EXERCISE 1

[NCERT TEXT BOOK EXERCISE]

Q.1 Calculate the molecular mass of the following :
(i) H_2O **(ii)** CO_2 **(iii)** CH_4

Q.2 Calculate the mass per cent of different elements present in sodium sulphate (Na_2SO_4)

Q.3 Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass.

Q.4 Calculate the amount of carbon dioxide that could be produced when
(i) 1 mole of carbon is burnt in air
(ii) 1 mole of carbon is burnt in 16 g of dioxygen
(iii) 2 moles of carbon are burnt in 16 g dioxygen.

Q.5 Calculate the mass of sodium acetate (CH_3COONa) required to make 500 mL of 0.375 molar aqueous solution. Molar mass of sodium acetate is 82.0245 g mol^{-1}.

Q.6 Calculate the concentration of nitric acid in moles per liter in a sample which has a density. 1.41 g mL^{-1} and the mass per cent of nitric acid in it being 69%.

Q.7 How much copper can be obtained from 100 g of copper sulphate ($CuSO_4$)?

Q.8 Determine the molecular formula of an oxide or iron in which the mass per cent of iron and oxygen are 69.9 and 30.1 respectively.

Q.9 Calculate the atomic mass (average) of chlorine using the following data;

	% natural abundance	Molar mass
^{35}Cl	75.77	34.9689
^{37}Cl	24.23	36.9659

Q.10 In three moles of ethane (C_2H_6), calculate the following:
(i) Number of moles of carbon atoms.
(ii) Number of moles of hydrogen atoms
(iii) Number of molecules of ethane.

Q.11 What is the concentration of sugar ($C_{12}H_{22}O_{11}$) in mol L^{-1} if its 20 g are dissolved in enough water to make a final volume up to 2L?

Q.12 If the density of methanol is 0.793 Kg L^{-1}, what is its volume needed for making 2.5 L of its 0.25 M solution?

Q.13 Pressure is determined as force per unit area of the surface. The SI unit of pressure, pascal is as shown below ?

$1Pa = 1N\ m^{-1}$

If mass of air at sea level is 1034 g cm^{-2}, calculate the pressure in pascal.

Q.14 What is the SI unit of mass? How is it defined ?

Q.15 A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be carcinogenic in nature. The level of contamination was 15 ppm(by mass)

(i) express this in percent by mass

(ii) determine the molality of chloroform in the water.

Q.16 Match the following prefixes with their multiples.

	Prefixes	**Multiples**
(i)	micro	10^6
(ii)	deca	10^9
(iii)	mega	10^{-6}
(iv)	giga	10^{-15}
(v)	femto	10

Q.17 The following data are obtained when dinitrogen and dioxygen react together to form different compounds.

	Mass of dinitrogen	**Mass of dioxygen**
(i)	14 g	16 g
(ii)	14 g	32 g
(iii)	28 g	32 g
(iv)	28 g	80 g

(a) Which law of chemical combination is obeyed by the above experimental data? Give its statements.

(b) Fill in the blanks in the following conversions:

(i) 1 km = ... mm = ... pm

(ii) 1 mg = ...kg = ...ng

(iii) 1 mL = ... L = ... dm^3

Q.18 In a reaction $A + B_2 \longrightarrow AB_2$

Identify the limiting reagent, if any, in the following reaction mixtures.

(i) 300 atoms of A + 200 molecules of B **(ii)** 2 mol A + 3 mol B

(iii) 2.5 mol A + 6 mol B

Q.19 Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation : $N_2(g) + H_2(g) \longrightarrow 2NH_3(g)$

(i) Calculate the mass of ammonia produced if 2.00×10^3 g dinitrogen reacts with 1.00×10^3 g of dihydrogen.

(ii) Will any of the two reactants remain unreacted ?

(iii) If yes, which one and what would be tis mass ?

Q.20 How are 0.50 mol Na_2CO_3 and 0.50 M Na_2CO_3 different ?

Q.21 If ten volumes of dihydrogen gas reacts with five volumes of dioxygen gas, how many volumes of water vapour would be produced ?

Q.22 Which one of the following will have largest number of atoms ?

(i) 1 g Au (s) **(ii)** 1 g Na (s) **(iii)** 1 g Li (s) **(iv)** 1 g of Cl_2 (s)

Q.23 Calculate the molarity of a solution ethanol in water in which the mole fraction of ethanol is 0.040.

Q.24 What will be the mass of one ^{12}C atom in g ?

Q.25 Use the data given in the following table to calculate the molar mass of naturally occurring organ isotopes.

Isotope	**Isotopic molar mass**	**Abundance**
^{36}Ar	35.96755 g mol^{-1}	0.337%
^{38}Ar	37.96272 g mol^{-1}	0.063%
^{40}Ar	39.9625 g mol^{-1}	99.600 %

Q.26 Calculate the number of atoms in each of the following :
(i) 52 moles of Ar **(ii)** 52 u of He **(iii)** 52 g of He.

Q.27 A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen give 3.38 g carbon dioxide, 0.690 g of water and no other products. A volume of 10.0 L (measured at STP) of this welding gas is found to weight 11.6 g. Calculate :
(i) empirical formula. **(ii)** molar mass of the gas, and **(iii)** molecular formula.

Q.28 Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction, $CaCO_3$ is required to react completely with 25 mL of 0.75 M HCl ?

Q.29 Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid according to the reaction

$$4\ HCl\ (aq) + MnO_2(s) \longrightarrow 2H_2O\ (I) + MnCl_2(aq) + Cl_2(g)$$

How many grams of HCl react with 5.0 g of magnese dioxide?

Q.30 Convert the following into basic units :
(i) 28.7 pm (B) 15.15 pm (iii) 25365 mg

EXERCISE 2

CONCEPTUAL OBJECTIVE

[SINGLE CORRECT]

Q.1 The solubility of K_2SO_4 in water is 16 g at 50ºC. The minimum amount of water requried to dissolve 4 g K_2SO_4 is:
(A) 10 g (B) 25 g (C) 50 g (D) 75 g

Q.2 One litre of N/2 HCl solution was heated in a beaker. When volume was reduced to 600 mL, 3.25 g of HCl was given out. The new normality of solution is:
(A) 6.85 (B) 0.685 (C) 0.1043 (D) 6.50

Q.3 Molarity of H_2SO_4 (density 1.8g/mL) is 18M. The molality of this H_2SO_4 is:
(A) 36 (B) 200 (C) 500 (D) 18

Q.4 Volume of 2M HCl required to neutralise the solution containing 1 mole of NH_4Cl and 1 mole of NaOH is:
(A) 1 litre (B) 2 litre (C) 3 litre (D) ½ litre

Q.5 8g of sulphur are burnt to form SO_2, which is oxidised by Cl_2 water. The solution is treated with $BaCl_2$ solution. The amount of $BaSO_4$ precipitated si:
(A) 1.0 mole (B) 0.5 mole (C) 0.75 mole (D) 0.25 mole

Q.6 In a compound A_xB_y:
(A) Mole of A = Mole of B = Mole of A_xB_y
(B) Eq. of A = Eq. of B. = Eq. of A_xB_y
(C) $y \times$ mole of A = $y \times$ mole of B = $(x+y) \times$ mole of A_xB_y
(D) $y \times$ mole of A = $y \times$ mole of B

Q.7 The molality of 1 M solution of NaCl (specific gravity 1.0585 g/mL) is:
(A) 1.0585 (B) 1.0 (C) 0.10 (D) 0.585

Q.8 The percentage of sodium in a breakfast cereal lebelled as 110 mg of sodium per 100 g of cereal is:
(A) 11% (B) 1.10% (C) 0.110% (D) 110%

Q.9 Two elements A (at.wt. 75) and B (at. wt. 16) combine to yield a compoud. The % by weight of A in the compound was found to be 75.08. The formula of the compound is:
(A) A_2B (B) A_2B_3 (C) AB (D) AB_2

Q.10 No. of oxalic acid molecules in 100 mL of 0.2N oxalic acid are:
(A) 6.023×10^{20} (B) 6.023×10^{21} (C) 6.023×10^{22} (D) 6.023×10^{23}

Q.11 Which sample contains the largest number of atoms:
(A) 1 mg of C_4H_{10} (B) 1 mg of N_2 (C) 1 mg of Na (D) 1 mL of water

Q.12 The total number of protons, electrons and neutrons in 12 g of $^{12}_{6}C$ is:
(A) 1.084×10^{25} (B) 6.022×10^{23} (C) 6.022×10^{22} (D) 18

Q.13 4.4g of CO_2 and 2.24 litre of H_2 at STP are mixed in a container. The total number of molecules present in the container will be
(A) 6.022×10^{23} (B) 1.2044×10^{23} (C) 2 mole (D) 6.023×10^{24}

Q.14 20 g of an acid furnishes 0.5 mole of H_3O^+ ions in its aqueous solution., The value of 1 equivalent of the acid will be:
(A) 40 g (B) 20 g (C) 10 g (D) 100 g

Q.15 Which is not a molecular formula:
(A) $C_6H_{12}O_6$ (B) $Ca(NO_3)_2$ (C) $C_2H_4O_2$ (D) N_2O

Q.16 The hydrated salt, $Na_2SO_4.nH_2O$ undergoes 55.9% loss in weigh ton heating and becomes anhydrous. The value of n will be:
(A) 5 (B) 3 (C) 7 (D) 10

Q.17 Which mode of experssing concentration is independent of temperature:
(A) Molarity (B) Molality (C) Formality (D) Normality

Q.18 1.0 g of pure calcium carbonate was found to require 50 mL of dilute HCl for complete reactions. The strength of the HCl solution is given by:
(A) 4 N (B) 2N (C) 0.4 N (D) 0.2 N

Q.19 100 mL each of 0.5 N NaOH, N/5 HCl and N/10 H_2SO_4 are mixed together. The resulting solution will be:
(A) Acidic (B) Neutral (C) Alkaline (D) None of these

Q.20 Vapoure density of a volatile substance is 4(CH_4 = 1). Its molecular weight would be:
(A) 8 (B) 2 (C) 64 (D) 128

Q.21 The equivalent weight of iron in Fe_2O_3 would be:
(A) 18.6 (B) 26.66 (C) 56 (D) 112

Q.22 25 mL of 3.0 M HNO_3 are mixed with 75 mL of 4.0 M HNO_3. If the volumes are additive, the molarity of the final mixture would be:
(A) 3.25 M (B) 4.0 M (C) 3.75 M (D) 3.50 M

Q.23 Two what extent must a given solution containing 40 mg $AgNO_3$ per mL be diluted to yield a solution ctntaining 16 mg $AgNO_3$ per mL:
(A) Each mL most be diluted to 2.5 mL
(B) To each mL of solution 2.5 mL of water should be added
(C) To 1.5 mL of solution 2 mL of water should be added
(D) To 1.5 mL of solution 1.5 mL of water should be added

Q.24 An oxide of metal have 20% oxygen, the eq. wt of oxide is:
(A) 32 (B) 40 (C) 48 (D) 52

Q.25 How much water is to be added to dilute 10 mL of 10 N HCl to make it decinormal:
(A) 990 mL (B) 1010 mL (C) 100 mL (D) 1000 mL

Q.26 The pair of compounds which cannot exist in solution is:
(A) $NaHCO_3$ and NaOH (B) Na_2SO_3 and $NaHCO_3$
(C) Na_2CO_3 and NaOH (D) $NaHCO_3$ and NaCl

Q.27 If 250 mL of a solution contains 24.5 g H_2SO_4 the molarity and normality respectively are:
(A) 1 M, 2 N (B) 1 M, 0.5 N (C) 0.5 M, 1 N (D) 2 M, 1 N

Q.28 0.5 mole of H_2SO_4 is mixed with 0.2 mole of $Ca(OH)_2$. The maximum number of mole of $CaSO_4$ formed is:
(A) 0.2 (B) 0.5 (C) 0.4 (D) 1.5

Q.29 The mole fraction of NaCl in a solution containing 1 mole of NaCl in 100 g of water is:
(A) 0.0177 (B) 0.001 (C) 0.5 (D) 1.5

Q.30 3.0 molal NaOH solution has a density of 1.110 g/mL. The molarity of the solution is:
(A) 2.9732 (B) 3.05 (C) 3.64 (D) 3.0504

Q.31 How many atoms ar contained in a mole of $Ca(OH)_2$:
(A) $30 \times 6.02 \times 10^{23}$ atoms/mol (B) $5 \times 6.02 \times 10^{23}$ atoms/mol
(C) $6 \times 6.02 \times 10^{23}$ atoms/mole (D) None of these

Q.32 Insulin contains 3.4% sulphur. The minimum mol. weight of insulin is:
(A) 941.176 (B) 944 (C) 945.27 (D) None of these

Q.33 One litre of CO_2 is passed over hot coke. The volume becomes 1.4 litre. The per cent composition of prodcuts is:
(A) 0.6 litre CO (B) 0.8 litre CO_2
(C) 0.6 litre CO_2 and 0.8 litre CO (D) None of these

Q.34 Number of mole of 1 m^3 gas at NTP are:
(A) 44.6 (B) 40.6 (C) 42.6 (D) 48.6

Q.35 Weight of oxygen in Fe_2O_3 and FeO is in the simple ratio of:
(A) 3 : 2 (B) 1 : 2 (C) 2 : 1 (D) 3 : 1

Q.36 The weight of 350 mL of a diatomic gas at 0ºC and 2 atm pressure is 1 g. The weight of one atom is (N is the Av. no.)
(A) 16/N (B) 32/N (C) 16 N (D) 32 N

Q.37 In a gseous reaction of the type,
$aA + bB \longrightarrow cC + dD$, which is wrong:
(A) a litre of A combines with b litre of B to give C and D
(B) a mole of A combines with b mole of B to gives C and D
(C) a g of A combines with b g of B to give C and D.
(D) a molecules of A combines with b molecules of B to give C and D

Q.38 2.76 g of silver carbonate on being strongley heated yields a residue weighing:
(A) 2.16 g (B) 2.48 g (C) 2.32 g (D) 2.64 g

Q.39 A metal oxide has 40% oxygen. The equivalent weight of the metal is:
(A) 12 (B) 16 (C) 24 (D) 48

Q.40 How many g of KCl would have to be dissolved in 60 g H_2O to give 20 % by weight of solution?
(A) 15 g (B) 1.5 g (C) 11.5 g (D) 31.5 g

Q.41 The per cent of N in 66% pure $(NH_4)_2SO_4$ sample is:
(A) 32 (B) 28 (C) 14 (D) Noen of these

Q.42 When the same amount of zinc is treated separately with exces of H_2SO_4 and excess of NaOH, the ratio of volumes of H_2 evolved is:
(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 9 : 4

Q.43 Eq. wt. of an acid salt $NaHSO_4$ is :
(A) M/1 (B) M/2 (C) M/3 (D) None of these

Q.44 When a metal is burnt, its weight is increased by 24%. The equivalent weight of the metal will be:
(A) 25 (B) 24 (C) 33.3 (D) 76

Q.45 If half mole of oxygen combine with Al to form Al_2O_3, the weight of Al used in the reaction is:
(A) 27 g (B) 40.5 g (C) 54 g (D) 18 g

Q.46 The specific heat of a metal is 0.836 J/g. The approximate at wt. is:
(A) 16 (B) 64 (C) 40 (D) 32

Q.47 0.71 g of chlorine combines with certain weight of a metal giving 1.11 g of its chloride. The eq. wt. of the metal is:
(A) 40 (B) 20 (C) 80 (D) None of these

Q.48 One mole of potassium chlorate is thermally decomposed and excess of aluminium is burn in the gaseous product. How many mole of aluminium oxide are formed:
(A) 1 (B) 1.5 (C) 2 (D) 3

Q.49 A compound has the molecular formula X_4O_6. If 10 g of X_4O_6 has 5.72 g X, atomic mass of X is:
(A) 32 amu (B) 37 amu (C) 42 amu (D) 98 amu

Q.50 Amount of phosphoric acid needed to neutralise 100 g of magnesium hydroxide is:
(A) 66.7 g (B) 252 g (C) 112 g (D) 168 g

EXERCISE 3

CONCEPTUAL SUBJECTIVES

Q.1 Calculate the number of gold atoms in 300 mg of a gold ring of 20 carat gold (atomic mass of gold = 197, pure gold is 24 carat)

Q.2 A poisonous compound cadaverine has 58.77% C, 13.81% H, and 27.42% N. Its molar mass is 102 g/mol. Determine its molecular formula.

Q.3 Given the following empirical formulae and molecular weights, compute the true molecular formulae:

	Empirical Formula	Molecular weight		Empirical Formula	Molecular weight
(A)	CH_2	84	(B)	CH_2O	150
(C)	HO	34	(D)	HgCl	472
(E)	HF				

Q.4 Hexachlorophene, $C_{13}H_6Cl_6O_2$, is a germicide in soaps, Calculate weight percent of each element in the compound.

Q.5 What is the empirical formula of a compound 0.2801 gm of which gave on complete combustion 0.9482 gm of carbon dioxide and 0.1939 gm of water.

Q.6 0.2000 gm of an organic compound was treated by Kjeldahl's method and the resulting ammonia was passed into 50 cc of M/4 H_2SO_4. The residual acid was then found to require 36.6 cc of M/2 NaOH for neutralisation. What is the percentage of nitrogen in the compound?

Q.7 0.252 gm of an organic compound gave on complete combustion 0.2186 gm of carbon dioxide and 0.1342 gm of water. 0.252 gm of the same compound gave by Carius method 0.7175 gm of silver chloride. What is the empirical formula of the compound?

Q.8 0.6872 gm of an organic compound gave on complete combustion 0.2186 gm of carbon dioxide and 0.1342 gm of water. 0.252 gm of the same compound gave by Carius method 0.7175 gm of silver chloride. What is the empirical formula of the compound?

Q.9 0.80g of the chloroplatinate of a mono acid base on ignition gave 0.262g of Pt. Calculate the mol. wt of the base.

Q.10 The relative abundance of various isotopes of silicon is as:
Si (28) = 92.25%, Si(29) = 4.65% and Si(30) = 3.10%
Calculate the average atomic mass of silicon.

Q.11 The density of a particular crystal of LiF is 2.65 g/cc. X-ray analysis shows that Li^+ and F^- ions are arranged in a cubic array at a spacing of 2.01 Å. From these data calculate the apparent Avogadro number [Li= 6.939 , F = 18.998 (1Å = 10^{-8} cm)],

Q.12 7.75 ml of a hydrocarbon gas was exploded with excess of oxygen. On cooling it was found to have undergone a contraction of 15 ml. If the vapour density of the hydrocarbon is 14, determine its molecular formula. ($C1_2$, H=1.)

Q.13 A 5.0 g sample of a natural gas consisting of CH_4, C_2H_5 was burnt in excess of oxygen yielding 14.5 g CO_2 and some H_2O as product. What is weight percentage of CH_4 and C_2H_4 in mixture.

Q.14 10 mL of any gas at NTP was heated with Tin. Tin converted into stannous sulphide and hydrogen was left. This hydrogen when passed over hot CuO, produced 0.081 g of water. If the vapour density of the gas is 17, find its formula.

Q.15 Nitrogen content in a sample of urea is 42.5%. What is the percentage purity of urea in urea sample?

Q.16 Calculate the weight of lime (CaO) obtained by heating 200 kg of 95% pure limeston ($CaCO_3$).

Q.17 On reacting 12.25 gm sample of $KClO_3$ with excess of H_2SO_4 according to following reaction 3 gm $HClO_4$ is obtained $3KClO_3 + 3H_2SO_4 \longrightarrow 3KHSO_4 + HClO_3 + 2ClO_2 + H_2O$
Calculate the % purity of the sample.

Q.18 3.25 gm impure zinc metal was oxidised to calculate % purity according to following reaction
$$4Zn + NaNO_3 + 7\ NaOH \longrightarrow 4Na_2ZnO_2 + NH_3 + H_2O$$
If 224 ml of NH_3 was obtained then calculate % purity of Zn metal and also the amount of Na_2ZnO_2 formed.

Q.19 The Sulphur content in a sample of H_2SO_4 is 15% . What is the % purity of sulphur in H_2SO_4 sample?

Q.20 1.5 g of impure sample of Na_2SO_4 (sodium sulphate) dissolved in water was treated with excess of $BaCl_2$ (barium chloride) solution when 1.74 g of $BaSO_4$ was obtained as dry ppt. Calculate the percentage purity of the sample.

Q.21 A gaseous alkane is exploded with oxygen. The volume of O_2 for complete combustion to CO_2 formed is in the ratio of 7 : 4. Deduce molecular formula of alkane.

Q.22 A sample of gaseous hydrocarbon occupying 1.12 litre at NTP, when completely burnt in air produced 2.2 g CO_2 and 1.8 g H_2O. Calculate the weight of hydrocarbon taken and the volume of O_2 at NPT required for its combustion.

Q.23 A mixture of NaI and NaCl, when heated with H_2SO_4, produced the same weight of sodium sulphate as that of the original mixture. Calculate percentage of NaI in the mixture.

Q.24 What volume of oxygen will be required for complete combustion of 18.2 litres of propane at NTP?

Q.25 20 ml of CO was mixed with 50 ml of oxygen and the mixture was exploded. On cooling, the resulting mixture was shaken with KOH. Find which and what volume of gas is left.

Q.26 Hydrazine N_2H_4(used as a fuel in rocket system) can be produced according to the following reaction, $ClNH_2 + 2NH_3 \longrightarrow N_2H_4 + NH_4Cl$
When 1.0 kg $ClNH_2$ is reacted with excess of NH_3, 473 g N_2H_4 is produced, What is the percentage yield of this reaction?

Q.27 60 mL of a mixture of nitrous oxide and nitric oxide was exploded with excess of hydrogen. If 38 mL of N_2 was formed, calculate the volume of each gas in mixture. All measurements are made at constant P and T. Assume H_2O in liquid phase.

Q.28 Equal masses of oxygen, hydrogen and methane are taken in a container identical conditions. Find the ratio of volume of the gases.

Q.29 If the components of air are N_2, 78%; O_2, 21%; Ar, 0.9% and CO_2, 0.1% by volume, what would be the molecular weight of air?

Q.30 The atomic weights of two elements A and B are 20 and 40 respectively. If x g of A contains y atoms, how many atoms are present in 2x g of B?

Q.31 0.05 mole of $LiAlH_4$ in ether solution was placed in a flask and 74g (1 mole) of t-butyl alcohol. The product $LiAlHC_{12}H_{27}O_3$ weighed 12.7 g. Calculate the percentage yield of the reaction if Li atoms are conserved? (Li = 7, Al = 27, H = 1, C = 12, O = 16)

Q.32 21.6 g of silver coin is dissolved in HNO_3. When NaCl is added to this solution, all silver is precipitated as AgCl. The weight of AgCl is found 14.35 g then calcualte % of silver in coin.

Q.33 A sample of clay was partially dried and then contained 50% silica and 7% water. The original clay contained 12% water. Find the % silica in original sample.

Q.34 Igniting MnO_2 in air converts it quantitatively to Mn_3O_4. A sample of pyrolusite has MnO_2 80%, SiO_2 15% and rest having water. The sample is heated in air to constant mass. What is the % of Mn in ignited sample?

Q.35 1 g sample containing KCl and NaCl on treatment with H_2SO_4 gave 1.18 g of mixture of K_2SO_4 and Na_2SO_4. Determine the percentage composition of the mixture.

Q.36 4 moles of a mixture of Mohr's salt and $Fe_2(SO_4)_3$ requires 500 mL of 1 M $K_2Cr_2O_7$ for complete oxidation in acidic medium. What is the mole % of the Moh'r salt in the mixture.

Q.37 0.1 g of a solution containing Na_2CO_3 and $NaHCO_3$ requires 10 mL of 0.1 N HCl for neutralization using phenolphthalein as an indicator. Weight % of Na_2CO_3 is:

Q.38 A mixture of NaOH and $Mg(OH)_2$ weights 2.325 g. It requires 3 g of H_2SO_4 for its neutralisation. What is % composition of mixture?

Q.39 1.387 g of a sample containing KCl and NH_4Cl is heated until constant weight. The residue is dissolved in 20 mL of N/10 $AgNO_3$ solution. Calculate % of chlorine in mixture.

EXERCISE 4

BRAINSTORMING OBJECTIVES

[SINGLE CORRECT]

Q.1 The haemoglobin from the red blood corpuscles of most mammals contains approximately 0.33% of iron by weight. the molecular weight of haemoglobin as 67, 200. The number of iron atoms in each molecule of haemoglobin is (atomic weight of iron = 56):
(A) 2 (B) 3 (C) 4 (D) 5

Q.2 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 neutralisatino 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 the 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

Q.3 0.7 g of $Na_2CO_3.xH_2O$ were dissolve in water and the vaolume was made to 100 mL, 20 mL of this solution required 19.8 mL of N/10 HCl for complete neutralisation. The value of x is:
(A) 7 (B) 3 (C) 2 (D) 5

Q.4 A partially dried clay mineral contains 8% water. The original sample contained 12% water. The original sample contained 12 % water and 45 % silica. The % of silica in the partically dried sample is nearly:
(A) 50 % (B) 49 % (C) 55 % (D) 47 %

Q.5 A sample of peanut oil weighig 1.5763 g is added to 25 mL of 0.4210 M KOH. After sponification is complete 8.46 mL of 0.2732 MH_2SO_4 is needed to neutralise excess of KOH. The sponification number of peanut oil is:
(A) 209.6 (B) 108.9 (C) 98.6 (D) 218.9

Q.6 On repeated sparking 10 mL of mixture of carbon monoxide and nitrogen required 7 mL of oxygen for combustion of CO and N_2 to CO_2 and NO. The volume of nitrogen in mixture is (all volumes are measured under identical conditions):
(A) 7/2 (B) 4 mL (C) 7 mL (D) 17/2 mL

Q.7 The isotopic abundance of C–12 and C–14 is 98% and 2% respectively. What would be the number of C–14 isotope in 12 g carbon sample.
(A) 1.032×10^{22} (B) 3.01×10^{23} (C) 5.88×10^{23} (D) 6.02×10^{23}

Q.8 Rakesh needs 1.71 g of sugar ($C_{12}H_{22}O_{11}$) to sweeten his tea. What would be the number of carbon atom present in his tea:
(A) 3.6×10^{22} (B) 7.2×10^{21} (C) 0.05×10^{23} (D) 6.6×10^{22}

Q.9 The total number of AlF_3 molecule in a sample of AlF_3 containing 3.01×10^{23} ions of F^- is:
(A) 9.0×10^{24} (B) 3.0×10^{24} (C) 7.5×10^{23} (D) 10^{23}

Q.10 The dehydraion yield of cyclohexanol to cyclohexene is 75%. What would be the yield if 100 g of cyclohexanol is dehydrated:
(A) 61.7 g (B) 16.5 g (C) 6.15 g (D) 615 g

Q.11 0.078 g $Al(OH)_3$ is dehydrated to Al_2O_3. The Al_2O_3 so obtained reacted with 6 milliequivalent of HCl. The equivalent of $AlCl_3$ produced during the reaction are:
(A) 10^{-3} (B) 3×10^{-3} (C) 4×10^{-3} (D) $\frac{10^3}{}$

Q.12 The volume equivalent of CO_2(at STP) in the reaction:

$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$ is:

(A) 22.4 litre (B) 112 litre (C) 11.2 litre (D) 5.6 litre

Q.13 Amount of oxygen in 32.2 g of $Na_2SO_4.10H_2O$ is:

(A) 20.8 g (B) 26.71 g (C) 2.24 g (D) 2.08 g

Q.14 100 mL of 0.1 M solution of H_2SO_4 is used to prepare 0.05 N solution of H_2SO_4. What is the volume of water added to prepare the desired solution:

(A) 300 mL (B) 400 mL (C) 100 mL (D) 200 mL

Q.15 1 g of Ca was burnt in excess of O_2 and the oxide formed was dissolved to make up one litre solution. The normality and molarity of solution respectively are:

(A) 0.05, 0.025 (B) 0.1, 0.05 (C) 0.1, 0.2 (D) 0.01, 0.02

Q.16 In the solubility of liquid solutions:

(A) The solubility of a solute always incrases with increasing temperature

(B) There is no noticeable temperature changes

(C) A positive enthalpy of solutions is when the system gains thermal energy on becoming saturated at the fixed temperature.

(D) A positive heat of solution means heat is absorbed as the solute dissolves to form the saturated solution.

Q.17 After equal volumes of 0.10 M solutions of $(NH_4)_2SO_4$ and $Ba(OH)_2$ have been mixed which of the following species is present in greatest concentration in solution:

(A) NH_4^+ (aq.). (B) Ba^{2+} (aq.) (C) NH_3 (aq.) (D) $BaSO_4$(aq.)

Q.18 Chlorophyll, a green colouring matter contains 2.68% Mg. The numbe of atoms of Mg present in 1 g chlorophyll are:

(A) 6.72×10^{20} (B) 6.72×10^{21} (C) 6.72×10^{22} (D) 6.72×10^{23}

Q.19 Sulphur molecule exists under various condition as S_8, S_6, S_4, S_2 and S. Which of the following statement is correct:

(A) Mass of one mole of each of these is same

(B) Number of mlecules in one mole of each of these is same

(C) Number of atoms in one mole of ecah of these is same

(D) None of these

Q.20 Weight of one atom of an element is 6.644×10^{-23} g. The g-atoms of element in 40 kg is:

(A) 102 (B) 103 (C) 104 (D) 105

Q.21 3 g of an oxide of a metal is converted completely to 5g chloride. equivalent weight of metal is:

(A) 33.25 (B) 3.325 (C) 12 (D) 20

Q.22 V_1 mL of NaOH of normality X and V_2 mL of $Ba(OH)_2$ of normality Y are mixed together. The mixture is completely neutralised by 100 mL of 0.1 N HCl. If $\frac{V_1}{V_2} = 1/4$ and $\frac{x}{y} = 4$, what fraction of the acid is neutarlise by $Ba(OH)_2$:

(A) 0.5 (B) 0.25 (C) 0.33 (D) 0.67

Q.23 A compound contains 10^{-2} of phosphorus. If atomic mas of phosphorus is 31, the molar mass of the compound having one phosphorus atom per molecule is:

(A) 31 (B) 31×10^2 (C) 31×10^{14} (D) 31×10^3

Q.24 One litre of N_2 and 7/8 litre of O_2 under identical conditions of P and T are mixed. The amount of gases present in mixture show:

(A) $w_{N_2} = 3w_{O_2}$ (B) $w_{N_2} = 8w_{O_2}$ (C) $w_{N_2} = w_{O_2}$ (D) $w_{N_2} = 16w_{O_2}$

Q.25 The atomic weight of a triatomic gas is a. The correct formula for the number of moles of gas in its w g is:

(A) $\frac{3w}{a}$ (B) $\frac{w}{3a}$ (C) 3wa (D) $\frac{a}{3w}$

EXERCISE 5

BRAINSTORMING SUBJECTIVE

Q.1 If 15 moles of each reactant are reacted according to the following reaction

$$2KMnO_4 + 10\ FeSO_4 + 8H_2SO_4 \longrightarrow 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$$

(i) Calculate maximum amount of $Fe_2(SO_4)_3$ formed.

(ii) Find out limiting reagent and calculate remaining moles of each reactant.

(iii) Calculate the amount of K_2SO_4 formed

(iv) In above reaction if 302 g of $MnSO_4$ is formed then calculate the remaining moles of each reactant.

Q.2 A drug mariguana owes its activity to tetrahydro cannabinol, which contains 70% as many as carbon atoms as hydrogen atoms and 15 times as many hydrogen atoms as oxygen atoms. The number of mole in a gram of tetrahydro cannabinol is 0.00318. Determine its molecular formula.

Q.3 Tha action of bacteria on metal and fish produces a poisonous compound called cadaverine. As its name and origin imply, it stinks! It is 58.77%C, 13.81%H, and 27.42% N. Its molar mass is 102 g/mol. Determine the molecular formula of cadaverine.

Q.4 Polychlorinated biphenyls, PCBs, known to be dangerous environmental pollutants, are a group compounds with the general empirical formula $C_{12}H_mCl_{10-m}$, where m is an integer. What is the value of m and hence the empirical formula of the PCB that contains 58.9% chlorine by mass?

Q.5 What is the percentage of nitrogen in an organic compound 0.1558 gm of which gave by Dumas method 56.3 c.c. of nitrogen collected over water at 16ºC and at a barometric pressure of 752 mm? (aqueous tension of water at 16ºC and at a barometric pressure of 752 mm? (aqueous tension of water at 16ºC is 12 mm)

Q.6 16 ml of a hydrocarbon gas was exploded with excess of oxygen. On cooling, the volume of resulting gaseous mixture was reduced by 48 ml. When KOH was added, there was a further decrease of 48 ml in volume. Find the molecular formula of the compound.

Q.7 A sample of gaseous hydrocarbon occupying 1.12 litre at NTP when completely burnt in air produced 2.2 g of CO_2 and 1.8 g of H_2O. Calculate the weight of the compound taken and the volume of O_2 at NTP required for tis burning. Find the molecular formula of the hydrocarbon

Q.8 A 5.0 g sample of a natural gas consisting of CH_4, C_2H_4 was burnt in excess of oxygen yielding 14.5 g CO_2 and some H_2O as products. What is weight percentage of CH_4 and C_2H_4 in mixture?

Q.9 100 ml of any gas at NTP was heated with tin. Tin converted into stannous sulphide and hydrogen was left. This hydrogen when passed over hot CuO, produced 0.081 g of water. If the vapour density of the gas is 17, find its formula.

Q.10 Determine the formula of ammonia from the following data
volume of ammonia = 25 ml
Volume on addition of O_2 after explosion = 71.2 ml
Volume after explosion with O_2 (on cooling) = 14.95 ml
Volume after being absorbed by alkaline pyrogallol = 12.5 ml

Q.11 Sodium chloride of 94% purity is used to produce salt cake, Na_2SO_4 of 83% purity according to the equation:

$$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$$

Calculate the number of kilogram of NaCl (impure) required to produce 1 kg of salt cake (impure)

Q.12 50 ml of pure and and dry oxygen subjected to silent electric discharge and on cooling to the original temperature the volume of ozonised oxygen was found to be 47 ml. The gas was then brought in contact with turpentine oil, when after the absorption of ozone, the remaining gas occupied a volume of 41 ml. Find the molecular formul of ozone.

Q.13 50 ml of mixture of CO and CH_4 was exploded with 85 ml of O_2. The volume of CO_2 produced was 50 ml. Calculate the percentage composiont of gaseous mixture, if all volumes are measured under same conditions and the given volume of O_2 is just sufficient for combustion of 50 ml of mixture of CO and CH_4.

Q.14 10 ml of a gaseous organic compound containing C, H and O only was mixed with 100 ml of oxygen and exploded under conditions which allowed the water formed to condense. The volume of the gas after explosion was 90 ml. On treatment with potash solution, a further contraction of 20 ml in volume was observed. Given that the vapour density of the compound is 23, deduce the molecular formula. All volume measurements were carried out under the same conditions.

Q.15 9 volumes of gaseous mixture consisting of a gaseous organic compound A and just sufficient amount of oxygen required for complete combustion yielded on burning 4 volumes of CO_2, 6 volumes of water vapour 2 volumes of N_2, all volumes measured at the same temperature and pressure. If the compound A contained only C, H and N (i) how many volumes of oxygen are required for complete combustion and (ii) what is the molecular formula of the compound A?

Q.16 An organic compound $C_xH_{2y}O_y$ was burnt with twice the amount of oxygen needed for complete combustion to CO_2 and H_2O. The hot gases when cooled to 0ºC and 1 atm pressure measured 2.24 litres. The water collected during cooling weighed 0.9 g. The vapour pressure of pure water at 20ºC is 17.5 mm of Hg and is lowered by 0.104 mm when 50 g of organic compound is dissolved in 1000 g of water. Give the molecular formula of the organic compound

Q.17 16 mL of hydrocarbon gas was exploded with excess of oxygen. On cooling, the volume of resulting gaseous mixture was reduced by 48 mL. When KOH was added, there was a further decrease of 48 mL in volume. Find the molecular formula of compound.

Q.18 2.505 g of hydrated diabasic acid requires 35 mL of 1N NaOH solution for complete neutralization. When 1.01 g of the hydrated acid is heated to constant weight, 0.72 g of the anhydrous acid is obtained. Calculate degree of hydration of the acid.

Q.19 10 ml of a gaseous hydrocarbon was burnt completely in 80 ml of O_2 at NTP. The remaining gas occupied 70 ml at NTP. This volume became 50 ml on treatment with KOH solution. What is the formula of the hydrocarbon?

Q.20 7.5 ml of a gaseous hydrocarbon was exploded with 36 ml of oxygen. The volume of gases on cooling was found to be 28.5 ml of which was absorbed by KOH and the rest was absorbed in a solution of alkaline pyrogallol. If all volumes are measured under same conditions, deduce the formula of the hydrocarbon.

Q.21 5 mL of a gaseous hydrocarbon was exposed to 30 mL of O_2. The resultant gas, on cooling is found to measure 25 mL of which 10 mL are absorbed by NaOH and the remainder by pyrogallol. Determine molecular formula of hydrocarbon. All measurements are made at constant pressure and temperature.

Q.22 A sample of Mg metal containing some MgO as impurity was dissolved in 125 mL of 0.1N H_2SO_4. the volume of H_2 evolved at 275ºC and 1 atm was 120.0 mL The resulting solution was found to be 0.02 N with respect to H_2SO_4. Calculate the weight of sample dissolved and the % by weight of pure Mg metal in sample. Neglect any change in volume.

Q.23 A mixture in which the mole ratio of H_2 and O_2 is 2:1 is used to prepare water by the reaction,

$$2H_2(g) + O_2(g) \longrightarrow 2H_2O(g)$$

The total pressure in the container is 0.8 atm at 20ºC before the reaction. Determine the final pressure at 120ºc after reaction assuming 80% yield of water.

Q.24 105 mL of pure water at 4ºC saturated with NH_3 gas yielded a solution of density 0.9 g mL^{-1} and containing 30% NH_3 by mass. Find out the volume of NH_3 solution resulting and the volume of NH_3 gas at 4ºC and 775 mm of Hg which was used to saturated water.

Q.25 When 2.5 g of a sample of Mohr's salt reacts completely with 50 mL of $\frac{N}{10}$ $KMnO_4$ solution. The % purity of the sample of Mohr's salts is:

Q.26 1.64 g of a mixture of $CaCO_3$ and $MgCO_3$ was dissolved in 50 mL of 0.8 M HCl. The excess of acid required 16 mL of 0.25 M NaOH for neutralization. Calculate the percentage of $CaCO_3$ and $MgCO_3$ in the sample.

Q.27 A fuel oil contains significant quantity of sulphur. When the oil is burnt, the sulphur is oxidised to SO_2 as; $S + O_2 \rightarrow SO_2$. In a city 465 tonnes of SO_2 are emitted by power plants each day. If 50% of SO_2 comes from the combustion of fuel oil that contains 3% S by weight, how many tonnes of oil is burnt per day?

Q.28 There is available 10 ton of a coal sample containing 2.5% sulphur. Two coal samples containing 0.8% and 1.1% sulphur are also available. How many tons of each of the later two samples should be mixed with the original 10 ton to give 20 ton sample containing 1.7% sulphur?

Q.29 32 g of a ample of $FeSO_4.7H_2O$ were dissolved in dilute sulphuric acid and water and its volume was made up to 1 litre, 25 mL of this solution required 20 mL of 0.02 M $KMnO_4$ solution for complete oxidation. Calculate the weight % of $FeSO_4.7H_2O$ in the sample

Q.30 A sample containing $HAsO_2$ (mol. wt. = 108) and weighing 3.78 g is dissolved and diluted to 250 mL in a volumetric flask. A 50 mL sample (aliquot) is withdrawn with a pipet and titrated with 35 ml of 0.05 M solution of I_2. Calculate the percentage $HAsO_2$ in the sample:

Q.31 A mixture of FeO and Fe_2O_3 is completely reacted with 100 mL of 0.25 M acidified $KMnO_4$ solution. The resultant solution was then titrated with Zn dust which converted Fe^{3+} of the solution to Fe^{2+}. The Fe^{2+} required 1000 mL of 0.10 M $K_2Cr_2O_7$ solution. Find out the weight % FeO_3 in the mixture.

Q.32 0.10 g of a sample containing $CuCO_3$ and some inert impurity was dissolved in diluted sulphuric acid and volume made up to 50 mL. This solution was added into 50 mL of 0.04 M KI solution where copper precipitates as CuI and I^- is oxidized into I_3^-. A 10 mL portion of this solution is taken for analysis, filtered and made up free I_3^- and then treated with excess of acidic permanganate solution. Liberated iodine required 20 mL of 2.5 mM sodium thiosulphate solution to reach the end point. Determine weight percentage of $CuCO_3$ in the original sample

Q.33 1 g of a mixture of Na_2CO_3 and K_2CO_3 was made upto 250 mL in aqueous solution. 25 mL of this solution was neutralized by 20 mL of HCl of unknown concentration. The neutralized solution required 16.24 mL of 0.1 N $AgNO_3$ for precipitation. Calculate:

(a) the % of K_2CO_3 in mixture. (b) conc. of HCl in g/litre.

(c) molarity of HCl.

Q.34 Find the number of mole of chloride ion needed to react with sufficient silver nitrate to make 10.0 g of AgCl. What mass of $CaCl_2$ is required to provide this number of mole of Cl^- ?

Q.35 How many kg of pure H_2SO_4 could be obtained from 2.00 kg of pure iron pyrites (FeS_2) according to the following reactions ?

$4FeS_2 + 11O_2 \longrightarrow 2Fe_2O_3 + 8SO_2$, $2SO_2 + O_2 \longrightarrow 2SO_3$, $SO_3 + H_2O \longrightarrow H_2SO_4$

Q.36 A solution contains 0.18 g/ml of a substance, X, whose molecular weight is approximately 68000. It is found that 0.27 ml of oxygen at 760 mm and 30°C will combine with the amount of X contained in 1.0 ml of the solution. How many molecules of oxygen will combine with one molecule of X ?

Q.37 5g sample of brass was dissolved in one litre dil. H_2SO_4. 20 ml of this solution were mixed with Kl, liberating I_2 and Cu^+ and the I_2 required 20 ml of 0.0327 N hypo solution for complete titration. Calculate the percentage of Cu in the alloy.

Q.38 A compound which contains one atom of X and two atoms of Y for each three atoms of Z is made by mixing 5.00 g of X, 1.15×10^{23} atoms of Y and 0.03 mole of Z atoms. Given that only 4.40 g of compound results. Calculate the atomic weight of Y if the atomic weights of X and Z are 60 and 80 amu respectively.

Q.39 Calculate the mass of oxalic acid which can be oxidized by 100ml of M MnO_4^- solution, 10ml of which is capable of oxidizing 50ml of 1N I^- to I_2.

Q.40 The iodide content of a solution was determined by the titration with cerium (IV) sulphate in the presence of HCl, in which I^- is converted of ICl. A 250 ml sample of the solution required 20 ml of 0.05 N Ce^{4+} solution. What is the iodide concentration in the original solution in g/litre.

Q.41 A solution is made by mixing 200 ml of 0.1M $FeSO_4$, 200 ml of 0.1 M $KMnO_4$ and 600 ml of 1M $HClO_4$. A reaction occurs in which Fe^{2+} is converted to Fe^{3+} & MnO_4^- to Mn^{2+} in acid solution. Calculate the concentration of each ion.

Q.42 How many mole $FeCl_3$ can be prepared by the reaction of 10.0g $KMnO_4$, 1.07 mol $FeCl_2$, and 500 mL of 3.00 M HCl? $MnCl_2$ is the reduction product.

Q.43 To 100ml of $KMnO_4$ solution containing 0.632 gm of $KMnO_4$, 200 ml of $SnCl_2$ solution containing 2.371 gm is added in presence of HCl. To the resulting solution excess of $HgCl_2$ is added all at once. How many gms of Hg_2Cl_2 will be precipitated.

Q.44 How many gram $KMnO_4$ should be taken to make up 250 mL of a solution of such concentration that 1mL is equivalent to 5.00 mg iron in $FeSO_4$?

Q.45 Exactly 40 ml of an acidified solution of 0.4 M iron (II) ion is titrated with $KMnO_4$ solution. After addition of 32 ml $KMnO_4$, one additional drop turns the iron solution purple. Calculate the concentration of permanganate solution.

Q.46 Potassium acid oxalate $K_2C_2O_4.3H_2C_2O_4.4H_2O$ can be oxidized by MnO_4^- in acid medium. Calculate the volume of 0.1M $KMnO_4$ reacting in acid sol. with one gram of the acid oxalate.

Q.47 The reaction $Cl_2 + S_2O_3^{2-} \longrightarrow SO_4^{2-} + Cl^-$ is to be carried out in basic medium. Starting with 0.15 mol of Cl_2, 0.01 mol $S_2O_3^{2-}$ and 0.3 mol of OH^-, how many moles of OH^- will be left in solution after the reaction is complete. Assume no other reaction occurs.

Q.48 0.5M $KMnO_4$ solution completely reacts with 0.05M FeC_2O_4 solution under acidic conditions where the products are Fe^{3+}, CO_2 and Mn^{2+}. The volume of FeC_2O_4 used is 125 ml. What volume of $KMnO_4$ was used.

Q.49 $K_2Cr_2O_7$ oxidizes HCl to Cl_2, which oxidizes K_2MnO_4. Calculate the weight of $KMnO_4$ formed from one gram of potassium dichromate by reacting it with excess HCl and using the generated chlorine for oxidizing K_2MnO_4 (Mn = 55; Cr = 52)

Q.50 A mixture of $CaCl_2$ and NaCl weighing 2.385 g was dissolved in water and treated with a solution of sodium oxalate which produces a precipitate of calcium oxalate. The precipitate was filtered from the mixture and then dissolved in HCl to give oxalic acid which when titrated against 0.2M $KMnO_4$ consumed 19.64 mL of the latter. What was percentage by mass of $CaCl_2$ in the original sample?

Q.51 A certain volume of Ferric sulphate solution was reduced by excess of zinc and was then titrated against 0.1N $KMnO_4$ solution. The titre value was 30 ml. The same volume of ferric salt solution was reduced by another metal X and then titrated against 0.1 N $KMnO_4$ and the titre value was 45 ml. What are the oxidation states of metal X .

Q.52 1.44g pure FeC_2O_4 was dissolved in dil. HCl and solution diluted to 100 mL. Calculate volume of 0.01 M $KMnO_4$ required to oxidize FeC_2O_4 solution completely.

Q.53 0.804 gm of a sample of iron ore was dissolved in acid. Iron was oxidized to +2 state and it required 117.2 ml of 0.112 N $KMnO_4$ solution for titration. Calculate the percentage of Fe and FeO in the ore.

Q.54 $KMnO_4$ oxidises X^{+n} ion to XO_3^-, itself changing to Mn^{+2} in acid solution. 2.68×10^{-3} mole of X^{+n} requires 1.61×10^{-3} mole of MnO_4^-. What is the value of n? Also calculate the atomic mass of X, if the weight of 1 g equivalent of XCl_n is 56.

Q.55 A sample of $Fe_2(SO_4)_3$ and FeC_2O_4 was dissolved in dil. H_2SO_4. The complete oxidation of reaction mixture required 40 mL of N/16 $KMnO_4$. After the oxidation, the reaction mixture was reduced by Zn and dil. H_2SO_4. On again oxidation by same $KMnO_4$, 60 mL were required. Calculate the ratio of Meq. of $Fe_2(SO_4)_3$ and FeC_2O_4 in mixture.

Q.56 2.6 g sample of pyrolusite was boiled with 65 mL. of N oxalic acid and excess of dil. H_2SO_4. The liquid was then filtered and the residue washed. The filtrate and the washing were mixed and made upto 500 mL. 100 mL of this solution required 50 mL of N/10 $KMnO_4$. Calculate % of MnO_2 in sample.

Q.57 0.5 g sample of iron containing mineral mainly in the form of $CuFeS_2$ was reduced suitably to convert all the ferric ions into ferrous ions ($Fe^{+3} \rightarrow Fe^{+2}$) and was obtained as solution. In the absence of any interfering radical, the solution required 42 mL of 0.01 M $K_2Cr_2O_7$ for titration. Calculate % of $CuFeS_2$ in sample.

Q.58 Mg can reduce NO_3^- to NH_3 in basic solution:

$$NO_3^- + Mg(s) + H_2O \longrightarrow Mg(OH)_2(s) + OH^-(aq) + NH_3(g)$$

A 25.0 mL sample of NO_3^- solution was treated with Mg. The $NH_3(g)$ was passed into mL of 0.15 N HCl. The excess HCl required 32.10 mL of 0.10 M NaOH for its neutralisation. What was the molarity of NO_3^- ions in the original sample?

EXERCISE 6

NEW IIT-JEE PATTERN QUESTION

MORE THAN ONE ANSWERS

Q.1 1g atom of nitrogen represents
(A) 6.02×10^{23} N_2 molecules
(B) 22.4 litre of N_2 at N.T.P.
(C) 11.2 litre of N_2 at N.T.P.
(D) 14 g of nitrogen

Q.2 1 g molecule of V_2O_5 contains :
(A) 5 mole of oxygen atom
(B) 2 mole of V atom
(C) 1 mole of oxygen atom
(D) 2.5 mole of oxygen atom

Q.3 Select dimensionless quantity(ies) :
(A) vapour density (B) molality (C) specific gravity (D) mass fraction

Q.4 Which of the following concentration terms is affected by a change in temperature ?
(A) Molarity (B) Molality (C) Normality (D) Specific gravity

Q.5 Which of the following statements regarding the compound A_xB_y is/are correct?
(A) 1 mole of A_xB_y contains 1 mole of A and 1 mole B
(B) 1 equivalent of A_xB_y contains 1 equivalent of A and 1 equivalent of B
(C) 1 mole of A_xB_y contains x moles of A and y moles of B
(D) equivalent weight of A_xB_y = equivalent weight of A + equivalent weight of B

Q.6 1 mole of $Be(OH)_2$ will exactly neutralize :
(A) 0.5 mole HCl
(B) 1 mole of H_2SO_4
(C) 1 mole of H_3PO_3
(D) 2 mole of H_3PO_2

Q.7 The pair of species having different percentage (mass) of carbon is :
(A) CH_3COOH and $C_6H_{12}O_6$
(B) CH_3COOH and C_2H_5OH
(C) $HCOOCH_3$ and HCOOH
(D) C_2H_5OH and CH_3OCH_3

Q.8 30 mL of CH_3OH($d = 0.8$ g/cm^3) is mixed with 60 mL of C_2H_5OH ($d = 0.92$ g/cm^3) at 25ºC to form a solution of density 0.88 g/cm^3. Select the correct option:
(A) Molarity and molality of resulting solution are 6.33 and 13.59 respectively
(B) The mole fraction of solute and molality are 0.385 and 13.59 respectively
(C) Molarity and % change in volume are 13.59 and zero respectively
(D) Mole fraction of solvent and molality are 0.615 and 13.59 respectively

Q.9 Which of the following is/are correct for 17 g/L of H_2O_2 solution?
(A) Volume strengths is 5.6 at 273 K and 1 atm
(B) Molarity of solution is 0.5 M
(C) 1 mL of this solution gives 2.8 mL O_2 at 273 K and 2 atm
(D) The normality of solution is 2 M

Q.10 Solutions containing 23g HCOOH is/are :
(A) 46 g of 70% $\left(\frac{w}{v}\right)$ HCOOH ($d_{solution}$ =1.40 g/mL)
(B) 50 g of 10 M HCOOH ($d_{solution}$ = 1 g/mL)
(C) 50 g of 25% $\left(\frac{w}{w}\right)$ HCOOH
(D) 46 g of 5 M HCOOH ($d_{solution}$ = 1 g/mL)

Q.11 A sample of H_2O_2 solution labelled as "28 volume" has density of 26.5 g/L. Mark the correct option(s) representing concentration of same solution in other units:

(A) $M_{H_2O_2} = 2.5$ (B) $\%\frac{w}{v} = 17$ (C) Mole fraction of $H_2O_2 = 0.2$ (D) $m_{H_2O_2} = 13.88$

Q.12 A mixture of 100 mL of CO, CO_2 and O_2 was sparked. When the resulting gaseous mixture was passed through KOH solution, contraction in volume was found to be 80 mL, the composition of initial mixture may be (in the same order):

(A) 30 mL, 60 mL, 10 mL (B) 30 mL, 50 mL, 20 mL

(C) 50 mL, 30 mL, 20 mL (D) 20 mL, 70 mL, 10 mL

Q.13 If 1 mole of H_3PO_4 is reacted with 1 mole of $X(OH)_2$ as:

$H_3PO_4 + X(OH)_2 \rightarrow XHPO_4 + 2H_2O$ then :

(A) The equivalent weight of base is $\frac{\text{mol.wt.}}{2}$

(B) The eq.wt. of H_3PO_4 is $\frac{98}{3}$

(C) The resulting solution is required 1 mole NaOH for complete neutralization

(D) 1 mole of $X(OH)_2$ more required for complete neutralization of $XHPO_4$.

Q.14 Dechromate ion in acidic medium oxidizes stannous ion as:

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

(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

Q.15 When a 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

Q.16 10.78 g of H_3PO_4 in 550 ml solution is 0.40 N. Thus this acid :

(A) has been neutralised to HPO_4^{2-} (B) has been neutralized to PO_4^{2-}

(C) has been reduced to HPO_3^{2-} (D) has been neutralised to $H_2PO_4^-$

Q.17 0.1 mol of MnO_4^- (in acidic medium) can :

(A) oxidise 0.5 mol of Fe^{2+} (B) oxidise 0.166 mol of FeC_2O_4

(C) oxidise 0.25 mol of $C_2O_4^{2-}$ (D) oxidise 0.6 mol of $Cr_2O_7^{2-}$

Q.18 Which of the following quantities are independent of temperature

(A) Molarity (B) mole fraction (C) molality (D) normality

Q.19 1 mol BaF_2 + 2mol H_2S_4 $\longrightarrow$ resulting mixture will be neutralised by :

(A) 1 mol of KOH (B) 2 mol of $Ca(OH)_2$

(C) 4 mol KOH (D) 2 mol of KOH

Q.20 Which of the following represent redox reactions :

(A) $Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$

(B) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$

(C) $2MnO_4^- + 3Mn^{2+} + 4OH \longrightarrow 5\ MnO_2 + 2H_2O$

(D) $2Cu^+ \longrightarrow Cu + Cu^{2+}$

Q.21 When $(NH_4)_2 Cr_2O_7$ is heated :

(A) there is oxidation of N (B) there is reduction of Cr

(C) net reaction is disproportionations (D) net reaction is neutralisation

Q.22 Which of the following are disproportionation reaction ?

(A) $2RCHO \xrightarrow{Al(OEt)_3} RCOOCH_2R$ (B) $4H_3PO_3 \xrightarrow{\Delta} 3H_3PO_4 + PH_3$

(C) $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$ (D) $PCl_5 \xrightarrow{\Delta} PCl_3 + Cl_2$

Q.23 For the reaction : $\underset{1\ mol}{H_3PO_4} + \underset{1\ mol}{Ca(OH)_2} \longrightarrow CaHPO_4 + 2H_2O$

Which are true statements :

(A) equivalent weight of H_3PO_4 is 49

(B) resulting mixture is neutralised by 1 mol of KOH

(C) $CaHPO_4$ is an acid salt

(D) 1 mol of H_3PO_4 is completely neutralised by 1.5 mol of $Ca(OH)_2$.

Q.24 $3H_3PO_2 \longrightarrow PH_3 + 2H_3PO_3$. In this reaction :

(A) H_3PO_2 undergoes disproportionation (B) equivalent weight of H_3PO_2 is 22

(C) equivalent weight of H_3PO_2 is 49.5 (D) NaH_2PO_2 is not acid salt.

Q.25 11.2 g of mixture of MCl (volatile) and NaCl gave 28.7 g of white ppt with excess of $AgNO_3$ solution. 11.2 g of same mixture on heating gave a gas that on passing into $AgNO_3$ solution gave 14.35 g of white ppt. Hence:

(A) ionic mass of M^+ is 18

(B) mixture has equal mole fraction of MCl and NaCl

(C) MCl and NaCl are in 1 : 2 molar ratio

(D) ionic mass of M^+ is 10

Q.26 $H_2C_2O_4$ and $NaHC_2O_4$ behave as acids as well as reducing agents. which are correct statement?

(A) equivalent weight of $H_2C_2O_4$ and $NaHC_2O_4$ are equal to their molecular weights when behaving as reducing agents

(B) 100 ml of 1 N solution of each is neutralised by equal volume of 1M $Ca(OH)_2$

(C) 100 ml of 1 N solution of each is neutralised by equal volume of 1N $Ca(OH)_2$

(D) 100 ml of 1 M solution of each is oxidised by equal volumes of 1M $KMnO_4$

Q.27 Which of the following are primary standard substances ?

(A) $Na_2CO_3.10H_2O$ (B) NaOH

(C) $Na_2B_4O_7.10H_2O$ (D) $KMnO_4$

Q.28 Which of the following statements are correct ?

(A) the point at which an equivalent amount of the titrant is added is called the equivalence point.

(B) the point at which the reaction is observed to be complete is called the end point

(C) at the end point of a reaction there is no change in the properties of the solution

(D) at the equivalence point of a reaction the stoichiometric amount of the titrant is not added

Q.29 100 mL of a 0.1 M SO_4^{2-} solution is :

(A) 10 millimoles (B) 5 millimoles

(C) 20 milliequivalents (D) 40 milliequivalent

Q.30 Which of following will be present in the solution formed when 50 mL of 0.1 M HCl is mixed with 50 mL of 0.1 M NaOH ?

(A) 4.5 m mol of H^+ (B) 0.05 m mol of OH^-

(C) 0.05 M NaCl (D) 10^{-7} M of H^+ ion

Q.31 Which of the following statements are correct ?

(A) during the titration of a strong acid against a strong base, the pH at the at the equivalence point will be neutral

(B) during the titration of a weak acid against a strong base, the pH at the at the equivalence point will be alkaline

(C) during the titration of a weak acid against a strong base, the pH at the at the equivalence point will be acidic

(D) during the titration of a weak acid against a weak base, the pH at the at the equivalence point will be neutral

Q.32 During the titration of a mixture of Na_2CO_3 and $NaHCO_3$ against HCl,

(A) phenolphthalein is used to detect the first end point

(B) phenolphthalein is used to detect the second end point

(C) methyl orange is used to detect the second end point

(D) methyl red is used to detect the first end point

Q.33 1 mol of H_2SO_4 will exactly neutralize

(A) 2 mol of ammonia (B) 1 mol of $Ba(OH)_2$

(C) 0.5 mol of $Ba(OH)_2$ (D) 2 mol of KOH

Q.34 At the end point there is a sharp change of colour in the indicator. This happens because the

(A) pH at the end point changes sharply

(B) structure of the indicator changes

(C) colour of indicator is adsorbed by water

(D) dissociation constants of acids and bases differ by ten

Q.35 '20 volumes' of H_2O_2 is equal to :

(A) 20% H_2O_2 by mass (B) 6% H_2O_2 by mass

(C) 1.764 N (D) 3.528 N

Q.36 A solution of $Na_2S_2O_3$ is standardized iodometrically against 0.1262 g of $KBrO_3$. This process requires 0.45 mL of $Na_2S_2O_3$ solution. What is the strength of the $Na_2S_2O_3$?

(A) 0.2 M (B) 0.1 M (C) 0.05 N (D) 0.1 N

Q.37 Which of the following expressions is correct (n = no. of moles of the gas, N_A = Avogadro constant, m = mass of molecule of the gas, N= no. of molecules of the gas)

(A) $n = mN_A$ (B) $m = nN_A$ (C) $N = nN_A$ (D) $m = mn/N_A$

Q.38 In which of the following pairs do 1g of each have an equal number of molecules?

(A) N_2O and CO (B) N_2 and C_3O_2 (C) N_2 and CO (D) N_2O and CO_2

Q.39 Among the following, which solutions contain equal numbers of millimoles ?

(A) 100 mL of 0.05 M H_2SO_4 (B) 200 mL of 0.0 M NaOH

(C) 100 mL of 0.10 M $Na_2C_2O_4$ (D) 200 mL of 0.025 MKOH

Q.40 1 mol of $^{14}_{7}N^{-3}$ ions contains

(A) $4N_A$ electrons (B) $7N_A$ protons (C) $7N_A$ neutrons (D) $14N_A$ protons

Q.41 11.2 L of gas at stp weighs 14.0 g. The gas could be :

(A) N_2O (B) NO_2 (C) N_2 (D) CO

Q.42 The oxidation number of Cr = + 6 in :

(A) $FeCr_2O_4$ (B) $KCrO_3Cl$ (C) CrO_5 (D) $[Cr(OH)_4]^-$

Q.43 The oxidation number of carbon is zero in :

(A) HCHO (B) CH_2Cl_2 (C) $C_6H_{12}O_6$ (D) $C_{12}H_{22}O_{11}$

Q.44 Which of the following are not redox reactions ?

(A) $Mg + N_2 \longrightarrow Mg_3N_2$

(B) $K_4[Fe(CN)_6] + H_2SO_4 + H_2O \longrightarrow K_2SO_4 + CO + FeSO_4 + (NH_4)_2SO_4$

(C) $I_2 + 3Cl_2 \longrightarrow ICl_3$

(D) $CuSO_4 + NH_3 \longrightarrow [Cu(NH_3)_4]SO_4$

Q.45 Which of the following are redox reactions ?

(A) $NaIO_3 + NaHSO_3 \longrightarrow NaHSO_4 + Na_2SO_4 + I_2 + H_2O$

(B) $FeCl_3 + K_4[Fe(CN)_6] \longrightarrow KCl + Fe_4[Fe(CN)_6]_3$

(C) $AgCl + Na_2S_2O_3 \longrightarrow Na_3[Ag(S_2O_3)_2] + NaCl$

(D) $NaBiO_3 + MnSO_4 + HNO_3 \longrightarrow HMnO_4 + Bi(NO_3)_3 + NaNO_3 + Na_2SO_4 + H_2O$

Q.46 Which among the following are examples of autoredox reactions?

(A) $P_4 + OH^- \longrightarrow H_2PO_4^- + PH_3$ (B) $S_2O_3^{2-} \longrightarrow SO_4^{2-} + S$

(C) $H_2O_2 \longrightarrow H_2O + O_2$ (D) $AgCl + NH_3 \longrightarrow [Ag(NH_3)_2]Cl$

Q.47 The oxidation number of S= +6 in

(A) peroxomonosulphuric acid (Caro's acid)

(B) peroxodisulphuric acid (Marshall's acid)

(C) pyrosulphuric acid (oleum)

(D) sodium thio sulphate (hypo)

Q.48 Which of the following have been arranged in order of decreasing oxidation number of sulphur?

(A) $H_2S_2O_7 > Na_2S_4O_6 > Na_2S_2O_3 > S_8$ (B) $SO^{2+} > SO_4^{2-} > SO_3^{2-} > HSO_4^-$

(C) $H_2SO_5 > S_2SO_3 > SCl_2 > H_2S$ (D) $H_2SO_4 > SO_2 > H_2S > H_2S_2O_8$

Q.49 Calculate the amount of lime (CaO) produced by heating 100 g of 90% pure limestone.

(A) 50.4 g (B) 0.98 mol (C) 0.90 mol (D) 56.0 g

Q.50 2 mol of CO_2 is required to prepare

(A) 336 of $NaHCO_3$ (B) 168 g of $NaHCO_3$

(C) 463 g of $Ca(HCO_3)_2$ (D) 162 g of $Ca(HCO_3)_2$

Q.51 1.5 g of oxygen is produced by heating $KClO_3$. How much KCl is produced in the reaction?

(A) 4.15×10^{-2} mol (B) 4.33 g (C) 1.78×10^{-2} mol (D) 1.33 g

Q.52 Which of the following gases are absorbed by an ammoniacal cuprous chloride solutions ?

(A) NO (B) CO (C) O_3 (D) C_2H_2

Q.53 50 milliliters of CO is mixed with 20 mL of oxygen and sparked. After the reaction, the mixture is treated with an aqueous KOH solution. Choose the correct option.

(A) The volume of the CO that reacts = 40 mL

(B) The volume of the CO_2 formed = 40 mL.

(C) The volume of the CO that remains after treatment with KOH = 10 mL

(D) The volume of the CO that remains after treatment with KOH = 20 mL

REASONING TYPE

Q.54 **Statement-1:** The atomic weight of an element is given by Dulong petits law. at. wt. × sp. heat (cal/mole) ≃ 6.4.

Statement-2: The formula is valid for metals only and not for all elements.

Q.55 **Statements:1** 1 mole O_3 = N molecule O_3 = 3N atoms of O = 48 g

Statemeent:2: A mole is the amount of matter that contains as many as objectes as the number of atoms exactly 12g C^{12}.

Q.56 **Statement-1:** The volume of 1 mole of an ideal gas at 1 bar pressure at 25ºC is 24.78 litre.

Statement-2: 1 bar = 0.987 atm

Q.57 **Statement-1:** Equivalennt weight of a species can be written as molecular weight of species divided by valence factor.

Statement-2: Valence factor represents valence in element, acidity in base, basicity in acids and total charge on cation or anion in an ionic compound.

Q.58 **Statement-1:** H_3PO_3 is a diabasic acid and its salt Na_3PO_3 does not exist.

Statement-2: Being dibasic nature, only two H are replaceable.

Q.59 **Statement-1:** 1 mole O_3 = N molecule O_3 = 3N atoms of O = 48 g

Statement-2: A mole is the amount of matter that contains as many as objects as the number of atoms exactly in 12g C^{12}.

Q.60 **Statement-1:** The volume of 1 mole of an ideal gas at 1 bar pressure at 25ºC is 24.78 litre.

Statement-2: 1 bar = 0.987 atm

Q.61 **Statement-1:** Equivalent weight of a species can be written as molecular weight of species divided by valence factor.

Statement-2: Valence factor represents valence in element, acidity in bases, basicity in acids and total charge on cation or anion in an ionic compound.

Q.62 **Statement-1:** Addition of water to a solution containing solute and solvent changes its normality or molarity only.

Statement-2: The milli-equivalent and milli-moles of solutes are not changed on dilution.

Q.63 **Statement-1:** On increasing the temperature the milli-moles of solute, milli - equivalent of solute, molality, mole fraction of solute and % by weight does not change.

Statement-2: Each of these involves only weights of solute and solvent.

Q.64 **Statement-1:** 1 equivalent of $K_2Cr_2O_7$ has 1 equivalent of K, Cr and O each.

Statement-2: Equivalent and milli-equivalent reacts in equal number to give same eq. or meq. of product

Q.65 **Statement-1:** 109% H_2SO_4 represent a way to express concentration of industrial H_2SO_4.
Statement-2: It represents that 9 gH_2O reacts with 40 g SO_3 to produce 49 g H_2SO_4 in addition to 100 g H_2SO_4.

Q.66 **Statement-1:** Equivalent weight of an element may have different value.
Statement-2: Equivalent weight depends upon the nature of chemical rection shown by that element.

LINKED COMPREHENSION TYPE

Passage–1

The term first used by ostwald in 1896 refers for the ratio of mass of a substance in g and its molecular weight. 1 mole of a gaseous compound occupies 22.4 litre at NTP and contains 6.023×10^{23} molecules of gas.

Q.67 Weight of 1 atom of hydrogen is:
(A) 1.66×10^{-24} amu (B) 3.32×10^{-24} g
(C) 1.66×10^{-24} g (D) 3.32×10^{-24} amu

Q.68 Avogadr's Number of Rupees can be spend in years ..... if 10 lacs rupees per second are spend:
(A) 1.91×10^{10} year (B) 2.91×10^{10} year (C) 3.91×10^{10} year (D) 4.91×10^{10} year

Q.69 The amout of sulphur required to produce 100 mole of H_2SO_4 is:
(A) 3.2×10^3 g (B) 32.65 g (C) 32 g (D) 3.2 g

Q.70 The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at 27ºC. The moles of NO_2 in 100 mole mixture is:
(A) 33.48 (B) 53.52 (C) 38.3 (D) 76.6

Q.71 A substance contains 3.4% sulphur. If it contains two molecules of sulphur per molecule the minimum molecular weigh of substance will be:
(A) 941 (B) 1882 (C) 470.5 (D) 1411.5

Q.72 2.76 g Ag_2CO_3 on heating strongly will produce equal to :
(A) 0.02 mole (B) 1 mole (C) 0.01 mole (D) 2 mole

Q.73 The volume of air need to burning 12 g carbon completely at STP is:
(A) 22.4 litre (B) 112 litre (C) 44.8 litre (D) 50 litre

Q.74 The maximum number of atoms present are in:
(A) 4 g He (B) 4 g O_2 (C) 4 g O_3 (D) 4 g H_2O_2

Q.75 The hydrated salt $Na_2SO_4.nH_2O$ unhdergoes 56% loss in weight on heating and becomes anhydrous. The value of n will be:
(A) 5 (B) 3 (C) 7 (D) 10

Passage–2

The concentration of solutions can be expressed in number of ways such that Normality, Molarity, Molality, Mole fractions, Strength, % by weight, % by volume and % by strength. The molarity of ionic compound is usually expressed as formality because we use formula weight of ionic compound. Addition of water to a solution changes all these terms, however increase in temperature does not change molality, mole fraction and % by weight terms.

Q.76 Number of oxaliate ions in 100 mL of 0.1 N oxalic acid is:

(A) $\frac{N_A}{100}$ (B) $\frac{N_A}{20}$ (C) $\frac{N_A}{200}$ (D) $\frac{N_A}{1000}$

Q.77 Volume of water required to convert 100 mL 0.5M NaOH solution to 0.2 M NaOH solution is:
(A) 250 mL (B) 150 mL (C) 100 mL (D) 400 mL

Q.78 The normality of 0.3 M H_3BO_3 is:
(A) 0.3 N (B) 0.15 N (C) 0.6 N (D) 0.9 N

Q.79 Which is not a molecular formula:
(A) $C_6H_{12}O_6$ (B) CH_3COOH (C) NO_2 (D) $Th(NO_3)_4$

Q.80 The weight of AgCl precipitated by adding 5.77 g $AgNO_3$ to 4.77 g NaCl in a solution:
(A) 4.88 g (B) 5.77 g (C) 4.77 g (D) None of these

Q.81 The equivalent weight of H_3PO_4 in the reaction,
$Ca(OH)_2 + H_3PO_4 \longrightarrow CaHPO_4 + 2H_2O$ is:
(A) 49 (B) 32.66 (C) 98 (D) None of these

Q.82 20 mL of 0.2 M $Al_2(SO_4)_3$ is mixed wtih 20 mL of 0.6 M $BaCl_2$. The normality of Al^{3+} and Cl^- ions in solution are respectively:
(A) 0.6 N, 0.6 N (B) 0.2 N, 0.6 N (C) 0.6 N, 0.2 (D) 0.2 N, 0.2 N

Q.83 A 6.90 M KOH solution in water has 30% by weight of KOH. The density of KOH solution is:
(A) 1.288 g/mL (B) 12.88 g/mL (C) 0.1288 g/mL (D) None of these

Q.84 The weight of H_2SO_4 in 1200 mL of 0.2 N solution is:
(A) 11.76 g (B) 5.83 g (C) 16.42 g (D) 2.92

Q.85 The weight of Na_2CO_3 sample of 95% purity required to neutralise 45.6 mL of 0.235 N acid is:
(A) 0.60 g (B) 0.80 g (C) 0.40 g (D) 0.20 g

Q.86 Two litre of NH_3 at 30ºC and 0.20 atm is neutralised by 134 mL of acid (H_2SO_4). The moloarity of H_2SO_4 is:
(A) 0.12 (B) 0.24 (C) 0.06 (D) 0.03

Q.87 Weight of $BaCl_2$ needed to make 240 mL of a solution having same concentration of Cl^- as the one containing 3.78 g of NaCl per 100 mL is:
(A) 8.40 g (B) 16.80 g (C) 25.20 g (D) 4.20 g

Q.88 Molecular weight of O_3 in the reaction:
$2O_3 \rightleftharpoons 3O_2$ is:
(A) 8 (B) 16 (C) 24 (D) 48

MATRIX MATCH TYPE

Q.89 Match the column

	Column–I		Column–II
(A)	0.5 mol of $SO_2(g)$	(p)	occupy 11.2 L at STP
(B)	1 g of $H_2(g)$	(q)	weights = 24 g
(C)	0.5 mole $O_3(g)$	(r)	total no. of atoms = $1.5 \times N_A$
(D)	1g of molecule of $O_2(g)$	(s)	weight 32 gm

Q.90 Match the column

	Column–I		Column–II
(A)	$\underline{P_2H_4} \rightarrow PH_3 + P_4H_2$	(p)	$E = \frac{3M}{4}$
(B)	$\underline{I_2} \rightarrow I^- + IO_3^-$	(q)	$E = \frac{3M}{5}$
(C)	$MnO_4^- + Mn^{2+} + H_2O \rightarrow \underline{Mn_3O_4} + H^+$	(r)	$E = \frac{15M}{26}$
(D)	$\underline{H_3PO_2} \rightarrow PH_3 + H_3PO_3$	(s)	$E = \frac{5M}{6}$

Q.91 Match the column

	Column–I		Column–II
(A)	Eq. wt. = $\frac{\text{Molecular weight}}{33}$	(p)	when CrI_3 oxidise into $Cr_2O_7^{2-}$ and IO_4^-
(B)	Eq. wt. = $\frac{\text{Molecular weight}}{27}$	(q)	when $Fe(SCN)_2$ oxidise into Fe^{3+}, SO_4^{2-}, CO_3^{2-} and NO_3^-
(C)	Eq. wt. = $\frac{\text{Molecular weight}}{28}$	(p)	when NH_4SCN oxidise into SO_4^{2-},CO_3^{2-} and NO_3^-
(D)	Eq. wt. = $\frac{\text{Molecular weight}}{24}$	(r)	when As_2S_3 oxidise into AsO_3^- and SO_4^{2-}

FILL IN THE BLANKS

Redox & equialent

Fill in the blanks with appropriate items:

Q.92 The number of water molecules in 0.5 mol of barium chloride dihydrated is.....

Q.93 20 mL of 0.1 M $H_2C_2O_4.2H_2O$ (oxalic acid) solution contains oxalic acid equal to ..... moles.

Q.94 The volume of 1.204×10^{24} molecules of water at 4ºC is .....

Q.95 0.2 mol of ozone (O3) at N.T.P. will occupy volume .....L.

Q.96 The balancing of chemical equation is based upon .....

Q.97 2 gm of hydrogen will have same number of H atoms as are there in ..... g hydrazine ($NH_2 - NH_2$).

Q.98 The mas of x atoms of element = $\frac{.....x}{N_A}$.

Q.99 The moles of x atoms of a triatomic gas = $\frac{x}{N_A}$ × ..... .

Q.100 The amount of Na_2SO_4 which gives 9.6 gm of SO_4^{2-} is ..... .

Q.101 The 44 mg of certain substance contain 6.02×10^{20} moleculs. The molecular mass of the substance is .....

Q.102 The mass of 1×10^{22} molecules of $CuSO_4.5H_2O$ is ..... .

Q.103 The atomic mass of iron is 56. The equivalent mass of the metal in $FeCl_2$ is ..... . and that in $FeCl_3$ is..... .

Q.104 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..... .

Q.105 A binary compound contains 50% of A(at. mass = 16) & 50% B (at. mass = 32). The empirical formula of the compound is..... .

Q.106 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 ..... .

Q.107 3 g of a salt (m. wt. 30) are dissolved in 250 ml of water. The molairity of solution is .....

Q.108 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 ....

Q.109 The Eq. weight of Na_2HPO_4 when it react with excess of HCl is ..... .

Q.110 The mole fraction of solute in 20% (by weight) aqueous H_2O_2 solution is..... .

Q.111 A metallic oxide contains 60% of the metal. The Eq. weight of the metal is.

Q.112 The number of gm of anhydrous Na_2CO_3 present in 250 ml of 0.25 N solution is..... .

Q.112 ..... ml of 0.1 M H_2SO_4 is required to neutralize 50 mL of 0.2 M NaOH solution.

Q.113 The number of mole of eater present in 90 g H_2O are..... .

Q.114 The concentration of K^+ ion in 0.2 M $K_2Cr_2O_7$ solution would be..... .

Q.115 280 ml of sulphur vapour at NTP weight 3.2 g. The mol. formula of the sulphur vapoure is .....

TRUE OR FALSE

Q.116 The ratio of the molecular weights of two elementary substances is the same as the ratio of their atomic weight.

Q.117 Vapour density of a gas is twice its molecular weight.

Q.118 A molal solution contains one mole of solute in 1000 g of solution.

Q.119 There are more atoms in one g of an element than in 1 g-atom of same element.

Q.120 Molality, % by weight and mole fraction are independent of temperature.

Q.121 Normality and molarity of a solution changes with temperature where as milliequivalent of solution remains constant.

Q.122 Molecular weight = Vapour density × 2. It is valid only for gaseous phase.

Q.123 Atomic weight ×Specific heat ≈ 6.4 . It is valid only for metals.

Q.124 Millimoles of reactans react according to balanced chaemical reaction and give products as well.

Q.125 Equal equivalent or milliequivalent of reactants react to give equal number of equivalent or milliequivalent of products.

Q.126 H_3BO_3 is monobasic acid.

Q.127 CO_2 is absorbed by alkalies.

Q.128 O_3 is absorbed by terpentine oil.

Q.129 12g carbon cantains the same no. of atoms as 32 g of the sulphur has.

Q.130 The reaction of an acid without equivalent quantity of a base always gives a neutral solution.

Q.131 N.T.P. refers to 1 atim pressure at 0ºK.

Q.132 H_3PO_3 is dibasic acid

Q.133 Molality is equal to molarity for very dilute aquious solutions.

Q.134 On' diluting a solution, its normality, molarity, molality and mole fraction changes where as Meq. of solute remains constant.

Q.135 Normality = Molarity ×Valence factor.

Q.136 Gases react either in their volume ratio or in mole ratio as represented by a change.

Q.137 Mole fraction of solute = 1 – mole fraction of solvent.

Q.138 5% aqueous solutions of NaCl and KCl are isomolar.

Q.139 1 mole of $CuSO_4.5H_2O$ contains 90 g water in hydrated form.

Q.140 1 mole of $K_2Cr_2O_7$ has 2 atoms of K, 2 atoms of Cr and 7 atoms of O.

EXERCISE 7

QUESTION FROM OTHER EXAMS

2002

Q.1 Number of atoms in 558.5 g Fe (at.wt.55.85) is :
(A) Twice that in 60 g carbon (B) 6.023×10^{22}
(C) Half in 8 g He (D) $558.5 \times 6.023 \times 10^{23}$

Q.2 Which of the following changes with increase in temperature:
(A) Molality (B) Weight fraction of solute
(C) Fraction of solution present in water (D) Mole fraction

Q.3 In a compound C, H, N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108. Its molecular formula is:
(A) $C_2H_6N_2$ (B) C_3H_4N (C) $C_6H_8N_2$ (D) $C_9H_{12}N_3$

Q.4 When $KMnO_4$ acts as an oxidizing agent and ultimately forms MNO_4^{2-}, MNO_2, Mn_2O_3, and Mn^{2+}, then the number of electrons transferred in each case is:
(A) 4, 3, 1 , 5 (B) 1, 5, 3, 7 (C) 1, 3, 4, 5 (D) 3, 5, 7, 1

Q.5 Which of the following is a redox reaction
(A) $NaCl + KNO_3 \longrightarrow NaNO_3 + KCl$ (B) $CaC_2O_4 + 2HCl \longrightarrow CaCl_2 + H_2C_2O_4$
(C) $Mg(OH)_2 + 2NH_4Cl \longrightarrow MgCl_2 + 2NH_4OH$ (D) $Zn + 2AgCN \longrightarrow 2Ag + Zn(CN)_2$

2003

Q.6 What will happen if the solution of potassium cromate reacts with excess amount of nitric acid

(A) CrO_4^{-2} reduces in the oxidation state +3 for Cr.
(B) CrO_4^{-2} oxidises in the oxidation state + 7 for Cr
(C) Cr^{+3} and $Cr_2O_7^{-2}$ will be formed (D) $Cr_2O_7^{-2}$ and H_2O will be formed

Q.7 What volume of hydrogen gas at 273 K and 1 atm pressure will be consumed in obtaining 21.6 gm of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen?
(A) 44.8 lit. (B) 22.4 lit (C) 89.6 lit (D) 67.2 lit

2004

Q.8 25 mL of a solution of barium hydroxide on titration with 0.1 molar solution of hydrochloric acid gave a titre value of 35 mL. The molarity of barium hydroxide is:
(A) 0.28 (B) 0.35 (C) 0.07 (D) 0.14

Q.9 6.02×10^{20} molecules of urea are present in 100 ml solution. The concentration of urea solution is:
(A) 0.1 M (B) 0.01 M (C) 0.02 M (D) 0.001 M

Q.10 To neutralize completely 20 ML of 0.1 M aqueous solution of phosphorus (H_3PO_3) acid the volume of 0.1 M aqueous KOH solution required is:
(A) 60 mL (B) 20 mL (C) 40 mL (D) 10 mL

Q.11 $CuSO_4$ reacts with excess amount of KI, followed by solution of $Na_2S_2O_3$. In this process which of following statement is incorrect.
(A) Cu_2I_2 will be formed (B) Evolved I_2 will be reduce
(C) $Na_2S_2O_3$ will be oxidised (D) CuI_2 will be formed

2005

Q.12 Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M of first solution with + 520 mL of 1.2 M of second solution. The molarity of solution is:
(A) 1.20 M (B) 1.50 M (C) 1.344 M (D) 2.70 M

Q.13 If 1/6 in place of 1/12, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will:

(A) Decrease twice (B) Increase two folds

(C) Remains unchanges (D) Be a function of the molecular mass of element

Q.14 The oxidation state of Cr is $[Cr(NH_3)]_4Cl_2]^+$ is

(A) +3 (B) +2 (C) +1 (D) 0

Q.15 The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is:

(A) + 4 (B) +6 (C) +2 (D) +3

2006

Q.16 How many moles of magneisum phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?

(A) 0.02 (B) 3.125×10^{-2} (C) 1.25×10^{-2} (D) 2.5×10^{-2}

Q.17 Density of 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of same solution is:

(A) 1.14 mol kg^{-1} (B) 3.28 mol kg^{-1} (C) 2.28 mol kg^{-1} (D) 0.44 mol kg^{-1}

2007

Q.18 The density (kn g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (molar mass 98 g mol^{-1}) by mass will be:

(A) 1.22 (B) 1.45 (C) 1.64 (D) 1.88

Q.19 In the reaction.

$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 6Cl^-_{(aq)} + 3H_{2(g)}$

(A) 11.2 L $H_{2(g)}$ at STP is produced for every mole $HCl_{(aq)}$ consumed

(B) 6L $HCl_{(aq)}$ is consumed for every 3 $LH_{2(g)}$ produced

(C) 33.6 L $H_{2(g)}$ is produced regardless of temperature and pressure for every mole A*l* that reacts

(D) 67.2 $H_{2(g)}$ at STP is produced for every mole A*l* that reacts.

EXERCISE 8

IIT - JEE FLASH BACK

[OBJECTIVE]

1981

Q.1 If 0.50 mole of $BaCl_2$ is mixed with 0.20 mole of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is

(A) 0.70 (B) 0.50 (C) 0.20 (D) 0.10

Q.2 One mole of N_2H_4 loses ten moles of electrons to form a new compound Y. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in Y ?

[There is no change in the oxidation state of hydrogen]

(A) -1 (B) -3 (C) +3 (D) +5

1982

Q.3 The oxidation number of carbon in CH_2O is

(A) -2 (B) +2 (C) 0 (D) +4

Q.4 In the following reactions, identify the species oxidised, the species reduced, the oxidising agent and the reducing agent :

(A) $4HCl + MnO_2 \longrightarrow MnCl_2 + 2H_2O + Cl_2$ (B) $SnCl_2 + 2FeCl_3 \longrightarrow SnCl_4 + 2FeCl_2$

(C) $2H^+ + Mg \longrightarrow Mg^{2+} + H_2$ (D) $H_2SO_4 + 2H_2S \longrightarrow 3S + 3H_2O$

1985

Q.5 The number of moles of solute per kg of a solvent is called as

(A) molarity (B) normality (C) mole fraction (D) molality

1986

Q.6 A molal solution is one that contains one mole of a solute in :

(A) 1000 g of the solvent (B) one litre of solvent

(C) one litre of the solution (D) 22.4 litres of the solution

1986

Q.7 Arrange the following in increasing oxidation number of iodine

I_2 , HI , HIO_4 , ICl

1987

Q.8 The brown ring complex compound is formulated as $[Fe(H_2O)_5(NO)^+]SO_4$. The oxidation state of the iron is :

(A) 1 (B) 2 (C) 3 (D) 4

1988

Q.9 The equivalent weight of $MnSO_4$ is half its molecular weight when it is converted to –

(A) Mn_2O_3 (B) MnO_2 (C) MnO_4^- (D) MnO_4^{2-}

1988

Q.10 In which mode of expression, the concentration of a solution remains independent of temperature ?

(A) molarity (B) Normality (C) Formality (D) Molality

1989

Q.11 The largest no. of molecules is in :

(A)28 g of CO (B) 46 g of C_2H_5OH (C) 36 g of H_2O (D) 54 g of N_2O_5

1990

Q.12 The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is

(A) +3 (B) +2 (C) +1 (D) –1

1991

Q.13 The volume strength of 1.5 N H_2O_2 solution is :

(A) 4.8 (B) 8.4 (C) 3.0 (D) 8.0

1991

Q.14 The oxidation states of the most electronegative element in the products of the reaction between BaO_2 and H_2SO_4 are :

(A) 0 and -1 (B) -1 and -2 (C) -2 and 0 (D) -2 and +1

1992

Q.15 For the redox reaction :

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

the correct coefficients of the reactants for the balanced reaction are –

	MnO_4^-	$C_2O_4^{2-}$	H^+
(A)	2	5	16
(B)	16	5	2
(C)	5	16	2
(D)	2	16	5

1997

Q.16 The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acidic medium.

(A) 3/5 (B) 2/5 (C) 4/5 (D) 1

2000

Q.17 Amongst these identify species with an atom in + 6 oxidation state :

(A) MnO_4^- (B) $Cr(CN)_6^{3-}$ (C) NiF_6^{2-} (D) CrO_2Cl_2

Q.18 The reaction, $3ClO^-(aq) \longrightarrow ClO_3^-(aq) + 2Cl^-(aq)$ is an example of

(A) oxidation reaction (B) reduction reaction

(C) disproportion reaction (D) decomposition reaction

Q.19 One mole of calcium phosphide on reaction with excess water gives :

(A) 1 mole of phosphine (B) 2 moles of phosphine

(C) 2 moles of phosphoric acid (D) 1 mole of phosphorus pentoxide

2001

Q.20 In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is

(A) (molecular weight)/2 (B) (molecular weight)/6

(C) (molecular weight)/3 (D) same as molecular weight

2002

Q.21 How many moles of electron weight one Kg :

(A) 6.023×10^{23} (B) $\frac{1}{9.108} \times 10^{31}$ (C) $\frac{6.023}{9.108} \times 10^{54}$ (D) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

2003

Q.22 Which has maximum number of atoms

(A) 24 g of C(12) (B) 56 g of Fe(56)

(C) 27 g of Al(27) (D) 108 g Ag (108)

2005.

Q.23 O_3 does not oxidise

(A) KI (B) $FeSO_4$ (C) $KMnO_4$ (D) K_2MnO_4

2007

Q.24 Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is:

(A) 3 (B) 4 (C) 5 (D) 6

EXERCISE 9

IIT - JEE FLASH BACK SUBJECTIVE

1980

Q.1 1 Mg is burnt in a closed vessel which contains 0.5 g of O_2.

(i) Which reactant is left in excess ?

(ii) Find the weight of the excess reactant.

1981

Q.2 A 1.00 gm sample of H_2O_2 solution containing X percent H_2O_2 by weight requires X ml of a $KMnO_4$ solution for complete oxidation under acidic conditions. Calculate the normality of the $KMnO_4$ solution.

Q.3 Balance the following equation :

(i) $Cu_2O + H^+ + NO_3^- \longrightarrow Cu^{2+} + NO + H_2O$

(ii) $K_4[Fe(CN)_6 + H_2SO_4 + H_2O \longrightarrow K_2SO_4 + FeSO_4 + (NH_4)_2SO_4 + CO$

(iii) $C_2H_5OH + I_2 + OH^- \longrightarrow CHI_2 + HCO_3^- + I^- + H_2O$

Q.4 50 mL of an aqueous solution of H_2O_2 was treated with an excess of KI solution and dilute H_2SO_4. The liberated iodine required 20 mL of 0.1 N $Na_2S_2O_3$ solution for complete interaction. Calculate the concentration of H_2O_2 in g/L.

1982

Q.5 Find the equivalent mass of H_3PO_4 in the reaction,

$$Ca(OH)_2 + H_3PO_4 \longrightarrow CaHPO_4 + 2H_2O$$

Q.6 4 g of mixture of NaCl and Na_2CO_3 were dissolved in water and volume made upto 250 mL. 15 mL of this solution required 50 mL of N/10 HCl for complete neutralisation. Calculate the percentage composition of the original mixture.

Q.7 25 g of a sample of ferrous sulphate was dissolved in water containing dilute H_2SO_4 and the volume made up to one litre. 25 mL of this solution required 20 mL of N/10 $KMnO_4$ solution for complete oxidation. Calculate the percentage of $FeSO_4.7H_2O$ in the sample.

Q.8 In the following reactions, identify the species oxidised, the species reduced, the oxidising agent and the reducing agent :

(A) $4HCl + MnO_2 \longrightarrow MnCl_2 + 2H_2O + Cl_2$ (B) $SnCl_2 + 2FeCl_3 \longrightarrow SnCl_4 + 2FeCl_2$

(C) $2H^+ + Mg \longrightarrow Mg^{2+} + H_2$ (D) $H_2SO_4 + 2H_2S \longrightarrow 3S + 3H_2O$

1983

Q.9 3 g of salt of molecular weight 30 is dissolved in 250 g of water. The molality of the solution is _____ .

Q.10 The density of a 3 M sodium thiosulphate solution ($Na_2S_2O_3$) is 1.25 g per ml. Calculate :

(i) the percentage by weight of sodium thiosulphate,

(ii) the mole fraction of sodium thiosulphate and

(iii) the molalities of Na^+ and $S_2O_3^{2-}$ ions.

1983

Q.11 Complete and balance the following reactions :

(i) $Zn + NO_3^- \longrightarrow Zn^{2+} + NH_4^+$

(ii) $Cr_2O_7^{-2} + C_2H_4O \longrightarrow C_2H_4O_2 + Cr^{3+}$

(iii) $HNO_3 + HCl \longrightarrow NO + Cl_2$

(iv) $Ce^{3+} + S_2O_8^{2-} \longrightarrow SO_4^{2-} + Ce^{4+}$

(v) $Cl_2 + OH^- \longrightarrow Cl^- + ClO^-$

1984

Q.12 2.68×10^{-3} moles of a solution containing an ion A^{n+} acquire 1.61×10^{-3} moles of MnO_4^- for the oxidation of A^{n+} to AO_3^- in acid medium. What is the value of n ?

1986

Q.13 The reaction, $2C + O_2 \longrightarrow 2CO$ is carried out by taking 24 g of carbon and 96 g O_2, find out:

(a) Which reactant is left in excess ?

(b) How much of it is left ?

(c) How many mole of CO are formed ?

(d) How many g of other reactant should be taken so that nothing is left at the end of reaction ?

Q.14 How many mL of a 0.05 M $KMnO_4$ solution are required to oxidise 2.0 g of $FeSO_4$ in a dilute solution (acidic).

1986

Q.15 Complete and balance the following reactions :

(i) $Mn^{2+} + PbO_2 \longrightarrow MnO_4^- + H_2O$

(ii) $S + OH^- \longrightarrow S_2^- + S_2O_3^{2-}$

(iii) $ClO_3^- + I^- + H_2SO_4 \longrightarrow Cl^- + HSO_4^-$

(iv) $Ag^+ + AsH_3 \longrightarrow H_3AsO_3 + H^+$

1986

Q.16 Give proper reasoning for the following :

(i) H_2S acts only as reducing agent while SO_2 can act both as a reducing agent and oxidising agent.

(ii) An acidified potassium dichromate paper on being exposed to sulphur dioxide turns green.

(iii) Mercuric chloride and stannous chloride cannot exist as such if present together in an aqueous solution.

1987

Q.17 What is the strength in g per litre of a solution of H_2SO_4, 12 mL of which neutralized 15 mL of N/10 NaOH solution ?

1988

Q.18 A sugar syrup of weight 214.2 g contains 34.2 g of sugar ($C_{12}H_{22}O_{11}$). Calculate (i) molal concentration and (ii) mole fraction of sugar in the syrup.

Q.19 0.50 g of a mixture of K_2CO_3 and Li_2CO_3 required 30 mL of 0.25 N HCl solution for neutralization. What is % composition of mixture ?

1990

Q.20 A solid mixture 5 g consists of lead nitrate and sodium nitrate was heated below 600°C until weight of residue was constant. If the loss in weight is 28%, find the amount of lead nitrate and sodium nitrate in mixture.

Q.21 Calculate molality of 1 litre solution of 93% H_2SO_4 (w/v). The density of solution is 1.84 g mL^{-1}.

1991

Q.22 Calculate no. of oxalic acid molecules in 100 mL of 0.02 N oxalic acid.

1992

Q.23 Complete & balance the reaction :

$$K_2Cr_2O_7 + HCl \longrightarrow KCl + ... + ... + H_2O$$

Q.24 The mass of 1×10^{22} molecules of $CuSO_4.5H_2O$ is ..... .

Q.25 Give proper reasoning for the following : $[CuCl_4]^{2-}$ is formed but $[CuI_4]^{2-}$ is not ?

1994

Q.26 8.0575×10^{-2} kg of Glauber's salt is dissolved in water to obtain 1 dm^3 of a solution of density 1077.2 kg m^{-3}. Calculate the molarity, molality and mole fraction of Na_2SO_4 in solution.

Q.27 The composition of a sample of wurtzite is $Fe_{0.93}O_{1.00}$. What percentage of the iron is present in the form of Fe(III).

1994

Q.28 Complete & balance the reaction :

(i) $Sn + 2KOH + 4H_2O \longrightarrow ..... + ...$

(ii) $MnO_4^{2-} + H^+ \longrightarrow MnO_2 + MnO_4^- + H_2O$

Q.29 The compound $YBa_2Cu_3O_7$ which show superconductivity, has copper in oxidation state ..... Assume that the rare earth element yttrium is in its usual +3 oxidation state.

1997

Q.30 Complete and balance the following equations :

(i) $H_2S + H_2SO_4$ (conc.) $\longrightarrow$ ..... + ... + ...

(ii) $NaOH + I_2 \longrightarrow ..... + ... + H_2O$

(iii) $NH_3 + NaOCl \longrightarrow ..... + NaCl + H_2O$

1998

Q.31 Complete and balance the following equations :

(i) $H_2SO_2 + HI \longrightarrow ..... + ... + ...$

(ii) $CaOCl_2 + NaI + HCl \longrightarrow ..... + CaCl_2 + H_2O + NaCl$

(iii) $Ag_2S + 2CuCl_2 + 2Hg \longrightarrow ..... + ... + S + 2\,Ag$

1999

Q.32 A plant virus is found to consist of uniform cylindrical particles of 150 Å in diameter and 5000 Å long. The specific volume of the virus is 0.75 cm^3/g. If the virus is considered to be a single particle, find its molecular weight.

Q.33 How many ml of 0.5 M H_2SO_4 are needed to dissolve 0.5 g of copper (II) carbonate.

Q.34 The oxidation number of S in S_8, S_2F_2 and H_2S is _____.

2000

Q.35 The formula weight of an acid is 82. 100 cm^3 of a solution of this acid containing 39.0 g of the acid per litre were completely neutralized by 95.0 cm^3 of aqueous NaOH containing 40.0 g of NaOH per litre. What is the basicity of the acid ?

2003

Q.36 Calculate the molarity of water, if its density is 1000 kg/m^3.

2005

Q.37 (a)What amount of CaO in grams is required to neutralise 852 g of P_4O_{10}.

(b) Write the structure of P_4O_{10}.

2009

Q.38 The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is

ANSWERSHEET

Exercise - 02

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

Exercise - 03

1	7.64×10^{20}	**2**	$C_5H_{14}N_2$				
3	(A) C_6H_{12} (B) $C_5H_{10}O_5$ (C) H_2O_2 (D) Hg_2Cl_2 (E) H_4F_4,						
4	H = 1.486%, C = 38.37%, O = 7.87%, Cl = 52.28%						
5	CH	**6**	46.9%	**7**	CH_3Cl	**8**	$C_7H_{10}NCl$
9	92.70	**10**	28.11 amu	**11**	6.01×10^{23}	**12**	C_2H_4
13	C_2H_4 = 39.2%, CH_4 = 60.8%			**14**	H_2S	**15**	91.07%
16	106.4 kg	**17**	89.55%	**18**	80%, 5.72 gm	**19**	45.94%
20	70.67 %	**21**	C_2H_6	**22**	0.8 g, 2.24 litre O_2		
23	28.85%	**24**	91 litre	**25**	O_2, 40 mL	**26**	76.12%
27	NO = 44ml,N_2O = 16 ml			**28**	1 : 16 : 2	**29**	28.964
30	y	**31**	100%	**32**	50%	**33**	47.31
34	59.37% Mn	**35**	26.85% NaCl, 73.42% KCl			**36**	75%
37		**38**	85.94%, 14.06%			**39**	64.31%

Exercise - 04

1	C	**2**	A	**3**	C	**4**	D	**5**	A	**6**	B	**7**	A
8	A	**9**	D	**10**	A	**11**	B	**12**	A	**13**	B	**14**	A
15	A	**16**	C	**17**	C	**18**	A	**19**	B	**20**	B	**21**	A
22	A	**23**	C	**24**	C	**25**	B						

Exercise - 05

1		**2**	$C_{21}H_{30}O_2$	**3**	$C_5H_{14}N_2$
4	m = 4, $C_6H_2Cl_3$	**5**	40.7%	**6**	C_3H_6
7	Ans. 2.24 liters	**8**	39.2, 60.8	**9**	H_2S
10	NH_3	**11**	0.727 kg impure NaCl	**12**	O_3
13	20%	**14**	C_2H_6O	**15**	$C_2H_6N_2$
16	$C_5H_{10}O_5$	**17**	C_3H_8	**18**	2
19	C_2H_4	**20**	C_2H_4	**21**	C_2H_4
22	0.1221 g, 95.57% Mg			**23**	0.787 atm.
24	166.66 mL, 59,03 litre			**25**	78.4
26	$MgCO_3$ = 52.02%, CaCO3 = 47.98%			**27**	3875 tonnes
28	3.3 ton 1.1% and 6.7 ton of 0.8%			**29**	69.5

30 25% **31** 80.85% **32** 74.1

33 [Ans. (a) 0.0812, (b) 2.9638 g (c) 60%] **34.** 0.0697, 3.86 g

35. 3.26 kg **36.** 4 **37.** 41.53%

38. At. wt. of Y = 70 amu **39.** 22.5 gm **40.** 0.254 g/l

41. Fe^{3+} = 0.02M;MnO_4^- = 0.016 M ; H^+ = 0.568 M;Mn^{2+} = 0.004M; SO_4^{--}=0.02M;K^+ = 0.02M, ClO_4^- = 0.6M

42. 0.316 mol $FeCl_3$ **43.** 1.176 gm **44.** $KMnO_4$ = 0.707g

45. 0.1M **46.** V = 31.68 ml **47.** 0.2 moles OH^-

48. 7.5 ml **49.** 3.22 gm **50.** $CaCl_2$ = 45.7%

51. +2 & +3 **52.** 600 mL MnO_4^- solution **53.** % Fe = 61.43; %FeO = 38.57

54. n = 2, a = 97 **55.** 7 : 6 **56.** 66.92%

57. 92.48% **58.** $N_{NO_3^-}$ = 1.37, $M_{NO_3^-}$ = 0.1716

Exercise - 06

ONE or MORE than one correct

1. CD	**2.** AB	**3.** ACD	**4.** ACD	**5.** BCD	**6.** BCD	**7.** BC
8. BD	**9.** ABC	**10.** AB	**11.** ACD	**12.** AB	**13.** AC	**14.** BCD
15. AB	**16.** AD	**17.** ABC	**18.** BC	**19.** CD	**20.** CD	**21.** AB
22. AB	**23.** ABCD	**24.** ACD	**25.** AB	**26.** ABD	**27.** AC	**28.** AB
29. AC	**30.** CD	**31.** ABC	**32.** AC	**33.** ABD	**34.**	**35.** AB
36. BD	**37.** BC	**38.** CD	**39.** AD	**40.** BC	**41.** CD	**42.** BC
43. ABCD	**44. CD**	**45.** AD	**46.** ABC	**47.** ABC	**48.** AC	**49.** AC
50. AD	**51.** CD	**52.** BD	**53.** ABC			

Assertion& Reason

54	**B**	**55**	**C**	**56**	**D**	**57**	**D**	**58**	**C**	**59**	**A**	**60**	**B**
61	**B**	**62**	**B**	**63**	**A**	**64**	**A**	**65**	**B**	**66**	**A**		

Paragraph.

67	C	**68**	A	**69**	A	**70**	A	**71**	B	**72**	A	**73**	B
74	A	**75**	D	**76**	C	**77**	C	**78**	A	**79**	D	**80**	A
81	A	**82**	A	**83**	A	**84**	A	**85**	A	**86**	B	**87**	B
88	A												

Match the followng columns

89 A-prs, B-p, C-pqr, D-s **90** A-s, B-q, C-r, D-p **91** A-q, B-p, C-s, D-r

Fill in the blanks

92	[6.02×10^{23}]	**93**	[2×10^{-3} mol]	**94**	[36 ml]	**95**	[4.48 L]
96	[Law of conservation of mass]			**97**	[16 gm]		
98	[4.13 g]	**99**	[1/3]	**100**	[14.2 gm]	**101**	[44 g mol^{-1}]
102	[4.13g]	**103**	[44.8 L]	**104**	[24.3]	**105**	[A_2B]
106	[Conservation of mass]	**107**	[0.4]	**108**	[0.1]	**109**	[M/2]
110	[0.1168]	**111**	[12]	**112**	[3.3125 g]	**112**	[50]
113	[5]	**114**	[0.4 M]	**115**	[S_8]		

True/False.

116	[T]	**117**	[F]	**118**	[F]	**119**	[F]	**120**	[T]	**121**	[T]
122	[T]	**123**	[T]	**124**	[T]	**125**	[T]	**126**	[T]	**127**	[T]
128	[T]	**129**	[T]	**130**	[F]	**131**	[F]	**132**	[T]	**133**	[T]
134	[T]	**135**	[T]	**136**	[T]	**137**	[T]	**138**	[F]	**139**	[T]
140	[F]										

Exercise - 07

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

Exercise - 08

1. D	**2.** C	**3.** C	**4.**	**5.** D	**6.** A	**7.** B
8. B	**9.** D	**10.** C	**11.** C	**12.** B	**13.** B	**14.** A
15. A	**16.** D	**17.** C	**18.** B	**19.** B	**20.** D	**21.** D
22. A	**23.** D	**24.** B				

Exercise - 09

1. (i) Mg **(ii)** 0.25 gm **2.** 0.6 N **3.** **4.** 0.68 g/L

5. 49 **6 .** NaCl = 33.75 % Na_2CO_3 = 66.25% **7.** 88.96%

8. **9.** 0.4 **10.** (i) 37.92 (ii) 0.065 (iii) 7.72, 3.86

11. Ca **12.** n = 2

13. 2 **14.** (a) O_2 (b) 2 mole of O_2 (c) 2 mole of CO (d) 72 g carbon

15. 52.57 mL **16.** A **17.** **18.** 55.55 M

19. 6.125 gm/lit **20.** (i) 0.56 (ii) 0.0099

21. K_2CO_3 = 96% , Li_2CO_3 = 4% **22.** $Pb(NO_3)_2$ = 3.323 g, $NaNO_3$ = 1.677 g

23. 10.42 **24.** 6.023×10^{20} **25.** **26.** 4.13 gms

27. Fe^{3+} = 15%, Fe^{2+} = 85%, **28.** 0.25 M, 0.24 m, 4.3×10^{-3}

29. 15.05 % **30.** **31.** +7/3 **32.** 7.07×10^{7} g /mol

33. 8.09 ml **34.** 0, +1, –2 **35.** n = 2 **36**. 55.55 M

37. 1008 g **38.** 6