Additional Problems For Self Practice (APSP)

PART - I : PRACTICE PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120.**
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question.
   ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

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1. The sodium salt of methyl orange has 7% sodium. What is the minimum molecular weight of the compound ?
(1) 420 (2) 375 (3) 328.57 (4) 294.46

2. 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}

3. Common salt obtained from sea - water contains 96% NaCl by mass. The approximate number of molecules of NaCl present in 10.0 g of the common salt is : (At. wt. Na = 23)
(1) 10^{21} (2) 10^{22} (3) 10^{23} (4) 10^{24}

4. 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

5. 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 :
(1) 15.2% (2) 32.1% (3) 21.8% (4) 11.07%

6. $2KI + I_2 + 22\ HNO_3 \rightarrow 2HIO_3 + 2KIO_3 + 22NO_2 + 10H_2O$
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

7. Minimum amount of Ag_2CO_3 (s) required to produce sufficient oxygen for the complete combustion of C_2H_2 which produces 11.2 ltr of CO_2 at S.T.P after combustion is: [Ag = 108]
$Ag_2CO_3(s) \rightarrow 2Ag(s) + CO_2(g) + {}^{1/2}O_2(g)$
$C_2H_2 + {}^{5/2}O_2 \rightarrow 2CO_2 + H_2O$
(1) 276 g (2) 345 g (3) 690 g (4) 1380 g

8. Consider the following statements :

1. If all the reactants are not taken in their stoichiometric ratio, then at least one reactant will be left behind.

2. 2 moles of $H_2(g)$ and 3 moles of $O_2(g)$ produce 2 moles of water.

3. equal wt. of carbon and oxygen are taken to produce CO_2 then O_2 is limiting reagent.

The above statements 1, 2, 3 respectively are (T = True, F = False)

(1) T T T (2) F T F (3) F F F (4) T F T

9. 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

10. 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) $6BiO_3^- + 12H^+ + 3Mn^{2+} \longrightarrow 6Bi^{3+} + 6H_2O + 3MnO_4^-$

11. 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

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

(1) 12.394 g (2) 1.29 g (3) 10.934 g (4) 12.934 g

13. 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}

14. 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

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

(1) 4.18 M (2) 8.14 M (3) 18.4 M (4) 18 M

16. 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}

17. Suppose you want an acidic solution to carry out a chemical reaction with 2 moles of NaOH. Which sample of acid is the best choice for you.

(1) 1 M H_2SO_4 (50 Rs per lt.) (2) 1 M H_2SO_4 (56 Rs per lt.)

(3) 1 M HCl (30 Rs per lt.) (4) 1 M HCl (27 Rs per lt.)

18. The correct expression relating molality (m), molarity (M), density of solution (d) and molar mass (M_2) of solute is :

(1) $m = \dfrac{M}{d + MM_2} \times 1000$ (2) $m = \dfrac{M}{1000d - MM_2} \times 1000$

(3) $m = \frac{d + MM_2}{M} \times 1000$ (4) $m = \frac{1000\,d - MM_2}{M} \times 1000$

19. 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) $C_{10}H_{14}N_2$

20. 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.

21. 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_3 N. (2) 2.91 g of Li_3 N. (3) 5.83 g of Li_3 N. (4) 10.50 g of Li_3 N.

22. 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.

23. 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 %. (4) 87.1 %.

24. 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

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,

$$2\,NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2\,HCl \quad ; \quad 2\,KCl + H_2SO_4 \rightarrow K_2SO_4 + 2\,HCl$$

(1) 42.89 % NaCl (2) 84.9 % NaCl (3) 31.5 % NaCl (4) 63.1 % NaCl

26. 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

27. 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

28. 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%

29. 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.

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

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

30. At room temperature, the density of water is 1.0 g/ml and the density of ethanol is 0.789 g/ml. What volume of ethanol contains the same number of molecules as are present in 175 ml of water ?
(1) 418.95 ml. (2) 736.33 ml. (3) 566.82 ml. (4) 911.84 ml.

Practice Test (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	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

1. The volume of a gas in discharge tube is 1.12×10^{-7} ml at STP then the number of molecule of gas in the tube is :
(1) 3.01×10^4 (2) 3.01×10^{15} (3) 3.01×10^{12} (4) 3.01×10^{16}

2. A person adds 1.71 gram of sugar ($C_{12}H_{22}O_{11}$) in order to sweeten his tea. The number of carbon atoms added are (mol. mass of sugar = 342)
(1) 3.6×10^{22} (2) 7.2×10^{21} (3) 0.05 (4) 6.6×10^{22}

3. A hydrocarbon contains 75% of carbon. Then its molecular formula is :

(1) CH_4 (2) C_2H_4 (3) C_2H_6 (4) C_2H_2

4. The percentage value of nitrogen in urea is about
(1) 46 (2) 85 (3) 18 (4) 28

5. 1.2 g of Mg (At mass 24) will produce MgO equal to :
(1) 0.05 mol (2) 40 g (3) 40 mg (4) 4 g

6. 4 g of hydrogen is ignited with 4 g of oxygen, the amount of water formed is ?
(1) 2.5 g (2) 0.5 g (3) 4.5 g (4) 8 g

7. What volume of 0.10 M H_2SO_4 must be added to 50 mL of a 0.10 M NaOH solution to make a solution in which the molarity of the H_2SO_4 is 0.050 M ?
(1) 400 mL (2) 50 mL (3) 100 mL (4) 150 mL

8. What volume of a 0.8 M solution contains 100 millimoles of the solute?
(1) 100 mL (2) 125 mL (3) 500 mL (4) 62.5 mL

9. Phosphorus has the oxidation state of +3 in
(1) Phosphorous acid (2) Orthophosphoric acid
(3) Hypophosphorous acid (4) Metaphosphoric acid

10. Which of the following behaves as both oxidising and reducing agents ?
(1) H_2SO_4 (2) SO_2 (3) H_2S (4) HNO_3

11. If 1/2 moles of oxygen combine with aluminium to form Al_2O_3 then weight of Aluminium metal used in the reaction is (Al = 27) –
(1) 27 g (2) 18 g (3) 54 g (4) 40.5 g

12. One mole of potassium chlorate ($KClO_3$) is thermally decomposed and excess of aluminium is burnt in the gaseous product. How many mol of aluminium oxide (Al_2O_3) are formed ?
(1) 1 (2) 1.5 (3) 2 (4) 3

13. A solution of $FeCl_3$ is $\frac{M}{30}$ its molarity for Cl^- ion will be :
(1) $\frac{M}{90}$ (2) $\frac{M}{30}$ (3) $\frac{M}{10}$ (4) $\frac{M}{5}$

14. In the reaction $xHI + yHNO_3 \longrightarrow NO + I_2 + H_2O$:
(1) x = 3, y = 2 (2) x= 2, y = 3 (3) x = 6, y = 2 (4) x = 6, y = 1

15. When SO_2 is passed through an acidified solution of potassium dichromate, the oxidation state of S changes from :
(1) + 4 to 0 (2) + 4 to +2 (3) + 4 to +6 (4) + 6 to +4

16. Oxidation state of nitrogen is correctly given for

Compound	**Oxidation state**
(1) $[Co(NH_3)_5Cl]Cl_2$	0
(2) NH_2OH	+ 1
(3) $(N_2H_5)_2SO_4$	+ 2
(4) Mg_3N_2	– 3

17. Which of the following reaction indicates the oxidising behaviour of H_2SO_4:
(1) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$ (2) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
(3) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ (4) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$

18. 10 mL of 0.5 N HCl, 30 mL of 0.1 N HNO_3 and 75 mL of 0.1 M H_2SO_4 are mixed together. The normality of the resulting solution will be

(1) 0.2 N (2) 0.1 N (3) 0.4 N (4) 0.5 N

19. 100 mL of conc. H_2SO_4 (d = 1.8 g/mL) is mixed with 100 mL H_2O (d = 1.0 g /mL), mass per cent (by mass of solution) of H_2SO_4 is :

(1) 50 (2) 60.0 (3) 64.3 (4) 35.7

20. A sodium hydroxide solution containing 40% by weight of pure NaOH has a specific gravity of 1.43. What volume of this solution will be required in the preparation of 500 mL of a 0.5 N NaOH solution?

(1) 22.5 mL (2) 17.5 mL (3) 20.5 mL (4) 25.5 mL

21. What volume of HCl solution of density 1.2 g/cm^3 and containing 36.5% by weight HCl, must be allowed to react with zinc (Zn) in order to liberate 4.0 g of hydrogen ?

(1) 333.33 ml (2) 500 ml (3) 614.66 ml (4) None of these

22. A 0.250-g sample of $(NH_4)_2\ SO_4$ was boiled with an excess of NaOH solution and the ammonia gas evolved was absorbed completely by 35 mL of 0-1 H_2SO_4. The percentage purity of $(NH_4)_2\ SO_4$ in the sample was

(1) 84.8 (2) 87.8 (3) 98.6 (4) 92.4

23. When the hydrocarbon (A) $C_n\ H_{2n-2}$ is reduced to (B) $C_n\ H_{2n+2}$, the increase in the % values of hydrogen from (A) to (B) is 4.91. What is the value of n?

(1) 4 (2) 5 (3) 6 (4) 7

24. $x + y \rightarrow x_2y$

$x_2y + z \rightarrow x_2z_2 + yz$

$yz + y \rightarrow y_3z$

If the above reaction are carried out by taking 2 moles each of x,y, and z in a closed container then find the number of moles of y_3z formed. If reaction takes in steps :

(1) $\frac{1}{2}$ (2) $\frac{1}{3}$ (3) $\frac{1}{4}$ (4) $\frac{2}{3}$

25. If 0.5 mol of $BaCl_2$ is mixed with 0.2 mol of Na_3PO_4, the maximum number of mol of $Ba_3(PO_4)_2$ that can be formed is :

(1) 0.7 (2) 0.5 (3) 0.30 (4) 0.10

26. $Ca_3(PO_4)_2(s)$ and $H_3PO_3(s)$ contains same number of 'P' atom then the ratio of oxygen atom in the two compounds respectively is :

(1) $\frac{8}{3}$ (2) $\frac{2}{3}$ (3) 3 (4) $\frac{4}{3}$

27. The weight of quick lime obtained by strongly heating 25 gm of marble is

(1) 14 gm (2) 28 gm (3) 42 gm (4) 56 gm

APSP Answers

PART - I

1.	(3)	**2.**	(2)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(1)	**7.**	(2)
8.	(1)	**9.**	(3)	**10.**	(2)	**11.**	(1)	**12.**	(4)	**13.**	(1)	**14.**	(3)
15.	(3)	**16.**	(3)	**17.**	(1)	**18.**	(2)	**19.**	(4)	**20.**	(1)	**21.**	(3)
22.	(1)	**23.**	(2)	**24.**	(4)	**25.**	(1)	**26.**	(4)	**27.**	(4)	**28.**	(2)
29.	(4)	**30.**	(3)										

PART - II

1.	(3)	**2.**	(1)	**3.**	(1)	**4.**	(1)	**5.**	(1)	**6.**	(3)	**7.**	(3)
8.	(2)	**9.**	(1)	**10.**	(2)	**11.**	(2)	**12.**	(1)	**13.**	(3)	**14.**	(3)
15.	(3)	**16.**	(4)	**17.**	(4)	**18.**	(1)	**19.**	(3)	**20.**	(2)	**21.**	(1)
22.	(4)	**23.**	(2)	**24.**	(1)	**25.**	(4)	**26.**	(4)	**27.**	(1)		

APSP Solutions

PART - I

1. % of Na = $\frac{mass\ of\ sodium}{molecular\ mass} \times 100 \Rightarrow 7 = \frac{23}{M} \times 100$

$M = \frac{23 \times 100}{7} = 328.6$

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

Mass of $NO_2 = 5 \times 10^{-3} \times 46 = 0.23$ gm ; Volume of $NO_2 = \frac{Mass}{Density} = \frac{0.23}{1.15} = 0.2$ ml

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

3. Mass of NaCl = 10 × 0.96 = 9.6 g

moles of NaCl = $\frac{9.6}{58.5}$

no. of molecules = $\frac{9.6}{58.5} \times 6.023 \times 10^{23} \simeq 10^{23}$

4. $\frac{32}{2x+3y} = 0.2$; $\frac{92.8}{3x+4y} = 0.4$

Hence: x = 56 & y = 16.

5. $CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + 2\,NaCl$

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

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 $CaCl_2$

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

% of $CaCl_2$ = $\frac{3.21}{10}$ × 100 = 32.1 %.

6. KI is limiting reagent

∴ 3 mole of KI will give 33 mole of NO_2 according to stoichiometry.

7. $Ag_2CO_3\,(s) \rightarrow 2Ag\,(s) + CO_2\,(g) + {}^{1}/_{2}\,O_2\,(g)$

$C_2H_2 + {}^{5}/_{2}\,O_2 \rightarrow 2CO_2 + H_2O$

By Stoichiometry of reaction

Moles of CO_2 formed = $\frac{11.2}{22.4} = \frac{1}{2}$

Moles of O_2 required = $\frac{5}{4} \times \frac{1}{2} = \frac{5}{8}$

Moles of Ag_2CO_3 required = $2 \times \frac{5}{8} = \frac{5}{4}$

Mass of Ag_2CO_3 required = $\frac{5}{4}$ × 276 = 345 g

8. (1) It is a fact.

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

Initial mole	2	3	0
final mole	0	3-1 =2	2

(3) $C + O_2 \longrightarrow CO_2$

$\frac{w}{12}$ $\frac{w}{32}$

Here C is limiting reagent.

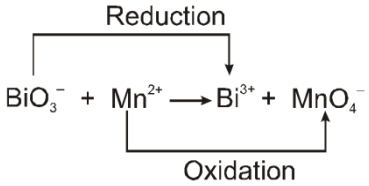
9.

	$4A$	+	$2B$	+	$3C$	$\longrightarrow$	$A_4B_2C_3$
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.

10.



(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.

11. $3I_2 + OH^- \longrightarrow IO_3^- + 5I^-$ (balance reaction)

So, ratio is 1 : 5.

12. (4) 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 $\frac{85}{23}$ × 3.5 = 12.934 g of $NaNO_3$

13. (1) Explanation : $m = \frac{M \times 1000}{(1000 \times d - M \times M.Wt.)}$ 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]

14. 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.

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

16. 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 = $2 \times 10^{-4} \times 6.023 \times 10^{23} = 1.204 \times 10^{20}$.

17. For reaction with 2 moles NaOH
1M H_2SO_4 1 lit. volume required
1M HCl 2 lit. volume required
∴ cheapest will be 1 M H_2SO_4 1 lit.

18. Molarity = M
Let volume of be 1 ltr.
∴ mass of solvent = 1000 d – M × M_2

$$\text{Molality} = m = \frac{M}{1000\,d - MM_2} \times 1000$$

19.

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)

$$\text{No. of empirical units per molecule} = n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{162}{81} = 2$$

Molecular formula = (Empirical formula) × 2 = $(C_5H_7N) \times 2 = C_{10}H_{14}N_2$

20. $C + O_2 \xrightarrow{\Delta} CO_2$
12g C = 1 mol O_2 = 22.4 L O_2

$$\therefore \quad 1000 \text{ g C} = \frac{22.4}{12} \times 1000 \quad \text{or} \quad 1866.67 \text{ L } O_2.$$

21.

	$6Li$	+	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.

22.

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

∴ moles of O_2 = 0.05

23. $KClO_3 \rightarrow KCl + O_2$

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

$$3 \times \frac{\text{wt.of } KClO_3}{\text{mol.wt.of } KClO_3} = 2 \times \frac{\text{volume at NTP(mL)}}{22400}$$

$$\text{Wt . of } KClO_3 = \frac{2 \times 146.8 \times 122.5}{3 \times 22400}$$

= 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 $KClO_4$

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

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

Wt. of residue = 1 – wt. of Oxygen

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

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

24. 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	

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

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

eqution (1) – (2)

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

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

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

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%.

26. 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.

27. 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 = $0.03 \times 6.023 \times 10^{23} = 1.81 \times 10^{22}$ ions.

28. $CuSO_4.5H_2O(aq) + BaCl_2(aq) \longrightarrow \underset{4.66\ g}{BaSO_4(s)} + CaCl_2\ (aq)$

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%.

29. 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

30. Let the volume of ethanol containing the same number of molecules as are present in 175 ml of H_2O be V ml. As given ,

moles of C_2H_5OH in V ml = moles of H_2O in 175 ml

Now , $\frac{\text{wt.of } C_2H_5OH}{\text{mol.wt.of } C_2H_5OH} = \frac{\text{wt.of } H_2O}{\text{mol.wt.of } H_2O}$

or , $\frac{0.789 \times V}{46} = \frac{1.0 \times 175}{18}$

$\therefore$ V = 566.82 ml.

PART - II

1. mole = $\frac{1.12 \times 10^{-7}}{22400}$

No. of molecule = $\frac{1.12 \times 10^{-7}}{22400} \times 6.02 \times 10^{23} = 3.01 \times 10^{12}$

2. No. of carbon atom in glucose = $\frac{1.71}{342} \times 12\ N_a$
$= 3.6 \times 10^{22}$

3.

			Simplest ratio	Ratio
C	75	75/12 = 6.25	6.25/6.25=1	1
H	25	25/1=25	25/6.25=4	4

Hence E.F is CH_4 & M.F is = n × E.F (n =1, 2, 3.....)
= 1 × CH_4 = CH_4.

4. Urea (NH_2CONH_2)
M.wt of Urea = 60

$$\% \text{ of N} = \frac{28}{60} \times 100 = 46\ \%.$$

5. $Mg + \frac{1}{2}O_2 \longrightarrow MgO$

$$\text{mole} = \frac{1.2}{24} = 0.05$$

(Since we have no idea about O_2 so we have taken it in excess)
from mole–mole analysis

$$\frac{n_{mg}}{1} = \frac{n_{mgO}}{1}$$ (here n = mole)
= 0.05 mole.

6. $2H_2 + O_2 \longrightarrow 2H_2O$

mole $\frac{4}{2}$ $\frac{4}{32} = \frac{1}{8}$

$\frac{4/2}{2}$ $\frac{1/8}{1}$ (O_2 is L.R.)

From mole–mole analysis

$$\frac{\frac{1}{8}}{1} = \frac{n_{H_2O}}{2}$$

$$n_{H_2O} = \frac{1}{4} \quad ; \quad \text{Mass}_{H_2O} = \frac{1}{4} \times 18 = 4.5 \text{ g.}$$

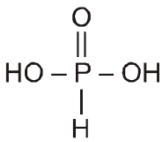
7. $0.050 \times 2 = \frac{0.10 \times 2 \times V - 50 \times 0.10 \times 1}{V + 50} \Rightarrow V = 100 \text{ ml}$

8. $M = \frac{n_{solute}}{V_{solution}}$

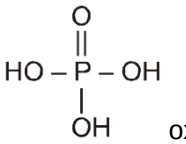
$$\frac{0.8}{1000} = \frac{100 \times 10^{-3}}{\text{vol. of solution}}$$

vol. of solution = 125 ml
(Here n_{solute} = mole of solute, $V_{solution}$ = vol. of solution).

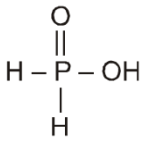
9. Phosphorous acid



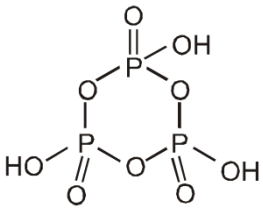
oxidation state of P = + 3



Orthophosphoric acid oxidation state of P = + 5



Hypophosphorous acid oxidation state of P = + 1



Metaphosphoric acid oxidation state of P = + 5

10. SO_2
Here S is in +4 state
It can be oxidized to +6 state as also reduced to –2 state.

11. $2Al + \frac{3}{2} O_2 \rightarrow Al_2O_3$
From mole-mole analysis

12. $2Al + KClO_3 \xrightarrow{} Al_2O_3 + KCl$
(excess) 1 mole ($KClO_3$ is L.R.) 1 mole ($KClO_3$ L.R. g‚)
From mole-mole analysis

$$\frac{n_{KClO_3}}{1} = \frac{n_{Al_2O_3}}{1} \Rightarrow n_{Al_2O_3} = 1 \text{ mole}$$

13. Molarity of Cl^- = 3 (molarity of $FeCl_3$)
$= 3\left(\frac{M}{30}\right) = \frac{M}{10}$.

14. Valency factor ratio is inversely related to molar ratio.
(V.f.)HI : (V.f.)HNO_3 = 1 : 3 = 2 : 6 ∴ Molar ratio = 6 : 2

15. $Cr_2O_7^{2-} + \overset{(+4)}{SO_2} \rightarrow Cr^{3+} + \overset{(+6)}{SO_3}$

16. In Mg_3N_2 ; 3(+2) +2 (x) = 0
2x = – 6
x = – 3

17. Oxidation state of S in H_2SO_4 is + 6 whereas oxidation state of S in SO_2 is + 4

21. $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$
moles of H_2 evolved = 2 ∴ moles of HCl required = 4
$\therefore \frac{V \times 1.2 \times 0.365}{36.5} = 4$; V = 333.33 ml

23. C_5H_8 C_5H_{12} % H = $\frac{8}{68}$ x 100 % H = $\frac{12}{72}$ x 100
= 11.76 % = 16.66%
% increases = 16.66 – 11.76 = 4.91%
hence n = 5

24. $2x + y \rightarrow x_2y$
2 2 1
$x_2y + 3z \rightarrow x_2z_2 + yz$
1 2 2/3 2/3
$yz + 2y \rightarrow y_3z$
2/3 1 1/2

26. Let $Ca_3(PO_4)_2$ is x-mole

H_3PO_3 is y-mole $\Rightarrow 2x = y \Rightarrow \frac{x}{y} = \frac{1}{2}$

$$\frac{\text{moles of 'O' } Ca_3(PO_4)_2}{\text{moles of 'O' in } H_3PO_3} = \frac{8x}{3y} = \frac{4}{3}$$