Self Practice Paper (SPP)

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 $X_2 Y_3$ 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 $4A + 2B + 3C \longrightarrow A_4\, B_2\, C_3$ 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) $m = \dfrac{d + MM_2}{M} \times 1000$ (4) $m = \dfrac{1000d - MM_2}{M} \times 1000$

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,

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

(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.

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

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

$$PH_3 + O_2 \longrightarrow P_2O_5 + H_2O$$

$$MgO + P_2O_5 \longrightarrow \underset{\text{magnesium metaphosphate}}{Mg(PO_3)_2}$$

(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.

31. Number of gm of oxygen in 32.2 g $Na_2SO_4 . 10H_2O$ is :

(1) 20.8 (2) 22.4 (3) 2.24 (4) 2.08

32. Calculate the empirical formula of a compound "A" which is obtained from the catalytic hydrogenation of acetylene if this compound contains 85.7% carbon and 14.3% hydrogen (by wt.).

(1) C_6H_6 (2) CH (3) C_3H_6 (4) CH_2

33. 12 lit. of H_2 and 11.2 lit. of Cl_2 are mixed and exploded. The composition by volume of mixture is :

(1) 24 lit. of HCl (g) (2) 0.8 litre Cl_2 and 20.8 lit. HCl (g)

(3) 0.8 lit. H_2 and 22.4 lit. HCl (g) (4) 22.4 lit. HCl (g)

34. A sample of calcium carbonate ($CaCO_3$) has the following percentage composition : Ca = 40%, C = 12% O = 48%. If the law of constant proportions is true, then the weight of calcium in 4g of a sample of calcium carbonate obtained from another source will be :

(1) 0.016 g (2) 0.16 g (3) 1.6 g (4) 16 g

35. The atomic mass of an element is 27. if valency is 3, the vapour density of the volatile chloride will be:

(1) 66.75 (2) 6.675 (3) 667.5 (4) 81

36. Copper metal reacts with nitric acid. Assume that the reaction

$$3Cu(s) + 8HNO_3(aq) \longrightarrow 3Cu(NO_3)_2\,(aq) + 2NO(g) + 4H_2O(\ell)$$

If 18.75 g $Cu(NO_3)_2$ is eventually obtained, then how many grams of nitric oxide, NO, would have also formed also, according to the preceeding equation ?

(1) 2 g. (2) 4 g. (3) 6 g. (4) 8 g.

37. Which of the following is the best example of law of conservation of mass :

(1) 12g of carbon combines with 32g of oxygen to form 44g of CO_2

(2) When 12 g of carbon is heated in a vacuum there is no change in mass

(3) A sample of air increases in volume when heated at constant pressure but its mass remains unaltered.

(4) The weight of a piece of platinum is the same before and after heating in air

38. The molecular weight of a compound is 180. If its empirical formula is CH_2O then the molecular formula of compound is :

(1) $C_2H_4O_2$ (2) $C_3H_6O_3$ (3) $C_6H_{12}O_6$ (4) $C_{12}H_{24}O_{12}$

39. 4 moles each of SO_2 and O_2 gases are allowed to react to form SO_3 in a closed vessel. At equilibrium, 25% of O_2 is used up. The total number of moles of all the gases at equilibrium is :

(1) 6.5 (2) 7.0 (3) 8.0 (4) 2.0

40. 1.12 mL of a gas is produced at STP by the action of 4.12 mg of alcohol ROH with methyl magnesium iodide. The molecular mass of alcohol is :

(1) 16.0 (2) 41.2 (3) 82.4 (4) 156.0

41. The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000 g of solvent.

(1) 1000 g (2) 1098.6 g (3) 980.4 g (4) 1019.6g

42. 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 .

(1) 590.0 kg solution of H_2SO_4. (2) 310.3 kg solution of H_2SO_4.

(3) 620.7 kg solution of H_2SO_4. (4) 708.2 kg solution of H_2SO_4 .

43. 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.

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

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

$$\ldots\ldots\ldots\ldots\ CS_2 + \ldots\ldots\ldots\ldots\ Cl_2 \longrightarrow CCl_4 + \ldots\ldots\ldots\ldots\ S_2Cl_2$$

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

45. 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.

(1) 3 (2) 10 (3) 1 (4) 6

SPP Answers

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)	**31.**	(2)	**32.**	(4)	**33.**	(3)	**34.**	(3)	**35.**	(1)
36.	(1)	**37.**	(1)	**38.**	(3)	**39.**	(2)	**40.**	(3)	**41.**	(4)	**42.**	(3)
43.	(1)	**44.**	(4)	**45.**	(2)								

SPP Solutions

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= $\frac{112}{22400}$ = 5×10^{-3}

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

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

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

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

Mass of $CaCl_2$ = Molar mass of $CaCl_2$

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

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

6. KI is limiting reagent

$\therefore$ 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 $= \dfrac{11.2}{22.4} = \dfrac{1}{2}$

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

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

Mass of Ag_2CO_3 required $= \dfrac{5}{4} \times 276 = 345$ g

8. (1) It is a fact.

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

	$2H_2$	O_2	$2H_2O$
Initial mole	2	3	0
final mole	0	3-1 =2	2

(3) $C + O_2 \longrightarrow CO_2$

$\dfrac{w}{12}$ $\quad \dfrac{w}{32}$

Here C is limiting reagent.

9. $4A + 2B + 3C \longrightarrow A_4B_2C_3$

	4A	2B	3C	$A_4B_2C_3$
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. Reduction

$BiO_3^- + Mn^{2+} \longrightarrow Bi^{3+} + MnO_4^-$

Oxidation

(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 $14H^+ + 5BiO_3^- + 5Mn^{2+} \longrightarrow 5Bi^{3+} + 2MnO_4^- + 7H_2O$

Hence, (2) is the correct balanced reaction.

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

So, ratio is 1 : 5.

12. Explanation : M. wt. of $NaNO_3 = 85$

70 mg of Na^+ are present in 1 mL

50 ml of solution contains $50 \times 70 = 3500$ 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 $NaNO_3$

13. 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 = $\frac{(\% w/w) \times density \times 10}{Molar\ mass\ of\ solute} = \frac{98 \times 1.84 \times 10}{98} = 18.4$ 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
$\therefore$ cheapest will be 1 M H_2SO_4 1 lit.

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

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)

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

$\therefore$ 1000 g C = $\frac{22.4}{12} \times 1000$ or 1866.67 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

$\therefore$ 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

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

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

= 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 $KClO_4$

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

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

Wt. of residue = 1 – wt. of Oxygen

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

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

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

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

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

equtions (1) – (2)

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

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

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

25. Consider that mass of NaCl = xg

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

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 $\times \dfrac{1}{2}$

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

or Moles of K_2SO_4 = Moles of KCl $\times \dfrac{1}{2}$

Total weight of Na_2SO_4 and K_2SO_4 is 76 g

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

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

$\Rightarrow$ 0.0459 x = 1.26

$\Rightarrow$ x = 27.45 g

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

% mass of KCl = 100 – 42.89 = 57.11%.

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

$= \frac{1.2 \times 25 \times 10}{98} = \frac{12 \times 25}{98}$ = 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 × 6.023 × 10^{23} = 1.81 × 10^{22} ions.

28. $CuSO_4.5H_2O(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + CaCl_2\,(aq)$

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%.

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

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

$\therefore$ V = 566.82 ml.

31. No. of moles of $Na_2SO_4.10H_2O = \frac{32.2}{322}$ = 0.1 mole.
Number of g of O_2 = 0.1 × 7 × 32 = 22.4 g.

32.

C	85.7	$\frac{85.7}{12} = 7.1$	simplest ratio $\frac{7.1}{7.1} = 1$	ratio 1
H	14.3	$\frac{14.3}{1} = 14.3$	$\frac{14.3}{7.1} = 2$	2

Hence E.F is CH_2.

33. $H_2 + Cl_2 \longrightarrow 2HCl$
12 lit 11.2 lit
0.8 lit L.R
So, HCl will be double i.e. 22.4 Lit. So, 0.8 lit. H_2 and 22.4 lit. HCl (g) (mixture).

34. $\frac{4 \times 40}{100}$ (40% Ca given)
= 1.6 g

35. It may be $AlCl_3$
V.D = $\frac{M.Wt_{\ AlCl_3}}{2}$
V.D = $\frac{133.5}{2}$ = 66.75

36. $3Cu\ (s) + 8HNO_3\ (aq) \longrightarrow 3Cu(NO_3)_2\ (aq) + 2NO(g) + 4H_2O(\ell)$

Mole of Cu $(NO_3)_2 = \frac{18.75}{187.5}$ = 0.1

Mole of NO = [Mole of $Cu(NO_3)_2$] $\times \frac{2}{3} = \frac{0.2}{3} \times 30$ = 2 g.

38. Molecular formula = empirical formula × n
n = $\frac{\text{Molecular mass}}{\text{Empirical mass}}$
Molecular mass = 180
Empirical mass = 1 × 12 + 2 × 1 + 16 × 1

$= 12 + 2 + 16 + 30$

$n = \frac{180}{30} = 6$

$\therefore$ Molecular formula = $(CH_2O)_6 = C_6H_{12}O_6$

39. $2SO_2 + O_2 \longrightarrow 2SO_3$

Initial moles 4 4 0

Moles of eqm. $4 — 2$ $4 - \frac{25}{100} \times 4$ 2 moles

$= 2$ moles $= 3$

$\therefore$ Total no. of moles of all gases at eqm.

$= 2 + 3 + 2 = 7.$

41. 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.

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

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

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

$\frac{430 \times 10^3}{36.5 \times 2}$ = 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.

43. $XeF_6 + I_2 \longrightarrow IF_7 + Xe$

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

44. $CS_2 + 3Cl_2 \longrightarrow CCl_4 + S_2Cl_2$

1 + 3 + 1 + 1 = 6

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

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

x = 10%

Answer is 10