EXERCISE I

Q.1 ***Fill in the blanks with appropriate items :***

1. The number of water molecules in 0.5 mol of barium chloride dihydrate is _____.

2. 20ml of 0.1 M $H_2C_2O_4 \cdot 2H_2O$ (oxalic acid) solution contains oxalic acid equal to _____ moles.

3. The volume of 1.204×10^{24} molecules of water at 4°C is _____.

4. 0.2 mol of ozone (O_3) at N.T.P. will occupy volume _____ L.

5. The balancing of chemical equation is based upon _____.

6. 2 gm of hydrogen will have same number of H atoms as are there in _____ g hydrazine (NH_2–NH_2).

7. The mass of x atoms of element = $\frac{.....x}{N_A}$.

8. The moles of x atoms of a triatomic gas = $\frac{x}{N_A} \times$ _____.

9. The amount of Na_2SO_4 which gives 9.6 gm of SO_4^{2-} is _____.

10. The 44 mg of certain substance contain 6.02×10^{20} molecules. The molecular mass of the substance is _____.

11. The mass of 1×10^{22} molecules of $CuSO_4 . 5H_2O$ is _____.

12. The atomic mass of iron is 56. The equivalent mass of the metal in $FeCl_2$ is _____ and that in $FeCl_3$ is _____.

13. The sulphate of a metal M contains 9.87% of M. The sulphate is isomorphous with $ZnSO_4.7H_2O$. The atomic mass of M is _____.

14. A binary compound contains 50% of A (at. mass = 16) & 50% B (at. mass = 32). The empirical formula of the compound is _____.

15. 10.6 g of Na_2CO_3 react with 9.8 g of H_2SO_4 to form 16 g of Na_2SO_4 & 4.4 g CO_2. This is in accordance with the law of _____.

16. 3 g of a salt (m. wt. 30) are dissolved in 250 ml of water. The molarity of solution is _____.

17. 0.5 mole of $BaCl_2$ are mixed with 0.2 mole of Na_3PO_4 the maximum number of mole of $Ba_3(PO_4)_2$ formed are _____.

18. The Eq. weight of Na_2HPO_4 (base) is _____.

19. The mole fraction of solute in 20% (by weight) aqueous H_2O_2 solution is _____.

20. A metallic oxide contains 60% of the metal. The Eq. weight of the metal is _____.

21. The number of gm of anhydrous Na_2CO_3 present in 250 ml of 0.25 N solution is_____.

22. _____ ml of 0.1 M H_2SO_4 is required to neutralize 50 ml of 0.2 M NaOH solution.

23. The number of mole of water present in 90 g H_2O are _____.

24. The concentration of K^+ ion in 0.2 M $K_2Cr_2O_7$ solution would be_____.

25. 280 ml of sulphur vapour at NTP weight 3.2 g . The Mol. formula of the sulphur vapour is _____.

Q.2 ***True or False Statements :***

1. Equal volumes of helium and nitrogen under similar conditions have equal number of atoms.

2. The smallest particle is a substance which is capable in independent existence is called an atom.

3. The number of formula units in 0.5 mole of KCl is 6.02×10^{23}.

4. 22.4 L of ethane gas at S.T.P. contains H atoms as are present in 3 gram molecules of dihydrogen.

5. Molarity of pure water is 55.5.

6. A 20% solution of KOH (density = 1.02 g/ml) has molarity = 3.64.

7. In a mixture of 1 g C_6H_6 & 1 g C_7H_8, the mole fraction of both are same.

8. 1 mole of $C_{12}H_{22}O_{11}$ contains 22 hydrogen atoms.

9. $KClO_4$ & $KMnO_4$ are isomorphous in nature.

10. Mass of 3.01×10^{23} molecules of of methane is 8 gm.

11. A hydrocarbon contains 86% C. 448 ml of the hydrocarbon weighs 1.68 g at STP. Then the hydrocarbon is an alkene.

12. 6.023×10^{54} e^{-s} weigh one kg.

13. An oxide of metal M has 40% by mass of oxygen. Metal M has relative atomic mass of 24. The empirical formula of the oxide is MO.

14. 5 g of a crystalline salt when rendered anhydrous lost 1.8 g of water. The formula weight of the anhydrous salt is 160. The number of molecules of water of crystallisation in the salt is 5.

15. Number of valence e^{-s} in 4.2 g of N^{3-} is 24 N_A.

16. The equivalent mass of $KMnO_4$ in alkaline medium is molar mass divided by five.

17. The equivalent mass of $Na_2S_2O_3$ in its reaction with I_2 is molar mass divided by two.

18. In a reaction, H_2MoO_4 is changed to MoO_2^+. In this case, H_2MoO_4 acts as an oxidising agent.

19. $KBrO_3$ acts as a strong oxidising agent. It accepts 6 electrons to give KBr.

20. 0.1 M sulphuric acid has normality of 0.05 N.

21. The reaction, $2H_2O_2 \longrightarrow 2H_2O + O_2$ is not an example of a redox reaction.

22. The disproportionation reaction,

$$2Mn^{3+} + 2H_2O \longrightarrow MnO_2 + Mn^{+2} + 4H^+$$

is an example of a redox reaction.

23. The oxidation number of hydrogen is always taken as + 1 in its all compounds.

24. The increase in oxidation number of an element implies that the element has undergone reduction.

25. The oxidation state of oxygen atom in potassium super oxide is $-\frac{1}{2}$.

EXERCISE-II

Q.1 A sample of calcium carbonate contains impurities which do not react with a mineral acid. When 2 grams of the sample were reacted with the mineral acid, 375 ml of carbon dioxide were obtained at 27°C and 760 mm pressure. Calculate the % purity of the sample of $CaCO_3$?

Q.2 One gram of an alloy of aluminium and magnesium when heated with excess of dil. HCl forms magnesium chloride, aluminium 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.

Q.3 Chloride samples are prepared for analysis by using NaCl, KCl, NH_4Cl separately or as mixtures. What minimum volume of a 5% (by weight) $AgNO_3$ solution (sp. gr = 1.04) must be added to a sample weighing 0.3 g in order to ensure complete precipitation of chloride in every possible case?

Q.4 Sulfur dioxide is an atmospheric pollutant that is converted to sulfuric acid when it reacts with water vapour. This is one source of acid rain, one of our most pressing environmental problems. The sulfur dioxide content of an air sample can be determined as follows. A sample of air is bubbled through an aqueous solution of hydrogen peroxide to convert all of the SO_2 to H_2SO_4

$$H_2O_2 + SO_2 \longrightarrow H_2SO_4$$

Titration of the resulting solution completes the analysis. In one such case, analysis of 1550 L of Los Angeles air gave a solution that required 5.70 ml of 5.96×10^{-3}M NaOH to complete the titration. Determine the number of grams of SO_2 present in the air sample.

Q.5 In a water treatment plant, Cl_2 used for the treatment of water is produced from the following reaction $2KMnO_4 + 16\ HCl \longrightarrow 2KCl + 2MnCl_2 + 8H_2O + Cl_2$. If during each feed 1 *l* $KMnO_4$ having 79% (w/v) $KMnO_4$ & 9 *l* HCl with d = 1.825 gm/ ml & 10% (w/w) HCl are entered & if that percent yield is 80% then calculate

(a) amount of Cl_2 produced.

(b) amount of water that can be treated by Cl_2 if 1 litres consumes 28.4 g of Cl_2 for treatment.

(c) Calculate efficiency η of the process if $\eta = \dfrac{\text{vol. of water treated}}{\text{vol of total feed}}$

Q.6 A 2.0 g sample of a mixture containing sodium carbonate, sodium bicarbonate and sodium sulphate is heated till the evolution of CO_2 ceases. The volume of CO_2 at 750 mmHg pressure and at 298 K is measured to be 123.9 mL. A 1.5 g of the sample requires 150 mL of M/10 HCl for complete neutralization. Calculate the percentage composition of the components of the mixture.

Q.7 3.6 g of Mg is burnt in limited supply of oxygen. The residue was treated with 100 mL of H_2SO_4 (35% by mass, 1.26 g mL^{-1} density). When 2.463 L of H_2 at 760 mm Hg at 27°C was evolved. After the reaction, H_2SO_4 was found to have a density of 1.05 g mL^{-1}. Assuming no volume change in H_2SO_4 solution. Find

(i) % by mass of final H_2SO_4

(ii) % by mass of Mg converted to oxide

(iii) mass of oxygen used. (Mg = 24, S = 32)

Q.8 One mole of a mixture of N_2, NO_2 and N_2O_4 has a mean molar mass of 55.4. On heating to a temperature at which all the N_2O_4 may be pressured to have dissociated : $N_2O_4 \longrightarrow 2NO_2$, the mean molar mass tends to the lower value of 39.6. What is the mole ratio of $N_2 : NO_2 : N_2O_4$ in the original mixture?

Q.9 A mixture of FeO and Fe_2O_3 is reacted with acidified $KMnO_4$ solution having a concentration of 0.2278 M, 100 ml of which was used. The solution was then titrated with Zn dust which converted Fe^{3+} of the solution to Fe^{2+}. The Fe^{2+} required 1000 ml of 0.13 M $K_2Cr_2O_7$ solution. Find the % of FeO & Fe_2O_3.

Q.10 50ml of a solution, containing 1gm each Na_2CO_3, $NaHCO_3$ and NaOH was titrated with N-HCl. What will be the titre readings if

(a) only Ph is used as indicator.

(b) only MeOH is used as indicator from the beginning.

(c) MeOH is added after the first end point with Ph.

Q.11 A 0.517g sample containing $Ba(SCN)_2$ was dissolved in a bicarbonate solution. 50.0 mL of 0.107 N iodine was added, and the mixture was allowed to stand for five minutes. The solution was then acidified, and the excess I_2 was titrated with 16.3 mL of 0.0965 M sodium thiosulphate. Calculate the percent $Ba(SCN)_2$ in the sample.

Q.12 A mixture of Xe and F_2 was heated. A sample of white solid thus formed reacted with H_2, to give 81 ml of Xe at STP and HF formed required 68.43 ml of 0.3172 M NaOH for complete neutralization. Determine empirical formula.

Q.13 Chrome alum $K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24\ H_2O$ is prepared by passing SO_2 gas through an aqueous solution of $K_2Cr_2O_7$ acidified with dilute sulphuric acid till the reduction is complete. The alum is crystallized followed by filtration/centrifugation. If only 90% of the alum can be recovered from the above process, how much alum can be prepared from 10kg of $K_2Cr_2O_7$? Give the number of moles of electrons supplied by SO_2 for reducing one mole of $K_2Cr_2O_7$.

Q.14 A substance of crude copper is boiled in H_2SO_4 till all the copper has reacted. The impurities are inert to the acid. The SO_2 liberated in the reaction is passed into 100 mL of 0.4 M acidified $KMnO_4$. The solution of $KMnO_4$ after passage of SO_2 is allowed to react with oxalic acid and requires 23.6 mL of 1.2 M oxalic acid. If the purity of copper is 91%, what was the weight of the sample.

Q.15 25 mL of a solution containing HCl was treated with excess of M/5 KIO_3 and KI solution of unknown concentration where I_2 liberated is titrated against a standard solution of 0.021M $Na_2S_2O_3$ solution whose 24 mL were used up. Find the strength of HCl and volume of KIO_3 solution consumed.

Q.16 A 10g sample of only CuS and Cu_2S was treated with 100 mL of 1.25 M $K_2Cr_2O_7$. The products obtained were Cr^{3+}, Cu^{2+} and SO_2. The excess oxidant was reacted with 50 mL of Fe^{2+} solution. 25 ml of the same Fe^{2+} solution required 0.875M acidic $KMnO_4$ the volume of which used was 20 mL. Find the % of CuS and Cu_2S in the sample.

Q.17 H_2O_2 is reduced rapidly by Sn^{2+}, the products being Sn^{4+} & water. H_2O_2 decomposes slowly at room temperature to yield O_2 & water. Calculate the volume of O_2 produced at 20°C & 1.00 atm when 200g of 10.0 % by mass H_2O_2 in water is treated with 100.0 ml of 2.00 M Sn^{2+} & then the mixture is allowed to stand until no further reaction occurs.

Q.18 A sample of steel weighing 0.6 gm and containing S as an impurity was burnt in a stream of O_2, when S was converted to its oxide SO_2. SO_2 was then oxidized to SO_4^{--} by using H_2O_2 solution containing 30ml of 0.04 M NaOH. 22.48 ml of 0.024 M HCl was required to neutralize the base remaining after oxidation. Calculate the % of S in the sample.

Q.19 $CuFeS_2$ mineral was analysed for Cu and Fe percentage. 10g of it was boiled with dil. H_2SO_4 and diluted to 1L. 10 mL of this solution required 2mL of 0.01M MnO_4^- in acidic medium. In another titration 25 mL of the same solution required 5 mL of 0.01M $S_2O_3^{2-}$ solution iodometrically. Calculate percentage of Cu and Fe in the mineral.

Q.20 A 10gm mixture of Cu_2S and CuS was treated with 200 ml of 0.75 M MnO_4^- in acid solution, producing SO_2, Cu^{2+} & Mn^{2+}. The SO_2 was boiled off and the excess MnO_4^- was titrated with 175 ml of 1M Fe^{2+} solution. Calculate the % CuS in the original mixture.

Q.21 3.3 gm of a sample of Anhydrous $CuSO_4$ was dissolved in water and made to 250ml. 25 ml of this solution after taking usual precautions was treated with a little excess of KI solution. A white ppt. of Cu_2I_2 and iodine was evolved. The iodine so evolved required 24.6 ml of hypo solution containing 20gm of ($Na_2S_2O_3 \cdot 5H_2O$) per litre. What is the purity of $CuSO_4$ solution.

Q.22 1.16 g $CH_3(CH_2)_n$ COOH was burnt in excess air and the resultant gases (CO_2 and H_2O) were passed through excess NaOH solution. The resulting solution was divided in two equl parts. One part requires 50 mL of 1 N HCl for neutralization using phenolphthalein as indicator. Another part required 80 mL of 1N HCl for neutralization using methyl orange as indicator. Find the value of n and the amount of excess NaOH solution taken initially.

Q.23 A 1.65 gm sample of FeS_2 was oxidized by excess oxygen & the products were SO_2 and Fe^{2+}. The SO_2 gas produced was passed through an acidified solution of 40ml $Ba(MnO_4)_2$ produced SO_4^{--} & Mn^{2+}. The excess permagnate was diluted to 100 ml & 10 ml of it was treated with excess KI & iodine produced req. 0.05 M 5 ml hypo solution producing $S_4O_6^{2-}$. In a separate titration the 25 ml of same solution of permagnate under alkaline condition when treated with KI produced I_2 that required 20 ml of 0.05 M hypo solution producing $S_4O_6^{2-}$ & Mn^{6+}. Calculate the % of FeS_2 in the sample.

Q.24 Reducing sugars are sometimes characterized by a number R_{Cu}, which is defined as the number of mg of copper reduced by 1 gm of sugar, in which half reaction for the copper is

$$Cu^{2+} + OH^- \longrightarrow Cu_2O + H_2O$$

It is sometimes more convenient to determine the reducing power of a carbohydrate by an indirect method. In this method 43.2 mg of the carbohydrate was oxidized by an excess of $K_3(Fe(CN)_6)$. The $Fe(CN)_6^{4-}$ formed in this reaction required 5.29 ml of 0.0345 N $Ce(SO_4)_2$ for reoxidation to $Fe(CN)_6^{3}$. Determine the R_{Cu} value for the sample.

Q.25 2g of chromite ore sample was mixed with enough potassium carbonate and potassium chlorate and fused. The reaction that occurred was:

$$6FeCr_2O_4 + 12K_2CO_3 + 7KClO_3 \rightarrow 3Fe_2O_3 + 12\ K_2CrO_4 + 7KCl + 12CO_2$$

The fused mass was cooled and extracted with 2N sulphuric acid. This was filtered and thoroughly washed. The filterate and washings were collected in a 500 ml. Volumetric flask. When all the soluble portion of the fused mass was extracted, 100 ml of 1M solution of ferrous ammonium sulphate were added and the solution made to 500ml. An aliquot of 25ml was titrated with potassium dichromate solution, prepared by dissolving 0.98 g of dried potassium dichromate in distilled water in a 250ml volumetric flask. The titration required 32.5 ml of this solution. Calculate the percentage of chromium in the sample of the ore.

EXERCISE-III

Q.1 Which has maximum number of atoms of oxygen
(A) 10 ml $H_2O(l)$ (B) 0.1 mole of V_2O_5
(C) 12 gm $O_3(g)$ (D) 12.044×10^{22} molecules of CO_2

Q.2 Mass of one atom of the element A is 3.9854×10^{-23}g. How many atoms are contained in 1 g of the element A?
(A) 2.509×10^{23} (B) 6.022×10^{23} (C) 12.044×10^{23} (D) None

Q.3 The total no. of electrons present in 11.2 litre of NH_3 at STP are
(A) 6.022×10^{23} (B) 3.011×10^{23} (C) 3.011×10^{24} (D) None

Q.4 1 gm-atom of nitrogen represents :
(A) 6.02×10^{23} N_2 molecules (B) 22.4 lit. of N_2 at N.T.P.
(C) 11.2 lit. of N_2 at N.T.P. (D) 28 g of nitrogen

Q.5 $Al_2(SO_4)_3 . x H_2O$ has 8.20 % aluminium by mass. The value of x is
(A) 4 (B) 10 (C) 16 (D) 18

Q.6 If average molecular wt. of air is 29, then assuming only N_2 and O_2 gases are there which options are correct regarding composition of air
(i) 75% by mass of N_2
(ii) 75% by moles N_2
(iii) 72.41% by mass N_2
(A) only (i) is correct (B) only (ii) is correct
(C) both (ii) and (iii) are correct (D) both (i) and (ii) are correct

Q.7 A spherical ball of radius 3 cm contains 66.66 % iron. If density is 1.5 g/cm^3, number of mole of Fe present approximately is:
(A) 1 (B) 2 (C) 20 (D) None

Q.8 Density of dry air containing only N_2 and O_2 is 1.146 gm/lit at 740 mm and 300 K. What is % composition of N_2 by weight in the air.
(A) 78% (B) 82% (C) 73.47% (D) 72.42%

Q.9 What is the number of moles of $Fe(OH)_3$ that can be produced by allowing 1 mole of Fe_2S_3, 2 mole of H_2O and 3 mole of O_2 to react
$2Fe_2S_3 + 6H_2O + 3O_2 \longrightarrow 4Fe(OH)_3 + 6S$
(A) 2 (B) 1.34 (C) 3.52 (D) none

Q.10 What percentage of phosphorus (P) is present in the compound $CaCO_3 . 3Ca_3(PO_4)_2$?
(A) 18% (B) 45.36% (C) 28.61% (D) 15.12%

Q.11 A gaseous mixture of H_2 and NH_3 gas contains 68 mass % of NH_3. The vapour density of the mixture is
(A) 6.1 (B) 5 (C) 2.5 (D) None of these

Q.12 A sample of ammonium phosphate, $(NH_4)_3 PO_4$, contains 3.18 mol of hydrogen atoms.The number of moles of oxygen atoms in the sample is :
(A) 0.265 (B) 0.795 (C) 1.06 (D) 3.18

Q.13 12 litre of H_2 and 11.2 litre of Cl_2 are mixed and exploded. The composition by volume of mixture is
(A) 24 litre of HCl (B) 0.8 litre Cl_2 and 20.8 lit HCl
(C) 0.8 litre H_2 & 22.4 litre HCl (D) 22.4 litre HCl

Q.14 Weight of oxygen in Fe_2O_3 and FeO is in the simple ratio for the same amount of iron is
(A) 3 : 2 (B) 1 : 2 (C) 2 : 1 (D) 3 : 1

Q.15 A mixture of gas "X" (mol. wt. 16) and gas Y (mol. wt. 28) in the mole ratio a : b has a mean molecular weight 20. What would be mean molecular weight if the gases are mixed in the ratio b : a under identical conditions (gases are non reacting).
(A) 24 (B) 20 (C) 26 (D) 40

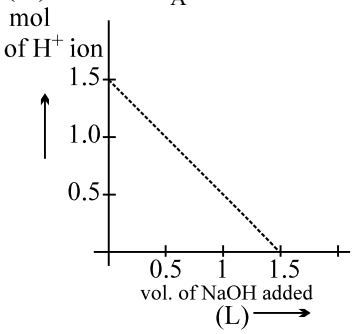
Q.16 A mixture of CuO and Cu_2O contain 88% Cu. What is the percentage of CuO present in the mixture?
(A) 91.35% (B) 8.89% (C) 18.9% (D) 20%

Q.17 Consider the following nuclear reactions involving X & Y.

$$X \longrightarrow Y + {}^{4}_{2}He$$
$$Y \longrightarrow {}_{8}O^{18} + {}_{1}H^{1}$$

If both neutrons as well as protons in both the sides are conserved in nuclear reaction then identify period number of X & moles of neutrons in 4.6 gm of X
(A) 3, 2.4 N_A (B) 3, 2.4 (C) 2, 4.6 (D) 3, 0.2 N_A

Q.18 To 500 ml of 2 M impure H_2SO_4 sample, NaOH solution 1 M was slowly added & the following plot was obtained. The percentage purity of H_2SO_4 sample and slope of the curve respectively are:



(A) 50%, $-\frac{1}{3}$ (B) 75%, $-\frac{1}{2}$
(C) 75% , –1 (D) none of these

Q.19 Equal volumes of 10% (v/V) of HCl is mixed with 10% (v/V) NaOH solution. If density of pure NaOH is 1.5 times that of pure HCl then the resultant solution be.
(A) basic (B) neutral (C) acidic (D) can't be predicted.

Q.20 The mole fraction of a given sample of I_2 in C_6H_6 is 0.2. The molality of I_2 in C_6H_6 is
(A) 0.32 (B) 3.2 (C) 0.032 (D) 0.48

Q.21 A sample of H_2SO_4 (density 1.8 g/ml) is 90% by weight. What is the volume of the acid that has to be used to make 1 litre of 0.2 –M H_2SO_4 ?
(A) 16 mL (B) 10 mL (C) 12 mL (D) 18 mL

Q.22 What volume of HNO_3 (sp. gravity 1.05 g ml^{-1} containing 9%(w/w) of HNO_3 reducing to NO_g) is required to oxidise iron 1 g $FeSO_4$. $7H_2O$ in acid medium is
(A) 70 ml (B) 0.80 ml (C) 80 ml (D) 0.65 ml

Q.23 One litre of a sample of hard water contain 2.22 mg $CaCl_2$ and 1.9 mg of $MgCl_2$ in 1 L H_2O. What is the total hardness in terms of ppm of $CaCO_3$. [Ca = 40; Mg = 24, Cl = 35.5]
(A) 2 ppm (B) 3 ppm (C) 4 ppm (D) 4.12 ppm

Q.24 10 L of hard water required 0.56 gm of lime for removing hardness. Hence temporary hardness in ppm of $CaCO_3$ is
(A) 100 (B) 200 (C) 10 (D) 20

Q.25 0.1 gm of a polyvalent metal of atomic mass 51.0 amu reacted with dilute sulphuric acid to give 43.9 ml of H_2 at STP. The solution in the lower oxidation state was found to require 58.8 ml of N/10 $KMnO_4$ solution for complete oxidation. The valencies of the metal is
(A) M^{2+} and M^{5+} (B) M^{3+} and M^{6+} (C) M^{1+} and M^{5+} (D) M^{2+} and M^{3+}

Q.26 Equivalent weight of H_3PO_2 when it disproportionate into PH_3 and H_3PO_3 is
(A) M (B) M/2 (C) M/4 (D) 3M/4

Q.27 A mixture of $NaHC_2O_4$ and $KHC_2O_4 \cdot H_2C_2O_4$ required equal volumes of 0.2 N $KMnO_4$ and 0.12 N NaOH separately. What is the molar ratio of $NaHC_2O_4$ and $KHC_2O_4 \cdot H_2C_2O_4$ in the mixture?
(A) 6 : 1 (B) 1 : 6 (C) 1 : 3 (D) none

Q.28 100 cm^3 of a solution of an acid (Molar mass = 82) containing 39 gm of the acid per litre were completely neutralized by 95.0 cm^3 of aq. NaOH containing 20 gm of NaOH per 500 cm^3. The basicity of the acid is
(A) 1 (B) 2 (C) 3 (D) data insufficient

Q.29 Which of the following is correct for 17 g/L of H_2O_2 solution.
(I) Volume strength is 5.6 at 273 K and 1 atm
(II) Molarity of solution is 0.5 M
(III) 1 ml of this solution gives 2.8 ml O_2 at 273 K and 2 atm
(IV) The normality of solution is 2M
(A) I, II, III (B) II, III (C) II, III, IV (D) I, II, III, IV

Q.30 In iodometric estimation of Cu^{2+} ion, the following reaction took place.

$$2Cu^{2+} + 4I^- \longrightarrow Cu_2I_2 + I_2$$
$$I_2 + 2Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$$

If 100 ml of $CuSO_4$ solution added to excess KI requires 50 ml of 0.2 M $Na_2S_2O_3$, the molarity of $CuSO_4$ solution is
(A) 0.05 M (B) 0.1 M (C) 0.2 (D) 0.25

Q.31 500 ml of a sample of H_2O_2 marked 33.6 volumes is used as source of oxygen. This sample partly reacted with certain reactive impurities causing wastage of half the amount of H_2O_2 present. Volume of O_2 available at 570 mm Hg & 27°C is:
(A) 12.3 L (B) 24.6 L (C) 16.8 L (D) none of these

Q.32 Calculate the mass of anhydrous oxalic acid, which can be oxidised to $CO_2(g)$ by 100 ml of an MnO_4^- solution, 10 ml of which is capable of oxidising 50 ml of 1N I^- to I_2.
(A) 45 gm (B) 22.5 gm (C) 30 gm (D) 12.25 gm

Q.33 Three different solutions of oxidising agents $KMnO_4$, $K_2Cr_2O_7$ and I_2 is titrated seperately with 0.158 gm of $Na_2S_2O_3$. If molarity of each oxidising agent is 0.1 M and reactions are

$$MnO_4^- + S_2O_3^{2-} \longrightarrow MnO_2 + SO_4^{2-}$$
$$Cr_2O_7^{2-} + S_2O_3^{2-} \longrightarrow Cr^{3+} + SO_4^{2-}$$
$$I_2 + Na_2S_2O_3 \xrightarrow{\text{Starch}} Na_2S_4O_6 + I^-$$

Then
(A) volume of $KMnO_4$ used is maximum (B) volume of $K_2Cr_2O_7$ used is minimum
(C) wt. of I_2 used in titration is maximum (D) none

Q.34 Find out % of oxalate ion in a given sample of an alkali metal oxalate salt, 0.30 gm of it is dissolved in 100 CC water required 90 CC of centimolar $KMnO_4$ solution in acidic medium.
(A) 66% (B) 55% (C) 44% (D) 88%

Q.35 1 gram at a sample of $CaCO_3$ was strongly heated and the CO_2 liberated was absorbed in 100 mL of 0.5 M NaOH. Assuming 90% purity for the sample. How much mL of 0.5 M HCl would be required to react with the solution of the alkali to reach the phenolphthalein end point?
(A) 73 mL (B) 41 mL (C) 82 mL (D) 87 mL

Q.36 A 0.518 g sample of lime stone is dissolved in HCl and then the calcium is precipitated as CaC_2O_4. After filtering and washing the precipitate, it requires 40.0 mL of 0.250 N $KMnO_4$, solution acidified with H_2SO_4 to titrate it as,

$$MnO_4^- + H^+ + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2 + 2H_2O$$

The percentage of CaO in the sample is:

(A) 54.0% (B) 27.1% (C) 42% (D) 84%

Q.37 0.3 g of an oxalate salt was dissolved in 100 mL solution. The solution required 90 mL of N/20 $KMnO_4$ for complete oxidation. The % of oxalalte ion in salt is:

(A) 33% (B) 66% (C) 70% (D) 40%

Q.38 A sample of H_2O_2 solution labelled as 33.6 volume has density of 264 gm/lit. Mark the correct option representing concentration of same solution in other units. [Solution contains only H_2O & H_2O_2]

(A) Mole fraction of H_2O_2 in the solution = 0.5

(B) % w/v = 102%

(C) $M_{H_2O_2} = 6$ M

(D) $m_{H_2O_2} = \frac{1000}{54}$ m

Q.39 Match the n-factor of following reactant :

(i)	$As_2S_3 \rightarrow AsO_4^{3-} + SO_4^{2-}$	(half reaction)	(a) 10
(ii)	$Bi_2S_3 \rightarrow Bi^{+5} + S$	(half reaction)	(b) 4
(iii)	$Mn(NO_3)_2 \rightarrow MnO_4^{2-} + NO_3^-$	(half reaction)	(c) 2/3
(iv)	$5P_2H_4 \rightarrow 6PH_3 + P_4H_2$		(d) 6/5
(v)	$MnO_4^{2-} + H_2O \rightarrow MnO_2 + MnO_4^- + OH^-$		(e) 28

(A) (i)-(a), (ii)-(b), (iii)-(c), (iv)-(d), (v)-(e) (B) (i)-(c), (ii)-(a), (iii)-(b), (iv)-(d), (v)-(e)

(C) (i)-(e), (ii)-(a), (iii)-(b), (iv)-(d), (v)-(c) (D) (i)-(e), (ii)-(b), (iii)-(a), (iv)-(c), (v)-(d)

Question No. 40 to 43 (4 questions)

A 4.925 g sample of a mixture of $CuCl_2$ and $CuBr_2$ was dissolved in water and mixed thoroughly with a 5.74 g portion of AgCl. After the reaction the solid, a mixture of AgCl and AgBr, was filtered, washed, and dried. Its mass was found to be 6.63 g.

Q.40 % By mass of $CuBr_2$ in original mixture is

(A) 2.24 (B) 74.5 (C) 45.3 (D) None

Q.41 % By mass of Cu in original mixture is

(A) 38.68 (B) 19.05 (C) 3.86 (D) None

Q.42 % by mole of AgBr in dried precipate is

(A) 25 (B) 50 (C) 75 (D) 60

Q.43 No. of moles of Cl^- ion present in the solution after precipitation are

(A) 0.06 (B) 0.02 (C) 0.04 (D) None

Question No. 44 to 46 (3 questions)

NaBr, used to produce AgBr for use in photography can be self prepared as follows :

$Fe + Br_2 \longrightarrow FeBr_2$ ....(i)

$FeBr_2 + Br_2 \longrightarrow Fe_3Br_8$ ....(ii) (not balanced)

$Fe_3Br_8 + Na_2CO_3 \longrightarrow NaBr + CO_2 + Fe_3O_4$ ....(iii) (not balanced)

Q.44 Mass of iron required to produce 2.06×10^3 kg NaBr

(A) 420 gm (B) 420 kg (C) 4.2×10^5 kg (D) 4.2×10^8 gm

Q.45 If the yield of (ii) is 60% & (iii) reaction is 70% then mass of iron required to produce 2.06×10^3 kg NaBr

(A) 10^5 kg (B) 10^5 gm (C) 10^3 kg (D) None

Q.46 If yield of (iii) reaction is 90% then mole of CO_2 formed when 2.06×10^3 gm NaBr is formed

(A) 20 (B) 10 (C) 40 (D) None

Question No. 47 and 48 are based on the following piece of information. Mark the appropriate options on the basis of information.

342 gm of 20% by mass of $Ba(OH)_2$ solution (sp. gr. 0.57) is reacted with 200 ml of 2M HNO_3 according to given balanced reaction.

$$\mathbf{Ba(OH)_2 + 2HNO_3 \longrightarrow Ba(NO_3)_2 + 2H_2O}$$

Q.47 The nature of the final solution is

(A) acidic (B) neutral (C) basic (D) can't say

Q.48 If density of final solution is 1.01 gm /ml then find the molarity of the ion in resulting solution by which nature of the above solution is identified, is

(A) 0.5 M (B) 0.8 M (C) 0.4 M (D) 1 M

Question No. 49 to 50 (2 questions)

In the gravimetric determination of sulfur the ignited precipitate of $BaSO_4$ sometimes partially reduces to BaS. This cause an error, of course, if the analyst does not realize this and thinks entire precipitate as $BaSO_4$. Suppose a sample which contains 32.3% SO_3 is analyzed and 20.0% of the final precipitate that is weighed is BaS. (80.0% is $BaSO_4$).

Q.49 Calculate the mass of sample, assuming 100 gm precipitate is formed

(A) 106.3 gm (B) 114.35 gm (C) 110.5 gm (D) None

Q.50 Percentage of SO_3 in the sample, calculated by analyst is (if the assume the entire 100 gm precipiate as $BaSO_4$)

(A) 30 (B) 30.5 (C) 32 (D) 32.3

ANSWER KEY

EXERCISE I

Q.1

1.	6.02×10^{23}	2.	2×10^{-3} mol	3.	36 ml	4.	4.48 L
5.	Laws of conservation of mass			6.	16 gm	7.	GAM
8.	3	9.	14.2 gm	10.	44 g mol^{-1}	11.	4.13 g
12.	44.8 L	13.	24.3	14.	A_2B	15.	Conservation of mass
16.	0.4	17.	0.1	18.	M/2	19.	0.1168
20.	12	21.	3.3125 g	22.	50	23.	5
24.	0.4 M	25.	S_8				

Q.2

1.	False	2.	False	3.	False	4.	True
5.	True	6.	True	7.	False	8.	False
9.	True	10.	True	11.	True	12.	False
13.	True	14.	True	15.	False	16.	False
17.	False	18.	True	19.	True	20.	False
21.	False	22.	True	23.	False	24.	False
25.	True						

EXERCISE-II

Q.1 76.15% Q.2 Al = 0.566 g; Mg = 0.434 g Q.3 18.33

Q.4 1.09×10^{-3} gm Q.5 (a)10 mol, (b) 25 *lit.*, (c) 2.5

Q.6 $NaHCO_3$= 42%, Na_2CO_3 = 26.5%, Na_2SO_4 = 31.5%

Q.7 (i) 28%, (ii) 33.33%, (iii) 0.8g Q.8 0.5 : 0.1 : 0.4

Q.9 FeO = 13.34%; Fe_2O_3 = 86.66% Q.10 34.4 ml; 55.8 ml; 21.3 ml

Q.11 15.4% Q.12 XeF_6 Q.13 30.55kg, 6 electrons

Q.14 5g Q.15 V_{KIO_3} = 0.42 mL, [HCl] = 0.02N

Q.16 57.4% CuS, 42.6% Cu_2S Q.17 4.67L Q.18 1.75%

Q.19 Fe = 5.6%, Cu = 1.27% Q.20 CuS = 57.9% Q.21 95.15%

Q.22 n = 4, NaOH = 6.4 g Q.23 10%

Q.24 R_{Cu} = 269 Q.25 41.6%

EXERCISE-III

Q.1	C	Q.2	D	Q.3	C	Q.4	C	Q.5	D	Q.6	C	Q.7	B
Q.8	D	Q.9	B	Q.10	A	Q.11	C	Q.12	C	Q.13	C	Q.14	A
Q.15	A,D	Q.16	B	Q.17	B	Q.18	C	Q.19	A	Q.20	B	Q.21	C
Q.22	B	Q.23	C	Q.24	A	Q.25	A	Q.26	D	Q.27	D	Q.28	B
Q.29	A	Q.30	B	Q.31	A	Q.32	B	Q.33	A	Q.34	A	Q.35	C
Q.36	A	Q.37	B	Q.38	D	Q.39	C	Q.40	C	Q.41	A	Q.42	D
Q.43	A	Q.44	B	Q.45	C	Q.46	B	Q.47	C	Q.48	A	Q.49	B
Q.50	A												