Additional Problems for Self Practice (APSP)

Marked questions are recommended for Revision.

This Section is not meant for classroom discussion. It is being given to promote self study and self testing amongst the Resonance students.

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

Max. Marks: 100 **Max. Time : 1 Hour**

Important Instructions:

A. General :

1. The test paper is of **1** hour duration.
2. The Test Paper consists of **25** questions and each questions carries **4** Marks. Test Paper consists of **Two** Sections.

B. Test Paper Format and its Marking Scheme:

1. Section-1 contains **20** multiple choice questions. Each question has four choices (1), (2), (3) and (4) out of which **ONE** is correct. For each question in Section-1, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. In all other cases, minus one **(–1)** mark will be awarded.
2. Section-2 contains **5** questions. The answer to each of the question is a **Numerical Value**. For each question in Section-2, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. No negative marks will be answered for incorrect answer in this section. In this section answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto two digit. If the numerical value has more than two decimal places **truncate/round-off** the value to **TWO** decimal placed.

SECTION-1

This section contains **20** multiple choice questions. Each questions has four choices (1), (2), (3) and (4) out of which Only **ONE** option is correct.

1. 112.0 mL of NO_2 at STP was liquefied, the density of the liquid being 1.15 g mL^{-1}. Calculate the volume and the number of molecules in the liquid NO_2.
(1) 0.10 mL and 3.01×10^{22} (2) 0.20 mL and 3.01×10^{21}
(3) 0.20 mL and 6.02×10^{23} (4) 0.40 mL and 6.02×10^{21}

2. X and Y are two elements which form X_2Y_3 and X_3Y_4. If 0.20 mol of X_2Y_3 weighs 32.0 g and 0.4 mol of X_3Y_4 weighs 92.8 g, the atomic weights of X and Y are respectively
(1) 16.0 and 56.0 (2) 8.0 and 28.0 (3) 56.0 and 16.0 (4) 28.0 and 8.0

3. $2KI + I_2 + 22\,HNO_3 \longrightarrow 2HIO_3 + 2KIO_3 + 22NO_2 + 10H_2O$
If 3 mole of KI & 2 moles I_2 are reacted with excess of HNO_3. Volume of NO_2 gas evolved at NTP is
(1) 739.2 Lt (2) 1075.2 Lt (3) 44.8 Lt (4) 67.2 Lt

4. In the reaction $4A + 2B + 3C \longrightarrow A_4B_2C_3$ what will be the number of moles of product formed. Starting from 2 moles of A, 1.2 moles of B & 1.44 moles of C :
(1) 0.5 (2) 0.6 (3) 0.48 (4) 4.64

5. Which of the following equations is a balanced one :
(1) $5BiO_3^- + 22H^+ + Mn^{2+} \longrightarrow 5Bi^{3+} + 7H_2O + MnO_4^-$
(2) $5BiO_3^- + 14H^+ + 2Mn^{2+} \longrightarrow 5Bi^{3+} + 7H_2O + 2MnO_4^-$
(3) $2BiO_3^- + 4H^+ + Mn^{2+} \longrightarrow 2Bi^{3+} + 2H_2O + MnO_4^-$
(4) $6BiO_3^- + 12H^+ + 3Mn^{2+} \longrightarrow 6Bi^{3+} + 6H_2O + 3MnO_4^-$

6. During the disproportionation of Iodine to iodide and iodate ions, the ratio of iodate and iodide ions formed in alkaline medium is :
(1) 1 : 5 (2) 5 : 1 (3) 3 : 1 (4) 1 : 3

7. The strength of 10^{-2} M Na_2CO_3 solution in terms of molality will be (density of solution = 1.10 g mL^{-1}). (Molecular weight of Na_2CO_3 = 106 g mol^{-1})
(1) 9.00×10^{-3} (2) 1.5×10^{-2} (3) 5.1×10^{-3} (4) 11.2×10^{-3}

8. The temperature at which molarity of pure water is equal to its molality is :
(1) 273 K (2) 298 K (3) 277 K (4) None

9. 5.85 g of NaCl is dissolved in 1 L of pure water. The number of ions in 1 mL of this solution is
(1) 6.02×10^{19} (2) 1.2×10^{22} (3) 1.2×10^{20} (4) 6.02×10^{20}

10. The correct expression relating molality (m), molarity (M), density of solution (d) and molar mass (M_2) of solute is :
(1) $m = \frac{M}{d + MM_2} \times 1000$ (2) $m = \frac{M}{1000d - MM_2} \times 1000$
(3) $m = \frac{d + MM_2}{M} \times 1000$ (4) $m = \frac{1000d - MM_2}{M} \times 1000$

11. A compound is composed of 74% C, 8.7% H and 17.3% N by mass. If the molecular mass of the compound is 162, what is its molecular formula ?
(1) C_5H_7N (2) $C_{10}H_{16}N_2$ (3) $C_8H_{14}N_3$ (4) $C_{10}H_{14}N_2$

12. Calculate the volume of O_2 needed for combustion of 1 kg of carbon at STP. $C + O_2 \xrightarrow{\Delta} CO_2$.
(1) 1866.67 L O_2. (2) 3733.33 L O_2. (3) 933.33 L O_2. (4) 4666.67 L O_2.

13. Li metal is one of the few substances that reacts directly with molecular nitrogen. The balanced equation for reaction is :

$$6Li(s) + N_2(g) \longrightarrow 2Li_3N(s)$$

How many grams of the product, lithium nitride, can be prepared from 3.5g of lithium metal and 8.4 g of molecular nitrogen ?
(1) 21.00 g of Li_3N. (2) 2.91 g of Li_3N. (3) 5.83 g of Li_3N. (4) 10.50 g of Li_3N.

14. Potassium super oxide, KO_2, is used in rebreathing gas masks to generate O_2. If a reaction vessel contains 0.15 mol KO_2 and 0.10 mol H_2O, what is the limiting reactant ? How many moles of oxygen can be produced?

$$2KO_2 + 2H_2O \longrightarrow 2KOH + H_2O_2 + O_2$$

(1) H_2O limiting reagent, 0.05 mol of O_2. (2) KO_2 limiting reagent, 0.05 mol of O_2.
(3) H_2O limiting reagent, 0.075 mol of O_2. (4) KO_2 limiting reagent, 0.075 mol of O_2.

15. A 1 g sample of $KClO_3$ was heated under such conditions that a part of it decomposed according to the equation.
(i) $2KClO_3 \longrightarrow 2KCl + 3O_2$
and the remaining underwent change according to the equation
(ii) $4KClO_3 \longrightarrow 3KClO_4 + KCl$
If the amount of O_2 evolved was 146.8 mL at NTP, calculate the percentage by weight of $KClO_4$ in the residue.
(1) 29.3 %. (2) 49.8 %. (3) 62.5 %. (1) 87.1 %.

16. Equal weights of mercury and I_2 are allowed to react completely to form a mixture of mercurous and mercuric iodide leaving none of the reactants. Calculate the ratio of the weights of Hg_2I_2 and HgI_2 formed.
(1) 1 : 0.653 (2) 0.732 : 1 (3) 1 : 0.523 (4) 0.523 : 1

17. A piece of aluminium weighing 2.7 g is heated with 75.0 ml of H_2SO_4 (sp. gr. 1.2 containing 25% H_2SO_4 by mass). After the metal is carefully dissolved the solution is diluted to 400ml. What is the molarity of the free H_2SO_4 in the resulting solution.
(1) 1.056 M (2) 0.560 M (3) 0.312 M (4) 0.198 M

18. 100 ml of 0.15 M solution of $Al_2(SO_4)_3$, the density of the solution is 1.5 g/ml. Report the no. of Al^{3+} ions in this weight.
(1) 1.8×10^{25} ions (2) 6×10^{22} ions (3) 1.8×10^{23} ions (4) 1.8×10^{22} ions

19. 5 g sample of $CuSO_4.5H_2O$ was dissolved in water. $BaCl_2$ solution was mixed in excess to this solution. The precipitate ($BaSO_4$) obtained was washed and dried, it weighed 4.66 g. What is the % of SO_4^{2-} by weight in the sample.
(1) 76.8% (2) 38.4% (3) 51% (4) 19.2%

20. Calcium phosphide (Ca_3P_2) formed by reacting calcium orthophosphate ($Ca_3(PO_4)_2$) with magnesium was hydrolysed by water. The evolved phosphine (PH_3) was burnt in air to yield phosphorus pentoxide (P_2O_5). How many grams of magnesium metaphosphate would be obtained, if 19.2 g of magnesium were used for reducing calcium phosphate.

$$Ca_3(PO_4)_2 + Mg \longrightarrow Ca_3P_2 + MgO$$
$$Ca_3P_2 + H_2O \longrightarrow Ca(OH)_2 + PH_3$$
$$PH_3 + O_2 \longrightarrow P_2O_5 + H_2O$$
$$MgO + P_2O_5 \longrightarrow \underset{\text{magnesium metaphosphate}}{Mg(PO_3)_2}$$

(1) 145.8 gram (2) 32 gram (3) 50.4 gram (4) 18.2 gram

SECTION-2

This section contains **5** questions. Each question, when worked out will result in **Numerical Value**.

21. A 10.0 g sample of a mixture of calcium chloride and sodium chloride is treated with Na_2CO_3 solution. This calcium carbonate is heated to convert all the calcium to calcium oxide and the final mass of calcium oxide is 1.62 g. The percentage by mass of calcium chloride in the original mixture is :

22. Minimum amount of Ag_2CO_3(s) (in gram) required to produce sufficient oxygen for the complete combustion of C_2H_2 which produces 1.12 ltr of CO_2 at S.T.P after combustion is: [Ag = 108]

$$Ag_2CO_3\,(s) \longrightarrow 2Ag\,(s) + CO_2\,(g) + \frac{1}{2}O_2\,(g)$$
$$C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$$

23. How much $NaNO_3$ must be weighed (in gram) out to make 50 ml of an aqueous solution containing 70 mg of Na^+ per mL ?

24. What is the molarity of H_2SO_4 solution that has a density 1.84 g/cc at 35ºC and contains 98% by weight-

25. 64 g of a mixture of NaCl and KCl were treated with concentrated sulphuric acid. The total mass of metal sulphates obtained was found to be 76 g. What are the mass percents of NaCl in the mixture. The reactions are,
$2\,NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2\,HCl$; $2\,KCl + H_2SO_4 \longrightarrow K_2SO_4 + 2\,HCl$

Practice Test-1 (IIT-JEE (Main Pattern))

OBJECTIVE RESPONSE SHEET (ORS)

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

PART - II : JEE (MAIN) / AIEEE OFFLINE PROBLEMS (PREVIOUS YEARS)

1. In an organic compound of molar mass 108 g mol^{-1} C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular formula can be : **[AIEEE 2002, 3/225]**
(1) $C_6H_8N_2$ (2) $C_7H_{10}N$ (3) $C_5H_6N_3$ (4) $C_4H_{18}N_3$

2. When $KMnO_4$ acts as an oxidising 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 : **[AIEEE 2002, 3/225]**
(1) 4, 3, 1, 5 (2) 1, 5, 3, 7 (3) 1, 3, 4, 5 (4) 3, 5, 7, 1

3. Which of the following is a redox reaction? **[AIEEE 2002, 3/225]**
(1) $NaCl + KNO_3 \longrightarrow NaNO_3 + KCl$ (2) $CaC_2O_4 + 2\,HCl \longrightarrow CaCl_2 + H_2C_2O_4$
(3) $Mg(OH)_2 + 2\,NH_4Cl \longrightarrow MgCl_2 + 2NH_4OH$ (4) $Zn + 2AgCN \longrightarrow 2\,Ag + Zn(CN)_2$

4. Which of the following concentration factor is affected by change in temperature? **[AIEEE 2002, 3/225]**
(1) Molarity (2) Molality (3) Mole fraction (4) Weight fraction

5. What volume of hydrogen gas at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen- **[AIEEE 2003, 3/225]**
(1) 44.8 lit. (2) 22.4 lit. (3) 89.6 lit. (4) 67.2 lit.

6. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is **[AIEEE 2004, 3/225]**
(1) 0.001 M (2) 0.01 M (3) 0.02 M (4) 0.1 M

7. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is : **[AIEEE 2005, 1½/225]**
(1) + 3 (2) + 2 (3) + 1 (4) 0

8. Two solution of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5M first solution + 520 ml of 1.2M second solution. What is the molarity of the final mixture ? **[AIEEE 2005, 3/225]**
(1) 2.70M (2) 1.344M (3) 1.50M (4) 1.20M

9. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms? **[AIEEE-2006, 3/165]**
(1) 0.02 (2) 3.125×10^{-2} (3) 1.25×10^{-2} (4) 2.5×10^{-2}

10. Density of a 2.05M solution of acetic acid in water is 1.02 g/ml. The molality of the solution is : **[AIEEE-2006, 3/165]**
(1) 1.14 mol kg^{-1} (2) 3.28 mol kg^{-1} (3) 2.28 mol kg^{-1} (4) 0.44 mol kg^{-1}

11. In the reaction $2Al_{(s)} + 6HCl_{(aq)} \longrightarrow 2Al^{3+}{}_{(aq)} + 6Cl^-{}_{(aq)} + 3H_2(g)$ **[AIEEE-2007, 3/120]**
(1) 6L $HCl_{(aq)}$ is consumed for every 3L H_2 produced.
(2) 33.6 L $H_{2(g)}$ is produced regardless temperature and pressure for every moles that reacts.
(3) 67.2 L $H_{2(g)}$ at STP is produced for every mole of Al that reacts .
(4) 11.2 L $H_{2(g)}$ at STP is produced for every mole of $HCl_{(aq)}$ consumed.

12. The density (in 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 : **[AIEEE-2007, 3/120]**
(1) 1.22 (2) 1.45 (3) 1.64 (4) 1.88

13. A 5.2 molal aqueous solution of methyl alcohol, CH_3OH, is supplied. What is the mole fraction of methyl alcohol in the solution? **[AIEEE-2011, 3/120]**
(1) 0.100 (2) 0.190 (3) 0.086 (4) 0.050

14. The molality of a urea solution in which 0.0100 g of urea, $[(NH_2)_2CO]$ is added to 0.3000 dm^3 of water at STP is : **[AIEEE-2011, 3/120]**
(1) 5.55×10^{-4} (2) 33.3 m (3) 3.33×10^{-2} m (4) 0.555 m

15. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is : **[AIEEE-2012, 4/120]**
(1) 0.50 M (2) 1.78 M (3) 1.02 M (4) 2.05 M

16. The molarity of a solution obtained by mixing 750 mL of 0.5(M) HCl with 250 mL of 2(M)HCl will be : **[JEE(Main)-2013, 4/120]**
(1) 0.875 M (2) 1.00 M (3) 1.75 M (4) 0.975 M

17. Consider the following reaction :
$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$
The values of x, y and z in the reaction are, respectively : **[JEE(Main)-2013, 4/120]**
(1) 5, 2 and 16 (2) 2, 5 and 8 (3) 2, 5 and 16 (4) 5, 2 and 8

18. In which of the following reactions H_2O_2 acts as a reducing agent ? **[JEE(Main)-2014, 4/120]**
(a) $H_2O_2 + 2H^+ + 2e^- \longrightarrow 2H_2O$
(b) $H_2O_2 - 2e^- \longrightarrow O_2 + 2H^+$
(c) $H_2O_2 + 2e^- \longrightarrow 2OH^-$
(d) $H_2O_2 + 2OH^- - 2e^- \longrightarrow O_2 + 2H_2O$
(1) (a), (b) (2) (c), (d) (3) (a), (c) (4) (b), (d)

19. The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na$ (Mol. wt. 206). What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin ? **[JEE(Main)-2015, 4/120]**
(1) $\frac{1}{103}$ (2) $\frac{1}{206}$ (3) $\frac{2}{309}$ (4) $\frac{1}{412}$

20.^ At 300 K and 1 atm, 15 mL of a gaseous hydrocarbon requires 375 mL air containing 20% O_2 by volume for complete combustion. After combustion the gases occupy 330 mL. Assuming that the water formed is in liquid form and the volumes were measured at the same temperature and pressure, the formula of the hydrocarbon is : **[JEE(Main)-2016, 4/120]**
(1) C_3H_8 (2) C_4H_8 (3) C_4H_{10} (4) C_3H_6

21. 1 gram of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2. The molar mass of M_2CO_3 in g mol^{-1} is : **[JEE(Main)-2017, 4/120]**
(1) 84.3 (2) 118.6 (3) 11.86 (4) 1186

22. The most abundant elements by mass in the body of a healthy human adult are : Oxygen (61.4%); Carbon (22.9%), Hydrogen (10.0%) ; and Nitrogen (2.6%). The weight which a 75 kg person would gain if all ^1H atoms are replaced by ^2H atoms is : **[JEE(Main)-2017, 4/120]**
(1) 37.5 kg (2) 7.5 kg (3) 10 kg (4) 15 kg

23. Which of the following reactions is an example of a redox reaction ? **[JEE(Main)-2017, 4/120]**
(1) $XeF_2 + PF_5 \longrightarrow [XeF]^+ PF_6^-$ (2) $XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$
(3) $XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$ (4) $XeF_4 + O_2F_2 \longrightarrow XeF_6 + O_2$

PART - III : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

1. The vapour density of carbon dioxide is **[NSEC-2000]**
(A) 44 (B) 32 (C) 22 (D) 12

2. The volume of 16 g of oxygen at S.T.P. is : **[NSEC-2000]**
(A) 2.24 dm^3 (B) 11.2 dm^3 (C) 22.4 dm^3 (D) 8 dm^3

3. Molality of a solution is the number of : **[NSEC-2000]**
(A) moles of the solute per 1000g of the solvent.
(B) gram equivalent of the solute per kilogram of the solvent
(C) gram moles of the solute per 1000 cm^3 of solution.
(D) moles of the solute per 100g of the solvent

4. Consider the following data **[NSEC-2000]**

Element	Atomic weight
A	12.01
B	35.5

A and B combine to form new substance X. If 4 moles of B combines with 1 mole of A to give 1 mole of X, then the weight of one mole of X is
(A) 154.0 g (B) 74.0 g (C) 47.5 g (D) 166.0 g

5. In the following reaction, $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ **[NSEC-2000]**
(A) sulphur is oxidised and reduced (B) sulphur is oxidised and hydrogen is reduced
(C) sulphur is reduced and there is no oxidation (D) hydrogen is oxidised and sulphur is reduced

6. The amount of salt required to prepare 10 dm^3 of decimolar solution is : **[NSEC-2001]**
(A) 0.05 mole (B) 0.02 mole (C) 0.01 mole (D) 1.00 mole

7. If 1 dm^3 of a gas weights 2.5 g at STP, its gram-molecular weight is : **[NSEC-2001]**
(A) 56 g (B) 11.2 g (C) 22.4 g (D) 224 g

8. If two compounds have the same empirical formula but differnet molecular formula, they must have : **[NSEC-2001]**
(A) same viscosity (B) different molecular weight
(C) different percentage composition (D) same vapour density

9. How many moles of air are there in the lungs of an average adult with a lung capacity of 3.8 L . (Assume that the person is at 1.0 atm pressure and has normal body temperature at 37ºC). **[NSEC-2002]**
(A) 0.15 mol (B) 0.25 mol (C) 1.15 mol (D) 2.25 mol.

10. The sterile saline solution used to rinse contact lenses can be made by dissolving 400 mg of NaCI in sterile water and diluting to 100 mL. The molarity of the solution will be of **[NSEC-2002]**
(A) 0.00684 M (B) 0.09564 M (C) 1.0684 M (D) 0.0684 M

11. A molal solution contains one gram mole of solute in : **[NSEC-2002]**
(A) one litre of solution (B) 1000 g of the solvent
(C) one litre of the solvent (D) 22.4 litre of the solution

12. An average cup of coffee contains about 125 mg of caffeine, $C_8H_{10}N_4O_2$. How many moles of caffeine are in a cup ? **[NSEC-2002]**
(A) 8.33×10^{-3} (B) 6.44×10^{-4} (C) 6.234×10^{-23} (D) none of these

13. Cystine has a sulphur content of 26.7%. If its molecule contains two atoms of sulphur, what is its molecular weight ? **[NSEC-2002]**
(A) 240 (B) 24 (C) 2400 (D) 120.

14. 1 gram mole of CO_2 contains : **[NSEC-2002]**
(A) 3 gram atoms of CO_2 (B) 6.022×10^{23} atoms of carbon
(C) 6.022×10^{23} atoms of oxygen (D) 3.011×10^{23} molecules of CO_2.

15. Which of the following solutions are unimolar solutions ? **[NSEC-2002]**
(A) 0.46 g of C_2H_5OH in 10 mL of solution (B) 110.98 g of $CaCl_2$ in 1000 mL of solution
(C) 0.23 g of CH_3OH in 100 mL of solution (D) 5.88 g of NaCI in 1000 mL of solution.

16. 1.00 g of a pure element contains 4.39×10^{21} atoms. The element is **[NSEC-2003]**
(A) U (B) Ce (C) Ba (D) Au.

17. The maximum amount of CH_3Cl that can be prepared by reacting 20.0 g of CH_4 with 10.0 g of Cl_2 is
(A) 30.0 g (B) 7.1 g (C) 63.1 g (D) 31.6 g

18. A mixture of aluminium and zinc weighing 1.67 g was completely dissolved in acid and evolved 1.69 L of hydrogen gas (measured at 273 K and 1 atm pressure). The amount of aluminium in the original mixture is approximately **[NSEC-2004]**
(A) 1.8 g (B) 2.0 g (C) 1.2 g (D) 2.2 g

19. The largest number of molecules is present in 1 g of **[NSEC-2004]**
(A) CO_2 (B) H_2O (C) C_2H_5OH (D) N_2O_5.

20. 20 g of solute X are dissolved in 50 g of water. 15 g of solute Y are dissolved in 70 g of benzene. The molalities of the solutes in these two solutions are the same. Hence, the ratio of the molecular weights of solute X to that of the solute Y is **[NSEC-2004]**
(A) 7:5 (B) 4:3 (C) 15:28 (D) 28:15

21. An ammonia bottle in the laboratory is labelled density 0.91 g cm^{-3} 25% w/w. The molarity of this solution is **[NSEC-2004]**
(A) 11.5 M (B) 15 M (C) 13.4 M (D) 17 M.

22. If 0.5 mol of $BaCl_2$ is mixed with 0.2 mol of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is **[NSEC-2004]**
(A) 0.1 (B) 0.2 (C) 0.5 (D) 0.7

23. The total number of electrons present in 8.0 g of methane is **[NSEC-2004]**
(A) 4.8×10^{24} (B) 3.01×10^{24} (C) 4.8×10^{25} (D) 3.01×10^{23}.

24. The percentage abundances of ^{12}C and ^{13}C are 98.9 and 1.1 respectively. The average mass of carbon (in a.m.u) is **[NSEC-2005]**
(A) 12.111 (B) 12.981 (C) 12.011 (D) 12.891

25. The strength of 10^{-2} molar Na_2CO_3 solution in terms of molality will be (density of the solution = 1.10 g mL^{-1}) **[NSEC-2005]**
(A) 9.00×10^{-3} (B) 1.5×10^{-2} (C) 5.1×10^{-3} (D) 11.2×10^{-3}.

26. 1000 mL of a gas weighs 1.5 g at NTP. Its gram molecular weight is **[NSEC-2005]**
(A) 22.4 g (B) 33.6 g (C) 11.2 g (D) 15 g.

27. 0.1 g of an element contains 4.39×10^{20} atoms. The element is **[NSEC-2005]**
(A) Ga (B) Ce (C) Pb (D) Ba.

28. The percentages of C, H and N in an organic compound are 40%, 13.3% and 46.7%. The empirical formula of this compound is **[NSEC-2006]**
(A) CH_2N (B) CH_4N (C) CH_5N (D) $C_3H_9N_3$.

29. The ideal mass (in kg) of aluminium metal produced after processing of 1 metric ton of Al_2O_3 ore is **[NSEC-2006]**
(A) 1000 (B) 530 (C) 795 (D) 265

30. An element has three isotopes with masses 24, 25 and 26 with relative abundance of 80%, 15% and 5% respectively. The average mass of the isotope mixture would be **[NSEC-2006]**
(A) 25.25 (B) 25.50 (C) 24.50 (D) 24.25

31. A qualitative analysis of papavering, an opium alkaloid showed carbon, hydrogen and nitrogen. A quantitative Analysis gave 70.8% carbon, 6.2% hydrogen and 4.1% nitrogen. The empirical formula of papavering is: **[NSEC-2007]**
(A) $C_{20}H_{20}N_2$ (B) $C_{20}H_{21}O_4N$ (C) $C_{10}H_{11}O_3N$ (D) $C_{21}H_{20}N$

32. Ethyl propanoate has a pineapple like odour and is used as a flavoring agent in fruit syrups. It is prepared as follows:

$$C_2H_5OH_{(aq)} + C_2H_5COOH_{(aq)} \longrightarrow C_2H_5COOC_2H_{5(aq)} + H_2O(\ell)$$

In an experiment, 349 grams of ethyl propanoate was obtained from 250 grams of ethanol, with propanoic acid in excess:
(M.W.of ethyl proanoate: 102, M.W.of ethanol : 46)
The percentage yield of the above reaction is : **[NSEC-2007]**
(A) 48.2 (B) 62.9 (C) 54.6 (D) 32.7

33. Which of the following molecules contains the maximum % of sulfur by mass ? **[NSEC-2007]**
(A) Na_2SO_4 (B) H_2SO_4 (C) Li_2SO_4 (D) $PbSO_4$

34. 17.1 grams of aluminum sulfate $Al_2(SO_4)_3$ is dissolved in enough water to prepare 1.00 L of solution. What is the molarity of the sulfate ion the solution? (Neglect any hydrolysis) **[NSEC-2007]**
(A) 1.67×10^{-2} M (B) 5.00×10^{-2} M (C) 1.50×10^{-1} M (D) 2.50×10^{-1} M

35. Chlorine can be prepared by reacting HCl with MnO_2. The reaction is represented by the equation:

$$MnO_2(s) + 4HCL_{(aq)} \longrightarrow Cl_2(g) + MnCl_{2(aq)} + 2H_2O(l)$$

Assuming the reaction goes to completion, what mass of concentrated HCl solution (36.0% HCl by mass) is needed to produce 2.50 g of Cl_2 **[NSEC-2007]**
(A) 5.15 g (B) 14.3 g (C) 19.4 g (D) 26.4 g

36. How many moles of Na^+ ions are there in 20mL of 0.40M solution of Na_3PO_4 ? **[NSEC-2007]**
(A) 0.008 (B) 0.020 (C) 0.024 (D) 0.008

37. What is the Na^+ ion concentration in the solution formed by mixing 20 mL of 0.10 M Na_2SO_4 solution with 50 mL of 0.30M Na_3PO_4 solution ? **[NSEC-2008]**
(A) 0.15 M (B) 0.24 M (C) 0.48 (D) 0.70

38. A currency counting machine counts 60 million notes per day. A bank has an many notes as number of oxygen atoms in 24.8 g of $Na_2S_2O_3.5H_2O$ (M.W. = 248). **[NSEC-2008]**
How many days would be required to count these notes ?
(A) 9.33×10^{17} (B) 7.03×10^{10} (C) 8.03×10^{15} (D) 6.66×10^{-12}

39. Which of the following equations represented an oxidation-reduction reaction ? **[NSEC-2008]**
(A) $H_2SO_4 + 2NH_3 \longrightarrow (NH_4)_2SO_4$
(B) $H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + H_2O + CO_2$
(C) $2K_2CrO_4 + H_2SO_4 \longrightarrow K_2Cr_2O_7 + K_2SO_4 + H_2O$
(D) $2H_2SO_4 + Cu \longrightarrow CuSO_4 + 2H_2O + SO_2$

40. Methyl-t-butyl ether, $C_5H_{12}O$, is added to gasoline to promote cleaner burning.How many moles of oxygen gas, O_2 are required to burn 1.0 mol of this compound completely to form carbon dioxide and water ? **[NSEC-2008]**
(A) 4.5 mol (B) 6.0 mol (C) 7.5 mol (D) 8.0 mol

41. The hydrated salt $Na_2SO_4.nH_2O$ loses all water of crystallization on heating and is reduced to 44.1% of its original weight. Therefore, the value n is : **[NSEC-2008]**
(A) 5 (B) 10 (C) 6 (D) 7

42. The simplest formula of a compound containing 50% of element 'A' (Atomic weight = 10) and 50% of element 'B' (Atomic weight = 20) is **[NSEC-2008]**
(A) AB (B) A_2B (C) A_2B_2 (D) A_2B_3

43. The simplest formula of a compound containing 50% of element 'A' (Atomic weight = 10) and 50% of element 'B' (Atomic weight = 20) is **[NSEC-2008]**
(A) AB (B) A_2B (C) A_2B_2 (D) A_2B_3

44. 3.7 dm^3 of 1 M NaOH solution is mixed with 5 dm^3 of 0.3 M NaOH solution. The molarity of the resulting solution is : **[NSEC-2009]**
(A) 0.80 M (B) 0.10 M (C) 0.73 M (D) 0.59 M

45. Heating of a solution does not change : **[NSEC-2009]**
(A) the normality of the solution (B) the molarity of the solution
(C) the molality of the solution (D) the density of the solution

46. 0.14 g of a substance when burnt in oxygen yields 0.28 g of oxide. The substance is – **[NSEC-2009]**
(A) nitrogen (B) carbon (C) sulphur (D) phosphorous

47.^ The number of molecules of hydration present in 252 mg of hydrated oxalic acid ($H_2C_2O_4.2H_2O$) is – **[NSEC-2009]**
(A) 2.68×10^{18} (B) 2.52×10^{21} (C) 1.83×10^{24} (D) 2.4×10^{21}

48. The oxidation-reduction reaction among the following is – **[NSEC-2009]**
(A) $H_2SO_4 + 2NH_3 \longrightarrow (NH_4)_2SO_4$
(B) $H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + H_2O + CO_2$
(C) $2K_2CrO_4 + H_2SO_4 \longrightarrow K_2Cr_2O_7 + K_2SO_4 + H_2O$
(D) $2H_2SO_4 + Cu \longrightarrow CuSO_4 + 2H_2O + SO_2$

49. Silver metal reacts with nitric acid according to the equation.
$3Ag\ (s) + 4HNO_3\ (aq) \longrightarrow 3AgNO_3\ (aq) + NO\ (g) + 2H_2O\ (l)$
The volume of 1.15 M HNO_3 (aq) required to react with 0.784 g of silver is : **[NSEC-2009]**
(A) 4.74 mL (B) 6.32 mL (C) 8.43 mL (D) 25.3 mL

50. The conversion which represents oxidation is : **[NSEC-2010]**
(A) $NO_2^- \rightarrow N_2$ (B) $VO_2^+ \rightarrow VO_3^-$ (C) $ClO^- \rightarrow Cl^-$ (D) $CrO_4^{2-} \rightarrow Cr_2O_7^{2-}$

51. A Compound Containing beryllium has the following composition, Be = 6.1%, N = 37.8% Cl=48%, H = 8.1 %. One mole of the compound has mass of 148 g and average atomic mass of beryllium is 9. The molecular formula of the compound is : **[NSEC-2010]**
(A) $BeN_4H_{12}Cl_2$ (B) $BeN_2H_{10}Cl$ (C) $BeN_4H_2Cl_3$ (D) $Be_2N_4H_{10}Cl_2$

52. The molarity of 20% w/w sulphuric acid of density 1.14 g cm^{-3} is **[NSEC-2010]**
(A) 2.32 (B) 2.02 (C) 2.12 (D) 2.22

53. An inorganic bromide impurity in a sample is precipitated as silver bromide. 2.00 g of the sample required 6.4 mL of 0.20 M $AgNO_3$ to completely precipitate the impurity. The mass percentage of the impurity is **[NSEC-2010]**
(A) 5.11 (B) 2.56 (C) 9.15 (D) 1.28

54. Maximum number of moles of barium phosphate formed when 0.9 mole of barium chloride is mixed with 0.4 mole of sodium phosphate is **[NSEC-2010]**
(A) 0.2 (B) 0.4 (C) 0.9 (D) 1.3

55. The largest number of molecules are present in **[NSEC-2010]**
(A) 70 g of Sulphur dioxide (B) 64 g of Nitrogen pentoxide
(C) 36 g of Water (D) 34 g of Carbon dioxide

56. The number of water molecules present in 0.20 g sample of $CuSO_4.5H_2O$ (Molar mass = 249.7) is **[NSEC-2011]**
(A) 1.2×10^{21} (B) 2.14×10^{21} (C) 2.14×10^{22} (D) 1.2×10^{23}

57. An element X is found to combine with oxygen to form X_4O_6. If 8.40 g of this element combine with 6.50 g of oxygen, the atomic weight of the element in u is **[NSEC-2011]**
(A) 24.0 (B) 31.0 (C) 50.4 (D) 118.7

58. Excess of silver nitrate is added to a water sample to determine the amount of chloride ion present in the sample. 1.4 g of silver chloride is precipitated. The mass of chloride ion present in the sample is :
Molar masses (g-mol^{-1}) : $AgNO_3$ 169.91, AgCl 143.25 **[NSEC-2011]**
(A) 0.25 g (B) 0.35 g (C) 0.50 g (D) 0.75 g

59. The maximum amount of CH_3Cl that can be prepared from 20g of CH_4 and 10g of Cl_2 by the following reaction, is :
$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$, (presume that no other reaction is taking place) **[NSEC-2012]**
(A) 3.625 mole (B) 0.141 mole (C) 1.41 mole (D) 0.365 mole

60. In the reaction, $2KClO_3 \rightarrow 2KCl + 3O_2$ when 36.75 g of $KClO_3$ is heated, the volume of oxygen evolved at N.T.P. will be : **[NSEC-2012]**
(A) 9.74 dm^3 (B) 8.92 dm^3 (C) 10.08 dm^3 (D) 22.4 dm^3

61. The mode of expression in which the concentration remains independent of temperature is: **[NSEC-2012]**
(A) Molarity (B) Normality (C) Formality (D) Molality

62. In a nitration experiment, 10.0 g of benzene gas and 13.2 g of nitrobenzene. The percentage yield is : **[NSEC-2012]**
(A) 83.5% (B) 62.7% (C) 88.9% (D) 26.7%

63. Approximate numbers of moles of hydrogen atoms in 1.006×10^{23} molecules of diethyl ether are : **[NSEC-2014]**
(A) 0.16 (B) 6 (C) 1.67 (D) 3

64. Aluminum carbide (Al_4C_3) liberates methane on treatment with water. The grams of aluminum carbide required to produce 11.2 L of methane under STP conditions is : [Given : Al = 27] **[NSEC-2014]**
(A) 48 (B) 72 (C) 144 (D) 24

65. The specific gravity of a HNO_3 solution is 1.42 and it is 70% w/w. The molar concentration of HNO_3 is : **[NSEC-2014]**
(A) 15.8 (B) 31.6 (C) 11.1 (D) 14.2

66. The ratio of the masses of methane and ethane In a gas mixture is 4 : 5. The ratio of number of their molecules in the mixture is: **[NSEC-2015]**
(A) 4 : 5 (B) 3 : 2 (C) 2 : 3 (D) 5 : 4

67. At constant T and P, 5.0 L of SO_2 are reacted with 3.0 L of O_2 according to the following equation
$2SO_2\ (g) + O_2\ (g) \rightarrow 2SO_3\ (g)$
The volume of the reaction mixture at the completion of the reaction is **[NSEC-2017]**
(A) 0.5 L (B) 8.0 L (C) 5.5 L (D) 5 L

68. Lithium oxide (Li_2O; molar mass = 30 g mol^{-1}) is used in space shuttles to remove water vapour according to the following reaction
$Li_2O_{(s)} + H_2O(g) \rightarrow 2LiOH_{(s)}$
If 60 kg of water and 45 kg of Li_2O are present in a shuttle
I. water will be removed completely
II. Li_2O will be the limiting reagent
III. 100 kg of Li_2O will be required to completely remove the water present
IV. 27 kg of water will remain in the shuttle at the end of the reaction **[NSEC-2017]**
(A) II only (B) II and IV (C) III and IV (D) II and III

69. Which of the following mixtures of water and H_2SO_4 would have mass percentage of H_2SO_4 close to 30? **[NSEC-2017]**
(A) 30 g H_2SO_4 + 100 g H_2O (B) 1 mol of H_2SO_4 + 2 mol of H_2O
(C) 1 mol of H_2SO_4 + 200g of H_2O (D) 0.30 mol H_2SO_4 + 0.70 mol H_2O

70. A fuel/ oxidant system consisting of N,N-dimethylhydrazine $(CH_3)_2NNH_2$ and N_2O_4 (both liquids) is used in space vehicle propulsion. The liquid components are mixed stichiometrically so that N_2, CO_2 and H_2O are the only products. If all gases are under the same reaction conditions, number of moles of gases produced from 1 mole of $(CH_3)_2NNH_2$ is **[NSEC-2017]**
(A) 3 (B) 6 (C) 9 (D) 4.5

71. Number of moles of $KClO_3$ that have to be heated to produce 1.0 L of O_2 (g) at STP can be expressed as **[NSEC-2018]**
(A) 1/3 (1/22.4) (B) ½(1/22.4) (C) 2/3 (1/22.4) (D) 3/2 (22.4)

72. Among the following, number of oxygen atoms present in the maximum in **[NSEC-2018]**
(A) 1.0 g of O_2 molecules (B) 4.0 g of O atoms
(C) 1.0 g of O_3 (D) 1.7 g of H_2O

73. Among the following, the reaction/s that can be classified as oxidation-reduction is/are. **[NSEC-2018]**
I. $Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightarrow 2CrO_4^{2-} + H_2O(l)$
II. $SiCl_4(l) + 2Mg(s) \rightarrow 2MgCl_2(l) + Si(s)$
III. $6Cl_2(l) + 12KOH(l) \rightarrow 2KClO_3(g) + 10\ KCl + 6H_2O(l)$
IV. $2H_2O_2 \rightarrow 2H_2O(l) + O_2(g)$
(A) I and IV (B) I, II and III (C) II, III and IV (D) IV only

74. In the following reaction, the values of a, b and c, respectively are **[NSEC-2018]**
a F_2(g) + b OH^-(aq) $\longrightarrow$ c F^-(aq) + d OF_2(g) + e H_2O(l)
(A) 3, 2, 4 (B) 3, 4, 2 (C) 2, 2, 4 (D) 2, 2, 2

75. In $YBa_2Cu_3O_{7-x}$, a superconducting oxide that got George Bednorz and Karl Muller the Noble prize in 1986, Cu can exist in both +2 and +3 oxidation states and their proportion depends on the value of 'x'. In $YBa_2Cu_3O_{7-0.5}$ **[NSEC-2018]**
(A) 0.5 moles of Cu are in +3 oxidation state (B) 5% of Cu is in +3 oxidation sate
(C) All the Cu is in +3 oxidation state (D) All Cu is in +2 oxidation state

76. A common method to clean spills is to use to Na_2CO_3(Molar mass 106 g.) If 50.0 mL of 0.75 M HCl is split on a wooden surface, the amount of Na_2CO_3 required is **[NSEC-2018]**
(A) 3.75 g (B) 7.5 g (C) 2.0 g (D) 4.0 g

77. Penicillamine is used in the treatment of arthritis. One molecule of penicillamine contains a single sulphur atom and the weight percentage of sulphur in penicillamine is 21.49%. Molecular weight of penicillamine in g mol^{-1} is **[NSEC-2018]**
(A) 85.40 (B) 68.76 (C) 125.2 (D) 149.2

78. The analysis of three different binary oxides of bromine (Br) and oxygen (O) gives the following results :

Compound	Mass of O combined with 1.0 g of Br
X	0.101 g
Y	0.303 g
Z	0.503 g

Which of the following statements is not correct ? **[NSEC-2018]**
I Compound Y is Br_2O_3
II Compound Z is Br_2O_5
III Compound Z is Br_2O_7
IV Compound Y is Br_2O_5
(A) I and III (B) II and IV (C) III and IV (D) I and II

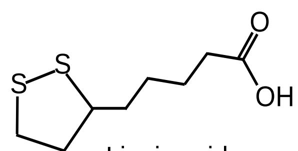
79. Which of the following statements is/are correct ? **[NSEC-2018]**
I. Number of significant figure in 2345.100 is three
II. 0.00787 rounded to two significant figures is written as 0.787×10^{-2}
III. 340 rounded to two significant figures is written as 0.34×10^3
IV. The number of significant figures in 0.020 is two
(A) II and III (B) III and IV (C) I, II and IV (D) III only

80. Myoglobin, (Mb), an oxygen storage protein, contains 0.34% Fe by mass and in each molecule of myoglobin one ion of Fe is present. Molar mass of Mb (g mol^{-1}) is (Molar mass of Fe = 5.845 g mol^{-1}) **[NSEC-2019]**
(A) 16407 (B) 164206 (C) 16425 (D) 164250

81. A balance having a precision of 0.0001 g was used to measure a mass of a sample of about 15 g. The number of significant figures to be reported in this measurement is **[NSEC-2019]**
(A) 2 (B) 3 (C) 5 (D) 1

82. Mercury is highly hazardous and hence its concentration is expressed in the units of ppb (micrograms of Hg present in 1 L of water). Permissible level of Hg in drinking water is 0.0335 ppb. Which of the following is an alternate representation of this concentration? **[NSEC-2019]**
(A) 3.35×10^{-2} mg dm^{-3} (B) 3.35×10^{-5} mg dm^{-3}
(C) 3.35×10^{-5} mg m^{-3} (D) 3.35×10^{-4} g L^{-1}

83. Lipoic acid with the following structure is a growth factor required by many organisms. Percentages of 'S' and 'O' in lipoic acid respectively are (atomic masses of 'S' and 'O' are 32.065 g mol^{-1} and 15.999 g mol^{-1} respectively) **[NSEC-2019]**



Lipoic acid

(A) 33.03, 16.48 (B) 31.11, 18.24 (C) 31.11, 15.52 (D) 31.42, 15.68

PART - IV : ADDITIONAL PROBLEMS

SUBJECTIVE QUESTIONS

1. Carbon disulphide, CS_2, can be made from by-product SO_2. The overall reaction is

$$5C + 2SO_2 \longrightarrow CS_2 + 4CO$$

How much CS_2 can be produced from 440 kg of waste SO_2 with 60 kg of coke if the SO_2 conversion is 80%?

ONLY ONE OPTION CORRECT TYPE

2. In a certain operation 358 g of $TiCl_4$ is reacted with 96 g of Mg. Calculate % yield of Ti if 32 g of Ti is actually obtained [At. wt. Ti = 48, Mg = 24]

(A) 35.38 % (B) 66.6 % (C) 100 % (D) 60 %

3. Phosphoric acid (H_3PO_4) prepared in a two step process.

(1) $P_4 + 5O_2 \longrightarrow P_4O_{10}$

(2) $P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$.

We allow 62 g of phosphorus to react with excess oxygen which form P_4O_{10} in 85% yield. In the step (2) reaction 90% yield of H_3PO_4 is obtained. Produced mass of H_3PO_4 is :

(A) 37.48 g (B) 149.94 g (C) 125.47 g (D) 564.48 g

4. For the redox reaction, $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$

the correct coefficients of the reactions 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

5. A mineral water sample was analysed and found to contain 1×10^{-3} % ammonia (w/w). The mole of dissolved ammonia gas in one litre water bottle is ($d_{water} \approx 1$ g/ml)

(A) 5.8×10^{-4} mol (B) 1×10^{-2} mol (C) 0.58×10^{-2} mol (D) same as w/w

6. (i) $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

(ii) $AlCl_3 + 3NaOH \rightarrow Al(OH)_3 + 3NaCl$

(iii) $Al(OH)_3 + NaOH \rightarrow NaAlO_2 + 2H_2O$

Above series of reactions are carried out starting with 18 g of Al and 109.5 g of HCl in first step and further 100 g of NaOH is added for step (ii) and (iii). Find out limiting reagent in each step and calculate the maximum amount of $NaAlO_2$ that can be produced in step (iii). (Assume reactions are taken in sequence and also that each reaction goes to 100% completion)

	L.R. in step (I)	L.R. in step (II)	L.R. in step (III)	Moles of $NaAlO_2$
(A)	Al	$AlCl_3$	$Al(OH)_3$	0.66
(B)	Al	Na(OH)	$Al(OH)_3$	0.5
(C)	Al	$AlCl_3$	NaOH	0.5
(D)	HCl	$AlCl_3$	NaOH	0.5

MATCH THE COLUMN

7.

	Column – I		Column - II
(A)	Molarity	(p)	Dependent on temperature
(B)	Molality	(q)	$\frac{M_A \times n_A}{n_A M_A + n_B M_B} \times 100$
(C)	Mole fraction	(r)	Independent of temperature
(D)	Mass %	(s)	$\frac{X_A}{X_B M_B} \times 1000$

Where M_A, M_B are molar masses, n_A, n_B are no of moles & X_A, X_B are mole fractions of solute and solvent respectively.

NUMERICAL VALUE QUESTIONS

8. The measured density at NTP of He is 0.1784 g/L. What is the weight (in g) of one mole of He ?

9. The 'roasting' of 100.0 g of a copper ore yielded 71.8 g pure copper. If the ore is composed of Cu_2S and CuS with 4.5 % inert impurity, calculate the percent of Cu_2S in the ore.
The reactions are :
$Cu_2S + O_2 \longrightarrow 2Cu + SO_2$ and $CuS + O_2 \longrightarrow Cu + SO_2$

10. A piece of Al weighing 27 g is reacted with 200 ml of H_2SO_4 (specific gravity = 1.8 and 54.5 % by weight) After the metal is completely dissolved 73 g HCl is added and solution is further diluted to 500 ml solution then find the concentration of H^+ ion in mol/litre.

11. 1 g of dry green algae absrobs 4.7×10^{-3} mole of CO_2 per hour by photosynthesis. If the fixed carbon atoms were all stored after photosynthesis as starch $(C_6H_{10}O_5)_n$. Aproximately how long (in hour) would it take for the algae to double their own weight assuming phtosynthesis takes place at a constant rate?

12. CN^- ion is oxidised by a powerful oxidising agent to NO_3^- and CO_2 or CO_3^{2-} depending on the acidity of the reaction mixture.
$CN^- \longrightarrow CO_2 + NO_3^- + H^+ + ne^-$
What is the number (n) of electrons per mole of CN^- involved in the process ?

13. To 100 ml of 5 M NaOH solution (density 1.2 g/ml) were added 200 ml of another NaOH solution which has a density of 1.5 g/ml and contains 20 mass percent of NaOH. What will be the volume of the gas (at STP) in litres liberated when aluminium reacts with this (final) solution.
The reaction is
$Al + NaOH + H_2O \longrightarrow NaAlO_2 + H_2$

14. A drop (0.05 mL) of 12 M HCl is spread over a thin sheet of aluminium foild (thickness 1 mm and density of Al = 2.7 g/mL). Assuming whole of the HCl is used to dissolve. At what will be the maximum area of hole produced in foil (in cm^2). [Report your answer after multiplying by 100].

ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

15. In the reaction $I_2 + C_2H_5OH + OH^- \longrightarrow CHI_3 + HCOO^- + H_2O + I^-$ which of the following statements is/are correct ?
(A) The coefficients of OH^- and I^- in the given in balanced equation are, respectively, 6 and 5.
(B) The coefficients of OH^- and I^- in the given balanced equation are , respectively, 5 and 6.
(C) C_2H_5OH is oxidised to CHI_3 and $HCOO^-$.
(D) The number of electrons in the conversion of C_2H_5OH to CHI_3 and $HCOO^-$ is 8.

16. 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 presumed to have dissociated : $N_2O_4 \rightleftharpoons 2NO_2$, 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 ?
(A) 0.5 : 0.1 : 0.4 (B) 0.6 : 0.1 : 0.3 (C) 0.5 : 0.2 : 0.3 (D) 0.6 : 0.2 : 0.2

17. Silver metal in ore is dissolved by potassium cyanide solution in the presence of air by the reaction
$4\,Ag + 8\,KCN + O_2 + 2H_2O \longrightarrow 4\,K[Ag(CN)_2] + 4\,KOH$
(A) The amount of KCN required to dissolve 100 g of pure Ag is 120 g.
(B) The amount of oxygen used in this process is 0.742 g (for 100 g pure Ag)
(C) The amount of oxygen used in this process is 7.40 g (for 100 g pure Ag)
(D) The volume of oxygen used at STP is 5.20 litres.

18. Crude calcium carbide, CaC_2, is made in an electric furnace by the following reaction,
$CaO + 3C \longrightarrow CaC_2 + CO$
The product contain 85% CaC_2 and 15% unreacted CaO.
(A) 1051.47 kg of CaO is to be added to the furnace charge for each 1000 kg of CaC_2.
(B) 893.8 kg of CaO is to be added to the furnace charge for each 1000 kg of crude product.
(C) 708.2 kg of CaO is to be added to the furnace charge for each 1000 kg of CaC_2.
(D) 910.3 kg of CaO is to be added to the furnace charge for each 1000 kg of crude product.

19. Which of the following statement is/are correct ?
Excess of $H_2S(g)$ is bubbled into 1.0 L of 0.1 M $CuCl_2$ solution.
$Cu^{2+} + H_2S(g) \longrightarrow CuS(s) + 2H^+$
(A) 9.55 g of CuS is produced.
(B) The concentration of H^+ ions is 0.2 M
(C) The concentration of H^+ ions is 0.1 M.
(D) 95.5 g CuS is produced.

PART - V : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr. **Max. Marks : 66**

Important Instructions

A. General :

1. The test is of 1 hour duration.
2. The Test Booklet consists of 22 questions. The maximum marks are 66.

B. Question Paper Format

3. Each part consists of five sections.
4. Section 1 contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
5. Section 2 contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.
6. Section 3 contains 6 questions. The answer to each of the questions is a numerical value, ranging from 0 to 9 (both inclusive).
7. Section 4 contains 1 paragraphs each describing theory, experiment and data etc. 3 questions relate to paragraph. Each question pertaining to a partcular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
8. Section 5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

C. Marking Scheme

9. For each question in Section 1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (–1) mark will be awarded.
10. For each question in Section 2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be answered for incorrect answer in this section.
11. For each question in Section 3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

This section contains 7 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

1. Calculate the number of Cl^- and Ca^{2+} ions in 222 g anhydrous $CaCl_2$
(A) $2N_A$ ions of Ca^{+2}, $2N_A$ ions of Cl^- (B) $2N_A$ ions of Ca^{+2}, $4N_A$ ions of Cl^-
(C) $2N_A$ ions of Ca^{+2}, $8N_A$ ions of Cl^- (D) $4N_A$ ions of Ca^{+2}, $4N_A$ ions of Cl^-

2. Equal masses of oxygen, hydrogen and methane are taken in a container in identical condition. Find the ratio of the volumes of the gases.
(A) $O_2 : H_2 : CH_4$ 1 : 16 : 2 (B) $O_2 : H_2 : CH_4$ 1 : 8 : 1
(C) $O_2 : H_2 : CH_4$ 16 : 1 : 8 (D) $O_2 : H_2 : CH_4$ 8 : 1 : 8

3. The elements A and B form a compound that contains 60% A and 40% B by mass. The atomic mass of B is twice that of A. Find the empirical formula of the compound.
(A) A_3B_2 (B) A_3B (C) A_2B_3 (D) AB_3

4. Equal weight of Zn metal and iodine are mixed together and the iodine is completely converted to ZnI_2. What fraction of weight of the original Zinc remains unreacted. (Atomic wt. Zn = 65)
(A) 0.500 (B) 0.744 (C) 0.488 (D) 0.256

5. One litre of a mixture of CO and CO_2 is passed through red hot charcoal in tube. The new volume becomes 1.4 litre. Find out % composition of mixture by volume. All measurements are made at same P and T.
(A) CO_2 40%, CO 60% (B) CO_2 60%, CO 40% (C) CO_2 25%, CO 75% (D) CO_2 30%, CO 70%

6. The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000 g of solvent.
(A) 1000 g (B) 1098.6 g (C) 980.4 g (D) 1019.6g

7. Generally commercial hydrochloric acid is prepared by heating NaCl with concentrated H_2SO_4. How much H_2SO_4 solution containing 93.0% H_2SO_4 by mass is required for the production of 1000 kg of concentrated hydrochloric acid containing 43% HCl by weight.
(A) 590.0 kg solution of H_2SO_4. (B) 310.3 kg solution of H_2SO_4.
(C) 620.7 kg solution of H_2SO_4. (D) 708.2 kg solution of H_2SO_4 .

Section-2 : (One or More than one options correct Type)
This section contains 5 multipole choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

8. If H_2SO_4 is formed from it's elements by taking 6.023×10^{23} atom of 'O' 5.6 litre of H_2 gas at STP and 8 g S then
(A) 0.125 moles of H_2SO_4 are formed (B) 0.25 moles of H_2SO_4 are formed
(C) no moles of 'S' are left (D) 1/4 mole of O_2 is left

9. 1120 mL of ozonised oxygen at S.T.P. weigh 1.76 g. Report the composition of the ozonised oxygen.
(A) It contain 400 mL O_2 (B) It contain 224 mL O_3
(C) It contain 400 mL O_3 (D) It contain 896 mL O_2

10. A 5L vessel contains 2.8 g of N_2 . When heated to 1800 K , 30% molecules are dissociated into atoms.
(A) Total no. of moles in the container will be 0.13
(B) Total no. of molecules in the container will be close to 0.421×10^{23}.
(C) Total no. of moles in the container will be 0.098.
(D) All of these are correct.

11. Equal masses of SO_2 and O_2 are placed in a flask at STP choose the correct statement.
(A) The number of molecules of O_2 are more than SO_2
(B) Volume occupied at STP is more for O_2 than SO_2
(C) The ratio of number of atoms of SO_2 and O_2 is 3 : 4.
(D) Moles of SO_2 is greater than the moles of O_2 .

12. For the reaction $2P + Q \rightarrow R$, 12 mol of P and 8 mol of Q are taken then
(A) 3 mol of R is produced (B) 6 mol of R is produced
(C) 25% of Q is left behind (D) 25% of Q has reacted

Section-3 : (Numerical Value Questions)
This section contains 6 questions. Each question, when worked out will result in a numerical value from 0 to 9 (both inclusive)

13. XeF_6 fluorinates I_2 to IF_7 and liberates Xenon(g). 3.5 mmol of XeF_6 can yield a maximum of_____ mmol of IF_7.

14. Balance the following equation and choose the quantity which is the sum of the coefficients of all species:

$$\text{.................}\ CS_2 + \text{.................}\ Cl_2 \longrightarrow CCl_4 + \text{.................}\ S_2Cl_2$$

15. Average atomic mass of magnesium is 24.31 a.m.u. This magnesium is composed of 79 mole % of ^{24}Mg and remaining 21 mole % of ^{25}Mg and ^{26}Mg. Calculate mole % of ^{26}Mg. Report your answer after multiplying by 0.1.

16. 200 g impure $CaCO_3$ on heating gives 5.6 lt. CO_2 gas at STP. Find the percentage of calcium in the lime stone sample.

17. Molarity of H_2SO_4 is 18 M. Its density is 1.8 g/cm^3, hence molality is (If your answer is 'x' then, Report your answer x/500).

18. 1 g of a mixture of equal number of moles of Li_2CO_3 and M_2CO_3 required 44.44 ml of 0.5 M HCl for completion of the reactions.

$Li_2CO_3 + 2HCl \longrightarrow 2LiCl + H_2O + CO_2$

$M_2CO_3 + 2HCl \longrightarrow 2\ MCl + H_2O + CO_2$

If the atomic mass of Li is 7, then find the Atomic mass of M. Report M – 16.

SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 3 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D)

Comprehension #

Cis-platin is used as an anticancer agent for the treatment of solid tumors, and its prepared as follows :

$K_2[PtCl_4] + 2NH_3 \longrightarrow [Pt(NH_3)_2Cl_2] + 2KCl$

Potassium tetra chloro platinate (II) — Cis-platin

Given 83.0 g of $K_2[PtCl_4]$ is reacted with 83.0 g of NH_3.

[Atomic weights : K = 39, Pt = 195, Cl = 35.5, N = 14]

19. Which reactant is the limiting reagent and which is in excess ?

Limiting	**Excess**
(A) $K_2[PtCl_4]$	NH_3
(B) NH_3	$K_2[PtCl_4]$
(C) None	None
(D) Both	Both

20. The number of mol of $K_2[PtCl_4]$ and NH_3 used, respectively, are

(A) 0.1, 0.2 (B) 0.2, 0.4 (C) 0.3, 0.6 (D) 0.03, 0.06

21. The number of mol of excess reactant is

(A) 4.68 (B) 4.78 (C) 4.58 (D) 4.48

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct

22. Match the reactions given in List I with the number of electrons lost or gained in List II

	Column – I		**Column – II**
	Reaction		**Number of electrons lost or gained**
(P)	$Mn(OH)_2 + H_2O_2 \longrightarrow MnO_2 + 2H_2O$	(1)	8
(Q)	$AlCl_3 + 3K \longrightarrow Al + 3KCl$	(2)	2
(R)	$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$	(3)	3
(S)	$3H_2S + 2HNO_3 \longrightarrow 3S + 2NO + 4H_2O$	(4)	6

Code :

	P	Q	R	S		P	Q	R	S
(A)	2	3	1	4	(B)	3	2	1	4
(C)	2	1	3	4	(D)	1	4	3	2

Practice Test-2 (IIT-JEE (ADVANCED Pattern))

OBJECTIVE RESPONSE SHEET (ORS)

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.										
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.										
Que.	**21**	**22**								
Ans.										

APSP Answers

PART - I

1.	(2)	**2.**	(3)	**3.**	(1)	**4.**	(3)	**5.**	(2)
6.	(1)	**7.**	(1)	**8.**	(3)	**9.**	(3)	**10.**	(2)
11.	(4)	**12.**	(1)	**13.**	(3)	**14.**	(1)	**15.**	(2)
16.	(4)	**17.**	(4)	**18.**	(4)	**19.**	(2)	**20.**	(4)
21.	32.10	**22.**	34.50	**23.**	12.934	**24.**	18.40	**25.**	42.89

PART - II

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(1)	**5.**	(4)
6.	(2)	**7.**	(1)	**8.**	(2)	**9.**	(2)	**10.**	(3)
11.	(4)	**12.**	(1)	**13.**	(3)	**14.**	(1)	**15.**	(4)
16.	(1)	**17.**	(3)	**18.**	(4)	**19.**	(4)	**20. (Bonus)**	
21.	(1)	**22.**	(2)	**23.**	(4)				

PART - III

1.	(C)	**2.**	(B)	**3.**	(A)	**4.**	(A)	**5.**	(A)
6.	(D)	**7.**	(A)	**8.**	(B)	**9.**	(A)	**10.**	(D)
11.	(B)	**12.**	(B)	**13.**	(A)	**14.**	(B)	**15.**	(B)
16.	(C)	**17.**	(B)	**18.**	(C)	**19.**	(B)	**20.**	(D)
21.	(C)	**22.**	(A)	**23.**	(B)	**24.**	(C)	**25.**	(A)
26.	(B)	**27.**	(D)	**28.**	(B)	**29.**	(B)	**30.**	(D)
31.	(B)	**32.**	(B)	**33.**	(B)	**34.**	(C)	**35.**	(B)
36.	(C)	**37.**	(D)	**38.**	(C)	**39.**	(D)	**40.**	(C)
41.	(B)	**42.**	(B)	**43.**	(B)	**44.**	(D)	**45.**	(C)
46.	(C)	**47.^**	(D)	**48.**	(D)	**49.**	(C)	**50.**	(B)
51.	(A)	**52.**	(A)	**53.**	(A)	**54.**	(A)	**55.**	(C)
56.	(B)	**57.**	(B)	**58.**	(B)	**59.**	(B)	**60.**	(C)
61.	(D)	**62.**	(A)	**63.**	(C)	**64.**	(D)	**65.**	(A)
66.	(B)	**67.**	(C)	**68.**	(D)	**69.**	(C)	**70.**	(C)
71.	(C)	**72.**	(B)	**73.**	(C)	**74.**	(D)	**75.**	(D)
76.	(C)	**77.**	(D)	**78.**	(C)	**79.**	(B)	**80.**	(C)
81.	(C)	**82.**	(B)	**83.**	(C)				

PART – IV

1.	76 kg of CS_2	**2.**	(A)	**3.**	(B)	**4.**	(A)	**5.**	(A)
6.	(C)	**7.**	(A - p); (B - r,s); (C - r); (D - r,q)			**8.**	4	**9.**	62%
10.	6	**11.**	8	**12.**	10	**13.**	67	**14.**	2
15.	(ACD)	**16.**	(A)	**17.**	(ACD)	**18.**	(AB)	**19.**	(AB)

PART – V

1.	(B)	**2.**	(A)	**3.**	(B)	**4.**	(B)	**5.**	(A)
6.	(D)	**7.**	(C)	**8.**	(BC)	**9.**	(BD)	**10.**	(AB)
11.	(ABC)	**12.**	(BC)	**13.**	3	**14.**	6	**15.**	1
16.	5	**17.**	1	**18.**	7	**19.**	(A)	**20.**	(B)
21.	(D)	**22.**	(A)						

APSP Solutions

PART – I

1. Mole of $NO_2 = \frac{112}{22400} = 5 \times 10^{-3}$

Mass of $NO_2 = 5 \times 10^{-3} \times 46 = 0.23$ g

Volume of $NO_2 = \frac{\text{Mass}}{\text{Density}} = \frac{0.23}{1.15} = 0.2$ ml

Number of molecule $= 5 \times 10^{-3} \times 6.023 \times 10^{23} = 3.1 \times 10^{21}$.

2. $\frac{32}{2x+3y} = 0.2$

$\frac{92.8}{3x+4y} = 0.4$

Hence x = 56 & y = 16.

3. KI is limiting reagent

$\therefore$ 3 mole of KI will give 33 mole of NO_2 according to stoichiometry.

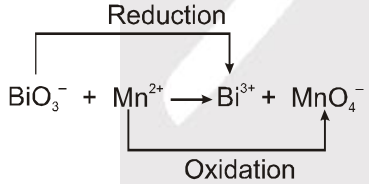
4.

	4A	+ 2B	+ 3C	$\longrightarrow A_4B_2C_3$
Initial mole	2	1.2	1.44	0
final mole			0	0.48

C is limiting reagent.

$\therefore$ moles of $A_4B_2C_3$ is 0.48.

5.



(i) $2e + 6H^+ + BiO_3^- \longrightarrow Bi^{3+} + 3H_2O$

(ii) $4H_2O + Mn^{2+} \longrightarrow MnO_4^- + 8H^+ + 5e$

(i) × 5 + (ii) × 2, we get $14 H^+ + 5 BiO_3^- + 5Mn^{2+} \longrightarrow 5Bi^{3+} + 2MnO_4^- + 7 H_2O$

Hence, (2) is the correct balanced reaction.

6. $3I_2 + OH^- \longrightarrow IO_3^- + 5I^-$ (balance reaction) So, ratio is 1 : 5.

7. Explanation : $m = \frac{M \times 1000}{(1000 \times d - M \times MWt.)}$ where 'm' is molality, M is molarity.

$= \frac{10^{-2} \times 1000}{(1000 \times 1.1 - 10^{-2} \times 106)}$

$= \frac{10}{1100 - 1.6} = \frac{10}{1099.4} = 9.00 \times 10^{-3}$ [Take 1099.4 = 1100]

8. At 4ºC i.e. 277 K density of water = 1 g/ml
$\therefore$ 1 kg water $\Rightarrow$ 1000 ml water = 1 lit.
$\therefore$ Molality & molarity remains same.

9. Mole of NaCl = $\frac{5.85}{58.5}$ = 0.1
Molarity = $\frac{0.1}{1}$ = 0.1 M
Moles in 1 ml of solution = MV = $0.1 \times 10^{-3} = 10^{-4}$ mole.
Number of ions in 1 ml = $2 \times 10^{-4} \times 6.023 \times 10^{23} = 1.204 \times 10^{20}$.

10. Molarity = M
Let volume of be 1 ltr.
$\therefore$ mass of solvent = 1000 d – M × M_2
Molality = m = $\frac{M}{1000d - MM_2} \times 1000$

11.

Element	Percent	r.a.m.	No. of atoms	atomic ratio
C	74	12	74/12 = 6.16	6.16/1.23 = 5
H	8.7	1	8.7/1 = 8.7	8.7/1.123 = 7
N	17.3	14	17.3/14 = 1.23	1.23/1.23 = 1

The ratio of atoms = C : H : N = 5 : 7 : 1
Empirical formula = C_5H_7N
Empirical formula mass = 5 C + 7H + N = 5 × 12 + 7 × 1 + 14 = 81
Molecular mass = 162 (given)
No. of empirical units per molecule = n = $\frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{162}{81}$ = 2
Molecular formula = (Empirical formula) × 2 = (C_5H_7N) × 2 = $C_{10}H_{14}N_2$

12. $C + O_2 \xrightarrow{\Delta} CO_2$
12g C = 1 mol O_2 = 22.4 L O_2
$\therefore$ 1000 g C = $\frac{22.4}{12} \times 1000$ or 1866.67 L O_2.

13.

	$6Li$	+	N_2	$\longrightarrow$	$2Li_3N$
Initial mole	$\frac{3.5}{7} = \frac{1}{2}$		$\frac{8.4}{28} = 0.3$		0
final mole	0		$0.3 - \frac{1}{12}$		$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

mass of Li_3N = $\frac{1}{6} \times 35$ = 5.83 g.

14.

	$2KO_2$	+	$2H_2O$	$\longrightarrow$	$2KOH$	+	H_2O_2	+	O_2
Initial mole	0.15		0.1		0		0		0
final mole	(0.15 – 0.1)		0		0.1		0.05		0.05

$\therefore$ moles of O_2 = 0.05

15. $KClO_3 \rightarrow KCl + O_2$
Applying POAC for O atoms in the eqn.(i),
moles of O in $KClO_3$ = moles of O in O_2
3 × moles of $KClO_3$ = 2 × moles of O_2
$3 \times \frac{\text{wt. of } KClO_3}{\text{mol. wt. of } KClO_3} = 2 \times \frac{\text{volume at NTP (mL)}}{22400}$
Wt . of $KClO_3$ = $\frac{2 \times 146.8 \times 122.5}{3 \times 22400}$ = 0.5358 g.
In the second reaction :

The amount of $KClO_3$ left = 1 – 0.5358 = 0.4642 g.

We have, $KClO_3 \rightarrow KClO_4 + KCl$

0.4642 g.

Applying POAC for O atoms,

moles of O in $KClO_3$ = moles of $KClO_4$

3 × moles of $KClO_3$ = 4 × moles of $KClO_4$

$$3 \times \frac{\text{wt. of } KClO_3}{\text{mol. wt. of } KClO_3} = 4 \times \frac{\text{wt. of } KClO_4}{\text{mol. wt. of } KClO_4}$$

Wt. of $KClO_4$ = $\frac{3 \times 0.4642 \times 138.5}{122.5 \times 4}$ = 0.3937 g. ......(ii)

Wt. of residue = 1 – wt. of Oxygen

$= 1 - \frac{146.8}{24400} \times 32$ g = 0.7902 g.

∴ % of $KClO_4$ in the residue = $\frac{0.3937}{0.7902} \times 100$ = 49.8 %.

16. Let mass of Hg is w g

	$2Hg$	+ I_2 $\longrightarrow$	Hg_2I_2
Initial mole	2a	a	
fianl mole	0	0	a

	Hg	+ I_2 $\longrightarrow$	Hg_2I_2
Initial mole	b	b	
fianl mole	0	0	b

∴ mole of Hg = 2a + b = $\frac{w}{200.6}$ .... (1)

∴ mole of I_2 = a + b = $\frac{w}{254}$ .... (2)

eqution (1) – (2)

$$a = \frac{w}{200.6} - \frac{w}{254}$$

$$\therefore \quad b = \frac{w}{254} - \left(\frac{w}{200.6} - \frac{w}{254}\right) = \frac{w}{127} - \frac{w}{200.6}$$

$$\therefore \quad \frac{\text{Mass of } Hg_2I_2}{\text{Mass of } HgI_2} = \frac{a \times 655.2}{b \times 454.6} = \frac{\left(\frac{w}{200.6} - \frac{w}{254}\right)655.2}{\left(\frac{w}{127} - \frac{w}{200.6}\right)454.6} = \frac{0.523}{1}.$$

17. Molarity of H_2SO_4 = $\frac{\text{sp. gravity} \times \% w/w \times 10}{\text{Molecular mass}}$

$= \frac{1.2 \times 25 \times 10}{98} = \frac{12 \times 25}{98}$ = 3.06 M

$3H_2SO_4 + 2Al \longrightarrow Al_2(SO_4)_3 + 3H_2$

$\frac{2.7}{27}$ =0.1

Mole of H_2SO_4 used = $\frac{3}{2} \times 0.1 = 0.15$

Initial mole of H_2SO_4 = 0.75 × 3.06 = 0.2295

Mole of H_2SO_4 remaining = 0.2295 – 0.15

Molarity of final H_2SO_4 = $\frac{0.0795}{0.4}$ = 0.198 M.

18. Moles of $Al_2(SO_4)_3$ = M × V = 0.15 × 0.1 = 0.015

Mass of $Al_2(SO_4)_3$ = Mole × Molar mass = 0.015 × 342 = 5.13 g.

Moles of Al^{3+} = 2 × moles of $Al_2(SO_4)_3$ = 2 × 0.015 = 0.03.

No. of Al^{3+} ions = 0.03 × 6.023 × 10^{23} = 1.81 × 10^{22} ions.

19. $CuSO_4.5H_2O(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + CaCl_2\ (aq)$
4.66 g

Mass of $BaSO_4$ = 4.66 g

Mole of $BaSO_4 = \frac{4.66}{233} = \frac{2}{100}$ $\therefore$ Mole of $SO_4^{2-} = \frac{2}{100}$

Mass of $SO_4^{2-} = \frac{2}{100}$ (ionic mass of SO_4^{2-}) = 1.92 g

% $SO_4^{2-} = \frac{1.92}{5} \times 100 = 38.4\%$.

20. Balance chemical equations are :

$Ca_3(PO_4)_2 + 8Mg \longrightarrow Ca_3P_2 + 8MgO$

$Ca_3P_2 + 6H_2O \longrightarrow 3Ca(OH)_2 + 2PH_3$

$2PH_3 + 4O_2 \longrightarrow P_2O_5 + 3H_2O$

$MgO + P_2O_5 \longrightarrow Mg(PO_3)_2$

moles of magnesium used = 0.8 moles
moles of MgO formed = 0.8 moles
moles of Ca_3P_2 formed 0.1 moles
moles of PH_3 formed = 0.2 moles
moles of P_2O_5 formed = 0.1 mole (limiting reagent)
moles of $Mg(PO_3)_2$ = 0.1 moles
mass of $Mg(PO_3)_2$ = 18.2 gram **Ans. 18 gram**

21. $CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + 2\ NaCl$

$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

Mole of $CaCl_2$ = mole of $CaCO_3$ = mole of CaO = $\left(\frac{1.62}{56}\right)$

Mass of $CaCl_2 = \left(\frac{1.62}{56}\right)$ Molar mass of $CaCl_2$

$= \left(\frac{1.62}{56}\right) \times 111$ g.

% of $CaCl_2 = \frac{3.21}{10} \times 100 = 32.10$ %.

22. $Ag_2CO_3\ (s) \longrightarrow 2Ag\ (s) + CO_2\ (g) + \frac{1}{2}O_2\ (g)$

$C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2 + H_2O$

By Stoichiometry of reaction

Moles of CO_2 formed $= \frac{1.12}{22.4} = \frac{1}{20}$

Moles of O_2 required $= \frac{5}{4} \times \frac{1}{20} = \frac{5}{80}$

Moles of Ag_2CO_3 required $= 2 \times \frac{5}{80} = \frac{5}{40}$

Mass of Ag_2CO_3 required $= \frac{5}{40} \times 276 = 34.50$ g

23. Explanation : M. wt. of $NaNO_3$ = 85
70 mg of Na^+ are present in 1 mL
50 ml of solution contains 50 × 70 = 3500 mg = 3.5 g Na^+ ion
23 g of Na^+ are present in 85 g of $NaNO_3$

3.5 g of Na^+ are present in $\frac{85}{23} \times 3.5 = 12.934$ g of $NaNO_3$

24. Molarity = $\frac{(\%w/w) \times density \times 10}{Molar\ mass\ of\ solute} = \frac{98 \times 1.84 \times 10}{98}$ = 18.4 M

25. Consider that mass of NaCl = xg

$\therefore$ Moles of NaCl will be = $\frac{x}{58.5}$ and moles of KCl will be = $\frac{64-x}{74.5}$

By using POAC for Na and K

$\because$ Moles of NaCl × 1 = Moles of Na_2SO_4 × 2

or Moles of Na_2SO_4 = Moles of NaCl × $\frac{1}{2}$

$\because$ Moles of KCl × 1 = Moles of K_2SO_4 × 2

or Moles of K_2SO_4 = Moles of KCl × $\frac{1}{2}$

Total weight of Na_2SO_4 and K_2SO_4 is 76 g

Hence $\frac{1}{2} \times \frac{x}{58.5} \times 142 + \frac{1}{2} \times \frac{64-x}{74.5} \times 174 = 76$

$\Rightarrow$ 1.2137 × 74.74 – 1.1678 x = 76

$\Rightarrow$ 0.0459 x = 1.26

$\Rightarrow$ x = 27.45 g

% mass of NaCl = $\frac{27.45}{64} \times 100$ = 42.89%

% mass of KCl = 100 – 42.89 = 57.11%.

PART - II

1. Molar mass = 108 g/mole

Element	Wt. Ratio	Wt. ratio/Atomic mass	Simple Ratio	Simple Integer ratio
C	9 x	$\frac{9x}{12} = \frac{3x}{4}$	3	3
H	1 x	x	4	4
N	3.5 x	$\frac{3.5x}{14} = \frac{x}{4}$	1	1

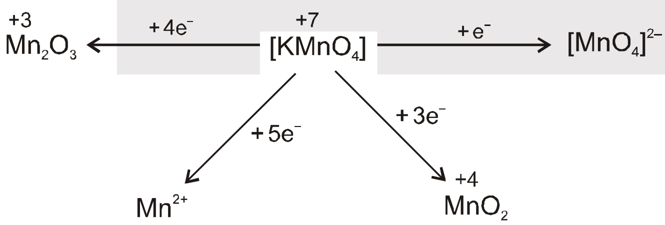
$\therefore$ C_3H_4N

Empirical mass = 12 × 3 + 4 + 14 = 54

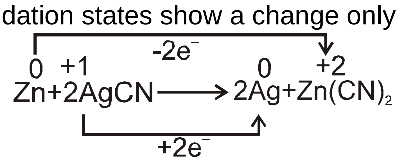
n = $\frac{108}{54}$ = 2

$\therefore$ Molecular Formula = $C_6H_8N_2$

2.



3. The oxidation states show a change only in reaction



4. Molarity depends on volume (volume changes with changes in temperature).

5. $2BCl_3 + 3H_2 \longrightarrow 2B + 6HCl$

moles of B = $\frac{21.6}{10.8}$ = 2

So moles of H_2 = 3

Now vol at STP = 3 × 22.4 = 67.2 lt.

6. Molarity = $\frac{\text{Moles of solute}}{V_{lt}} = \frac{6.02\times 1^{20}/6.02\times 10^{23}}{100/1000}$ = 0.01 M

7. Let the oxidation state of Cr is x.

x + 4(0) + 2 (–1) = + 1

x – 2 = + 1 or, x = + 1 + 2 = + 3.

8. Final molarity = $\frac{M_1V_1+M_2V_2}{V_1+V_2} = \frac{1.5\times 480+1.2\times 520}{480+520}$ = 1.344M

9. 1 mole of $Mg_3(PO_4)_2$

⇒ 3 mole of Mg atom + 2 mole of P atom + 8 mole of O atom. 8 mole of oxygen atoms are present in = 1 mole of $Mg_3(PO_4)_2$, 0.25 mole of oxygen atoms are present in $\frac{1\times 0.25}{8}$ = 3.125×10^{-2} moles of $Mg_3(PO_4)_2$.

10. molality (m) = $\frac{M}{1000d-MM_1} \times 1000 = \frac{2.05}{(1000\times 1.02)-(2.05\times 60)} \times 1000$ = 2.28 mol kg^{-1}

M = Molarity, M_1 = Molecular mass of solute, d = density

11. $2Al(s) + 6HCl(aq) \longrightarrow 2Al^{3+}(aq) + 6Cl^-(aq) + 3H_2(g)$

3 mole H_2 from 6 mole HCl consumed.

∴ 1 mole H_2 from 2 mole HCl consumed.

1/2 mole(11.2 Lit) H_2 from 1 mole HCl consumed.

12. 3.6 M solution means 3.6 mole of H_2SO_4 is present in 1000 ml of solution

∴ Mass of 3.6 moles of H_2SO_4 is = 3.6 × 98 g = 352.8 g

∴ Mass of H_2SO_4 in 1000 ml of solution = 352.8 g

Given, 29g of H_2SO_4 is present in 100 g of solution

∴ 352.8 g of H_2SO_4 is present in $\frac{100}{29}$ × 352.8 = 1216 g of solution

Now density = $\frac{\text{Mass}}{\text{Volume}} = \frac{1216}{1000}$ = 1.216 g/mL = 1.22 g/mL

13. $X_{\text{ethyl alcohol}} = \frac{5.2}{5.2+\frac{1000}{18}}$ = 0.086

14. Molality = $\frac{0.01/60}{0.3} = \frac{0.01}{60\times 0.3}$; d = 1 g/ml = 5.55×10^{-4} m.

15. Molarity = $\frac{\text{mols of solute}}{\text{volume of sol. }(\ell)} = \frac{120\times 1.15}{60\times 1120}$ = 2.05 M

16. $M_f = \frac{M_1V_1+M_2V_2}{V_1+V_2} = \frac{0.5\times\frac{3}{4}+2\times\frac{1}{4}}{1}$ = 0.875 M

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

vf = 1(7 – 2) = 5   vf = 2(3–2) = 2

Balanced Equation :

$2MnO_4^- + 5C_2O_4^{2-} + 16\,H^+ \longrightarrow 2Mn^{2+} + 10\,CO_2 + 8H_2O$

So, x = 2, y = 5 & z = 16.

18. H_2O_2 acts as reducing agent when it releases electrons. i.e. (b) & (d)

19. 1 g of $C_8H_7SO_3Na = \frac{1}{206}$ mole

$2C_8H_7SO_3Na + Ca^{2+} \longrightarrow (C_8H_7SO_3)_2Ca + 2Na^+$

$\frac{1}{206}$ mole $\frac{1}{412}$ mole

20. $C_xH_y\,(g) + \left(x+\frac{y}{4}\right) O_2\,(g) \rightarrow xCO_2\,(g) + \frac{y}{2} H_2O\,(\ell)$

15ml

Volume of O_2 used $= \frac{20}{100} \times 375 = 75$ ml.

Volume of air remaining = 300 ml

Total volume of gas left after combustion = 330 ml

Volume of CO_2 gases after combustion = 330 – 300 = 30 ml.

$C_xH_y\,(g) + \left(x+\frac{y}{4}\right) O_2\,(g) \rightarrow xCO_2\,(g) + \frac{y}{2} H_2O\,(\ell)$

15 ml   75 ml   30 ml

$\frac{x}{1} = \frac{30}{15} \quad \Rightarrow \quad x = 2$

$\frac{x+\frac{y}{4}}{1} = \frac{75}{15} \quad \Rightarrow \quad x + \frac{y}{4} = 5$

$\Rightarrow \quad y = 12$

$\Rightarrow \quad C_2H_{12}$

Confirmed :

Such compound is impossible and also not in option. So it should be bonus.

However if we seriously wish to give an answer then by looking at options, we can see that only C_3H_8 is able to consume 75 ml O_2. So (1) can also be given as answer.

21. $M_2CO_3 + 2HCl \longrightarrow MCl_2 + H_2O + CO_2$

$\frac{1}{M_0}$ Mol   0.01186 mol.

M_0 = Molar mass of M_2CO_3

$$\frac{1}{M_0} = 0.0118$$

$$M_0 = 84.3\ g/mol$$

22. 75 kg person contain 10% hydrogen i.e. 7.5 kg Hydrogen.

If all H atom are replaced by ^2H, the weight of Hydrogen become twice i.e. it increases by 7.5 kg.

23. 1, 2, 3 are non redox

In 4, O_2F_2 is oxidising agent & XeF_4 is reducing agent.

PART - IV

1. SO_2 that converted $= 440 \times \frac{80}{100}$ Kg = 352 kg

	$5C$	+	$2SO_2$	$\longrightarrow$	CS_2	+	$4CO$
Initial mole	5×10^3		$\frac{352}{64} \times 10^3$ $= 5.5 \times 10^3$		0		0
final mole	0		$5.5 \times 10^3 - \frac{2}{5} \times 5 \times 10^3$		1×10^3		4×10^3

mole of CS_2 = 1000
mass = 1000 × 76 g = 76 Kg

2.

	$TiCl_4$	+	$2Mg$	$\longrightarrow$	Ti	+	$2MgCl_2$
Initial mole	$\frac{358}{190} = 1.88$		$\frac{96}{24} = 4$				
final mole	0		$4 - 2 \times 1.88$		1.88		2×1.88

wt of Ti obtained $= \frac{358}{190} \times 48$

% yield $= \dfrac{32 \times 100}{\frac{358 \times 48}{190}} = 35.38$ %

3. Produced mass of $H_3PO_4 = \left(\frac{62}{4 \times 31}\right) \times 0.85 \times 0.9 \times 4 \times 98 = 149.94$ g

4. The balanced equation is
$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

5. 10^{-3} g NH_3 in 100 g solution
one litre water has mass = 1000 × 1 g
As NH_3 is very less hence we can say
100 g water has 10^{-3} g NH_3
$\therefore$ 1000 g water has $= \frac{10^{-3}}{100} \times 1000$ g $= 10^{-2}$ g $NH_3 = \frac{10^{-2}}{17}$ mole $NH_3 = 5.88 \times 10^{-4}$ mole NH_3.

6. Mole of Al $= \frac{18}{27} = \frac{2}{3}$

Mole of HCl $= \frac{109.5}{36.5} = 3$

Moles of NaOH $= \frac{100}{40} = 2.5$

	$2\,Al + 6\,HCl \longrightarrow 2\,AlCl_3 + 3H_2$			
Initial mole	2/3	3	0	0
final mole	0	1	2/3	

	$AlCl_3 + 3NaOH \longrightarrow Al(OH)_3 + 3NaCl$			
Initial mole	2/3	2.5	0	0
final mole	0	2.5 – 2/3 × 3 = 0.5	2/3	

	$Al(OH)_3 + NaOH \longrightarrow NaAlO_2 + 2H_2O$			
Initial mole	2/3	0.5	0	0
final mole		0	0.5	

Ans. $NaAlO_2$ = 0.5 moles.

8. Density of He = 0.1784 g/lit.
1 mole of He will occupy 22.4 lit. at NTP
$\therefore$ Mass of 1 mole = V × d = 22.4 × 0.1784 = 3.99 = 4 g.

9. Mass of Cu_2S & CuS = 100 – 4.5 = 95.5 g
Let mass of Cu_2S is x g.
$Cu_2S + O_2 \longrightarrow 2Cu + SO_2$
$CuS + O_2 \longrightarrow Cu + SO_2$
Mass of Cu from Cu_2S + Mass of Cu from CuS = 71.8
$\frac{x}{159} \times 63.3 \times 2 + \frac{(95.5 - x)}{95.5} 63.5 = 71.8$
$x\left(\frac{127}{159} - \frac{63.5}{95.5}\right) = 8.3$
$x = \frac{8.3}{0.134} = 62.01$ g.
$\therefore$ % of Cu_2S is 62.

10. Molarity of $H_2SO_4 = \frac{1.8 \times 54.5 \times 10}{98} = 10$
$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$
1 moles 2 moles
(limiting)
Moles of H_2SO_4 left = 2 – 1.5 = 0.5 moles
moles of HCl added = 2 moles
final volume of the solution = 500 ml
moles of H^+ ion = 3
concentration of H^+ ion = 6 M

11. 1 × moles of CO_2 = 6n × moles of starch
$= 6n \times \frac{1}{162\,n}$
So moles of $CO_2 = \frac{6}{162}$
Now 4.7×10^{-3} moles of CO_2 are absorbed in 1 hr
So $\frac{6}{162}$ moles of CO_2 are absorbed in $= \frac{1}{4.7 \times 10^{-3}} \times \frac{6}{162} = 8$ hrs.

12. Balanced the equation.
$15H_2O + 3CN^- \longrightarrow 3CO_2 + 3NO_3^- + 30H^+ + 30e^-$

13. Mole of NaOH in 1st solution = 0.5 moles
moles of NaOH addded $= \frac{200 \times 1.5 \times 0.2}{40} = 1.5$
moles of NaOH in the final solution = 1.5 + 0.5 = 2 moles
$Al + NaOH + H_2O \longrightarrow NaAlO_2 + 3/2\ H_2$
moles of H_2 produced from 2 moles of NaOH = 3 moles
volume of H_2 produced at STP = 3 × 22.4 = 67.2 litre **Ans. 67**

14. m moles of HCl = 12 × 0.05 = 0.6
Now $Al + 3HCl \rightarrow AlCl_3 + \frac{3}{2}H_2$
so m moles of Al $= \frac{1}{3} \times 0.6$
or weight of Al $= \frac{1}{3} \times \frac{0.6 \times 27}{1000} = 0.0054$ gram
$\therefore$ Volume of foil $= \frac{0.0054}{2.7}$ mL or $cm^3 = 0.002\ cm^3$

Now , Area × thickness = Volume

∴ Area = $\frac{0.002}{0.01}$ = 0.2 cm^2 (thickness = 0.01 cm)

= 0.2 × 10 = **2 Ans.**

Note : The maximum area of hole is possible when 0.01 cm foil of Al is completely attacked.

16. Let mol of N_2 = x, mol of NO_2 = y, mol of N_2O_4 = z

therefore $\frac{28x+46y+92z}{1}$ = 55.4 ....(1)

If $N_2O_4 \longrightarrow 2NO_2$

$\frac{28x+(y+2z)46}{x+y+z+z}$ = 39.6

⇒ $\frac{28x+46y+92z}{1+z}$ = 39.6 ....(2)

By deviding equation (1) by equation (2)

1 + z = $\frac{55.4}{39.6}$ = 1.4

z = 0.4 mol

Given x + y + z = 1 ....(3)

Put the value of z in eq. (1)

28x + 46y + 92 + 0.4 = 55.4

28x + 46y = 18.6 ....(4)

By equation (3) & (4)

y = 0.1

∴ x = 0.5 ,y = 0.1 ,z = 0.4

17. (A) , (C) and (D) Explanation :

$4\ Ag + 8\ KCN + O_2 + 2\ H_2O \longrightarrow 4\ K[Ag(CN)_2] + 4\ KOH$

⇒ 4 × 108 g of Ag reacts with 8 × 65 g of KCN

100 g of Ag reacts with

$\frac{8 \times 65}{4 \times 108}$ × 100 = 120

Hence ,, to dissolve 100 g of Ag , the amount of KCN required = 120 g

Hence , statement (A) is correct.

⇒ 4 × 108 g of Ag require 32 g of O_2

1 g of Ag require $\frac{32}{4 \times 108}$ = 0.0740 g

⇒ 100 g of Ag require = 7.4 g

Hence, choice (C) is correct.

Hence, volume of O_2 required = $\frac{7.4}{32}$ × 22.4 = 5.20 litre

Hence, (A) , (C) , (D) are correct while (B) is incorrect.

18. $CaO(s) + 3C(s) \longrightarrow CaC_2(s) + CO(g)$

(A) Final product contain 85% CaC_2 & 15% CaO

Let mass of product is 100 g

∴ Mass of CaC_2 = 85 g

Mass of CaO = 15 g

Used mole of CaO = mole of CaC_2 produced = $\frac{85}{64}$

∴ mass of CaO for producing 85 g CaC_2 = $\frac{85}{64}$ × 56 = 74.375 g.

∴ Initial total mass of CaO = 74.375 + 15 = 89.375.

85 g CaC_2 obtained from = 89.38 g CaO

∴ 1 g CaC_2 obtained from = $\frac{89.38}{85}$ g CaO

10^6 g CaC_2 obtained from = $\frac{89.38}{85} \times 10^6$ = 1051470 g

For 1000 kg CaC_2 requires = 1051.47 kg CaO.

(B) 100 g product requires CaO = 89.38 g

1 g product requires = $\frac{89.38}{100}$

10^6 g product requires = $\frac{89.38}{100} \times 10^6$

For 1000 kg (crude) product = 893.8 kg CaO.

19. Mol of Cu^{2+} = 1.0 L × 0.1 M = 0.1 M Cu^{2+} = 0.1 × 2 mol H^+

(A) Weight of CuS = 0.1 × 95.5 = 9.55 g

(B) Concentration of H^+ = $\frac{0.2\ mol}{1.0\ L}$ = 0.2 M

(C) and (D) are wrong.

PART - V

1. mol. wt. $CaCl_2$ = 111 g

∵ 111 g $CaCl_2$ has N_A ions Ca^{+2} (N_A = Avogadro number)

∴ 222 g $CaCl_2$ has N_A ions Ca^{+2} = $\frac{N_A \times 222}{111}$ = **2** N_A **ions of Ca^{+2}**

∵ 111 g $CaCl_2$ has 2 N_A ions of Cl^-

∴ 222 g $CaCl_2$ has 2 N_A ions of Cl^- = $\frac{2 \times N_A \times 222}{111}$ ions of Cl^- = **4** N_A **ions of Cl^-**

2. Suppose each gas has a mass of X g.

Therefore , O_2 : H_2 : CH_4

Weight – X X X

No. of moles – $\frac{X}{32}$ $\frac{X}{2}$ $\frac{X}{16}$

Volume of ratio – $\frac{X}{32} : \frac{X}{2} : \frac{X}{16}$

Hence , $O_2 : H_2 : CH_4$ 1 : 16 : 2

3.

Elements	Atomic mass	%	Relative No. of atoms	Simple ratio	Simplest whole no.
A	x	60	60/x	3	3
B	2x	40	40/2x = 20/x	1	1

∴ Empirical formula A_3B

4.

	Zn	+ I_2 ⟶	ZnI_2
Mass	x	x	0
Initial mole	$\frac{x}{65}$	$\frac{x}{254}$	0
finally	$\frac{x}{65} - \frac{x}{254}$	0	$\frac{x}{254}$

Fraction of Zn unreacted = $\dfrac{\frac{x}{65} - \frac{x}{254}}{\frac{x}{65}} = 1 - \frac{65}{254}$ = 0.744

5. On passing through charcoal only CO_2 reduces to CO.

$CO + C \longrightarrow$ No reaction

Volume a

$CO_2 + C \longrightarrow 2\,CO$

Volume before reaction b 0

Volume after reaction 0 2b

As given $a + b = 1$ and $a + 2b = 1.4$

$\therefore$ b = 0.4 litre $\therefore$ % of b = $\frac{0.4}{1} \times 100 = 40\ \%$

$\therefore$ a = 0.6 litre $\therefore$ % of a = $\frac{0.6}{1} \times 100 = 60\ \%$

6. m = 0.2 mole / kg

weight of solvent = 1000 gram

weight of solute = 0.2 × 98 = 19.6 gram

Total weight of solution = 1000 + 19.6 = 1019.6 ml.

7. Mass of HCl = $1000 \times \left(\frac{43}{100}\right) = 430$ kg.

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

$$\frac{\text{Mole of HCl}}{2} = \frac{\text{Mole of } H_2SO_4}{1}$$

$$\frac{430 \times 10^3}{36.5 \times 2} = \text{mole of } H_2SO_4$$

Mass of H_2SO_4 = $\frac{98 \times 430 \times 10^3}{36.5 \times 2} = 577.26 \times 10^3$ g

Mass of 93% H_2SO_4 = $577.26 \times \frac{100}{93} = 620.71$ kg.

8. $H_2 + S + 2O_2 \rightarrow H_2SO_4$

$n_{H_2} = \frac{5.6}{22.4} = \frac{1}{4}$ $n_s = \frac{8}{32} = \frac{1}{4}$ $n_{O_2} = \frac{1}{2}$

As all reactants are in stoichiometric ratios, none will be left behind.

Hence $\frac{1}{4}$ mole of H_2SO_4 is formed.

9. Let the volume of oxygen in 1120 mL of ozonised oxygen be x mL at S.T.P.

$\therefore$ Volume of ozone = (1120 - x) mL at S.T.P.

We known that

vol. of mixture × its density = mass

= vol. of oxygen × its density + vol. of ozone × its density

Also, density = $\frac{\text{mass}}{\text{volume}}$

$\therefore$ density of oxygen = $\frac{32}{22400}$ g/mL (at S.T.P.)

and density of ozone = $\frac{48}{22400}$ g/mL (at S.T.P.)

Hence, $x \times \frac{32}{22400} + (1120 - x) \times \frac{48}{22400} = 1.76$

or, $2x + (1120 - x) \times 3 = 1.76 \times 1400$

or, x = (3360 – 2464) mL = **896 mL O_2.**

10. (A) and (B) Explanation : 30% of molecule dissociated $N_2 \rightarrow 2N$

Amount of N_2 left = $\frac{2.8}{28} \times \frac{70}{100}$ = 0.1 × 0.7 = 0.07
(in moles)

No. of moles of N atoms formed = 2 × $\frac{30}{100}$ × 0.1 = 0.06

(A) Total no . of moles = 0.07 + 0.06 = 0.13
(B) Total number of molecules = 0.07 ×6.023 × 10^{23} = 4.2 × 10^{22} molecule = 0.421 × 10^{23}
∵ We have to calculate molecule of nitrogen not atoms.

11. Let W gas of SO_2 and O_2 are taken

moles of SO_2 = $\frac{W}{64}$; moles of O_2 = $\frac{W}{32}$

molecules of O_2 = $\frac{WN_A}{32}$; molecules of SO_2 = $\frac{WN_A}{64}$

hence molecules of O_2 > molecules of SO_2
since moles of O_2 > moles of SO_2 , hence volume of O_2 at STP > volume of SO_2 at STP.

12.

	$2P + Q \longrightarrow R$		
initial mole	12	8	0
final mole	0	8 – 6	6

∴ moles of R formed = 6

% of Q left behind = $\frac{2}{8}$ × 100 = 25%

13. $XeF_6 + I_2 \longrightarrow IF_7 + Xe$
POAC on 'F' :
6 (m.mole of XeF_6) = 7 (m.mole of IF_7)
$\frac{3.5 \times 6}{7}$ = 3 m.moles of IF_7

14. $CS_2 + 3Cl_2 \longrightarrow CCl_4 + S_2Cl_2$
1 + 3 + 1 + 1 = 6

15. Let mole % of ^{26}Mg be x.

∴ $\frac{(21 - x)25 + x(26) + 79(24)}{100}$ = 24.31

x = 10%
Answer = 1

16. $CaCO_3 \longrightarrow CaO + CO_2$

$\frac{5.6}{22.4} = \frac{1}{4}$mole

mole of CaO = mole of Ca = $\frac{1}{4}$

mass of Ca = $\frac{1}{4}$ × 40 = 10

% of Ca in sample = $\frac{10}{200}$ × 100 = 5%

17. Let volume of solution is 1000 ml
moles of H_2SO_4 = 18
mass of H_2SO_4 = 18 × 98 = 1764 g
mass of solution = 1000 × 1.8 = 1800 g
mass of solvent = 1800 – 1764 = 36 g

molality = $\frac{18}{\left(\frac{36}{1000}\right)}$ = 500 ⇒ $\frac{500}{500}$ = 1

18. Let each species be a moles, M be molecular mass of metal
$a \times [2 \times 7 + 12 + 48] + a [2 \times M + 12 + 48] = 1$ ....(1)
and a moles of each carbonate reacts with 2a mole of HCl
hence $4a = 44.44 \times 0.5 \times 10^{-3}$
or $a = 11.11 \times 0.5 \times 10^{-3}$ ....(2)
Thus M from solving the equation (1) and (2) is 23 g
M = 23 g
M – 16 = 7

19. Mw of $K_2[PtCl_4] = 2 \times 39 + 195 + 4 \times 35.5 = 415$ g
Mw of NH_3 = 17 g
Mol of $K_2[PtCl_4] = \frac{83.0}{415} = 0.2$ mol (limiting reagent)
Mol of $NH_3 = \frac{83}{17} = 4.88$ mol (excess)

20. Mol of $K_2[PtCl_4]$ consumed = 0.2 mol = mol of cisplatin
NH_3 consumed = 2 × 0.2 0.4 mol

21. Excess of NH_3 unreacted = 4.88 – 0.4 = 4.48 mol

22. (P) $Mn^{2+} \longrightarrow Mn^{4+} + 2e^-$ (Oxidation)
$2e^- + H_2O_2 \longrightarrow 2H_2O$ (Reduction)
(Q) $3K \longrightarrow 3K^+ + 3e^-$ (Oxidation)
$3e^- + Al^{3+} \longrightarrow Al$ (Reduction)
(R) $3Fe \longrightarrow Fe_3O_4 + 8e^-$ (Oxidation)
3x = 0 3x – 8 = 0
3x = 8
$8e^- + 4H_2O \longrightarrow 4H_2$ (Reduction)
8x – 8 = 0 8x = 0
8x = 8
(S) $3H_2S \longrightarrow 3S + 6e^-$ (Oxidation)
2 + x = 0 x = 0
x = –2
$6e^- + 2NO_3^- \longrightarrow 2NO$ (Reduction)
x – 6 = –1 x – 2 = 0
x = 5 x = 2