
b + a = 1
b = 1 – 0.5 = 0.5

$$\text{wt. of } Na_2\,CO_3/\text{ lit} = a \times 10^{-3} \times \frac{106}{2} \times \frac{1}{10} \times 1000$$

$$= 1 \times \frac{53}{10} = 5.3\,\text{gm}$$

wt. of $NaHCO_3$/lit

$$= b \times 10^{-3} \times 84 \times \frac{1}{10} \times 1000 = 4.2\,\text{gm}$$

11. A 1.85 g. sample of a mixture of $CuCl_2$ and $CuBr_2$ was dissolved in water and mixed thoroughly with a 1.8 g portion of AgCl. After the reaction, a mixture of AgCl and AgBr, was filtered, washed, and dried. Its mass was found to be 2.052 g. What percent by mass of the original mixture was $CuBr_2$?

Sol. Suppose $CuCl_2$ = x g
and $CuBr_2$ = (1.85 – x) g

$$\text{Wt. of AgCl consumed} = \frac{(1.85 - x) \times 2 \times 143.5}{223.5}$$

Exercise

Single Correct Type Questions (01 to 51)

1. 15 gm $Ba(MnO_4)_2$ sample containing inert impurity is completely reacting with 100 ml of '11.2 V' H_2O_2, then what will be the purity of $Ba(MnO_4)_2$ in the sample?

(*a*) 5% (*b*) 10%
(*c*) 50% (*d*) none

2. In what ratio should a 15% solution of acetic acid be mixed with a 3% solution of the acetic acid to prepare a 10% solution (all percentages are mass/mass percentages):

(*a*) 7 : 3 (*b*) 5 : 7 (*c*) 7 : 5 (*d*) 7 : 10

3. 105 ml of pure water at 4ºC saturated with NH_3 gas, yielded a solution of density 0.9 g/ml and containing 30% NH_3 by mass. Find the volume of resulting NH_3 solution

(*a*) 66.67 ml (*b*) 166.67 ml
(*c*) 133.33 ml (*d*) 266.67 ml

4. X gram of pure As_2S_3 is completely oxidised to respective highest oxidation states by 50 ml of 0.1 M hot acidified $KMnO_4$ then X, mass of As_2S_3 taken is: (Molar mass of As_2S_3 = 246)

(*a*) 22.4 g (*b*) 0.22 g (*c*) 64.23 g (*d*) 1.06 g

5. Volume V_1 mL of 0.1 M $K_2Cr_2O_7$ is needed for complete oxidation of 0.678 g N_2H_4 in acidic medium. The volume of 0.3 M $KMnO_4$ needed for the same oxidation in acidic medium will be:

(*a*) $\frac{2}{5}V_1$ (*b*) $\frac{5}{2}V_1$ (*c*) 113 V_1 (*d*) $\frac{7}{5}V_1$

6. 25 mL of 2N HCl, 50 mL of 4N HNO_3 and x mL of 2M H_2SO_4 are mixture together and the total volume is made up to 1 L after dilution. 50 mL of this acid mixture completely reacted with 25 mL of a 1N Na_2CO_3 solution. The value of x is:

(*a*) 250 mL (*b*) 62.5 mL
(*c*) 100 mL (*d*) None of these

7. An excess of NaOH was added to 100 mL of a ferric chloride solution. This caused the precipitation of 1.425 g of $Fe(OH)_3$. Calculate the normality of the ferric chloride solution.

(*a*) 0.20 N (*b*) 0.50 N
(*c*) 0.25 N (*d*) 0.40 N

8. 0.4 g of a polybasic acid H_nA (all the hydrogens are acidic) requires 0.5g of NaOH for complete neutralization. The number of replaceable hydrogen atoms in the acid and the molecular weight of 'A' would be: (Molecular weight of the acid is 96 gms/mole.)

(*a*) 1, 95 (*b*) 2, 94 (*c*) 3, 93 (*d*) 4, 92

9. 25.0 g of $FeSO_4{\cdot}7H_2O$ was dissolved in water containing dilute H_2SO_4, and the volume was made up to 1.0 L. 25.0 mL of this solution required 20 mL of an N/10 $KMnO_4$ solution for complete oxidation. The percentage of $FeSO_4{\cdot}7H_2O$ in the acidic solution is

(*a*) 78% (*b*) 98% (*c*) 89% (*d*) 79%

10. 25 mL of solution containing HCl and H_2SO_4 required 10 mL of a 1 N NaOH solution for neutralization. 20 mL of the same acid mixture on being treated with an excess of $AgNO_3$ gives 0.1435g of AgCl. The normality of the HCl and the normality of the H_2SO_4 are respectively.

(*a*) 0.40 N and 0.50 N (*b*) 0.05 N and 0.35 N
(*c*) 0.50 N and 0.25 N (*d*) 0.40 N and 0.5 N

11. 0.70 g of mixture $(NH_4)_2SO_4$ was boiled with 100 mL of 0.2 N NaOH solution till all the $NH_3(g)$ gets evolved and separated. The remaining solution was diluted to 250 mL. 25mL of this solution was neutralized using 10 mL of a 0.1 N H_2SO_4 solution. The percentage purity of the $(NH_4)_2\,SO_4$ sample is

(*a*) 94.3 (*b*) 50.8 (*c*) 47.4 (*d*) 79.8

12. A mixed solution of potassium hydroxide and sodium carbonate required 15 mL of an N/20 HCl solution when titrated with phenolphthalein as an indicator. But the same amount of the solution when titrated with methyl orange as an indicator required 25 mL of the same acid. The amount of KOH present in the solution is

(*a*) 0.014 g (*b*) 0.14 g
(*c*) 0.028 g (*d*) 1.4 g

47. $K_2Cr_2O_7 + HCl \rightarrow KCl + CrCl_3 + Cl_2 + H_2O$. One mole of HCl reacts completely with $K_2Cr_2O_7$ to give Cl_2. How many grams of MnO_2 will be required for the production of same amount of chlorine from HCl?

(*a*) 18.642 g (*b*) 1.19717 g

(*c*) 14.034 g (*d*) 43.5 g

48. A solution contains Na_2CO_3 and $NaHCO_3$.10 ml of the solution required 2.5 ml of 0.1 M H_2SO_4 for neutralisation using phenolphthalein as indicator. Methyl orange is then added when a further 2.5 ml of 0.2 M H_2SO_4 was required. The amount of Na_2CO_3 and $NaHCO_3$ in 1 litre of solution is

(*a*) 5.3 g and 4.2 g (*b*) 3.3 g and 6.2 g

(*c*) 4.2 g and 5.3 g (*d*) 6.2 g and 3.3 g

49. The equivalent weight of HNO_3 in following reaction $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ is

(*a*) $4 \times \frac{63}{3}$ (*b*) $\frac{63}{5}$ (*c*) $\frac{63}{3}$ (*d*) 63

50. x gram of an acid furnishes 0.5 mole H_3O^+ in aqueous solution. What will be normality of acid if y gram dissolve in 500 ml solution?

(*a*) $\frac{y \times 1000}{x \times 500}$ (*b*) $\frac{y}{x}$

(*c*) $\frac{y}{2x \times 500}$ (*d*) $\frac{y \times x}{5000}$

51. 1 g of carbonate of metal was dissolved in 25 ml of 1 N HCl. The resulting liquid required 5 ml of 1 N NaOH for neutralisation. The equivalent weight of the metal carbonate is (Consider neutralisation of NaOH only with HCl)

(*a*) 50 (*b*) 30

(*c*) 20 (*d*) None of these

Multiple Correct Type Questions (52 to 84)

52. 500 ml aqueous solution is made by dissolving a certain amount of Na_2CO_3 and NaOH mixture. 100 ml of this solution require 40 ml, 0.1 M HCl solution for the colour change when phenolphthalein is used as indicator, while 60 ml 0.1 N HCl require for the colour change when methyl orange is used as indicator in a separate titration. The correct option(s) is/are

(*a*) Weight % of NaOH in the mixture is 27.4.

(*b*) Weight of NaOH in the mixture is 0.08 gm.

(*c*) Weight of Na_2CO_3 in the mixture is 1.06 gm.

(*d*) Total weight of mixture is 0.292 gm.

53. Which of the following solutions have the same concentration?

(*a*) 20 g of NaOH in 200 mL of solution

(*b*) 0.5 mol of KOH in 200 mL of solution

(*c*) 40 g of NaOH in 100 mL of solution

(*d*) 20 g of KOH in 200 mL of solution

54. Which of the following statement(s) is(are) not true about the following decomposition reaction?

$2KClO_3 \rightarrow 2KCl + 3O_2$

(*a*) Potassium is undergoing oxidation

(*b*) Chlorine is undergoing oxidation

(*c*) Oxygen is reduced

(*d*) None of the species are undergoing oxidation or reduction

55. A solution contains Na_2CO_3 and $NaHCO_3$ 10 ml of this solution requires 2.5 ml of $\left(\frac{1}{5}\right)$M – HCl solution for the end point using phenolphthalein, as indicator. In another experiment, 10 ml of the same original solution requires 7.5 ml of $\left(\frac{1}{5}\right)$ M – HCl solution for the end point using methyl orange, as indicator. Which of the following statement(s) is/are correct regarding the original solution.

(*a*) 10 ml of original solution contains 0.053 g Na_2CO_3.

(*b*) 10 ml of original solution contains 0.042 g $NaHCO_3$.

(*c*) Concentration of Na_2CO_3 in original solution is 0.05 M

(*d*) Concentration of $NaHCO_3$ in original solution is 0.05 M

56. Select the correct statements:

(*a*) Oxidation number of oxygen in O_2^+ is $+\frac{1}{2}$

(*b*) Oxidation number of oxygen in O_2^- is $-\frac{1}{2}$

(*c*) Oxidation number of Cr in K_3CrO_8 is +5.

(*d*) Average oxidation number of Br in tribromooctaoxide is $+\frac{18}{3}$

57. When an equimolar mixture of Cu_2S and CuS is titrated with $Ba(MnO_4)_2$ in acidic medium, the final product's contains Cu^{2+}, SO_2 and Mn^{2+}. If the mol. wt. of Cu_2S, CuS and $Ba(MnO_4)_2$, are M_1, M_2 and M_3 respectively then

(*a*) Eq. wt. of Cu_2S is $\frac{M_1}{8}$

(*b*) Eq. wt. of CuS is $\frac{M_2}{6}$

(*c*) Eq. wt. of $Ba(MnO_4)_2$ is $\frac{M_3}{5}$

(*d*) Cu_2S and CuS both have same equivalents in mixture

58. A mixture of $Na_2C_2O_4$ and $H_2C_2O_4$ requires 100 mL of 0.1 M $KMnO_4$ for complete neutralisation. The same mixture of neutralisation by a base requires 50 mL of 0.2 M NaOH solution. Which is/are correct?

(*a*) Mole ratio of $Na_2C_2O_4$ and $H_2C_2O_4$ = 4 : 1

(*b*) Equivalent ratio of $Na_2C_2O_4$ and $H_2C_2O_4$ with respect to $KMnO_4$ = 4 : 1

(*c*) Mole of $C_2O_4^{2-}$ in mixture = 25×10^{-3}

(*d*) Mole ratio of $Na_2C_2O_4$ and $H_2C_2O_4$ = 1 : 4

59. In acidic medium dichromate ion oxidises stannous ion as:

$xSn^{2+} + yCr_2O_7^{2-} + zH^+ \rightarrow aSn^{4+} + bCr^{3+} + cH_2O$

(Where x,y,z,a,b,c have lowest possible integer values)

(*a*) The value of x : y is 1 : 3

(*b*) The value of x + y + z is 18

(*c*) a : b is 3 : 2

(*d*) The value of z – c is 7

60. For a given reaction

$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

The correct statements is/are

(*a*) For the complete reaction of 1 equivalents of $Ca(OH)_2$, 2 equivalents of H_2SO_4 required

(*b*) n factor of $Ca(OH)_2$ is two

(*c*) Equivalent mass of H_2SO_4 is 49

(*d*) n factor of H_2SO_4 is always 2 for any reaction

61. A sample of air containing SO_2 as an impurity measures 1 kiloliter at STP. It is passed through excess of aqueous solution of H_2O_2. The resultant solution required 20 ml of 0.1 N NaOH solution for complete neutralization. Pick out the correct statements

(*a*) Volume of SO_2 at STP is 22.4 ml

(*b*) Concentration of SO_2 in air by volume is 22.4 ppm

(*c*) n factor of SO_2 is 2

(*d*) Equivalent weight of SO_2 is 16

62. When the MnO_2 reacts with HCl the chlorine gas is evolved according to the equation

$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$.

Which are correct regarding this equation?

(*a*) n factor of HCl is 0.5

(*b*) Equivalent mass of HCl will be equal to molecular mass of HCl

(*c*) Equivalent mass of MnO_2 is half of its molecular mass

(*d*) It is redox reaction

63. The oxidation number of Cr is +6 in

(*a*) $FeCr_2O_4$ (*b*) $KCrO_3Cl$

(*c*) CrO_5 (*d*) $[Cr(OH)_4]$

64. Ammonium sulphate reacts with one mole of MnO_2 in acidic medium in a reaction giving $MnSO_4$ and $(NH_4)_2S_2O_8$ which are correct statements regarding the above reaction?

(*a*) n factor of $(NH_4)_2SO_4$ is 1

(*b*) moles of $(NH_4)_2SO_4$ reacted is 2

(*c*) n factor of MnO_2 is 2

(*d*) n factor of MnO_2 is 1

84. 0.1 M solution of KI reacts with excess of H_2SO_4 and KIO_3 solutions, according to equation $5I^- + IO_3^- + 6H^+ \rightarrow 3I_2 + 3H_2O$; which of the following statement is correct

(*a*) 400 ml of the KI solution react with 0.004 mole of KIO_3

(*b*) 100 ml of the KI solution reacts with 0.006 mole of H_2SO_4

(*c*) 0.5 litre of the KI solution produced 0.005 mole of I_2.

(*d*) Equivalent weight of KIO_3

$$= \left(\frac{\text{Molecular Weight}}{5}\right)$$

Numerical/Integer Type Questions (85 to 104)

Part I: Numerical Type Questions (85 to 94)

85. A sample contains both H_3PO_4 and HIO_3 along with other unknown substances. 10 g sample required 85 ml of 0.15 N NaOH during titration using phenolphthalein as indicator, a separate 10 g sample required 66 ml of 0.15 N NaOH during titration using methyl orange as indicator. Calculate the sum of % composition of H_3PO_4 and HIO_3 in the sample

$H_3PO_4 + OH^- \rightarrow H_2PO_4^-$
(methyl orange end point)

$H_3PO_4 + 2OH^- \rightarrow [HPO_4]^{2-}$
(phenolphthalein end point)

86. A sample of Magnesium was burnt in air to give a mixture of MgO and Mg_3N_2. The ash was dissolved in 60 meq of HCl and the resulting solution back titrated with NaOH. 12 meq of NaOH were required to react to the end point. An excess of NaOH was then added and the solution distilled. The ammonia released was then trapped in 10 meq of second acid solution. Back titration of this solution required 6 meq. of the base. Calculate the percentage of magnesium burnt to the nitride.

87. A mixture containing 1 mole of N_2 and 3 mole of H_2 is partially converted into NH_3. The NH_3 formed is completely neturalized by 200 ml of 2.5 M H_3PO_4. Calculate the vapour density of first mixture (containing N_2, H_2 and NH_3) if NH_3 is not consumed in second reaction.

88. 1.00 g of a mixture consisting of equal number of moles of carbonates of the two univalent metals, required 44.4 mL of 0.5 N HCl for complete reaction. If the atomic weight of one of the metals is 7, what will be the total amount of metal sulphate formed on gravimetric conversion of 1 g of the mixture of sulphates?

89. 0.6 g of a sample of pyrolusite was boiled with 200 mL of N/10 oxalic acid and excess of dilute H_2SO_4. The liquid was filtered and the residue washed. The filtrate and washings were mixed and made up to 500 mL. 100 mL of this solution required 50 mL of N/30 $KMnO_4$ solution. Calculate the percentage of MnO_2 in the given sample of pyrolusite.

90. 0.9546 g of a Rochelle salt, $NaKC_4H_4O_6{\cdot}4H_2O$, on ignition gave $NaKCO_3$ which was treated with 41.72 mL of 0.1307 N H_2SO_4. The unreacted H_2SO_4 was then neutralised by 1.91 mL of 0.1297 N NaOH. Find the percentage purity of the Rochelle salt in the sample.

91. A nugget of gold and quartz weighs 100 g. Specific gravity of gold, quartz and the nugget are 19.3, 2.6 and 6.4 respectively. Calculate the weight of gold in the nugget.

92. A mixture containing $KClO_3$, $KHCO_3$, K_2CO_3 and KCl was heated, producing CO_2, O_2 and H_2O gases according to the following equations:

$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2$

$2KHCO_3(s) \rightarrow K_2O(s) + H_2O(g) + 2CO_2(g)$

$K_2CO_3(s) \rightarrow K_2O(s) + CO_2(g)$

The KCl does not react under the conditions of the reaction. If 100.0 g of the mixture produces 1.80 g of H_2O,13.20 g of CO_2 and 4.0 g of O_2, what is the mass of K_2CO_3 in the original mixture?

93. When a mixture of NaBr and NaCl is repeatedly digested with sulphuric acid, all the halogens are expelled and Na_2SO_4 is formed quantitatively. With a particular mixture, it was found that the weight of Na_2SO_4 obtained was precisely the same as the weight of NaBr-NaCl mixture taken. Calculate the percentage weight of NaBr in the mixture.

94. A 3.0 g sample of Cu_2O is dissolved in dil. H_2SO_4 where it undergoes disproportionation quantitatively. The solution is filtered off and 8.3 g pure KI crystals are added to clear filtrate in order to precipitate CuI with evolution of I_2. The solution is again filtered and boiled till all the I_2 is expelled. Now excess of an oxidizing agent is added to filtrate which liberates I_2 again. The liberated I_2 this time requires 10 mL of 1.0 N $Na_2S_2O_3$ solution. Calculate % by mass of Cu_2O in sample.

Part II: Integer Type Questions (95 to 104)

95. 5.7 g of bleaching powder was suspended in 500 ml of water 25 ml of this suspension on treatment with KI and HCl liberated iodine which reacted with 24.35 ml of $\frac{N}{10}$ $Na_2S_2O_3$. Calculate the % of available Cl_2 in bleaching powder. (Nearest Integer)

96. 10 g $CaCO_3$ was strongly heated and CO_2 liberated was absorbed in 1000 ml of 0.5 M NaOH. Assuming 90% purity of $CaCO_3$. How much solution of 0.5 M HCl in ml would be required to react with the solution of the alkali to reach phenolphthalein end point?

97. A human patient suffering from a duodenal ulcer may show a hydrochloric acid concentration of 0.080 mol/L in his gastric juice. It is possible to neutralize this acid with aluminium hydroxide, $Al(OH)_3$, which reacts with HCl according to the chemical reaction shown below.

$Al(OH)_3 + HCl \rightarrow AlCl_3 + H_2O$. If the patient's stomach receives 3.0 L of gastric juice per day, the amount of aluminium hydroxide in gram must be consumed per day to counteract the acid is 624×10^{-x}. Find the value of x.

98. A 7.32 g sample of $BaCl_2 \cdot 2H_2O$ is dissolved and excess of CrO_4^{2-} is added to the solution. Barium chromate is filtered, washed and dissolved in suitable acid to convert CrO_4^{2-} into $Cr_2O_7^{2-}$. An excess of KI is added, the liberated iodine requires 90 ml of 0.2 M $Na_2S_2O_3$ for complete reaction. Find the percentage purity of the sample.

99. A certain oxide of iron contains 2.5 grams of oxygen for every 7.0 grams of iron. If it is regarded as a mixture of FeO and Fe_2O_3 in the weight ratio a : b. If a is 9, than what is b?

100. Acid samples are prepared for analysis by using H_2SO_4, H_3PO_4 and HNO_3 separately or as mixture. What minimum volume(in ml) of 33.6 (w/v)% KOH solution (d = 1.6 g/ml) must be added to a sample of 1.96 mole in order to ensure complete neutralisation of acid in every possible case.

101. 100 ml '11.2 Vol' H_2O_2 solution is mixed with 200 ml of 2.8 M H_2O_2 solution of density 1.0952 g/ml. The molarity of the resulting solution, if 10% expansion in volume occurs, is

102. 1.00 g of a moist sample of a mixture of KCl and $KClO_3$ was dissolved in water and made up to 250 mL. 25 mL of this solution was treated with SO_2 to reduce the chlorate ion to chloride ion and excess SO_2 was removed by boiling. The total chloride ion was precipitated as silver chloride. The weight of the precipitate was 0.1435 g. In another experiment, 25 mL of the original solution was heated with 30 mL of 0.2 N solution of ferrous sulphate and unreacted ferrous sulphate required 37.5 mL of 0.08 N solution of an oxidising agent for complete oxidation. Calculate the molar ratio of chlorate ion to chloride ion in the given mixture. Fe^{2+} reacts with ClO_3^- according to the reaction.

$ClO_3^- + 6Fe^{2+} + 6H^+ \rightarrow Cl^+ + 6Fe^{3+} + 3H_2O$

103. 25 mL of solution containing Fe^{2+} and Fe^{3+} sulphate acidified with H_2SO_4 is reduced by 3 g of metallic zinc. The solution required 34.25 mL of N/10 solution of $K_2Cr_2O_7$ for oxidation. Before reduction with zinc, 25 mL of the same solution required 22.45 mL of same $K_2Cr_2O_7$ solution. Calculate the sum of strength of $FeSO_4$ and $Fe_2(SO_4)_3$ in solution. (Nearest integer)(Consider entire Fe^{3+} is reduced by zinc)

104. 0.90 g of a solid organic compound ($C_xH_yO_z$ molecular weight = 90) containing C, H and O was heated with oxygen corresponding to a volume of 224 mL at STP. After the combustion the total volume of the gases was 560 mL at STP. On treatment with KOH the volume decreased to 112 mL. Determine the value of (x + y + z) from the molecular formula of the compound.

Matrix Type Questions (105 to 114)

Part I: List Type Questions (105 to 109)

105. Match the following:

	List-I		List-II
I.	$\underset{3.5\text{ mole}}{Sn^{+2}} + \underset{1.2\text{ mole}}{MnO_4^-}$ (acidic)	P.	Amount of oxidant available decides the number of electrons transfer.
II.	$\underset{8.4\text{ mole}}{H_2C_2O_4} + \underset{3.6\text{ mole}}{MnO_4^-}$ (acidic)	Q.	Amount of reductant available decides the number of electrons transfer
III.	$\underset{7.2\text{ mole}}{S_2O_3^{2-}} + \underset{3.6\text{ mole}}{I_2}$	R.	Number of electrons involved per mole of oxidant > Number of electrons involved per mole of reductant.
IV.	$\underset{9.2\text{ mole}}{Fe^{+2}} + \underset{1.6\text{ mole}}{Cr_2O_7^{-2}}$ (acidic)	S.	Number of electrons involved per mole of oxidant < Number of electrons involved per mole of reductant.

(*a*) I-P, R; II-Q, R; III-P, Q, R; IV-Q, R

(*b*) I-Q, R; II-P, R; III-P, Q, R; IV-S, R

(*c*) I-R; II-Q, R; III-P, S, R; IV-Q, R

(*d*) I-S, R; II-Q, R; III-P, Q, R; IV-Q, R

106. Match the following:

	List-I		List-II
I.	4.5 m solution of $CaCO_3$ of density 1.45 gm/ml	P.	Mole fraction of solute is 0.2
II.	3 M 100 ml H_2SO_4 mixed with 1 M 300 ml H_2SO_4 solution	Q.	Mass of the solute is 360 g
III.	14.5 m solution of $Ca(NO_3)_2$	R.	Molarity = 4.5
IV.	In 2 litre solution of 4 M NaOH, 40 g NaOH is added	S.	Molarity = 1.5

(*a*) I-P; II-S; III- R; IV-Q, R

(*b*) I-R; II-S; III- P; IV-Q, R

(*c*) I-R; II-P; III- S; IV-Q, R

(*d*) I-R; II-Q; III- P; IV-S

107. A sample of raw material containing $NaNO_3$ also contains $NaIO_3$. The $NaIO_3$ can be used as a source of iodine, produced in the following reactions:

$$IO_3^- + HSO_3^- \longrightarrow I^- + SO_4^{2-} \qquad \ldots(i)$$

$$I^- + IO_3^- \longrightarrow I_2 + H_2O \qquad \ldots(ii)$$

One litre of sample solution containing 396 g of $NaIO_3$ is treated with stoichiometric quantity of $NaHSO_3$. Now a substantial amount of same solution is added to reaction mixture to bring about the reaction (ii).

	List-I		List-II
I.	n-factor of IO_3^- in reaction (2)	P.	6
II.	Number of moles of HSO_3^- used in reaction (1)	Q.	1.2
III.	Moles of I_2 produced	R.	2
IV.	Equivalent of IO_3^- used in reaction (2)	S.	5

(*a*) I-P; II-S; III-Q; IV-R

(*b*) I-S; II-Q; III-P; IV-R

(*c*) I-S; II-P; III-Q; IV-R

(*d*) I-S; II-P; III-R; IV-Q

108. Match the following:

List-I (Atomic Masses)				List-II (% Composition of Lighter Isotope)	
	Isotope-I	Isotope-II	Avg.		
I.	(a+ 4)	(a – 1)	a	P.	66.67% by moles
II.	a	5a	2a	Q.	50% by moles
III.	(a+ 3)	(a + 1)	(a +2)	R.	% by mass independent of 'a'
IV.	(a + 2)	(a – 1)	a	S.	80% by moles

(*a*) I-R; II-S; III-Q; IV-P
(*b*) I-S; II-Q; III-R; IV-P
(*c*) I-S; II-R; III-P; IV-Q
(*d*) I-S; II-R; III-Q; IV-P

109. Match the following:

List-I		List-II	
I.	$CrI_3 \rightarrow Cr_2O_7^{2-} + IO_4^-$	P.	n.f = 33
II.	$Fe(SCN)_2 \rightarrow Fe^{3+} + SO_4^{2-} + CO_3^{2-} + NO_3^-$	Q.	n.f = 27
III.	$NH_4SCN \rightarrow SO_4^{2-} + CO_3^{2-} + NO_3^-$	R.	n.f = 28
IV.	$As_2S_3 \rightarrow AsO_3^- + SO_4^{2-}$	S.	n.f = 24
		T.	Oxidation of metal atom

(*a*) I-Q, T; II-P, T; III-S; IV-R, T
(*b*) I-P, T; II-Q, T; III-S; IV-R,T
(*c*) I-Q, T; II-S, T; III-P; IV-R, T
(*d*) I-Q, T; II-P, T; III-R; IV-S, T

Part II: Matrix Match Questions (110 to 114)

110. Match the following:

Column-I		Column-II (Equivalent Mass)	
I.	60 % metal in metal oxide	P.	12
II.	64.4 % metal in metal oxide	Q.	8
III.	29 % metal in metal chloride	R.	14.5
IV.	Mg	S.	35.5
		T.	Eq. mass $= \frac{\text{Molar mass}}{\text{n - factor}}$

111. Match Column-I with Column-II:

Column-I (Atomic Masses (M))				Column-II (% Composition of Lighter Isotope)	
	Isotope-I	Isotope-II	Avg.		
I.	(z– 1)	(z + 3)	z	P.	25% by moles
II.	(z + 1)	(z + 3)	(z +2)	Q.	50% by moles
III.	z	3z	2z	R.	% by mass independent of z
IV.	(z – 1)	(z + 1)	z	S.	75% by mass

112. Match the following:

Column-I		Column-II	
I.	1.7 g of NH_3	P.	0.4 N_0 atom
II.	3.2 g oxygen	Q.	2.24 L at NTP
III.	2.6 g C_2H_2	R.	N_0 no. of electrons
IV.	6.4 g of SO_2	S.	0.2 N_0 atoms
		T.	0.1 N_0 molecule

113. Match the following:

Column-I		Column-II	
I.	Molarity	P.	Number of gram formula mass of solute dissolved per litre of solution
II.	Molality	Q.	Number of moles of solute dissolved per kg of solvent
III.	Formality	R.	Depend on temperature
IV.	Strength of solution	S.	Number of moles of solute dissolved per litre of solution

114. Match the following:

	Column-I		Column-II
I.	$CaOCl_2$(Oxidation state of Cl)	P.	Oxidation state = +1, –1
II.	NH_4NO_3 (Oxidation state of N)	Q.	Oxidation state = +6, +6
III.	Caro's acid and Marshall's acid (Oxidation state of S)	R.	Oxidation state = –3, +5
IV.	$K_2Cr_2O_7$, K_2CrO_4 (Oxidation state of Cr)	S.	Peroxy linkage is present
		T.	Oxidising agent

Comprehension Type Questions (115 to 146)

Comprehension-1

Oleum or fuming H_2SO_4 acid contains SO_3 gas dissolved in sulphuric acid. When water is added to oleum, SO_3 reacts with H_2O to form H_2SO_4 as a result mass of the solution increases:

$SO_3 + H_2O \rightarrow H_2SO_4$

% labelling of oleum = total mass of H_2SO_4 present in oleum after dilution.

Choose the correct answer:

115. An oleum sample contains 40% free SO_3 (by mass). How many moles of H_2SO_4 can be obtained after dilution with sufficient amount of water?

(*a*) 1.8 (*b*) 1.11
(*c*) 0.612 (*d*) 0.4

116. An 100 g oleum sample has that much moles of free SO_3 which can be obtained from 4 g of sulphur. What is the percentage labelling of oleum sample?

(*a*) 102.25% (*b*) 104.25%
(*c*) 106.6% (*d*) 109%

Comprehension-2

Concentration of a solution is generally expressed in terms of

molarity $\left(M = \frac{n_{solute}}{V_{L(solution)}}\right)$, normality $\left(N = \frac{n_{eq.}}{V_{L(solution)}}\right)$, molality $\left(m = \frac{n_{(solute)}}{W_{kg(solvent)}}\right)$,

strength $\left(S = \frac{W_{(solute)}}{V_{L(solution)}}\right)$ etc.

Normality of solution on mixing can be calculated by $N_1V_1 + N_2V_2 + ... = N_R (V_1 + V_2 + ...)$,

NR $\rightarrow$ resultant normality.

Choose the correct answer:

117. What is molarity of 9.8% H_2SO_4 solution (w/w). (d of solution is 1.05 g/cc) molecular weight of H_2SO_4 is 98?

(*a*) 2.10 M (*b*) 1.05 M (*c*) 1.24 M (*d*) 1.50 M

118. 100 ml of 0.1 M HCl mixed with 200 ml of 0.5 M HBr solution, what is the molarity of resulting solution?

(*a*) $\frac{11}{30}$M (*b*) $\frac{30}{11}$M (*c*) $\frac{1}{4}$M (*d*) $\frac{1}{10}$M

119. 39.2 g mohr salt $[FeSO_4(NH_4)_2SO_4\cdot6H_2O)$ dissolved in 250 cc of solution. The normality of solution is [Atomic mass of Fe = 56, S = 32, O = 16, N = 14]

(*a*) 0.4 N (*b*) 0.8 N (*c*) 1.6 N (*d*) 3.2 N

Comprehension-3

10 mL of 0.1 N HCl, 20 mL of 0.2 N H_2SO_4 are mixed and resulting solution is diluted with water upto 1 litre.

Choose the correct answer:

120. The normality of resulting solution is

(*a*) $\frac{N}{20}$ (*b*) $\frac{N}{100}$ (*c*) $\frac{N}{200}$ (*d*) $\frac{N}{400}$

121. The number of equivalent of acid present in the resulting solution is

(*a*) 0.001 (*b*) 0.005 (*c*) 0.01 (*d*) 0.02

122. How many grams of NaOH required to neutralise the resulting solution?

(*a*) 2 gm (*b*) 0.2 gm (*c*) 0.4 gm (*d*) 0.6 gm

Comprehension-4

632 g of sodium thiosulphate ($Na_2S_2O_3$) reacts with copper sulphate to form cupric thiosulphate which is reduced by sodium thiosulphate to give cuprous compound which is dissolved in excess of sodium

thiosulphate to form a complex compound sodium cuprothiosulphate ($Na_4[Cu_6(S_2O_3)_5]$)

$CuSO_4 + Na_2S_2O_3 \rightarrow CuS_2O_3 + Na_2SO_4$

$2CuS_2O_3 + Na_2S_2O_3 \rightarrow Cu_2S_2O_3 + Na_2S_4O_6$

$3Cu_2S_2O_3 + 2Na_2S_2O_5 \rightarrow Na_4[Cu_6(S_2O_3)_5]$
Sodium cuprothiosulphate

In this process, 0.2 mole of sodium cuprothiosulphate is formed.

(O = 16, Na = 23, S = 32)

123. The average oxidation states of sulphur in $Na_2S_2O_3$ and $Na_2S_4O_6$ are respectively.

(*a*) +5 and +2 (*b*) +2 and +2.5
(*c*) +5 and 2.5 (*d*) +2 and +4

124. Moles of sodium thiosulphate reacted and unreacted after the reaction are respectively.

(*a*) 3 and 2 (*b*) 2 and 3
(*c*) 2.2 and 1.8 (*d*) 1.8 and 2.2

125. If instead of given amount of sodium thiosulphate, 2 moles of sodium thiosulphate along with 3 moles of $CuSO_4$ were taken initially. Then moles of sodium cuprothiosulphate formed is

(*a*) 0 (*b*) 1 (*c*) 1.5 (*d*) 2

Comprehension-5

We know that balancing of a chemical equation is entirely based on law of conservation of mass. However the concept of Principle of Atom Conservation (POAC) can also be related to law of conservation of mass in a chemical reaction. So, POAC can also act as a technique for balancing a chemical equation. For example, for a reaction:

$ABC_3 \longrightarrow AB + C_2$

On applying POAC for A, B and C and relating the 3 equations, we get:

$\frac{n_{ABC_3}}{2} = \frac{n_{AB}}{2} = \frac{n_{c_2}}{3}$ (n_x : number of moles of X)

Thus, the coefficient of ABC_3, AB and C_2 in the balanced chemical equation will be 2, 2 and 3 respectively and the balanced chemical equation can be represented as:

$2ABC_3 \longrightarrow 2AB + 3C_2$

Now answer the following questions:

126. Which of the following relation is correct regarding the numerical coefficients p, q, r in the balanced chemical equation:

$pA + qB_2 \longrightarrow rA_2B_5$

(*a*) 2p = r (*b*) q = 1.25 p
(*c*) r = 2q (*d*) q = 0.8p

127. If the weight ratio of C and O_2 present is 1 : 2 and both of reactants completely consume and form CO and CO_2 and we will obtain a gaseous mixture of CO and CO_2. What would be the weight ratio of CO and CO_2 in mixture.

(*a*) 11 : 7 (*b*) 7 : 11 (*c*) 1 : 1 (*d*) 1 : 2

128. If the atomic masses of X and Y are 10 and 30 respectively, then the mass of XY_3 formed when 120 g of Y_2 reacts completely with X is:

Reaction $X + Y_2 \longrightarrow XY_3$

(*a*) 133.3 g (*b*) 200 g
(*c*) 266.6 g (*d*) 400 g

Comprehension-6

Oleum is considered as a solution in H_2SO_4, which is obtained by passing SO_3 in solution of H_2SO_4. When 100 g sample of oleum is diluted with desired weight of H_2O then the total mass of H_2SO_4 obtained after dilution is known as % labelling of oleum.

For example, a oleum bottle labelled as '109% H_2SO_4' means the 109 g total mass of pure H_2SO_4 will be formed when 100 g of oleum is diluted by 9g of H_2O which combines with all the free SO_3 to form H_2SO_4 as

$SO_3 + H_2O \longrightarrow H_2SO_4$

129. What is the % of free SO_3 in an oleum that is labelled as '104.5% H_2SO_4'?

(*a*) 10 (*b*) 20
(*c*) 40 (*d*) None of these

130. If excess water is added into a 100 g bottle sample labelled as "112% H_2SO_4" and is reacted with 5.3 g Na_2CO_3, then find the volume of CO_2 evolved at 1 atm pressure and 300 K temperature after the completion of the reaction:

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

$H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + H_2O + CO_2$

(*a*) 2.46 L (*b*) 24.6 L (*c*) 1.23 L (*d*) 12.3 L

131. 1 g of oleum sample is diluted with water. The solution required 54 ml of 0.4 N NaOH for complete neutralization. The % of free SO_3 in the sample is:

(*a*) 74 (*b*) 26
(*c*) 20 (*d*) None of these

Comprehension-7

Molality: It is defined as the number of moles of the solute present in 1 kg of the solvent. It is denoted by 'm'

$$\text{Molality (m)} = \frac{\text{No. of moles of solute}}{\text{No. of kilo-grams of the solvent}}$$

Let w_A grams of the solute of molecular mass m_A be present in w_B grams of the solvent, then

$$\text{Molality (m)} = \frac{w_A}{m_A \times w_B} \times 1000$$

Relation between mole fraction and Molality:

$$X_A = \frac{n}{N+n} \text{ and } X_B = \frac{N}{N+n}$$

$$\frac{X_A}{X_B} = \frac{n}{N+n} = \frac{\text{Moles of solute}}{\text{Moles of solvent}} = \frac{w_A \times m_B}{w_B \times m_A}$$

$$\frac{X_A \times 1000}{X_B \times m_B} = \frac{w_A \times 1000}{w_B \times m_A} = m$$

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

132. If the ratio of the mole fraction of a solute is changed from $\frac{1}{3}$ to $\frac{1}{2}$ in the 800 g of solvent then the ratio of molality will be:

(*a*) 1 : 3 (*b*) 3 : 1 (*c*) 4 : 3 (*d*) 1 : 2

133. The mole fraction of the solute in the 12 molal solution of Na_2CO_3 is:

(*a*) 0.822 (*b*) 0.177 (*c*) 1.77 (*d*) 0.0177

134. What is the quantity of water that should be added to 16 g methanol to make the mole fraction of methanol as 0.25 -

(*a*) 27 g (*b*) 12 g (*c*) 18 g (*d*) 36 g

135. A 300 g, 30% (w/w) NaOH solution is mixed with 500 g 40% (w/w) NaOH solution. What is % (w/v) NaOH. If density of final solution is 2 g/ml.

(*a*) 72.5 (*b*) 65 (*c*) 62.5 (*d*) None

136. What is the molality of final solution obtained in the above problem

(*a*) 1.422 (*b*) 14.22 (*c*) 15.22 (*d*) None

Comprehension-8

Zelina, a student of class XI is working in the chemistry lab of her school. She is provided with 4 containers of large capacity by the lab assistant.

Container 1 contains 2L of '2.8 V' H_2O_2.

Container 2 contains 2L of '16.8 V' H_2O_2.

Container 3 contains sufficient amount of water.

Container 4 is empty.

She has been asked by her teacher to prepare H_2O_2 solution using the components of container 1, 2 or 3 (partially or completely) and store it in container 4.

137. The volume of water required by Zelina to prepare maximum volume of 2.55% (w/v) H_2O_2 solution is:

(*a*) 0.33 L (*b*) 1 L (*c*) 0.67 L (*d*) 2 L

138. Zelina prepared a 12.6 V H_2O_2 solution and mixed it with excess of Kl solution and titrated the liberated I_2 with $\frac{9}{7}$M hypo solution. Find the maximum volume (in L) of hypo solution that could have been consumed in above process:

(*a*) 5.44 L (*b*) 5 L (*c*) 4.67 L (*d*) 2.5 L

Comprehension-9

The strength of H_2O_2 is expressed in several ways like molarity, normality, % (w/V), volume strength, etc. The strength of "10 V" means 1 volume of H_2O_2 on decomposition gives 10 volumes of oxygen at 1 atm and 273 K or 1 litre of H_2O_2 gives 10 litres of O_2 at 1 atm and 273 K. The decomposition of H_2O_2 is shown as under:

$$H_2O_2(aq) \longrightarrow H_2O(l) + \frac{1}{2}O_2(g)$$

H_2O_2 can acts as oxidising as well as reducing agent, as oxidizing agent H_2O_2 is converted into H_2O and as reducing agent H_2O_2 is converted into O_2, in both cases it's n-factor is 2.

$\therefore$ Normality of H_2O_2 solution = 2 × Molarity of H_2O_2 solution

139. What is the molarity of "11.2V" of H_2O_2?

(*a*) 1 M (*b*) 2 M (*c*) 5.6 M (*d*) 11.2 M

140. What is the percentage strength (% w/V) of "11.2 V" H_2O_2?

(*a*) 1.7 (*b*) 3.4

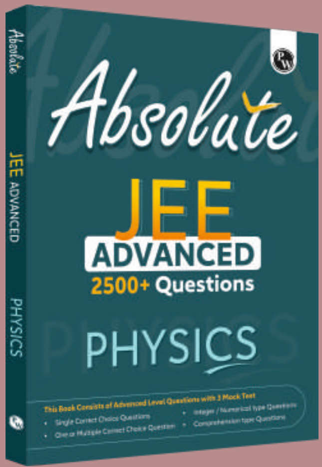
(*c*) 34 (*d*) None of these

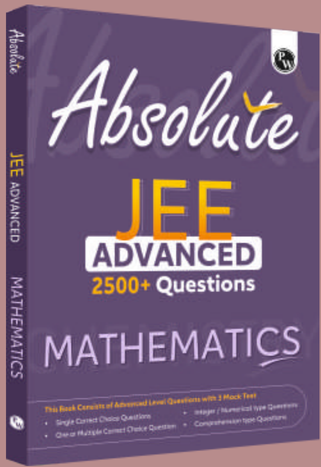
ANSWER KEY

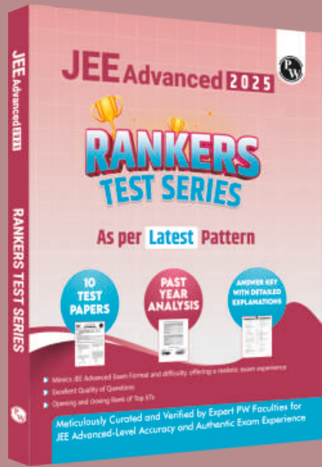
Scan for Detailed Explanations

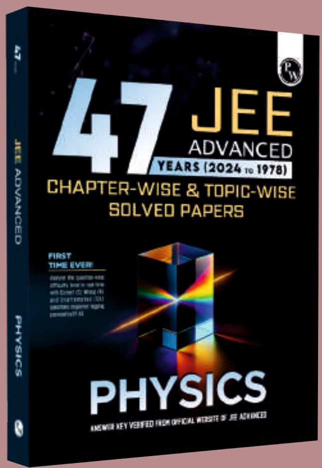
1. (*c*) **2.** (*c*) **3.** (*b*) **4.** (*b*) **5.** (*a*) **6.** (*b*) **7.** (*d*) **8.** (*c*) **9.** (*c*) **10.** (*b*)
11. (*a*) **12.** (*a*) **13.** (*d*) **14.** (*d*) **15.** (*a*) **16.** (*a*) **17.** (*c*) **18.** (*b*) **19.** (*b*) **20.** (*b*)
21. (*c*) **22.** (*a*) **23.** (*c*) **24.** (*b*) **25.** (*d*) **26.** (*b*) **27.** (*a*) **28.** (*d*) **29.** (*b*) **30.** (*c*)
31. (*c*) **32.** (*a*) **33.** (*a*) **34.** (*b*) **35.** (*a*) **36.** (*c*) **37.** (*d*) **38.** (*a*) **39.** (*d*) **40.** (*a*)
41. (*c*) **42.** (*b*) **43.** (*b*) **44.** (*b*) **45.** (*d*) **46.** (*c*) **47.** (*a*) **48.** (*a*) **49.** (*a*) **50.** (*b*)
51. (*a*) **52.** (*a*, *c*) **53.** (*a*, *b*) **54.** (*a*, *b*, *c*) **55.** (*a*) (*b*) (*c*) (*d*) **56.** (*a*, *b*, *c*) **57.** (*a*, *b*)
58. (*a*, *b*, *c*) **59.** (*b*, *c*, *d*) **60.** (*b*, *c*) **61.** (*a*, *b*, *c*) **62.** (*a*, *c*, *d*) **63.** (*b*, *c*)
64. (*a*, *c*) **65.** (*a*, *c*, *d*) **66.** (*a*, *b*) **67.** (*a*, *b*, *d*) **68.** (*b*, *c*) **69.** (*a*, *b*) **70.** (*b*, *c*)
71. (*b*, *c*, *d*) **72.** (*a*, *b*, *c*) **73.** (*a*, *b*, *c*) **74.** (*a*, *b*, *c*, *d*) **75.** (*a*, *b*, *d*)
76. (*a*, *c*) **77.** (*b*, *d*) **78.** (*a*, *b*, *c*, *d*) **79.** (*a*, *c*, *d*) **80.** (*a*, *b*, *d*) **81.** (*a*, *b*, *d*)
82. (*b*, *c*) **83.** (*a*, *b*, *c*) **84.** (*b*, *d*) **85.** (15.20) **86.** (27.27) **87.** (6.80)
88. (1.40) **89.** (84.58) **90.** (76.88) **91.** (68.62) **92.** (13.80)
93. (41.00) **94.** (95.33) **95.** (30) **96.** (820) **97.** (2) **98.** (20) **99.** (10) **100.** (10)
101. (2) **102.** (1) **103.** (23) **104.** (8) **105.** (*a*) **106.** (*b*) **107.** (*c*) **108.** (*d*) **109.** (*a*)
110. I-P,Q,T; II-Q,R,T; III-R,S,T, IV-P,T **111.** I-S; II-Q; III-Q,R; IV-Q
112. I-P,Q,R,T; II-Q,S,T; III-P,Q,T; IV-Q, T **113.** I-R,S; II-Q; III-P,R; IV-R
114. I-P,T; II-R,T; III-Q,S,T; IV-Q,T
115. (*b*) **116.** (*a*) **117.** (*b*) **118.** (*a*) **119.** (*c*) **120.** (*c*) **121.** (*b*) **122.** (*b*) **123.** (*b*) **124.** (*c*)
125. (*a*) **126.** (*b*) **127.** (*b*) **128.** (*a*) **129.** (*b*) **130.** (*c*) **131.** (*b*) **132.** (*d*) **133.** (*b*) **134.** (*a*)
135. (*a*) **136.** (*b*) **137.** (*c*) **138.** (*b*) **139.** (*a*) **140.** (*b*) **141.** (*b*) **142.** (*b*) **143.** (*c*) **144.** (*a*)
145. (*a*) **146.** (*b*)

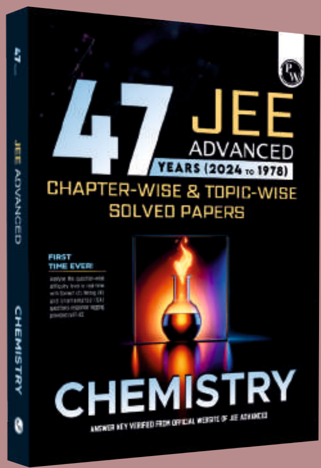
Other Helpful Books

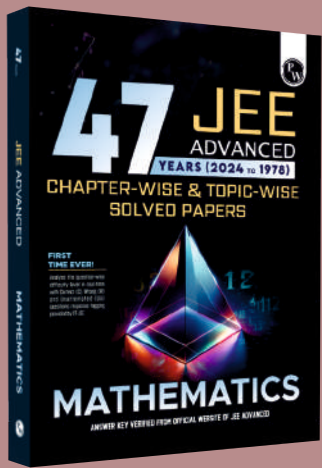












₹ 649/-

PHYSICS WALLAH PUBLICATION

To Buy PW Books
SCAN ME!

To share Feedback
SCAN ME!

ISBN 978-93-6897-655-4
9 789368 976554

4d355960-af65-494a-a620-72efb507681c