

Mole Concept Booklet Solution

Foundation builder

1. $A: n_H = 4 \times \frac{169}{169} = 4$; $B: n_H = 4 \times \frac{31.2}{76} = 1.64$
 $C: n_H = 22 \times \frac{34.2}{342} = 2.2$; $D: n_H = 12 \times \frac{136}{180} = 2.4$
Hence [A]
2. $W_H = 3 \times 3 = 9 \text{ g}$ $W_N = 3 \times 14 = 42 \text{ g}$
[B]
3. In one H_2O molecule: 10 proton, 8 neutrons, 10 electrons
Hence in 36 ml, $n_{\text{H}_2\text{O}} = \frac{369}{189/\text{mol}} = 2 \text{ mols}$
 \therefore Protons = $2N_A \times 10 = 20N_A$
[C]
4. $n_{\text{atoms}} = \frac{W}{\text{at.wt}}$. Hence it should be of same weight 'W'
[A]
5. no. of moles = $\frac{10^{-3}N_A}{N_A} = 10^{-3}$
 \therefore wt = $10^{-3} \times \text{mol.wt} = 10^{-3} \text{ M o g} = \text{M o m g}$
[B]
6. Total atoms = $200 + 0.05 \times N_A + 10^{-20} \times N_A$
 $\approx 0.05 N_A = 3 \times 10^{22}$
[C]
7. Mol. Wt of $\text{A}_2\text{B}_3 = 150 + 96 = 246$
 \therefore For 5 mol, $(246 \times 5)_{\text{g}} = 1.23 \text{ kg}$
[C]
8. A: 12 g; B = $\frac{1}{2} \times 16 = 8 \text{ g}$; C: 10 g; D = $\frac{16}{2} = 8 \text{ g}$
 \therefore [A]
9. A: $2.5 \times 5N_A = 12.5N_A$; B: $10N_A$; C: $4 \times 3N_A = 12N_A$; D: $1.8 \times 8N_A = 14.4N_A$.
Hence [A]

10. $A: 10N_A$; $B: 11 \times \frac{200}{342} = 6.43N_A$; $C: \frac{144}{48}N_A \times 3 = 9N_A$

$D: 2.5 \times 3N_A = 7.5N_A$.

Hence [A]

11. [D] obvious

12. $A: \frac{1}{44} \times 3N_A$; $B: \frac{1}{114} \times 26N_A$; $C: \frac{1}{30} \times 8N_A$; $D: \frac{1}{26} \times 2N_A$

Hence [A]

13. $\frac{9.2}{46} \times 2 = n \times 1 \Rightarrow n = 0.4 \quad \therefore \text{wt} = 0.4 \times 30 = 12\text{g}$

[A]

14. $\frac{52 \text{ amu}}{4 \text{ amu}} = 13$

[C]

15. One ion contains: $7 + 24 + 1 = 32 \bar{e}$

$\therefore \text{total } \bar{e} \text{ s} = 2N_A \times 32 = 64N_A$

[B]

16. $n_C = 0.5 \times 6 = 3 \quad \therefore \text{wt} = 36 \text{ g}$

[D]

17. $A: \frac{28}{44}$; $B: \frac{46}{46}$; $C: \frac{36}{18}$; $D: \frac{54}{108}$

\therefore [C]

18. $n_{\text{H}_2\text{O}} = \frac{180}{18} = 10$

$\therefore \text{no. of } \bar{e} \text{ s} = 10 \times 10N_A = 100N_A$

[D]

19. $n_{\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}} = \frac{2.48}{248} = 0.01$

$\therefore n_{\text{H}_2\text{O}} = 5 \times 0.01 \Rightarrow \text{molecules} = 0.05N_A$

[c]

20. $n_{\text{Ag}} = \frac{90}{100} \times \frac{10}{108} = \frac{1}{12} \Rightarrow \text{atom} = \frac{1}{12}N_A = 5 \times 10^{22}$

[c]

21. $n_{\text{CO}_2} = n$, say. Then ${}^n\text{O} = 2n = \frac{8}{16} \Rightarrow n = \frac{1}{4}$

\therefore [D]

22. A : $0.2 \times 14 \text{ g} = 2.8 \text{ g}$; B : $\frac{3 \times 10^{23}}{6 \times 10^{23}} \times 12 \text{ g} = 69$; C : 32 g ; D : 7 g.

Hence [A]

23. [D] 1 gram molecule: 44 g
1 molecule of $\text{CO}_2 = 44 \text{ amu}$

24. $n_{\text{H}} = n \times 2 + 2n \times 4 = 10n$

$n_{\text{C}} = 2n \times 1 = 2n$

$\therefore n_{\text{C}} : n_{\text{H}} = 1 : 5$

[A]

25. Total charge = $1 \times N_{\text{A}} \times 3e = 3N_{\text{A}}e$ coulomb

Hence [D]

26. $n_{\text{H}_2\text{O}} = 18 \times 333 = 9$. Hence [B]

$(54 + 96 \times 3 + 18 \times 18)$

27. $n_{\text{H}_2\text{O}} = \frac{0.018}{18} = 10^{-3}$. Hence, molecules = $10^{-3} N_{\text{A}}$

\therefore [C]

28. $n_{\text{N}_3} = \frac{4.2}{14} = 0.3$. \therefore total = $0.3 \times 8N_{\text{A}} = 2.4N_{\text{A}}$

29. $n_{\text{C}} = 12 \times n_{\text{C}_{12}\text{H}_{22}\text{O}_{11}} = 12 \times \frac{3.42}{342} = 0.12$

\therefore atom = $0.12N_{\text{A}} \Rightarrow$ [D]

30. $n_{\text{MgCO}_3} = \frac{8.4}{84} = 0.1$

Each contain $(12 + 6 + 24)$ protons

Hence, total = $0.1 \times 42N_{\text{A}} = 2.5 \times 10^{24}$

[B]

31. $n_{\text{total}} = \frac{4.4}{44} + \frac{2.24}{22.4} = 0.2$ \therefore molecules = $0.2N_{\text{A}}$

[B]

32. [D]

$$33. \quad n_{\text{gas}} = \frac{w}{\text{mol.wt.}} = \frac{w}{3a}$$

[B]

$$34. \quad n_{\text{Fe}} = \frac{558.5}{55.85} = 10 \text{ moles}$$

In 60 g carbon, ${}^n\text{C} = 5 \quad \therefore \text{twice} = 10 \text{ moles}$

[A]

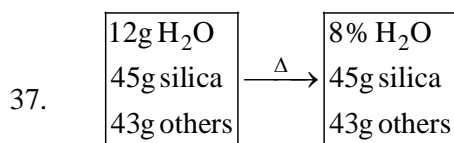
$$35. \quad \text{Say } n_{\text{Mg}_3(\text{PO}_4)_2} = n; \text{ then } {}^n\text{O} = 8n$$

$$\therefore 8n = 0.25 \Rightarrow n = \frac{0.25}{8} = 3.125 \times 10^{-2}$$

[B]

$$36. \quad \frac{69.98}{100} \times \text{Mol.wt} = 21 \times 12 \Rightarrow \text{mol.wt} = 360$$

[D]



100g original 'w' grams

80 % of w = water

i.e. 92 % of w = silica others

$$\text{Hence, } \frac{92}{100} \times w = 88\text{g} \Rightarrow w = 95.65$$

$$\therefore \% \text{ of silica} = \frac{45}{95.65} \times 100 = 47\%$$

[D]

$$38. \quad \text{M}_3\text{N}_2. \quad 28 \% \text{ nitrogen}$$

$$\therefore \frac{28}{100} \times (3M + 28) = 28 \Rightarrow M = 24$$

[C]

$$39. \quad \frac{55.9}{100} \times (46 + 96 + 18x) = 18x \Rightarrow x = 10$$

[D]

$$40. \quad n_x : n_y = \frac{(w/2)}{10} : \frac{(w/2)}{20} = 2 : 1$$

Hence [B]

41. Same as question 39. [C]

$$42. \quad n_I : n_O = \frac{25.4}{127} : \frac{8}{16} = \frac{1}{5} : \frac{1}{2} = 2 : 5$$

Hence I_2O_5 . [C]

$$43. \quad 0.014\% \times \text{mol.wt} = 2 \times \text{at. wt of N}$$

$$\text{i.e. } \frac{0.014}{100} \times M = 2 \times 14 = 28$$

$$\Rightarrow M = \frac{2800}{14 \times 10^{-3}} = 2 \times 10^5$$

[D]

$$44. \quad \text{mol. Wt} = 2 \text{ VD} = 100$$

$$w_{\text{chlorine}} = \frac{71}{100} \times 100 = 71\text{g}$$

$$w_{\text{metal}} = 29\text{g}$$

[A]

$$45. \quad \text{Mol.wt.} = 0.8 \times 28 + 0.2 \times 32 = 28.8$$

$$\therefore \text{VD} = \frac{M}{2} = 14.4$$

[C]

$$46. \quad Da_{2\text{w.r.t air}} = \frac{Da_2}{D_{\text{air}}} = \frac{Ma_2}{M_{\text{air}}} \approx \frac{71}{29}$$

Hence [A]

$$47. \quad \text{Say } NO_x. \text{ Then } \frac{30.4}{100} (14 + 16x) = 14 \Rightarrow x = 2$$

$$\therefore D_{\text{oxide wrt } O_2} = \frac{M_{\text{oxide}}}{M_{O_2}} = \frac{14}{32} = 1.44$$

[B]

$$48. \quad n_{H_2O} = n_{CH_3OH} \times 2 = 4 \quad \therefore \text{wt} = 4 \times 18 = 72$$

[D]

$$49. \quad \text{Say 'x' g. } \frac{x}{60+x} = \frac{20}{100} \Rightarrow x = 15$$

[A]



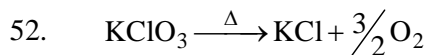
$$\therefore W_{Ag} = \frac{2.7}{(216+60)} \times 2 \times 108 = 2.11\text{g}$$

[A]

$$51. \quad n_{\text{CO}_2} = 2 \times n_{\text{C}_2\text{H}_5\text{OH}} = 2$$

$$\therefore W_{\text{CO}_2} = 2 \times 44 = 88 \text{ g}$$

Hence [D]



$$\text{Hence \% loss in wt} = \frac{48 \text{ g}}{122.5} \times 100 = 39.18$$

[C]

$$53. \quad n_{\text{Fe}} = \frac{2}{3} \times n_{\text{H}_2\text{O}} = \frac{2}{3} \quad \therefore W_{\text{iron}} = \frac{2}{3} \times 56 = 37.39$$

[A]

$$54. \quad n_{\text{CaCO}_3} = n_{\text{CaO}} = \frac{1.62}{56} = n_{\text{CaCl}_2} = 0.0289$$

$$\% \text{ of CaCl}_2 = \frac{0.0289 \times 111}{10} \times 100 = 32.11\%$$

[B]

$$55. \quad n_{\text{BaSO}_4} = n_{\text{SO}_2} = n_{\text{S}} \text{ (POAC on S)}$$

$$= \frac{8}{32} = \frac{1}{4} \quad \therefore \text{[D]}$$

$$56. \quad n_{\text{NaBr}} = n_1, \quad n_{\text{KBr}} = n_2 \text{ (say)}$$

$$n_{\text{AgBr}} = n_{\text{Br}} = n_1 + n_2 = \frac{0.97}{(108 + 88)} = 0.00516$$

$$\text{Also, } n_1 \times (103) + n_2 \times (119) = 0.569$$

$$\therefore n_2 = \frac{0.56 - 103 \times 0.00516}{16} = 0.00516$$

$$\therefore W_{\text{kBr}} = 119n_2 = 0.2118 \text{ g}$$

[B]

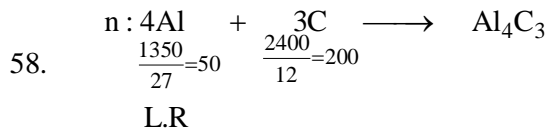
$$57. \quad W_{\text{O}} = 3.6769 - 2.0769 = 1.6 \text{ g}$$

$$2 \text{ mole} \times \xrightarrow{\text{with}} 5 \text{ mole 'O'}$$

$$'n' \text{ moles} \xrightarrow{\text{with}} \frac{1.6}{16} \text{ mole 'O'}$$

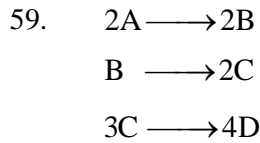
$$n = \frac{0.2}{5} = 0.04$$

[A]



$$\left. \begin{array}{l} 4\text{Al} \xrightarrow{\text{given}} 144 \\ 50 \xrightarrow{\text{given}} W \end{array} \right\} \Rightarrow w = 1800 \text{ g}$$

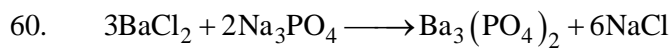
[D]



$$\therefore n_D = n_A \times \frac{2}{2} \times \frac{2}{1} \times \frac{4}{3}$$

$$= \frac{32}{3}$$

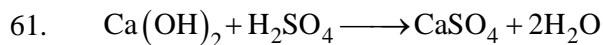
[D]



$n : 0.5 \quad \boxed{0.2}$
 L.R.

$$n_{\text{Ba}_3(\text{PO}_4)_2} = \frac{n_{\text{Na}_3\text{PO}_4}}{2} = 0.1$$

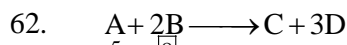
[D]



$\boxed{0.2}$
 LR

$$n_{\text{CaSO}_4} = n_{\text{Ca}(\text{OH})_2} = 0.2$$

[A]



$\frac{5}{8}$
 LR

$$n_C = \frac{n_B}{2} = 4; \quad n_D = 3 \times \frac{n_B}{2} = 12$$

Hence [B]

63. $\text{molality} = \frac{n}{w_{\text{solvent}}} \times 1000 \left(\text{urea : } \text{NH}_2 \underset{\text{O}}{\parallel} \text{C NH}_2 \right)$

$$= \frac{18/60}{(1500 \times 1.052 - 18)} \times 1000 = 0.192$$

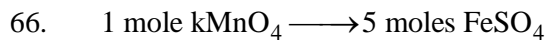
[B]

$$64. \text{ Molarity} = \frac{n}{V(\text{mL})} \times 1000 = \frac{1/98}{1000} \times 1000 \approx 0.01$$

[D]

$$65. [\text{Al}^{3+}] = \frac{20 \times 0.2 \times 2}{40} = 0.2\text{M}$$

[A]



$$V \times 0.01 \longrightarrow 50 \times 0.01$$

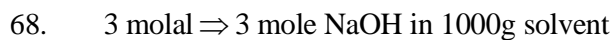
$$\Rightarrow V = 10\text{mL}$$

[D]

$$67. n_{\text{H}^+} = \left(\frac{100}{1000} \right) \times 0.001 \times 2 = 2 \times 10^{-4}$$

$$\therefore \text{no. of } \text{H}^+ = 2 \times 10^{-4} N_A = 1.2 \times 10^{20}$$

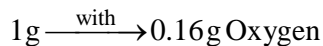
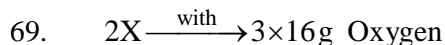
[B]



$$\therefore \text{vol} = \frac{\omega}{d} = \left(\frac{120 + 1000}{1.11} \right) = 1009\text{mL}$$

$$\therefore \text{Molarity} = \frac{n}{V(\text{mL})} \times 1000 = \frac{3}{1.009} = 2.97$$

[A]

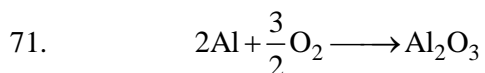


$$\therefore X = \frac{3 \times 16}{0.16 \times 2} = 150$$

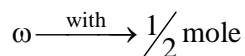
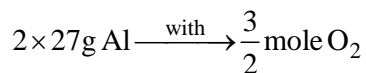
[D]

$$70. X_{\text{NaCl}} = \frac{n_{\text{NaCl}}}{n_{\text{NaCl}} + n_{\text{H}_2\text{O}}} = \frac{1}{1 + \frac{1000}{18}} = 0.0177$$

[A]

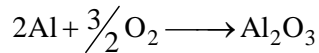
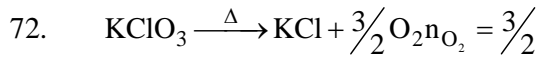


$$n: \quad n \quad \frac{1}{2}$$



$$\omega = \frac{2 \times 27}{3} = 18\text{g}$$

[D]



$$n_{\text{Al}_2\text{O}_3} = \frac{n_{\text{O}_2}}{\frac{3}{2}} = 1$$

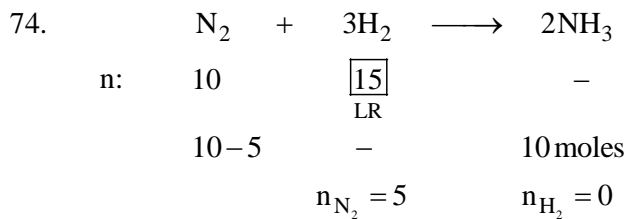
[A]

73. Consider 1 c solution

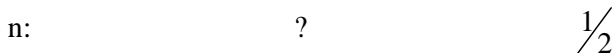
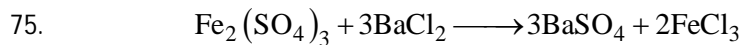
$$\frac{29}{100} \times (d \times 1000) = \omega_{\text{H}_2\text{SO}_4} = 3.6 \times 98$$

$$\therefore d = 1.22 \text{ g/mL}$$

[A]

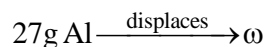
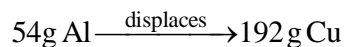
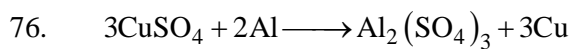


[A]



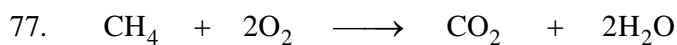
$$\frac{n_{\text{BaCl}_2}}{3} = \frac{n_{\text{FeCl}_3}}{2} \Rightarrow n_{\text{BaCl}_2} = \frac{1}{2} \times 3 = 0.75 \text{ moles}$$

[C]



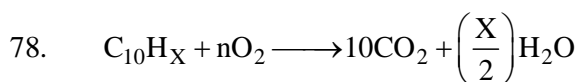
$$\therefore \omega = 96 \text{ g}$$

[C]



$$\therefore n_{\text{CO}_2} = 4; n_{\text{CH}_4} (\text{remaining}) = 1$$

[A]



Hence, $n = 10 + \frac{X}{4}$

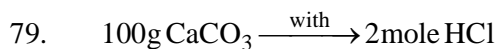
1 mole $C_{10}H_X \xrightarrow{\text{with}} \left(10 + \frac{X}{4}\right)$ moles

2.5 moles $\xrightarrow{\text{with}} 40$ moles

i.e. $10 + \frac{x}{4} = \frac{40 \times 1}{2.5} = 16$

$\therefore x = (16 - 10) \times 4 = 24$

[A]



$\omega \text{ g} \xrightarrow{\text{with}} \left(\frac{25\text{L}}{1000}\right) \times 0.75 \text{ M HCl}$

$\therefore \omega = 0.9375 \text{ g}$

[D]

80. $n_{\text{AgCl}} = n_{\text{Cl}^-} = n_{\text{HCl}} = \frac{2.125}{143.5} = V(\text{L}) \times \text{Molarity}$

$\therefore \text{Molarity} = \frac{2.125 \times 1000}{143.5 \times 25} = 0.59$

[B]

FOUNDATION BUILDER (SUBJECTIVE)

1. $\frac{X}{20} = y(\text{given})$. For B : $\frac{2X}{40} = \frac{X}{20} = Y$

2. $n_{\text{CH}_4} = \frac{1.6}{1.6} = 0.1 \text{ moles} = 6 \times 10^{22} \text{ molecules}$

Each molecule has $(6 + 4) = 10\bar{e}s$

$\therefore \text{total } \bar{e}s = 6 \times 10^{23}$

3. $n_{\text{H}_2\text{O}} = \frac{18\text{g}}{18\text{g/mol}} = 1 \text{ mole}$

1 molecule has $(2 + 8) = 10\bar{e}s$

\therefore 1 mole contains $10N_A$ electrons.

4. $O^{2-} : 10\bar{e}, 8\text{protons}, 8\text{neutrons per ion.}$

\therefore in 1 mole: $10N_A \bar{e}$, $8N_A$ protons, $8N_A$ neutrons

5. Atomic mass = $n_A \times$ mass of one atom
 $= 6 \times 10^{23} \times 6.64 \times 10^{-23} \text{ g} = 40 \text{ g}$

6. no. of atoms = $\frac{\text{wt}}{\text{wt of one atom}} = \frac{1}{3.98 \times 10^{-23}}$
 $= 2.5 \times 10^{22}$

7. $\omega_{\text{removed}} = 10^{21} \times 44 \text{ amu} = 7.35 \times 10^{-2} \text{ g}$
 $\therefore \omega_{\text{CO}_2, \text{remaining}} = 200 - 73.5 = 126.5 \text{ mg}$
 $\therefore n_{\text{CO}_2} = \frac{126.5 \times 10^{-3}}{44} = 0.002875$

8. 1 mole N^{3-} \therefore charge = $n_A \times 3e = 2.88 \times 10^5 \text{ C}$

9. $n_{\text{O}} = n_{\text{SO}_2} \times 2 = \frac{3.2 \times 10^{-3}}{64} \times 2 = 10^{-4} \text{ moles}$
 $n_{\text{S}} = n_{\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}} \times 2 = 2 \times 5 \times 10^{-3} = 10^{-2}$
 $\therefore n_{\text{O}} : n_{\text{S}} = \frac{10^{-4}}{10^{-2}} = 0.01$

10. $n_{\text{O}} = 3 \times n_{\text{NaNO}_3} + 2 \times n_{\text{NO}_2}$
 $= m \times (10\text{m}) + 2 \times \frac{1}{6} = 0.03 + 0.333 = 0.363$
 $n_{\text{N}} = n_{\text{NaNO}_3} + n_{\text{NO}_2} = 10 \times 10^{-3} + \frac{1}{6}$
 $= 0.01 + 0.166$
 $= 0.176$

11. $t(\text{s}) = \frac{6 \times 10^{23}}{10^6} = 6 \times 10^{17} \text{ S}$
 $t(\text{nr}) = \frac{6 \times 10^{17}}{3600} = 1.67 \times 10^{14}$
 $t(\text{yr}) = \frac{1.67 \times 10^{14}}{24 \times 365} = 1.9 \times 10^{10} \text{ years}$

12. atomic wt = $6.644 \times 10^{-23} \times 6 \times 10^{23}$
 $= 40 \text{ g/mol}$
 $\therefore n = \frac{40 \times 1000 \text{ g}}{40 \text{ g/mol}} = 1000 \text{ moles}$

$$13. \quad n_C = \frac{10^{-6} \text{ g}}{129 / \text{mol}}$$

$$\text{No. of atoms} = n_C \times 6 \times 10^{23} = 5 \times 10^{16}$$

$$14. \quad r = 0.1 \text{ inch} = 0.254 \text{ cm}$$

$$\omega_{\text{Fe}} = \frac{85.6}{100} \times \omega_{\text{ball}}$$

$$\omega_{\text{ball}} = V_{\text{ball}} \times \text{density}$$

$$= \frac{4}{3} \pi \times (0.254)^3 \times 7.75 = 0.532 \text{ g}$$

$$\omega_{\text{Fe}} = \frac{85.6}{100} \times 0.532 \text{ g} = 0.455 \text{ g}$$

$$n_{\text{Fe}} = \frac{0.455}{56} \text{ and no. of atoms} = 4.88 \times 10^{21}$$

$$15. \quad \frac{0.086}{100} \times \omega_{\text{starch}} = \text{wt of 1 atom} = 31 \text{ g}$$

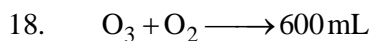
$$\therefore \omega_{\text{starch}} = \frac{3100}{0.086} = 3.6 \times 10^4$$

$$16. \quad V_{\text{NH}_3} = n_{\text{NH}_3} \times 22.4 \text{ L}$$

$$= \frac{3.4}{17} \times 22.4 = 4.48 \text{ L}$$

$$17. \quad n_{\text{O}_2} = \frac{\rho V}{RT} = \frac{\left(\frac{7.6 \times 10^{-10}}{760} \right) \times 1}{\frac{1}{12} \times 273} = \frac{10^{-12}}{22.75}$$

$$\therefore n_{\text{molecules}} = n_{\text{O}_2} \times n_A = \frac{60}{22.75} \times 10^{10} = 2.6 \times 10^{10}$$

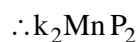


$$V_{\text{mL}} (600 - v) \text{ mL}$$

$$\frac{V}{22400} \times 48 + \frac{(600 - V)}{22400} \times 32 = 1 \text{ g}$$

$$\therefore V = 200 \text{ mL}$$

19. Element	% (with in 100 g)	no. of (in 100 g) atom	ratio
K	40.2	$\frac{40.2}{39} = 1.03$	2
Mn	26.8	$\frac{26.8}{55} = 0.48$	1
P	33	$\frac{33}{31} = 1.06$	2



20. Say $n_{\text{O}} = n$
 Then $n_{\text{H}} = 15n$
 And $n_{\text{C}} = \frac{70}{100} \times 15n = 10.5n$
 $\therefore \text{C}_{10.5}\text{H}_{15}\text{O}$ or $\text{C}_{21}\text{H}_{30}\text{O}_2$ is empirical formula
 Mol. Wt = $\frac{1}{0.00318} = 314$
 $\therefore \text{C}_{21}\text{H}_{30}\text{O}_2$

21. $9.03 \times 10^{20} \xrightarrow{\text{weight}} 0.311 \text{ g}$
 $6.02 \times 10^{23} \xrightarrow{\text{weight}} \text{mol. wt.}$
 $\therefore \text{mol. wt} = 207.33 \text{ g}$
 $\Rightarrow 131.3 + 19n = 207.33 \Rightarrow n = 4$

22. $\omega_{\text{C}} = \frac{58.97}{100} \times 102 = 59.9 \Rightarrow n_{\text{C}} = 5$
 $\omega_{\text{H}} = \frac{13.81}{100} \times 102 = 14.08 \Rightarrow n_{\text{H}} = 14$
 $\omega_{\text{N}} = \frac{27.42}{100} \times 102 = 27.97 \Rightarrow n_{\text{N}} = 2$
 $\therefore \text{C}_5\text{H}_{14}\text{N}_2$

23. $\omega_{\text{C}} = \frac{12}{44} \times \omega_{\text{CO}_2} = \frac{12}{44} \times 0.9482 = 0.2586$
 $\therefore n_{\text{C}} = 0.02155$
 $\omega_{\text{H}} = \frac{2}{18} \times \omega_{\text{H}_2\text{O}} = 0.02154$
 $\therefore n_{\text{H}} = 0.02154$
 $n_{\text{C}} : n_{\text{H}} = 1 : 1 \quad \therefore \text{CH}$

24. $\omega_{\text{CO}} = \frac{12}{100} \times \omega_{\text{cylinder}}$
 $\omega_{\text{cylinder}} = \pi r^2 h \times \text{density}$
 $= (3.14 \times 6.25 \times 10) \times 8.2 = 1610.7$
 $\therefore \frac{\omega_{\text{CO}}}{58.9} = n_{\text{CO}} = \frac{1}{15.9} \times \frac{12}{100} \times 1610.7 = 3.28$
 $\therefore \text{no. of atoms} = 3.28 \times 6 \times 10^{23}$
 $\approx 1.98 \times 10^{24}$

25. Mol. Wt = wt of 1 mole mix = $2VD = 76.6$
 $(x \text{ mol. NO}_2 + (1 - x) \text{ mol. N}_2\text{O}_4) = 76.6 \text{ g}$
 $\therefore x \times 46 + (1 - x) \times 92 = 76.6$

$$x = \frac{15.4}{46} = n_{\text{NO}_2} \text{ in 1 mole} = 0.335$$

$$n_{\text{mix}} \text{ in } 100 \text{ g} = \frac{100}{76.6}$$

$$\begin{aligned} \therefore n_{\text{NO}_2} \text{ in } 100 &= 0.335 \times n_{\text{mix}} \\ &= 0.437 \end{aligned}$$

26. molality = $\frac{n}{\omega_{\text{solvent}}} \times 1000$

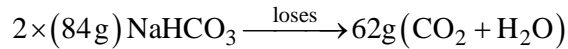
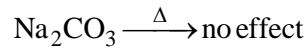
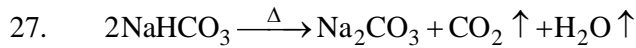
Consider 1L of solvent

$\text{C}_2\text{H}_5\text{OH}$
mol.wt = 46

$$N = 8$$

$$\omega_{\text{solvent}} = (1.025 \times 1000) - (8 \times 46) = 657$$

$$\therefore \text{molality} = \frac{8}{657} \times 1000 = 12.18$$

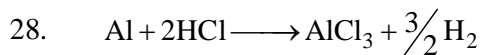


$$\omega_{\text{g}} \xrightarrow{\text{loses}} 0.124$$

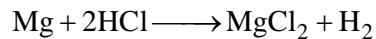
$$\therefore \omega = \frac{0.124}{62} \times 168 = 0.336 \text{ g}$$

$$\% \text{ of NaHCO}_3 = \frac{0.336 \times 100}{2} = 16.8\%$$

$$\text{and Na}_2\text{CO}_3 = 100 - 16.8 = 83.2\%$$



$$n_1 \text{ moles} \qquad \qquad \frac{3}{2} n_1 \text{ moles}$$



$$n_2 \text{ moles} \qquad \qquad n_2 \text{ moles}$$

$$1 \text{ g mix} \Rightarrow n_1 \times 27 + n_2 \times 24 = 1 \text{ g}$$

$$\begin{aligned} n_{\text{H}_2} = \frac{3}{2} n_1 + n_2 &= \frac{\rho V}{RT} = \frac{0.92 \times 1.2}{0.0821 \times 273} \\ &= 0.04926 \\ &\approx 0.05 \end{aligned}$$

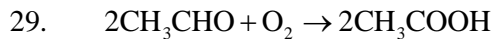
$$\therefore n_1 \approx \frac{0.2}{9} \Rightarrow \omega_{\text{Al}} = \frac{0.2}{9} \times 27 = 0.69$$

$$\text{And } \omega_{\text{Mg}} = 1 - 0.6 = 0.49$$

$$\text{Exact values: } n_1 = \frac{0.18225}{9} = 0.02025$$

$$\text{and } \omega_{\text{Al}} = 0.546759$$

$$\text{and } \omega_{\text{Mg}} = 0.453259$$



$$\omega : \quad 20\text{g} \quad 10\text{g}$$

$$n : \quad \frac{20}{40} \times 0.45 \quad \frac{10}{32} = 0.31$$

L.R

$$(A) \quad n_{\text{CH}_3\text{COOH}} = n_{\text{CH}_3\text{CHO}} = 0.45$$

$$\omega_{\text{CN}_3\text{COOH}} = 27.27\text{g.}$$

$$(B) \quad n_{\text{O}_2} (\text{left}) = \frac{10}{32} - \frac{20/44}{2} = 0.852$$

$$\omega_{\text{O}_2} = n_{\text{O}_2} \times 32 = 2.727\text{g}$$

$$I \% \text{ yeild} = \frac{23.8}{27.3} \times 100 = 87.2\%$$

30. $n_{\text{CH}} = n_{\text{A}} \times \frac{3}{2} \times \frac{20}{100} \times \frac{4}{2} \times \frac{40}{100} \times \frac{8}{3} \times \frac{50}{100} = 3.2 \text{ I}$

31. $n_{\text{CH}_4} = n_1$ and $n_{\text{C}_2\text{H}_4} = n_2$, say

$$\text{now, } n_1 \times 16 + n_2 \times 28 = 5\text{g}$$

$$\text{also, } n_{\text{CO}_2} = n_1 + 2n_2 = \frac{14.5}{44} = 0.33$$

$$\therefore n_1 = 0.193 \text{ and } n_2 = 0.068$$

$$\% \text{CH}_4 = \frac{\omega_{\text{CH}_4} \times 100}{5} = \frac{16n_1 \times 100}{5} = 60\% . \% \text{C}_2\text{H}_4 = 40\%$$

32. POAC on carbon

$$n_{\text{C}} = n_{\text{K}_2\text{CO}_3} \times 1 = n_{\text{K}_2\text{Zn}_2[\text{Fe}(\text{CN})_6]_2} \times 12$$

$$\therefore \text{ moles of product} = \frac{n_{\text{K}_2\text{CO}_3}}{12} = 0.0166$$

33. $n_{\text{Cu}} = n_{\text{Cu}} (\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ (POAC on Cu)

$$\omega_{\text{product}} = \left(\frac{10}{63.5} \right) \times [63.5 + 124 + 54]$$

$$= 38.03\text{g}$$



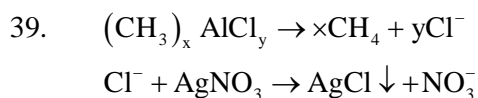
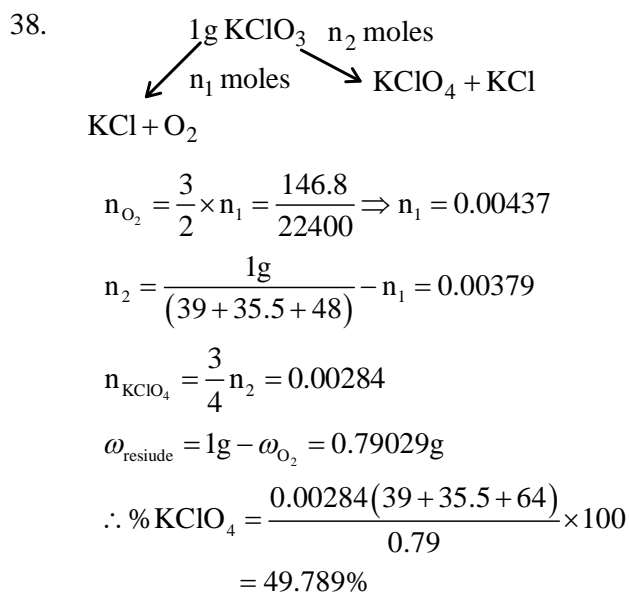
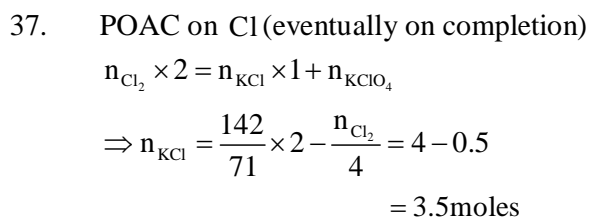
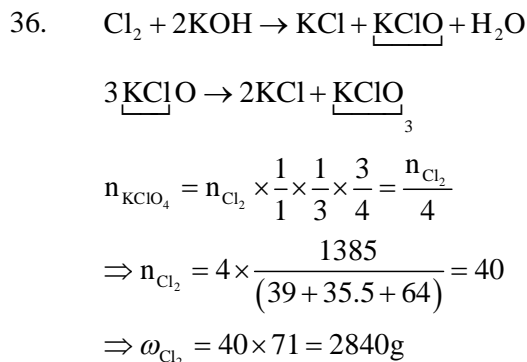
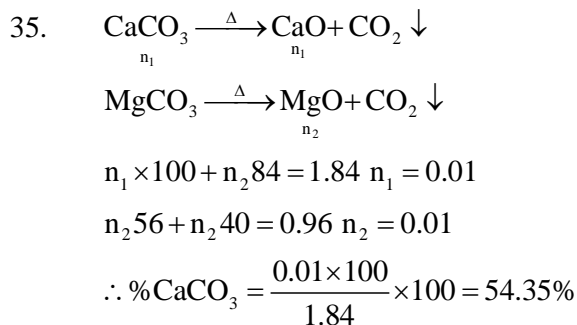
$$n = \frac{5.77}{170} \quad n = \frac{4.77}{58.5}$$

$$= 0.0394 \quad = 0.08$$

L.R.

$$n_{\text{AgCl}} = n_{\text{AgNO}_3} = 0.033$$

$$\therefore \omega_{\text{AgCl}} = 0.033 \times 143.5 = 4.87\text{g}$$



$$1. n_{\text{CH}_4} = x \cdot n_{(\text{CH}_3)_x \text{AlCl}_y}$$

$$\Rightarrow \frac{0.996}{(108 + 35.5)} = y \cdot \frac{0.643}{(15x + 27 + 35.5y)}$$

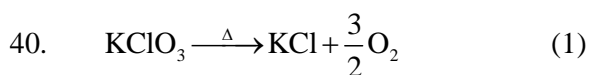
$$2. n_{\text{AgCl}} = n_{\text{Cl}^-} = y \cdot n_{(\text{CH}_3)_x \text{AlCl}_y}$$

$$\Rightarrow \frac{0.996}{(108 + 35.5)} = y \cdot \frac{0.643}{(15x + 27 + 35.5y)}$$

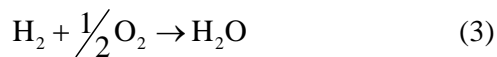
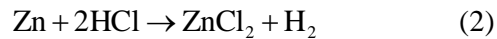
$$1 \div 2 \Rightarrow \frac{x}{y} = 1.99 \approx 2$$

$$\therefore \text{in 1, } \frac{0.222}{16} = \frac{0.643(2y)}{(30y + 27 + 35.5y)}$$

$$\Rightarrow y = 1 \text{ and } x = 2$$



6.125g



in (1),

$$n_{\text{O}_2} = \frac{3}{2} \times n_{\text{KClO}_3} = 0.075$$

in (3),

$$n_{\text{H}_2} = 2 \times n_{\text{O}_2} = 0.15$$

in (2),

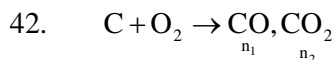
$$n_{\text{Zn}} = n_{\text{H}_2} = 0.15$$

$$\therefore w_{\text{Zn}} = 0.15 \times 65.3 = 9.795 \text{g}$$

41. (A): B, obviously

(B): A, obviously

$$\text{I: } n_{\text{C}} = \frac{7}{2} \times n_{\text{B}} = \frac{7}{2}$$



POAC on C

$$n_{\text{C}} = \frac{12}{12} = n_1 + n_2 = 1$$

$$\text{POAC on O: } n_{\text{O}} = n_1 + 2n_2 = \frac{20}{16} = 1.25$$

$$\Rightarrow n_2 = 1.25 - 1 = 0.25$$

and $n_1 = 0.75$

$$\therefore n_{\text{CO}} : n_{\text{CO}_2} = n_1 : n_2 = 3 : 1$$



$$\frac{n_{\text{NaOH}}}{2} = n_{\text{H}_2\text{SO}_4} = \left(\frac{15}{1000}\right) \times \frac{1}{10} \times \frac{1}{2} = 7.5 \times 10^{-4}$$

$$\begin{aligned} \therefore \text{strength} &= \frac{\omega_{\text{H}_2\text{SO}_4}}{V_{\text{H}_2\text{SO}_4} (\text{mL})} \times 1000 \\ &= 6.125 \text{g/L} \end{aligned}$$

44. $\text{Molarity} = \frac{n}{V(\text{mL})} \times 1000 = \frac{10 \times 10^{-3}}{100} \times 10^{-3} = 0.1 \text{M}$

$$\text{in gram/L} = 0.1 \times (39 + 16 + 1) = 5.6 \text{g/L}$$

45. $n_{\text{SO}_4^{2-}} = n_{\text{H}_2\text{SO}_4} = \left(\frac{100}{1000}\right) \times 0.001 \text{M} = 10^{-4}$

$$\therefore \text{no. of ion} = n_{\text{SO}_4^{2-}} \times n_A = 6 \times 10^{19}$$

46. $n_{\text{CuSO}_4 \cdot 5\text{H}_2\text{O}} = n_{\text{Cu}^{2+}} = 0.5 \times 0.01 = 5 \times 10^{-3}$

$$\begin{aligned} \text{weight} &= n \times \text{mol.wt} = 5 \times 10^{-3} \times 249.5 \\ &= 1.2475 \text{g} \end{aligned}$$

47. $M_1V_1 + M_2V_2 = M_3V_3$

$$\begin{aligned} \therefore M_{\text{final}} = M_3 &= \frac{50 \times 0.5 + 75 \times 0.25}{50 + 75} \\ &= 0.35 \text{Molar} \end{aligned}$$

48. $\text{Molality} = \frac{n}{\omega_{\text{solvent}}} \times 1000$

$$= \frac{3/30}{250} \times 1000 = 0.4 \text{molal}$$

49. $\frac{n_{\text{I}_2}}{n_{\text{I}_2} + n_{\text{C}_6\text{H}_6}} = 0.2$

Say, we have 1 mole mix.

$$\text{Then, } n_{\text{I}_2} = 0.2 \text{ and } n_{\text{C}_6\text{H}_6} = 0.8$$

$$\begin{aligned} \therefore \text{molality} &= \frac{n_{\text{I}_2}}{\omega_{\text{C}_6\text{H}_6}} \times 1000 \\ &= \frac{0.2}{0.8 \times 78} \times 1000 = 3.205 \text{m.} \end{aligned}$$

50. Consider 1L solution.

$$\omega_{\text{solution}} = 1000 \times 1.06 = 10609.$$

$$\omega_{\text{KCl}} = \frac{10}{100} \times \omega_{\text{solution}} = 106 \text{g}$$

$$\begin{aligned}\text{Molality} &= \frac{n_{\text{KCl}}}{V_{\text{solution}}(\text{mL})} \times 1000 \\ &= \frac{106/74.5 \times 1000}{1000} = 1.4228\text{M}\end{aligned}$$

51. 30% NH₃. ⇒ 70% water.

$$\text{i.e. } \frac{70}{100} \times \omega_{\text{solution}} = \omega_{\text{water}} = 105\text{g}$$

$$\text{i.e. } \omega_{\text{solution}} = \frac{100}{70} \times 150 = 150\text{g}$$

$$V_{\text{solution}} = \frac{\omega}{\text{density}} = \frac{150}{0.9} = 166.67\text{mL}$$

52. Consider 1L of solution,

$$\omega_{\text{solution}} = 1.025 \times 1000 = 1025\text{g}$$

$$n_{\text{ethanol}} = M \times V = 8 \times 1 = 8\text{moles}$$

$$\omega_{\text{ethanol}} = 8 \times 46 = 368$$

$$\begin{aligned}\text{molality} &= \frac{n_{\text{ethanol}}}{\omega_{\text{solvent}}} \times 1000 \\ &= \frac{8}{(1025 - 368)} \times 1000 \\ &= 12.176\text{molal}\end{aligned}$$

53. 2SO₂ + O₂ → 2SO₃

$$n\text{SO}_2 = n\text{SO}_3 \Rightarrow n\text{SO}_3 = 5$$

Page 53 of booklet missing. Q 54 50 63

58. AgCl + AgBr

$$\% \text{Ag} = \frac{(n_1 + n_2)108}{n_1 \times 143.5 + n_2 \times 188} = \frac{60.94}{100}$$

$$\Rightarrow \frac{n_1}{n_2} = 0.31955$$

$$\begin{aligned}\% \text{Cl} &= \frac{n_1 \times 35.5}{n_1 \times 143.5 + n_2 \times 188} \times 100 = \frac{\left(\frac{n_1}{n_2}\right) \times 35.5 \times 100}{\left(\frac{n_1}{n_2}\right) 143.5 + 188} \\ &= 4.856\%\end{aligned}$$

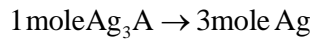
$$\% \text{Br} = 100 - (60.94 + 4.856) = 34.2\%$$

59. (COOH)₂ $\xrightarrow[\text{H}_2\text{SO}_4]{\Delta}$ CO₂ + H₂O (unbalanced)

$$\text{POAC}^n \text{C} = {}^n \text{CO}_2 \times 1 = {}^n (\text{COOH}) \times 2 = \frac{10}{90} \times 2 = \frac{2}{9}$$

$$\therefore {}^v \text{CO}_2 = \frac{2}{9} \times 22.4\text{L} = 4.977\text{L}$$

60. acid is H_3A . salt is Ag_3A



$$\therefore {}^n \text{Ag}_3\text{A} = \frac{{}^n \text{Ag}}{3} = \frac{0.37/108}{3} = 0.00114$$

$$\therefore \frac{0.607}{\text{mol.wt of } \text{Ag}_3\text{A}} = 0.00114$$

$$\Rightarrow \text{mol.wt} = (108 \times 3 + \text{A}) = 531$$

$$\therefore \text{A} = 207$$

$$\therefore \text{wt of } \text{H}_3\text{A} = 210$$

GET EQUIPPED

ONLY ONE OPTION

1. $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

say, wt : 14x 3x

$$\text{n, t = o} \quad \frac{14x}{28} = \frac{x}{2} \quad \frac{3x}{2} \quad -$$

$$\text{t = t} \quad \frac{x}{2} - y \quad \frac{3x}{2} - 3y \quad 2y$$

NH_3 was 40% by mol.

$$\text{i.e. } 2y = \frac{40}{100} \left(\frac{x}{2} \cdot y + \frac{3x}{2} - 3y + 2y \right)$$

$$\Rightarrow 5y = 2x - 2y \Rightarrow y = \frac{2x}{7} \Rightarrow \frac{x}{y} = 3.5$$

$$\begin{aligned} X_{\text{N}_2} &= \frac{(x/2 - y)}{(2x - 2y)y} = \frac{\left[\frac{x/y - 1}{2} \right]}{2[x/y - 1]} \\ &= \frac{1.75 - 1}{2(2.5)} = \frac{0.75}{5} \\ &= 0.15 \end{aligned}$$

(A)

2. ${}^n \text{A} = {}^n \text{B}$. (obviously)

$$\therefore M_A \times {}^A \text{A} = 1.4\text{g} \text{ and } M_B \times {}^n \text{B} = 0.8$$

$$\therefore \frac{M_B}{M_A} = \frac{0.8}{1.4} = 0.57.$$

(C)

3. $3.2\text{g metal} \xrightarrow{\text{with}} 0.4\text{g oxygen}$

$64\text{g metal} \rightarrow w_g \text{ oxygen}$

$$w = \frac{64}{3.2} \times 0.4 = 8\text{g}$$

$\therefore 128\text{g metal with } 16_g \text{ O}$

i.e. H_2O

(B)

4. $4M \times \xrightarrow{\text{with}} 4.28_g \text{ O. (since } X_4O_6)$

$5.72_g \times \xrightarrow{\text{with}} 4.28_g \text{ O}$

$$\therefore M_x = \frac{5.72 \times 6 \times 16}{4 \times 4.28} = 32$$

(A)

5. $n = \frac{w}{\text{mol.wt}} = \frac{224}{22400} = 0.01$

$$\text{mol.wt} = \frac{wt}{n} = \frac{1}{0.01} = 100$$

$$\Rightarrow 3 \times \text{at.wt.} = 100 \Rightarrow \text{at.wt} = 33.3_g$$

$$\text{mass of one atom} = \frac{33.3}{6.02 \times 10^{23}} = 5.53 \times 10^{-23}_g$$

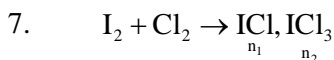
(C)

6. $n = \frac{w}{\text{mol.wt}} = \frac{PV}{RT} = \frac{2 \times 0.35}{0.0821 \times 273} = 3.123 \times 10^{-2}$

$$\text{i.e. } \frac{1}{2 \times \text{At.wt}} = 3.123 \times 10^{-2}$$

$$\text{wt of one atom} = \frac{\text{at.wt}}{N_A} = \frac{16}{N_A}$$

(C)



POAC on I

$${}^n\text{I} = \frac{25.4}{127} = n_1 + n_2 \quad n_1 = 0.1$$

$$n_2 = 0.1$$

POAC on Cl

$${}^n\text{Cl} = \frac{14.2}{35.5} = n_1 + 3n_2$$

$$\therefore n_1 : n_2 = 1 : 1$$

(A)

8. $\text{FeSO}_4 : n_1 \Rightarrow \text{SO}_4^{2-} = n_1$ and $\text{Fe}^{2+} = n_1$
 $\text{Fe}_2(\text{SO}_4)_3 : n_2 \Rightarrow \text{SO}_4^{2-} = 3n_2$ and $\text{Fe}^{3+} = 2n_2$
 $n_1 = 3n_2$ (given) $\Rightarrow \frac{n_1}{n_2} = 3$

$$\frac{\text{Fe}^{2+}}{\text{Fe}^{3+}} = \frac{n_1}{2n_2} = 3$$

$$\frac{\text{Fe}^{2+}}{\text{Fe}^{3+}} = \frac{n_1}{2n_2} = \frac{n_1/n_2}{2} = 3 : 2$$

(D)

9. $0.36\text{M} : V_1$ say and $0.15\text{M} : V_2$ say

$$M_{\text{final}} = 0.24 = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$

$$\Rightarrow \frac{36V_1 + 0.15V_2}{V_1 + V_2} = 0.24$$

$$\text{or } \frac{0.36 \times \frac{V_1}{V_2} + 0.15}{\frac{V_1}{V_2} + 1} = 0.24$$

$$\therefore 0.12 \left(\frac{V_1}{V_2} \right) + 0.15 = 0.24 \left(\frac{V_1}{V_2} \right) + 0.24$$

$$\Rightarrow \frac{V_1}{V_2} = \frac{0.09}{0.12} = \frac{3}{4}$$

(D)

10. At mass = $N_A \times$ mass of an atom
 $= 6 \times 10^{23} \times 3.98 \times 10^{-23} = 24\text{g}$

(C)

11. $\text{Fe}_2[\text{Fe}(\text{CN})_6]$

$$\frac{\omega_{\text{Fe}}}{\omega_{\text{C}}} = \frac{3 \times 56}{6 \times 12} = \frac{7}{3}$$

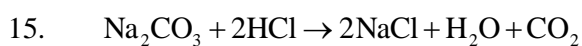
(C)

12. obvious (D)

13. obvious (B)

14. 1g atom \Rightarrow 1 mole of atom – 14g.

(A)



$$n_{\text{HCl}} = 2 \times n_{\text{Na}_2\text{CO}_3} = V_{\text{HCl}} \times M_{\text{HCl}}$$

$$\Rightarrow V \times 3 = 2 \times \frac{1.431}{106} \Rightarrow V = 9\text{mL.}$$

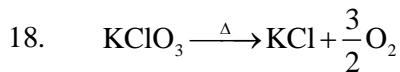
(B)

16. They must have same mol. wt.

(C)

$$17. \frac{V_{\text{micron sphere}}}{V_{\text{20 \AA sphere}}} = \frac{\frac{4}{3}\pi \times (2 \times 10^{-6})^3}{\frac{4}{3}\pi \times (2 \times 10^{-9})^3} = 10^9$$

(A)



$$n_{\text{KClO}_3} = \frac{n_{\text{O}_2}}{3/2} = \frac{0.1}{3/2} = \frac{2}{30}$$

$$\% \text{ purity} = \frac{2}{30} \times (122.5) \times 100 = 81.66\%$$

(B)

$$19. n = \frac{V(m_2) \times m}{1000} = \frac{1 \times 0.65}{1000} = 6.5 \times 10^{-4} \text{ moles}$$

$$\therefore w_{\text{BaCl}_2} \cdot 2\text{H}_2\text{O} = (137 + 71 + 36) \times 6.5 \times 10^{-4} = 0.1586\text{g}$$

$$w_{\text{BaCl}_2} = (137 + 71) \times 6.5 \times 10^{-4} = 0.1352\text{g}$$

(A)

$$20. \frac{1.36 \times V + 200 \times 2.4}{500} = 1.24$$

$$\Rightarrow V = 102.94 \text{ mL}$$

(B)

$$21. wt = \frac{11.5}{M_{\text{C}_6\text{H}_5\text{COOK}}} \times \frac{100}{71} \times M_{\text{C}_6\text{H}_5\text{CH}_3} = 9.31\text{g}$$

22. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} : n$, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O} : n_2$

total wt = 5g and anhydrous 3g

$$\therefore n_1 \times 249 + 249n_2 = 5$$

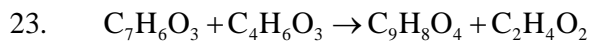
$$\text{and } n_1 \times 159 + 120n_2 = 3$$

on solving, $n_1 = 0.0149$ and $n_2 = 0.0052$

$$\Rightarrow w_{\text{CuSO}_4 \cdot 7\text{H}_2\text{O}} = 3.729\text{g.}$$

$$\therefore \% \text{ by wt} = \frac{3.72}{5} \times 100 = 74.4\%$$

(C)



$$\omega : 2g \quad 4g$$

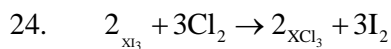
$$n : 0.0144 \quad 0.039 \quad 0.01449$$

$$\text{theoretical yield} = 0.01449 \times M_{C_4H_6O_3}$$

$$= 2.69$$

$$\therefore \% \text{ yeild} = 80.76\%$$

(A)



$$n_{XI_3} = n_{XCl_3} \Rightarrow \frac{0.5}{(M + 381)} = \frac{0.236}{(M + 106.5)}$$

$$\Rightarrow M = 138.88 = 139$$

(B)

25. $n = \frac{\text{no.of molecular}}{N_A} = \frac{(500\text{cm}^2/0.21\text{nm}^2)}{6 \times 10^{23}} = V \times \text{Molarity}$

$$\text{i.e. } V = \frac{n}{(4.24/256)} = 2.395 \times 10^{-5} \text{L.}$$

(B)



$$n_{AgBr} = 2n_2 \text{ and } n_{AgCl} = 2n_1,$$

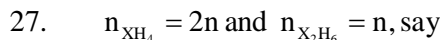
$$\therefore 2n_1(143.5) + 2n_2(188) = 0.9065g$$

$$\text{and } (2n_1 + 2n_2)188 = 1.005g$$

$$\text{then } n_1 = 0.00115 \text{ and } \omega_{CuBr_2} = 0.35g$$

$$\therefore 25\% \text{ and } 58\%$$

(A)



$$n_x = m_{XH_4} + (n_{X_2H_6} \times 2) = 4n$$

$$\text{i.e. } \frac{5}{X} = 4n \text{ and } (2n)(X + 4) + n.(2X + 6) = 5.628$$

$$\text{i.e. } \frac{5}{X}(X + 4) + \frac{5}{4X}(2X + 6) = 5.628$$

$$\text{or, } \frac{5}{2} + \frac{10}{2} + \frac{5}{2} + \frac{7.5}{X} = 5.628$$

$$\text{or } X = \frac{17.5}{0.628} = 27.86 \approx 28$$

(A)

$$28. \quad M_{\text{AgNO}_3} = \frac{0.0125 / (39 + 80)}{1 \text{ mL}} = 0.0105 \text{ M}$$

$$\therefore 0.0105 \times \frac{42.5}{1000} = n_{\text{AgNO}_3}$$

$$= 0.00446$$

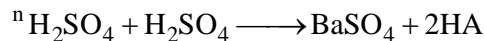
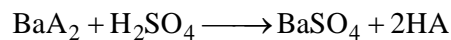
$$n_{\text{AgNO}_3} = n_{\text{NaBr}} + 2n_{\text{Na}_2\text{SO}_4}$$

$$\therefore n_1 + 2n_2 = 0.00446$$

$$\text{also, } n_1 \times 103 + n_2 \times 142 = 2/5 \left(\text{wt of } \frac{1}{5}^{\text{th}} \text{ portion} \right)$$

29. Let acid be HA

Salt: $\text{BaA}_2 \cdot 2\text{H}_2\text{O}$



$$\therefore \frac{4.29}{137} = \frac{21.64}{1000} \times 0.477$$

$$\therefore A = 121$$

$$\therefore \text{HA} = 122$$

30. total moles = n (say)

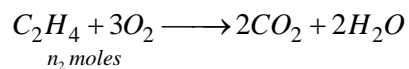
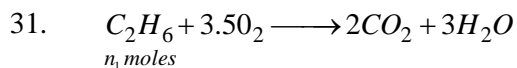
$$0.15n = ^n \text{CH}_3\text{XCOOH} \text{ and } 85^n = ^n \text{H}_2\text{O}$$

$$\therefore 0.15n \times 60 + 0.85n \times 18 = 30$$

$$\therefore n = \frac{30}{9 + 15.3} = 1.234$$

$$\therefore ^n \text{NaOH} = ^n \text{CH}_3\text{COOH} = 0.15n = 0.18519$$

$$\therefore V_{\text{NaOH}} = 18.5 \text{ L} [B]$$



$$n_1 + n_2 = \frac{PV}{RT} = \frac{1 \times 40}{0.0821 \times 400} = 1.218$$

$$\text{also } 3.5n_1 + 3n_2 = n_{\text{O}_2} = \frac{130}{32} = 4.06$$

$$\therefore n_1 = 0.817$$

$$n_2 = 0.401$$

$$\therefore \% \text{C}_2\text{H}_4 = 33\% \text{ and } \% \text{C}_2\text{H}_6 = 67\% [A]$$

32.	%	no. of atom	ratio
Al	10.5	0.3889	1
K	15.1	0.388	1
S	24.8	0.775	2
O	49.6	3.1	8

$$33. \quad V_{molecule} = \frac{\sqrt{3}}{4} \left(100 \text{ \AA} \right)^2 \times 300 \text{ \AA}$$

$$= 1.299 \times 10^{-24}$$

$$\therefore \text{mol. Wt} = N_A \times V_{mol} \times \text{density}$$

$$= 6 \times 10^{23} \times 1.299 \times 10^{-24} \times 1.2 \times 10^3 \text{ kg/m}^3$$

$$= 939 \text{ kg (B)}$$

One and more than one right

1. 3 moles in 1L (1250 g)

$$w_{Na_2S_2O_3} = 3 \times (46 + 64 + 48) = 474$$

(A) % by weight = $\frac{474}{1250} \times 100 = 37.92\%$

(B) $x = \frac{3}{3 + \left(\frac{1250 - 474}{18} \right)} = \frac{3}{46.11} = 0.065$

(C) molality of Na^+ = $\frac{n}{w_{solvent}} \times 1000$

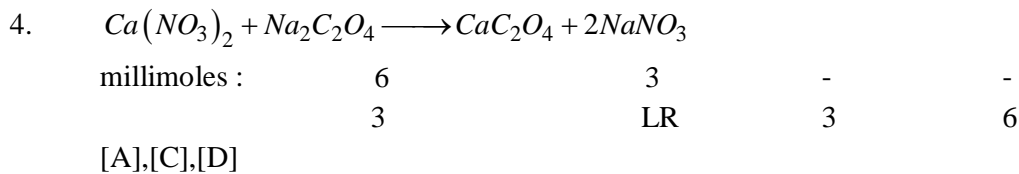
$$= \frac{3 \times 2}{(1250 - 474)} \times 1000 = 7.73$$

2. mo. wt = wt of 22.4 L = 28.896 g

$$V_D = \frac{\text{mol. wt}}{2} = 14.48$$

(A) and (B)

3. [A] : 32 g [B] $\frac{1}{2} \times b4 = 32 \text{ g}$ [D] : 32 g



5. ${}^n CaO = {}^n CaCO_3 = \frac{1.12}{56} = 0.02$

$$w_{CaCO_3} = 0.02 \times 100 = 2 \text{ g}$$

$$w_{CaCl_2} = 0.02 \times 111 = 2.22 \text{ g}$$

$$\therefore w_{NaCl} = 2.22 \text{ g}$$

[A, C]

6. ${}^n NaCl = 100 \text{ mmoles} ; {}^n HCl = 300 \text{ mmoles}$

$${}^n CaCl_2 = 200 \text{ mmoles} \left(200 Ca^{2+}, 400 Cl^- \right)$$

$$\frac{\text{cation}}{\text{anions}} = \frac{600}{800} = \frac{3}{4}$$

$$[Cl^-] = \frac{800}{400} = 2M$$

$$\therefore [A], [C]$$

7. Obvious A,B,D (${}^n H = 4$)

8. 3 mole NH_3

$$w_H = 3 \times 14 = 42 \text{ g}$$

$$W_N = 3 \times 14 = 42 \text{ g}$$

$$\text{molecule} = 3N_A = 18 \times 10^{23}$$

$$\text{atoms} = 4 \times 3 \times N_A = 72 \times 10^{23}$$

[A], [B], [C], [D]

9. Obvious : [A], [B]

10. [B],[C]: obvious others depend on volume

n: 5m 5m - -

5 millimoles in 100 ml

Hence [C] and [D]

14. Hence [C], [D]

$$\text{Mol. Wt} = \frac{14}{11.2} \times 22.4 = 28$$

Match the following

1. (I) wt % of C = $\frac{13 \times 12}{407} \times 100 = 38.33\%$ (D)

(II) wt % of H = $\frac{6}{407} \times 100 = 1.47\%$ (A)

(III) wt of H: wt of Cl = 6 : 6 × 35.5 (C)

(IV) mo. of C: O = 13:2 (E)

2. (a) $\frac{w_{SO_2}}{W_{O_2}} = 2(s)$

(b) $d = 10/5 = 2 \text{ g/cc} \therefore \text{sp. gr} = 2(s)$

(c) $M = 2VD = 32(Q)$

(d) molecular = $\frac{132}{44} = 3 \therefore \text{at anons} = 9(R)$

3. (a) $[Al^{3+}] = \frac{20}{400} = 0.04M$

$$[H^+] = \frac{40}{500} = 0.084$$

Total = 0.12 M

$$[Cl^-] = \frac{60+40}{500} = 0.2M$$

(P), (S)

$$(b) [K^+] = \frac{20}{100} = 0.2M$$

$$[Cl^-] = \frac{20}{100} = 0.2M$$

(S)

$$(c) [K^+] = \frac{12}{100} = 0.12M$$

[P], [Q]

$$[SO_4^{2-}] = \frac{6}{100} = 0.06M$$

[S]

$$(d) w_{H_2SO_4} = 200 \times \frac{24.5}{100} = 49 \Rightarrow {}^n H_2SO_4 = 1/2$$

$$[H^+] = \frac{1}{200} \times 1000 = 5M$$

$$[SO_4^{2-}] = \frac{1/2}{200} \times 1000 = 2.5M$$

[R]

4. (A) $V_{SO_2} = 11.2L$

$$w_{SO_2} = 32g$$

$$\text{total atoms} = \frac{1}{2} \times 2 \times N_A$$

(B) ${}^n H_2 = 1/2 \therefore V_{H_2} = 11.2L$

$$w_{H_2} = 1g, \text{ , total atoms} = N_A [P]$$

(C) no. of atoms = $0.5 \times 3 \times N_A = 1.5 N_A$

[P], [Q], [R]

(D) $1 \text{ mole } O_2 \therefore V = 22.4L$

$$\text{Atoms} = 12 \times 10^{23}$$

$$wt = 32g$$

[S]

COMPREHENSION

Passage 1

1. wt of 1 atom = 1amu = 1.66×10^{-24} g. (C)
2. $n_s = n_{\text{H}_2\text{SO}_4} = 100 \therefore \text{wt} = 3200\text{g}$. (A)
3. $\frac{3.4}{100} \times (M) = \omega_s = 2 \times 32 \Rightarrow M = 1882.3$ (B)
4. $\text{C} + \text{O}_2 \rightarrow n_{\text{C}} = n_{\text{C}} = n_{\text{O}_2} = 1$
 $\Rightarrow V_{\text{O}_2} = \frac{20}{100} \times V_{\text{air}} = 22.4\text{C} \Rightarrow V_{\text{air}} = 112\text{L}$ (B)

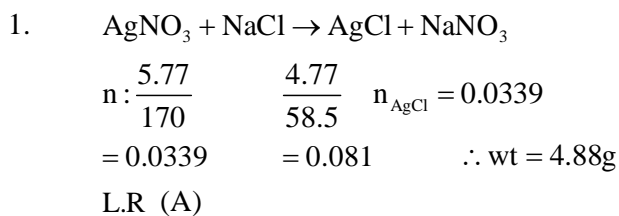
Passage – 2

1. Consider 1 L.
 $n_{\text{KOH}} = 6.9 \Rightarrow \omega_{\text{KOH}} = 6.9 \times 56 = 386.4$
 $\frac{30}{100} \times \omega_{\text{solu}} = 386.4 \Rightarrow \omega_{\text{solu}} = 1288\text{g}$
 $\therefore d = 1.2889\text{g/mL}$. (A)
2. $\frac{134}{1000} \times m_{\text{H}_2\text{SO}_4} \times 2 = n_{\text{NH}_3} = \frac{PV}{RT} = \frac{0.2 \times 2}{0.0821 \times 303}$
 $\Rightarrow M_{\text{H}_2\text{SO}_4} = 0.06$ (C)
3. $\frac{1600 \times 0.205}{1600 + V} = 0.2 \Rightarrow V = 40\text{mL}$ ()
4. $\frac{n_{\text{H}_2\text{S}}}{1} = \frac{n_{\text{H}_2\text{SO}_4}}{5} \Rightarrow n_{\text{H}_2\text{SO}_4} = \frac{5 \times 34}{34} = 5$
 $\therefore V \times 0.2 = 5 \Rightarrow V = 25\text{L}$ (A)

Passage – 3

1. $m_{\text{H}_2\text{O}} = \frac{18\text{g}}{6 \times 10^{23}} = 3 \times 10^{-23}$ g (D)
2. Avogadro's law. (A)
3. obvious Mass is 16amu. (C)
4. obvious (A)

Passage – 4



2. repeated passage 2, Q-2

3. $\therefore \omega_{\text{H}_2\text{SO}_4} = 0.12 \times 98 = 11.7\text{g (A)}$

INTEGER

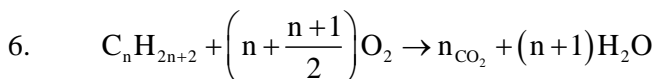
1. 0.5 mole N^{3-} . N^{3-} has $10\bar{e}$.
 \therefore 5 moles.

2. $10.5 \times 10^3 \text{ kg/m}^3 \therefore \text{mass} = 10.5 \times 10^3 \times 10^{-12}$
 $= 1.05 \times 10^{-8} \text{ kg}$
 $\therefore n_{\text{Ag}} = \frac{1.05 \times 10^{-5}}{108} \Rightarrow \text{atom} = n_{\text{Ag}} \times n_{\text{A}}$
 $\approx 5.83 \times 10^{16}$

3. MCl_x : say. mol.wt = $(M + 106.5)$
 $n_{\text{Cl}^-} = (n_{\text{MCl}_x}) \times (X) = \frac{0.22x}{(M + 106.5)}$
 $n_{\text{Cl}^-} = n_{\text{Ag}} + \frac{0.51}{(170)} = 3 \times 10^{-3}$
 $M \approx \frac{6.4}{0.57} = 112\text{s (Dulong petite's law)}$
 $\therefore \frac{0.22 \times x}{(112 + 106.5)} = 3 \times 10^{-3} \therefore x = 3$

4. $n_{\text{Fe}} = \frac{8}{100} \times \frac{2800}{56} = 4$

5. $\frac{x + 5 + 20 \times 2}{x + 20} = 2.6 \Rightarrow 5x + 40 = 2.6x + 52$

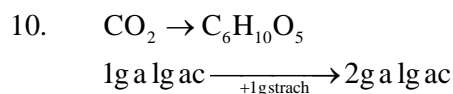


$$\frac{n + \frac{n+1}{2}}{n} = \frac{7}{4} \Rightarrow 4n + 3n + 2 = 7n \quad \text{or} \quad n = 2$$

$$7. \quad n = \frac{\omega}{\text{mol.wt}} = \frac{1440}{60 \times 12} = 2$$

$$8. \quad \frac{5}{100} \times \omega_{\text{solu}} = 0.3 \text{g} \Rightarrow \omega_{\text{solu}} = 6 \text{g}$$

$$9. \quad \frac{0.25}{100} \times 89600 = \omega_{\text{Fe}} = n \times 56 \Rightarrow n = 4.5$$



1g strach

POAC on carbon

$$n_{\text{CO}_2} \times 1 = n_{\text{C}_6\text{H}_{10}\text{O}_5} \times 6$$

$$= \frac{1}{162} \times 6 = \frac{1}{27}$$

$$\therefore \text{time} = \frac{1/27}{4.7 \times 10^{-3}} = 8$$

EXPERTISE ATTAINERS

1. POAC on Co

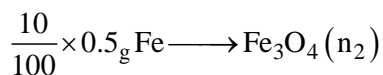
$$n_{\text{CO}_3\text{O}_4} \times 3 = n_{\text{CO}} \times 1$$

$$\Rightarrow n_{\text{CO}} = \frac{0.2125 \times 3}{(177 + 64)} \therefore \omega_{\text{CO}} = n_{\text{CO}} \times 59 = 0.156 \text{g}$$

$$n_{\text{PPt}} \times 1 = n_{\text{Co}}$$

$$\therefore \omega_{\text{ppt}} = n_{\text{ppt}} \times \text{mol.wt} = 1.52 \text{g}$$

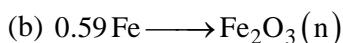
2. (a) $\frac{90}{100} \times 0.5 \text{g Fe} \rightarrow \text{Fe}_2\text{O}_3 (n_1)$



$$n_1 \times 2 = \frac{0.45}{56} \Rightarrow n_1 = 0.04$$

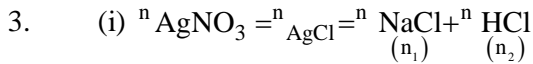
$$n_2 \times 3 = \frac{0.05}{56} \Rightarrow n_2 = 0.0003$$

$$\therefore \text{wt of mix} = (160) \times n_1 + (232) n_2 = 0.71 \text{g}$$



$$n \times 2 = \frac{0.5}{56} \Rightarrow n = 4.46 \times 10^{-3}$$

$$\Rightarrow \omega_{\text{Fe}_2\text{O}_3} = 0.7142 \text{ g}$$



$$\therefore \frac{2.567}{143.5} = n_1 + n_2 = 0.0179$$

(ii) NaCl is not affected

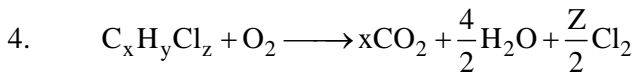
$${}^n\text{Cl} = {}^n\text{AgCl} = n_2 \frac{1.341}{143.5}$$

$$\Rightarrow n_2 = 0.009345$$

$$\therefore n_1 = 0.0856$$

Now, $n_1 \times 58.5 + n_2 \times M = 1 \text{ gram}$

$$\therefore M = \frac{0.5}{0.009345} = 53.5$$

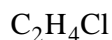


$$\left(\frac{0.22}{12x + y + 35.5Z} \right) \times (x) = {}^n\text{CO}_2 = \frac{0.195}{44} \dots\dots\dots(1)$$

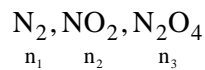
$$\left(\frac{0.22}{12x + y + 35.5Z} \right) \times \left(\frac{y}{z} \right) = {}^n\text{H}_2\text{O} = \frac{0.0804}{18} \dots\dots(2)$$

$$\left(\frac{0.12}{12x + y + 35.5Z} \right) = n = \frac{PV}{RT} = \frac{\left(\frac{768}{760} \right) \times \left(\frac{37.24}{1000} \right)}{0.0821 \times 382} = 0.0012 \dots\dots(3)$$

Solving, $x = 2; y = 4$ and $z = 2$



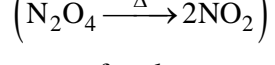
5. Consider 1 mole mix ($\omega_t = 55.4$)



$$n_1 \quad n_2 \quad n_3$$

$$n_1 + n_2 + n_3 = 1$$

Now, after heating, ${}^n\text{NO}_2 = n_2 + 2n_3$



$$\therefore \text{no. of moles} = n_1 + n_2 + 2n_3 = 1 + n_3$$

New Angular mol. Wt = 39.57 =

$$\therefore \frac{55.4}{1 + n_3} = 39.57$$

$$\therefore n_3 = 0.4$$

Now, $n_1 \times 28 + n_2 \times 46 + n_3 \times 92 = 55.4$

$$\therefore 28n_1 + 46n_2 = 18.6 \dots\dots(1)$$

also $n_1 + n_2 + n_3 = 1$

$$\therefore n_1 + n_2 = 0.6 \quad \dots\dots(2)$$

Solving (1) and (2),

$$n_1 = 0.5, \text{ and } n_2 = 0.1$$

$$\therefore 5:1:4$$

$$6. \quad \frac{{}^n\text{IO}_3^-}{1} = \frac{{}^n\text{HSO}_3^-}{3} \Rightarrow {}^n\text{HSO}_3^- = \frac{3 \times 5.8}{(23+127+48)} = 0.8788$$

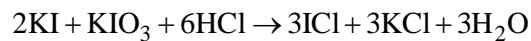
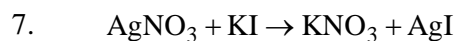
$$\therefore w_{\text{NaHSO}_3} = 9.139 \text{ g}$$

$${}^n\text{I}^- \text{ in } 1^{\text{st}} = {}^n\text{IO}_3^- = \frac{5.8}{198}$$

$$\frac{{}^n\text{IO}_3^-}{1} = \frac{{}^n\text{I}^-}{5} \Rightarrow {}^n\text{IO}_3^- = 0.00586$$

$$M_{\text{NaIO}_3} = 5.8/(198)$$

$$\therefore V = \frac{{}^n\text{IO}_3^-}{M_{\text{IO}_3^-}} = 0.2\text{L} = 200 \text{ mL}$$



$$\frac{M_{\text{KI}} \times V_{\text{KI}}}{2} = \frac{{}^n\text{KIO}_3}{1} \Rightarrow \frac{M_{\text{KI}} \times 20}{2} = \frac{30 \times \frac{1}{10}}{1}$$

$$\therefore M_{\text{KI}} = 0.3\text{M}$$

$$\text{Now, } \frac{{}^n\text{KI, excess}}{2} = \frac{{}^n\text{KIO}_3}{1} \Rightarrow {}^n\text{KI, excess} = 10 \text{ m mole}$$

$$\text{Original KI} = 50 \times 0.3 = 15 \text{ m mole}$$

$$\therefore \text{KI(used)} = 5 \text{ m mole}$$

$$\therefore {}^n\text{AgNO}_3 = {}^n\text{KI(used)} = 5 \text{ M.mole} \Rightarrow w_{\text{AgNO}_3} = 0.85 \text{ g}$$

$$\therefore \text{purity} = 85\%$$