

FOUNDATION BUILDER (OBJECTIVE)

1. (D)

2. (D)

3. (B)

4. (A)
(Most stable isotope of carbon)

5. (D)

6. (C)

7. (A)

$$\text{Moles of gas} = \frac{5.6}{22.4} = 0.25$$

$$\text{Molecular weight of gas} = \frac{7.5}{0.25} = 30$$

Hence NO.

8. (A)

$$\text{Molecular weight of } C_{60}H_{122} = 60 \times 12 + 122 = 842.$$

$$\text{Weight of a molecule} = \frac{842}{6.022 \times 10^{23}} = 1.39 \times 10^{-21} \text{ g}.$$

9. (A)

1 mole contains Avogadro number of atoms.

10. (A)

$$\text{Moles of } N_2 = \frac{1.4}{28} = 0.05.$$

$$\begin{aligned} \text{Number of atoms} &= 0.05 \times 2 \times 6.02 \times 10^{23} . \\ &= 6.02 \times 10^{22} . \end{aligned}$$

11. (D)

$$(A) \quad \frac{22.4 \times 10^3}{22400} \times NA = 6.022 \times 10^{23}$$

$$(B) \quad \frac{22}{44} \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$$

$$(C) \quad \frac{11.2}{22.4} \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$$

$$(D) \quad 0.1 \times 6.022 \times 10^{23} = 6.022 \times 10^{22}$$

12. (C)

$$\text{Number of gms of } H_2SO_4 = 0.25 \times 98 = 24.5$$

13. (D)

$$\text{Moles of } H_2 = \frac{1}{2} = 0.5$$

Volume of H_2 in $l = 0.5 \times 22.4 = 11.2l$.

14. (D)

$$\text{Moles of Au} = \frac{19.7 \times 1000}{197} = 100$$

$$\text{Atoms of Au} = 100 \times 6.022 \times 10^{23} = 6.022 \times 10^{25}.$$

15. (A)

$$\text{Mass of one molecule of } CO_2 = \frac{44}{6.02 \times 10^{23}} = 7.31 \times 10^{-23}$$

16. (C)

$$\text{Number of moles of } H_2 = \frac{0.224}{22.4} = 0.01$$

17. (B)

$$18. \quad W_H = 3 \times 3 = 9g \quad W_N = 3 \times 14 = 42g$$

[B]

19. In one H_2O molecule: 10 proton, 8 neutrons, 10 electrons

$$\text{Hence in 36 ml, } n_{H_2O} = \frac{36g}{18g/mol} = 2\text{mols}$$

$$\therefore \text{Protons} = 2N_A \times 10 = 20N_A$$

[C]

$$20. \quad n_{\text{atoms}} = \frac{W}{\text{at.wt}}. \text{ Hence it should be of same weight 'W'}$$

[A]

$$21. \quad \text{no. of moles} = \frac{10^{-3}N_A}{N_A} = 10^{-3}$$

$$\therefore \text{wt} = 10^{-3} \times \text{mol.wt} = 10^{-3}M_0g = M_0mg$$

[B]

$$22. \quad A: 12g; B = \frac{1}{2} \times 16 = 8g; C: 10g; D = \frac{16}{2} = 8g$$

\therefore [A]

$$23. \quad A: 2.5 \times 5N_A = 12.5N_A; B: 10N_A; C: 4 \times 3N_A = 12N_A; D = 1.8 \times 8N_A = 14.4N_A.$$

Hence [D]

$$24. \quad \frac{52 \text{amu}}{4 \text{amu}} = 13$$

[C]

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

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

[B]

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

[D]

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

\therefore [C]

28. $n_{H_2O} = \frac{180}{18} = 10$

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

[D]

29. $n_{Na_2S_2O_3 \cdot 5H_2O} = \frac{2.48}{248} = 0.01$

$$\therefore n_{H_2O} = 5 \times 0.01 \Rightarrow \text{molecules} = 0.05 N_A$$

[c]

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

[c]

31. $n_{H_2O} = \frac{18 \times 333}{54 + (96 \times 3) + (18 \times 18)} = 9$. Hence [B]

32. $n_{H_2O} = \frac{0.018}{18} = 10^{-3}$. Hence, molecules = $10^{-3} N_A$

\therefore [C]

33. $n_{N^{3-}} = \frac{4.2}{14} = 0.3$. $\therefore \text{total} = 0.3 \times 8 N_A = 2.4 N_A$

\therefore [A]

34. $n_C = 12 \times n_{C_{12}H_{22}O_{11}} = 12 \times \frac{3.42}{342} = 0.12$

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

35. $n_{MgCO_3} = \frac{8.4}{84} = 0.1$

Each contain (12 + 6 + 24) protons

Hence, total = $0.1 \times 42N_A = 2.5 \times 10^{24}$

[B]

36. $n_{\text{total}} = \frac{4.4}{44} + \frac{2.24}{22.4} = 0.2 \quad \therefore \text{molecules} = 0.2N_A$

[B]

37. [D]

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

[B]

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

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

[A]

40. Say $n_{\text{Mg}_3(\text{PO}_4)_2} = n$; then $n_O = 8n$

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

[B]

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

Hence [B]

42. $\frac{X}{100} \times (46 + 96 + 180) = 180 \Rightarrow X = 55.9$

[C]

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

Hence I_2O_5 . [C]

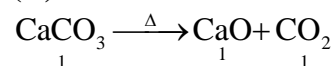
44. mol. Wt = $2 \text{ VD} = 100$

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

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

[A]

45. (D)

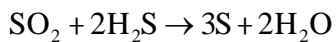


Quantity of limes tones = wt. of one mole mole of CaCO_3
= 100 kg

46. (A)

$$\text{Moles of H}_2\text{S} = 2$$

$$\text{Moles of SO}_2 = \frac{11.2}{22.4} = 0.5$$



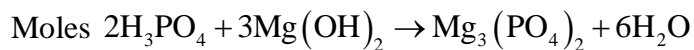
$$\text{moles } 1 \quad 2 \quad 3 \quad 2$$

$$\text{given } 0.5 \quad 2 \quad x = \frac{3 \times 0.5}{1} = 1.5$$

(L.R.)

47. (C)

$$\text{Moles of Mg(OH)}_2 = \frac{100}{58} = 1.724$$



$$\text{Moles } 2 \quad 3 \quad 1 \quad 6$$

$$\text{Given } \frac{2 \times 1.724}{3}$$

$$\text{Weight of H}_3\text{PO}_4 = \frac{2 \times 1.724}{3} \times 98 = 112.6\text{g}$$

$$48. \quad n_{\text{H}_2\text{O}} = n_{\text{CH}_3\text{OH}} \times 2 = 4 \quad \therefore \text{wt} = 4 \times 18 = 72\text{g}$$

[D]

$$49. \quad W_{\text{O}} = 3.6769 - 2.0769 = 1.6\text{g}$$

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

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

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

[A]



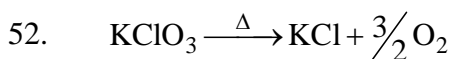
$$\therefore W_{\text{Ag}} = \frac{2.7}{(216 + 60)} \times 2 \times 108 = 2.11\text{g}$$

[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]

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

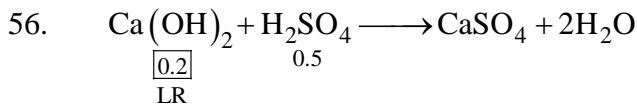
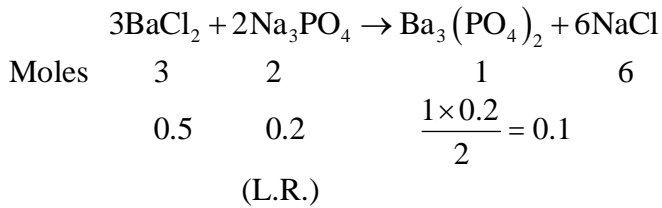
[A]

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

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

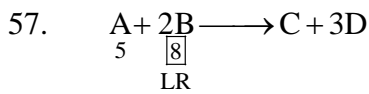
[B]

55. (D)



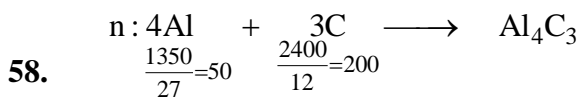
$$n_{\text{CaSO}_4} = n_{\text{Ca}(\text{OH})_2} = 0.2$$

[A]



$$n_{\text{C}} = \frac{n_{\text{B}}}{2} = 4; \quad n_{\text{D}} = 3 \times \frac{n_{\text{B}}}{2} = 12$$

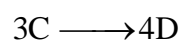
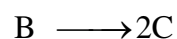
Hence [B]



L.R

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

[D]



$$\therefore n_{\text{D}} = n_{\text{A}} \times \frac{2}{2} \times \frac{2}{1} \times \frac{4}{3}$$

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

[D]

60. Mol.wt. = $0.8 \times 28 + 0.2 \times 32 = 28.8$

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

[C]

61. $D_{\text{Cl}_2 \text{ wrt air}} = \frac{D_{\text{Cl}_2}}{D_{\text{air}}} = \frac{M_{\text{Cl}_2}}{M_{\text{air}}} \approx \frac{71}{29}$

Hence [A]

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

$$\therefore D_{\text{oxide wrt O}_2} = \frac{M_{\text{oxide}}}{M_{\text{O}_2}} = \frac{46}{32} = 1.44$$

[B]

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

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

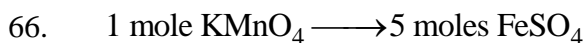
[B]

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

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

[B]

68. 3 molal \Rightarrow 3 mole NaOH in 1000g solvent

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

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

[A]

69. (B)

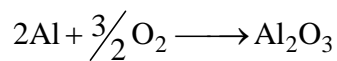
$$\text{Molarity of } \text{NO}_2\text{CO}_3 = \frac{2.65 \times 1000}{106 \times 250} = 0.1 \text{ M.}$$

$$\text{After dilution of 10 mL solution} = \frac{0.1 \times 10}{1000} = 0.001 \text{ M}$$

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

[A]

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

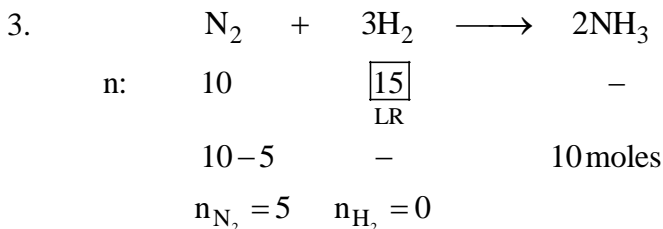
[A]

2. Consider 1 L solution

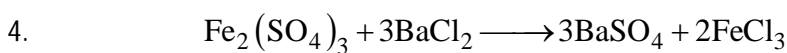
$$\frac{29}{100} \times (d \times 1000) = \omega_{\text{H}_2\text{SO}_4} = 3.6 \times 98$$

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

[A]



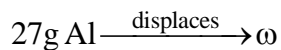
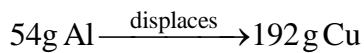
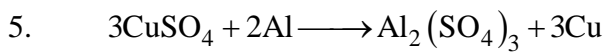
[A]



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

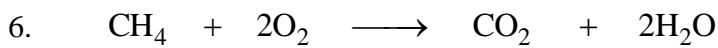
$$\frac{n_{\text{BaCl}_2}}{3} = \frac{n_{\text{FeCl}_3}}{2} \Rightarrow n_{\text{BaCl}_2} = \frac{1}{2} \times 3 = 0.75 \text{ moles}$$

[C]



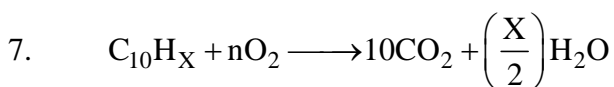
$\therefore \omega = 96\text{g}$

[C]

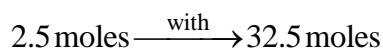
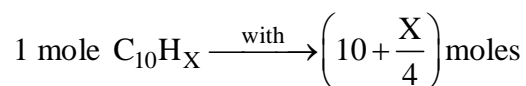


$\therefore n_{\text{CO}_2} = 4; n_{\text{CH}_4} (\text{remaining}) = 1$

[A]



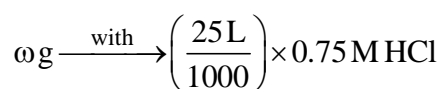
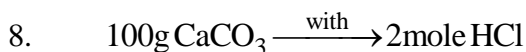
Hence, $n = 10 + \frac{X}{4}$



i.e. $10 + \frac{x}{4} = \frac{32.5 \times 1}{2.5} = 13$

$\therefore x = (13 - 10) \times 4 = 12$

[C]



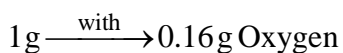
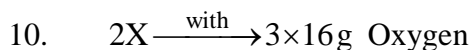
$\therefore \omega = 0.9375\text{g}$

[D]

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

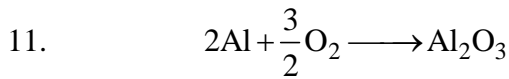
$\therefore \text{Molarity} = \frac{2.125 \times 1000}{143.5 \times 25} = 0.59$

[B]



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

[D]



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

$2 \times 27\text{g Al} \xrightarrow{\text{with}} \frac{3}{2} \text{mole O}_2$

$w \xrightarrow{\text{with}} \frac{1}{2} \text{mole}$

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

[D]

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

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

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

$n_{\text{AgBr}} = n_{\text{Br}} = n_1 + n_2 = \frac{0.97}{(108 + 80)} = 0.00516$

Also, $n_1 \times (103) + n_2 \times (119) = 0.560$

$\therefore n_2 = \frac{0.56 - 103 \times 0.00516}{16} = 0.00178$

$\therefore W_{\text{KBr}} = 119n_2 = 0.212\text{g}$

[B]

14. A: $n_{\text{H}} = 4 \times \frac{16\text{g}}{16\text{g}} = 4$; B: $n_{\text{H}} = 4 \times \frac{31.2}{76} = 1.64$

C: $n_{\text{H}} = 22 \times \frac{34.2}{342} = 2.2$; D: $n_{\text{H}} = 12 \times \frac{36}{180} = 2.4$

Hence [A]

15. Total atoms = $200 + 0.05 \times N_{\text{A}} + 10^{-20} \times N_{\text{A}}$
 $\approx 0.05 N_{\text{A}} = 3 \times 10^{22}$

[C]

16. 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]

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

D: $2.5 \times 3N_{\text{A}} = 7.5N_{\text{A}}$.

Hence [A]

18. [D] obvious

19. 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]

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

[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: $\frac{3 \times 10^{23}}{6 \times 10^{23}} \times 12\text{g} = 6\text{g}$; C: 32g ; D: 7g .

Hence [A]

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

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

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

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

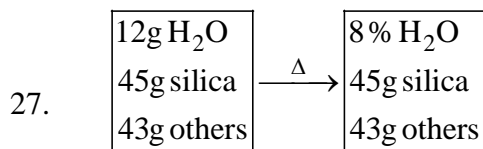
[A]

25. Total charge = $1 \times N_A \times 3e = 3N_A e$ coulomb

Hence [D]

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

[D]



100g original 'w' grams

8 % of w = water

i.e. 92 % of w = silica others

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

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

[D]

28. M_3N_2 . 28 % nitrogen

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

[C]

29. $0.014\% \times \text{mol.wt} = 2 \times \text{at. wt of N}$

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

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

[D]

30. (A)

$$\text{Average atomic mass} = \frac{90 \times 20 + 21x + 22 \times (10 - x)}{100} = 20.11$$

$$x = 9\%$$

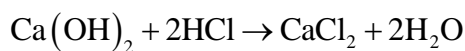
31. (B)

32. (C)

$$\text{Moles of Ca(OH)}_2 = \frac{6.023 \times 10^{23}}{6.023 \times 10^{23}} = 1$$

$$\text{Moles of HCl} = \frac{3.01 \times 10^{22}}{6.02 \times 10^{23}} = 0.05$$

$$\text{HCl} = \frac{3.01 \times 10^{22}}{6.02 \times 10^{23}} = 0.05$$



$$\begin{array}{ccc} 1 & 2 & 1 \\ 1 & 0.05 & \frac{0.05 \times 1}{2} = 0.025 \end{array}$$

(L.R.)

33. (A)

$$\text{Moles of CuSO}_4 = \frac{1.595}{1595} = 0.01$$

$$\text{Weight of solvent} = 100 - 1.595 = 98.505$$

$$\text{Volumes of solvent} = \frac{98.505}{1.2 \times 1000} = 82 \times 10^{-3} \text{ L}$$

$$\text{Molarity} = \frac{0.01}{82 \times 10^{-3}} = 0.12 \text{ M}$$

34. (B)

$$(A) \quad \text{atoms of O}_2 = \frac{2 \times 8}{32} \times 6.022 \times 10^{23} \sim 3 \times 10^{23}$$

$$(B) \quad \text{atoms of Be} = \frac{3}{9} \times 6.022 \times 10^{23} \sim 2 \times 10^{23}$$

$$(C) \quad \text{atoms of C} = \frac{8}{12} \times 6.022 \times 10^{23} \approx 4 \times 10^{23}$$

$$(D) \quad \text{atoms of F}_2 = \frac{19}{19} \times 6.022 \times 10^{23} \approx 1 \times 10^{23}$$

35. (C)

	X	Y		X	Y	
	$\frac{20}{10}$	$:\frac{80}{200}$		1	$:\ 2$	$\therefore XY_2$

36. (C)
Avogadro's hypothesis

37. (A)

Moles of magnesium = $\frac{3}{24} \times \frac{2.68}{100} = 0.00335$

Number of magnesium atoms = $0.00335 \times 6.022 \times 10^{23}$
 $= 2.01 \times 10^{21}$ atoms.

38. (A)

Moles of compound = $\frac{25 \times 10^{-3}}{10 \times 12 + 16 + 16} = 0.164 \times 10^{-3}$

Number of atoms = $0.164 \times 10^{-3} \times 6.022 \times 10^{23}$
 $= 9.9 \times 10^{19}$

39. (D)

Moles of $e^- = 52 + 2 = 54$.

40. (B)

Moles of Ag = $\frac{1}{107}$.

Moles of Ag_2S required = $\frac{1}{107 \times 2}$

Mass of $Ag_2S = \frac{(107 \times 2 + 32)}{107 \times 2} = 1.1495$

Mass of ore required = $\frac{1.1495}{1.34} \times 100 = 85.78g$

41. (D)

Moles of Al = $\frac{27}{27} = 1$

	$2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$				
Moles	2	2	2	2	3
Given	1	excess			$\frac{3 \times 1}{2} = 1.5$

(L.R.)

Vol. of H_2 evolved = $1.5 \times 22.4 = 33.6$ L.

WINDOW TO JEE MAIN

1. (A)

Molarity = $\frac{n_{\text{soluble}}}{V_{\text{soluble}} (\text{Lt})}$

V_{solution} is affected by Temperature.

2. (C)

$n_{Fe} = \frac{560}{56} = 10$

No. of atoms = $10 N_A$

In 70 g of N no. of atoms = $\frac{70}{14} \times N_A = 5 N_A$

In 20 g of H no. of atoms = $\frac{20}{1} \times N_A = 20 N_A$

3. (A) 4. (D)

5. (B)

$$\text{Molarity} = \frac{6.02 \times 10^{20}}{N_A \times 0.1} = 0.01$$

6. (C)

7. (C)

$$V = 1 \text{ L}$$

$$W_{\text{total}} = 1 \times 1.02 \times 1000 = 1020 \text{ g}$$

$$n_{\text{soluble}} = 2.05$$

$$W_{\text{total}} = \frac{352.8}{29} \times 100 = 1216.55 \text{ g}$$
$$= 1020 - 123 = 897 \text{ g}$$

$$\text{molality} = \frac{2.05}{0.897} = 2.28$$

8. (B)

9. (B)

$$V = 1 \text{ L}$$

$$n_{\text{soluble}} = 3.6$$

$$W_{\text{soluble}} = 3.6 \times 98 = 352.8$$

$$W_{\text{total}} = \frac{352.8}{29} \times 100 = 1216.55 \text{ g}$$

$$\text{density} = \frac{1216.55}{1000}$$
$$= 1.22 \text{ g/ml}$$

10. (C) 11. (B) 12. (C) 13. (C)

14. (A)

$$\text{Number of atoms} = \frac{\text{weight}}{\text{atomic weight}} \times N_A \times \text{species}$$

∴ In 4 g of hydrogen

$$\text{Number of atoms} = \frac{4}{2} \times N_A \times 2 = 4N_A$$

[Here species = 2 because hydrogen is present as H₂]

In 71 g of chlorine = $2N_A$

$$\text{Number of atoms} = \frac{71}{71} \times N_A \times 2 = 2N_A$$

In 127 g of iodine,

$$\text{Number of atoms} = \frac{127}{127} \times N_A \times 2 = 2N_A$$

In 48 g of magnesium,

$$\text{Number of atoms} = \frac{48}{24} \times N_A \times 1 = 2N_A$$

[Here Mg is present as Mg so species = 1]

Thus, the number of atoms are largest in 4 g of hydrogen.

15. (b)
Heavy water is D₂O
In it,
Number of p⁺ = 1 × 2 + 8 = 10
Number of e⁻ = 1 × 2 + 8 = 10
Number of n⁰ = 1 × 2 + 8 = 10
(∵ D have 1 n⁰ because it is actually, ¹H²)
16. (d)
18 g H₂O contains 2 g H
∴ 0.72 g H₂O contains 0.08 g H.
44 g CO₂ contains 12 g C
∴ 3.08 g CO₂ contains 0.84 g C
∴ C : H = $\frac{0.84}{12} : \frac{0.08}{1} = 0.07 : 0.08 = 7 : 8$
∴ Empirical formula = C₇H₈
17. (c)
3 M solution means 3 moles of solute (NaCl) are present in 1000 L of solution.
Mass of solution = volume of solution × density
= 1000 × 1.252
= 1252 g
Mass of solute = No. of mole × molar mass of NaCl
= 3 × 58.5 g
= 175.5 g
Mass of solvent = (1252 - 175.5)g
= 1076.5 g
= 1.076 kg
Molality = $\frac{\text{moles of solute}}{\text{mass of solvent (in kg)}}$
= $\frac{3}{1.076} = 2.79\text{m}$
18. (a)
Final concentration, M = $\frac{M_1V_1 + M_2V_2}{V_1 + V_2}$
= $\frac{10 \times 2 + 200 \times 0.5}{200 + 10}$
= $\frac{20 + 100}{210}$
= $\frac{120}{210} = 0.57\text{M}$

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

$$2. \quad n_{\text{CH}_4} = \frac{1.6}{16} = 0.1 \text{ moles} = 6 \times 10^{22} \text{ molecules}$$

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

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

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

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

\therefore 1 mole contains $10N_A$ electrons.

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

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

$$5. \quad \text{Atomic mass} = N_A \times \text{mass of one atom}$$

$$= 6 \times 10^{23} \times 6.64 \times 10^{-23} \text{ g} = 40 \text{ g}$$

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

$$7. \quad \omega_{\text{removed}} = 10^{21} \times 44 \text{ amu} = 7.35 \times 10^{-2} \text{ g}$$

$$\therefore \omega_{\text{CO}_2, \text{remaining}} = 200 - 73.5 = 126.5 \text{ mg}$$

$$\therefore n_{\text{CO}_2} = \frac{126.5 \times 10^{-3}}{44} = 0.002875$$

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

$$9. \quad n_{\text{O}} = n_{\text{SO}_2} \times 2 = \frac{3.2 \times 10^{-3}}{64} \times 2 = 10^{-4} \text{ moles}$$

$$n_{\text{S}} = n_{\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}} \times 2 = 2 \times 5 \times 10^{-3} = 10^{-2}$$

$$\therefore n_{\text{O}} : n_{\text{S}} = \frac{10^{-4}}{10^{-2}} = 0.01$$

$$10. \quad n_{\text{O}} = 3 \times n_{\text{NaNO}_3} + 2 \times n_{\text{NO}_2}$$

$$= m \times (10m) + 2 \times \frac{1}{6} = 0.03 + 0.333 = 0.363$$

$$n_{\text{N}} = n_{\text{NaNO}_3} + n_{\text{NO}_2} = 10 \times 10^{-3} + \frac{1}{6}$$

$$= 0.01 + 0.166$$

$$= 0.176$$

$$11. \quad t(\text{s}) = \frac{6 \times 10^{23}}{10^6} = 6 \times 10^{17} \text{ s}$$

$$t(\text{hr}) = \frac{6 \times 10^{17}}{3600} = 1.67 \times 10^{14}$$

$$t(\text{yr}) = \frac{1.67 \times 10^{14}}{24 \times 365} = 1.9 \times 10^{10} \text{ years}$$

$$12. \quad \text{atomic wt} = 6.644 \times 10^{-23} \times 6 \times 10^{23}$$

$$= 40 \text{ g/mol}$$

$$\therefore n = \frac{40 \times 1000 \text{ g}}{40 \text{ g/mol}} = 1000 \text{ moles}$$

$$13. \quad n_{\text{C}} = \frac{10^{-6} \text{ g}}{12 \text{ g/mol}}$$

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

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

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

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

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

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

$$n_{\text{Fe}} = \frac{0.455}{56} \text{ and no. of atoms} = 4.9 \times 10^{21}$$

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

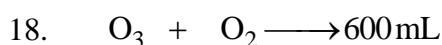
$$\therefore \omega_{\text{starch}} = \frac{3100}{0.086} = 3.6 \times 10^4$$

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

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

$$17. \quad n_{\text{O}_2} = \frac{PV}{RT} = \frac{1 \times 1}{0.0821 \times 273} = 0.04464$$

$$\therefore n_{\text{molecules}} = n_{\text{O}_2} \times N_{\text{A}} = 2.69 \times 10^{22}$$



$$V \text{ ml } (600 - V) \text{ mL}$$

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

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

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



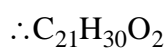
20. Say $n_{\text{O}} = n$

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

$$\text{Mol. Wt} = \frac{1}{0.00318} = 314$$



21. $9.03 \times 10^{20} \xrightarrow{\text{weight}} 0.311 \text{ g}$

$$6.02 \times 10^{23} \xrightarrow{\text{weight}} \text{mol. wt.}$$

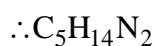
$$\therefore \text{mol. wt} = 207.33 \text{ g}$$

$$\Rightarrow 131.3 + 19n = 207.3 \Rightarrow n = 4$$

22. $\omega_{\text{C}} = \frac{58.97}{100} \times 102 = 59.9 \Rightarrow n_{\text{C}} = 5$

$$\omega_{\text{H}} = \frac{13.81}{100} \times 102 = 14.08 \Rightarrow n_{\text{H}} = 14$$

$$\omega_{\text{N}} = \frac{27.42}{100} \times 102 = 27.97 \Rightarrow n_{\text{N}} = 2$$

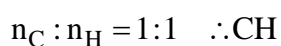


23. $\omega_{\text{C}} = \frac{12}{44} \times \omega_{\text{CO}_2} = \frac{12}{44} \times 0.9482 = 0.2586$

$$\therefore n_{\text{C}} = 0.02155$$

$$\omega_{\text{H}} = \frac{2}{18} \times \omega_{\text{H}_2\text{O}} = 0.02154$$

$$\therefore n_{\text{H}} = 0.02154$$



24.
$$\omega_{\text{Co}} = \frac{12}{100} \times \omega_{\text{cylinder}}$$

$$\omega_{\text{cylinder}} = \pi r^2 h \times \text{density}$$

$$= (3.14 \times 6.25 \times 10) \times 8.2 = 1610.7$$

$$\therefore \frac{\omega_{\text{Co}}}{58.9} = n_{\text{Co}} = \frac{1}{58.9} \times \frac{12}{100} \times 1610.7 = 3.28$$

$$\therefore \text{no. of atoms} = 3.28 \times 6 \times 10^{23}$$

$$\approx 1.98 \times 10^{24}$$

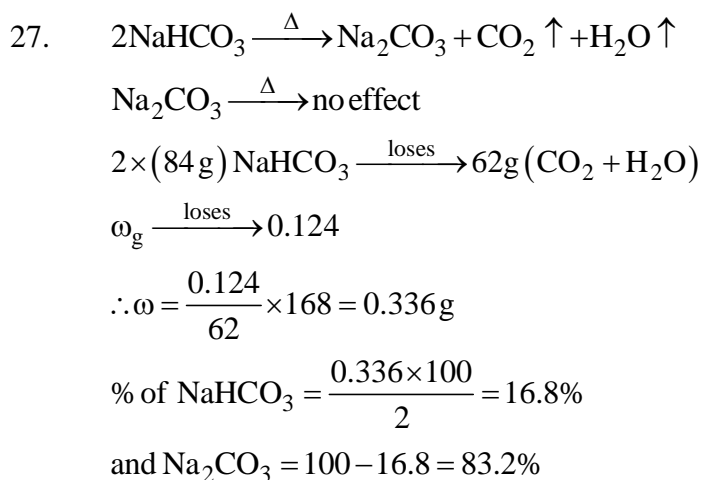
25. Mol. Wt = wt of 1 mole mix = 2VD = 76.6
 $(x \text{ mol. NO}_2 + (1 - x) \text{ mol. N}_2\text{O}_4) = 76.6 \text{ g}$
 $\therefore x \times 46 + (1 - x) \times 92 = 76.6$
 $x = \frac{15.4}{46} = n_{\text{NO}_2} \text{ in 1 mole} = 0.335$
 $n_{\text{mix in 100g}} = \frac{100}{76.6}$
 $\therefore n_{\text{NO}_2 \text{ in 100}} = 0.335 \times n_{\text{mix}}$
 $= 0.437$

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

Consider 1L of solvent

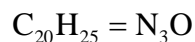
$\text{C}_2\text{H}_5\text{OH}$
mol.wt = 46

$n = 8$
 $\omega_{\text{solvent}} = (1.025 \times 1000) - (8 \times 46) = 657$
 $\therefore \text{molality} = \frac{8}{657} \times 1000 = 12.18$



28.

C 74.27	$\frac{74.27}{12} = 6.1892$	$\frac{6.1892}{0.309} = 20$
H 7.79	$\frac{7.79}{1} = 7.79$	$\frac{7.79}{0.309} = 25$
N 12.99	$\frac{12.99}{14} = 0.928$	$\frac{0.918}{0.309} = 3$
O 4.95	$\frac{4.95}{16} = 0.309$	$\frac{0.309}{0.309} = 1$



$$\begin{aligned} \% \text{ of C atoms} &= \frac{20}{49} \times 100 \\ &= 40.816\% \end{aligned}$$



$$\begin{aligned} \omega: & \quad 20g \quad 10g \\ n: & \quad \frac{20}{44} = 0.45 \quad \frac{10}{32} = 0.31 \end{aligned}$$

L.R

$$(A) n_{CH_3COOH} = n_{CH_3CHO} = 0.45$$

$$\omega_{CH_3COOH} = 27.27g.$$

$$(B) n_{O_2} (\text{left}) = \frac{10}{32} - \frac{20/44}{2} = 0.852$$

$$\omega_{O_2} = n_{O_2} \times 32 = 2.727g$$

$$(C) \% \text{ yeild} = \frac{23.8}{27.3} \times 100 = 87.2\%$$

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

31. $n_{CH_4} = n_1$ and $n_{C_2H_4} = n_2$, say

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

$$\text{also, } n_{CO_2} = n_1 + 2n_2 = \frac{14.5}{44} = 0.33$$

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

$$\%CH_4 = \frac{\omega_{CH_4} \times 100}{5} = \frac{16n_1 \times 100}{5} = 60\%.$$

$$\%C_2H_4 = 40\%$$

32. POAC on carbon

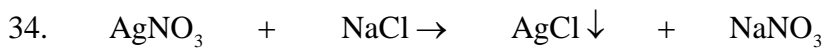
$$n_C = n_{K_2CO_3} \times 1 = n_{K_2Zn_2[Fe(CN)_6]_2} \times 12$$

$$\therefore \text{moles of product} = \frac{n_{K_2CO_3}}{12} = 0.0166$$

33. $n_{Cu} = n_{Cu(NO_3)_2 \cdot 3H_2O}$ (POAC on Cu)

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

$$= 38.03\text{g}$$



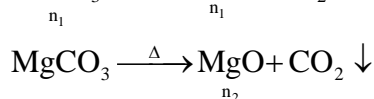
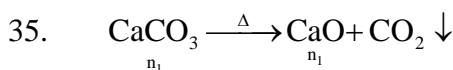
$$n = \frac{5.77}{170} \quad n = \frac{4.77}{58.5}$$

$$= 0.03394 \quad = 0.08$$

L.R.

$$n_{AgCl} = n_{AgNO_3} = 0.03394$$

$$\therefore \omega_{AgCl} = 0.03394 \times 143.5 = 4.87\text{g}$$



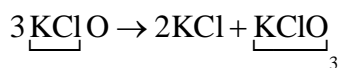
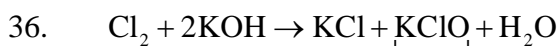
$$n_1 \times 100 + n_2 \times 84 = 1.84$$

$$n_1 \times 56 + n_2 \times 40 = 0.96$$

$$n_1 = 0.01$$

$$n_2 = 0.01$$

$$\therefore \% CaCO_3 = \frac{0.01 \times 100}{1.84} \times 100 = 54.35\%$$



$$n_{KClO_4} = n_{Cl_2} \times \frac{1}{1} \times \frac{1}{3} \times \frac{3}{4} = \frac{n_{Cl_2}}{4}$$

$$\Rightarrow n_{Cl_2} = 4 \times \frac{1385}{(39 + 35.5 + 64)} = 40$$

$$\Rightarrow \omega_{Cl_2} = 40 \times 71 = 2840\text{g}$$

37. POAC on Cl (eventually on completion)

$$n_{Cl_2} \times 2 = n_{KCl} \times 1 + n_{KClO_4}$$

$$\Rightarrow n_{KCl} = \frac{142}{71} \times 2 - \frac{n_{Cl_2}}{4} = 4 - 0.5$$

$$= 3.5\text{moles}$$

38.

$$\begin{array}{c}
 \text{1g KClO}_3 \xrightarrow{n_2 \text{ moles}} \text{KClO}_4 + \text{KCl} \\
 \swarrow \text{n}_1 \text{ moles} \\
 \text{KCl} + \text{O}_2
 \end{array}$$

$$n_{\text{O}_2} = \frac{3}{2} \times n_1 = \frac{146.8}{22400} \Rightarrow n_1 = 0.00437$$

$$n_2 = \frac{1\text{g}}{(39 + 35.5 + 48)} - n_1 = 0.00379$$

$$n_{\text{KClO}_4} = \frac{3}{4} n_2 = 0.00284$$

$$\omega_{\text{residue}} = 1\text{g} - \omega_{\text{O}_2} = 0.79029\text{g}$$

$$\therefore \% \text{KClO}_4 = \frac{0.00284(39 + 35.5 + 64)}{0.79} \times 100$$

$$= 49.789\%$$

39.

$$(\text{CH}_3)_x \text{AlCl}_y \rightarrow x\text{CH}_4 + y\text{Cl}^-$$

$$\text{Cl}^- + \text{AgNO}_3 \rightarrow \text{AgCl} \downarrow + \text{NO}_3^-$$

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

$$\Rightarrow \frac{0.222}{16} = x \cdot \frac{0.643}{(15x + 27 + 35.5y)}$$

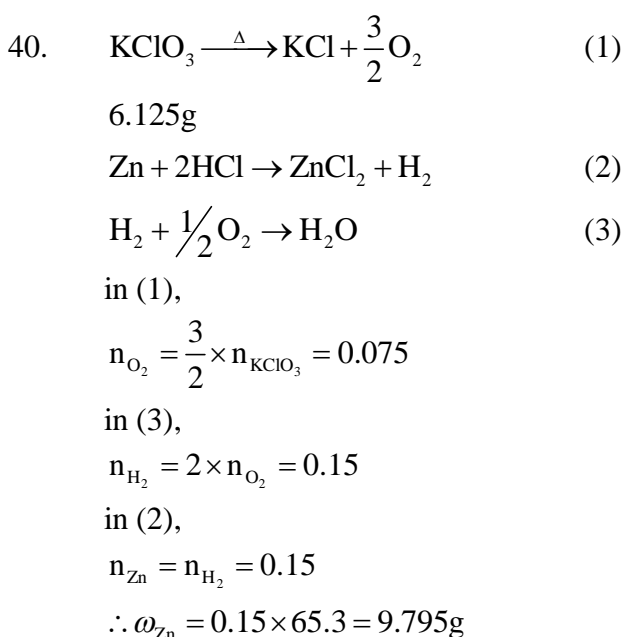
2. $n_{\text{AgCl}} = n_{\text{Cl}^-} = y \cdot n_{(\text{CH}_3)_x \text{AlCl}_y}$

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

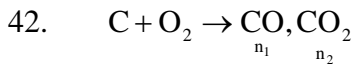
$$1 \div 2 \Rightarrow \frac{x}{y} = 1.99 = 2$$

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

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



41. (A): B,
 (B): A,
 (C): $n_C = \frac{7}{2} \times n_B = \frac{7}{2}$.



POAC on C

$$n_C = \frac{12}{12} = n_1 + n_2 = 1$$

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

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

$$\text{and } n_1 = 0.75$$

$$\therefore n_{CO} : n_{CO_2} = n_1 : n_2 = 3 : 1$$



$$\frac{n_{NaOH}}{2} = n_{H_2SO_4} = \left(\frac{15}{1000} \right) \times \frac{1}{10} \times \frac{1}{2} = 7.5 \times 10^{-4}$$

$$\therefore \text{strength} = \frac{\omega_{H_2SO_4}}{V_{H_2SO_4} (\text{mL})} \times 1000$$

$$= 6.125 \text{ g/L}$$

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. $n_{SO_4^{2-}} = n_{H_2SO_4} = \left(\frac{100}{1000} \right) \times 0.001 \text{ M} = 10^{-4}$

$$\therefore \text{no. of ion} = n_{SO_4^{2-}} \times n_A = 6 \times 10^{19}$$

46. $n_{CuSO_4 \cdot 5H_2O} = n_{Cu^{2+}} = 0.5 \times 0.01 = 5 \times 10^{-3}$

$$\text{weight} = n \times \text{mol.wt} = 5 \times 10^{-3} \times 249.5$$

$$= 1.2475 \text{ g}$$

47. $M_1 V_1 + M_2 V_2 = M_3 V_3$

$$\therefore M_{\text{final}} = M_3 = \frac{50 \times 0.5 + 75 \times 0.25}{50 + 75}$$

$$= 0.35 \text{ Molar}$$

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

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

49.
$$\frac{n_{I_2}}{n_{I_2} + n_{C_6H_6}} = 0.2$$

Say, we have 1 mole mix.

Then, $n_{I_2} = 0.2$ and $n_{C_6H_6} = 0.8$

$$\begin{aligned} \therefore \text{molality} &= \frac{n_{I_2}}{w_{C_6H_6}} \times 1000 \\ &= \frac{0.2}{0.8 \times 78} \times 1000 = 3.205 \text{ m.} \end{aligned}$$

50. Consider 1L solution.

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

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

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

51. 30% NH_3 . \Rightarrow 70% water.

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

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

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

52. Consider 1L of solution,

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

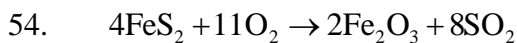
$$n_{\text{ethanol}} = M \times V = 8 \times 1 = 8 \text{ moles}$$

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

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

53. $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$

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

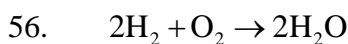


$$\frac{600}{120} = 5 \quad \frac{800}{32} = 23$$

$$\text{So moles of } \text{Fe}_2\text{O}_3 = \frac{1}{2} \times 2.5$$

55. $n_{\text{NH}_3} = n_{\text{HCl}} = \frac{146}{36.5} = 4$

$$\text{Wt } \text{NH}_3 = 4 \times 17 = 68 \text{ g}$$



$$\frac{6}{2} = 3 \quad \frac{29}{32} = 0.90625$$

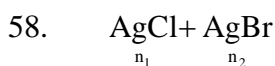
LR

$$\text{wt } \text{H}_2\text{O} \text{ formed} = 0.90625 \times 2 \times 18 = 32.625 \text{ g}$$

$$\text{wt } \text{H}_2 \text{ left} = (3 - (0.90625 \times 2)) \times 2 = 2.1325 \text{ g}$$

57. $\frac{245}{95} \times 3 = \frac{w}{58.5} \times 2$

$$w = 226 \text{ g}$$



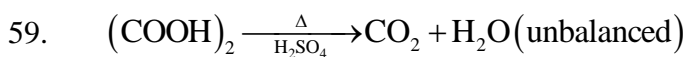
$$\frac{\% \text{Ag}}{100} = \frac{(n_1 + n_2)108}{n_1 \times 143.5 + n_2 \times 188} = \frac{60.94}{100}$$

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

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

$$= 4.856\%$$

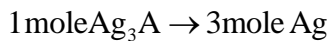
$$\% \text{Br} = 100 - (60.94 + 4.856) = 34.2\%$$



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

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

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 FOR JEE ADVANCE

ONE OPTION CORRECT



say, wt : $14x$ $3x$

$$t = 0 \quad \frac{14x}{28} = \frac{x}{2} \quad \frac{3x}{2} \quad -$$

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

NH_3 was 40% by mol.

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

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

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

(A)

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

$$\therefore M_{\text{A}} \times n(\text{A}) = 1.4\text{g} \text{ and } M_{\text{B}} \times n(\text{B}) = 0.8$$

$$\therefore \frac{M_{\text{B}}}{M_{\text{A}}} = \frac{0.8}{1.4} = 0.57.$$

(C)

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

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

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

\therefore 128g metal with 16g O

i.e. M_2O

(B)

$$4. \quad 4M \times \xrightarrow{\text{with}} 96\text{g O. (since } X_4O_6)$$

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

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

(A)

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

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

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

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

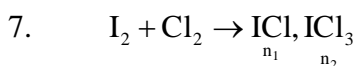
(C)

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

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

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

(C)



POAC on I

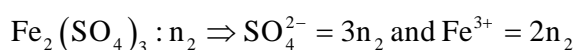
$$n(I) = \frac{25.4}{127} = n_1 + n_2$$

POAC on Cl

$$n(Cl) = \frac{14.2}{35.5} = n_1 + 3n_2$$

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

(A)



$$n_1 = 3n_2 \text{ (given)} \Rightarrow \frac{n_1}{n_2} = 3$$

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

(D)

9. 0.36M : V_1 say and 0.15M : V_2 say

$$M_{\text{final}} = 0.24 = \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2}$$

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

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

$$\therefore 0.36 \left(\frac{V_1}{V_2} \right) + 0.15 = 0.24 \left(\frac{V_1}{V_2} \right) + 0.24$$

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

(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)

15. $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$

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

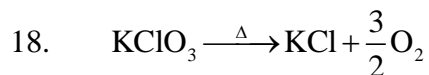
$$\Rightarrow V \times 3 = 2 \times \frac{1.431}{106} \Rightarrow V = 9\text{mL.}$$

(B)

16. They must have same mol. wt.
(C)

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

(A)



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

$$\% \text{ purity} = \frac{\frac{2}{30} \times (122.5)}{10} \times 100 = 81.66\%$$

(B)

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

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

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

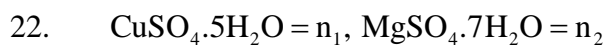
(A)

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

$$\Rightarrow V = 102.941\text{mL}$$

(B)

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



total $\omega t = 5\text{g}$ and anhydrous 3g

$$\therefore 249.5n_1 + 246n_2 = 5$$

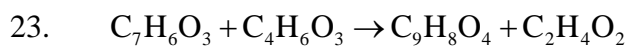
$$\text{and } 159.5n_1 + 120n_2 = 3$$

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

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

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

(C)



$$\omega : 2\text{g} \quad 4\text{g}$$

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

$$\text{theoretical yield} = 0.01449 \times M_{C_9H_8O_4} \\ = 2.69$$

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

(A)



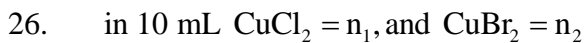
$$n_{XI_3} = n_{XCl_3} \Rightarrow \frac{0.5}{(M + 381)} = \frac{0.236}{(M + 106.5)} \\ \Rightarrow M = 138.88 = 139$$

(B)

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

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

(B)



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

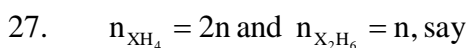
$$\therefore 2n_1(143.5) + 2n_2(188) = 0.9065 \text{ g}$$

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

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

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

(A)



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

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

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

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

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

(A)

28. $M_{AgNO_3} = \frac{0.0125 / (39 + 80)}{1 \text{ mL}} = 0.0105 \text{ M}$

$$\therefore 0.0105 \times \frac{42.5}{1000} = n_{AgNO_3}$$

$$= 0.00446$$

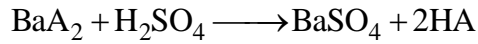
$$n_{\text{AgNO}_3} = n_{\text{NaBr}} + 2n_{\text{Na}_2\text{SO}_4}$$

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

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

29. Let acid be HA

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



$$\therefore \frac{4.29}{137 + 2A + 36} = \frac{21.64}{1000} \times 0.477$$

$$\therefore A = 121 \qquad \qquad \qquad \therefore \text{HA} = 122$$

30. total moles = n (say)

$0.15n = \text{moles of } \text{CH}_3\text{COOH}$

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

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

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

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

31. $\text{C}_2\text{H}_6 + 3.5\text{O}_2 \longrightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$
 $n_1 \text{ moles}$

$\text{C}_2\text{H}_4 + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$
 $n_2 \text{ moles}$

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

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

$$\therefore n_1 = 0.817$$

$$n_2 = 0.401$$

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

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

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

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

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

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

More than one correct

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^+ = $\frac{n}{w_{solvent}} \times 1000$

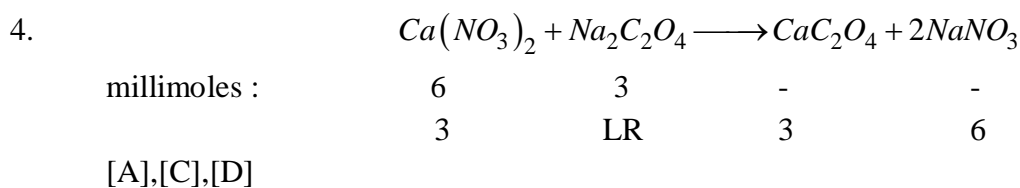
$$= \frac{3 \times 2}{(1250 - 474)} \times 1000 = 7.73$$

2. mol. 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] $\frac{1}{2} \times 64 = 32 \text{ g}$ [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. $n_{NaCl} = 100 \text{ m moles} ; n_{HCl} = 300 \text{ m moles}$

$$n_{CaCl_2} = 200 \text{ m moles} (200 Ca^{2+}, 400 Cl^-)$$

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

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

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

7. Obvious A,B,D ($n_H = 4$)

8. 3 mole NH_3

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

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

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

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

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

9. Obvious : [A], [B]

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

14. Hence [C], [D]

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

Match the following

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

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

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

Total = 0.12 M

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

(P), (S)

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

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

(S)

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

[P], [Q]

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

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

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

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

[R]

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

$$w_{SO_2} = 32 g$$

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

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

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

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

[P], [Q], [R]

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

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

$$wt = 32 g \quad [S]$$

COMPREHENSION TYPE

Passage 1

1. wt of 1 atom = 1 amu = 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. $\frac{3.4}{100} \times (M) = \omega_s = 2 \times 32 \Rightarrow M = 1882.3 \text{ (B)}$
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. $\frac{134}{1000} \times M_{\text{H}_2\text{SO}_4} \times 2 = n_{\text{NH}_3} = \frac{PV}{RT} = \frac{0.2 \times 2}{0.0821 \times 303}$
 $\Rightarrow M_{\text{H}_2\text{SO}_4} = 0.06 \text{ (C)}$
3. $\frac{1600 \times 0.205}{1600 + V} = 0.2 \Rightarrow V = 40\text{mL (A)}$
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. $m_{\text{H}_2\text{O}} = \frac{18\text{g}}{6 \times 10^{23}} = 3 \times 10^{-23}\text{g (D)}$
2. Avogadro's law. (A)
3. obvious Mass is 16amu. (C)
4. obvious (A)

Passage – 4

1. $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
 $n: \frac{5.77}{170} \quad \frac{4.77}{58.5} \quad n_{\text{AgCl}} = 0.0339$

$$= 0.0339 \quad = 0.081 \quad \therefore \text{wt} = 4.88\text{g}$$

L.R (A)

$$2. \quad \therefore \omega_{\text{H}_2\text{SO}_4} = 0.12 \times 98 = 11.7\text{g (A)}$$

INTEGER

$$1. \quad 0.5 \text{ mole } \text{N}^{3-} \cdot \text{N}^{-3} \text{ has } 10\bar{e} .$$

$$\therefore 5 \text{ moles.}$$

$$2. \quad n_{\text{CO}_2} = \frac{132}{44} = 3$$

$$n_{\text{C}} = 3$$

$$3. \quad \text{MCl}_x : \text{say. mol.wt} = (M + 106.5)$$

$$n_{\text{Cl}^-} = (n_{\text{MCl}_x}) \times (X) = \frac{0.22x}{(M + 106.5x)}$$

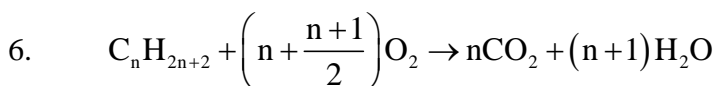
$$n_{\text{Cl}^-} = n_{\text{Ag}} = \frac{0.51}{(170)} = 3 \times 10^{-3}$$

$$M \approx \frac{6.4}{0.57} = 112\text{s (Dulong petite's law)}$$

$$\therefore \frac{0.22 \times x}{(112 + 106.5x)} = 3 \times 10^{-3} \therefore x = 3$$

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

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

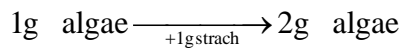
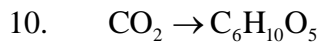


$$\frac{n + \frac{n+1}{2}}{n} = \frac{7}{4} \Rightarrow 4n + 3n + 2 = 7n \quad \text{or} \quad n = 2$$

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

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

$$9. \quad \frac{0.25}{100} \times 89600 = \omega_{\text{Fe}} = n \times 56 \Rightarrow n = 4$$



1g strach

POAC on carbon

$$\begin{aligned} n_{\text{CO}_2} \times 1 &= n_{(\text{C}_6\text{H}_{10}\text{O}_5)_n} \times 6n \\ &= \frac{1}{162n} \times 6n = \frac{1}{27} \end{aligned}$$

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

EXPERTISE ATTAINERS

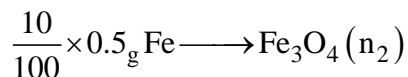
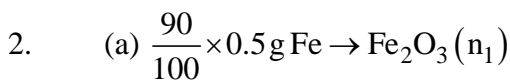
1. POAC on Co

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

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

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

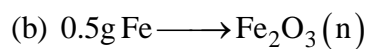
$$\therefore \omega_{\text{ppt}} = n_{\text{ppt}} \times \text{mol.wt} = 1.52 \text{ g}$$



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

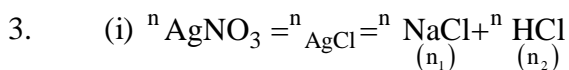
$$n_2 \times 3 = \frac{0.05}{56} \Rightarrow n_2 = 0.0003$$

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



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

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



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

(ii) NaCl is not affected

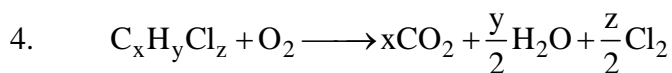
$$n_{\text{Cl}} = n_{\text{AgCl}} = n_2 = \frac{1.341}{143.5}$$

$$\Rightarrow n_2 = 0.009345$$

$$\therefore n_1 = 0.0856$$

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

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



$$\left(\frac{0.22}{12x + y + 35.5z} \right) \times (x) = {}^n CO_2 = \frac{0.195}{44} \dots\dots(1)$$

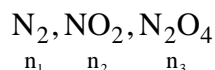
$$\left(\frac{0.22}{12x + y + 35.5z} \right) \times \left(\frac{y}{2} \right) = {}^n H_2O = \frac{0.0804}{18} \dots\dots(2)$$

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

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



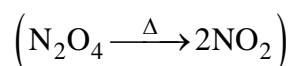
5. Consider 1 mole mix ($\omega t = 55.4$)



$$n_1 \quad n_2 \quad n_3$$

$$n_1 + n_2 + n_3 = 1$$

Now, after heating, ${}^n NO_2 = n_2 + 2n_3$



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

New Average mol. Wt = 39.57

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

$$\therefore n_3 = 0.4$$

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

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

$$\text{also } n_1 + n_2 + n_3 = 1$$

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

Solving (1) and (2),

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

$$\therefore 5:1:4$$

$$6. \quad \frac{{}^n IO_3^-}{1} = \frac{{}^n HSO_3^-}{3} \Rightarrow {}^n HSO_3^- = \frac{3 \times 5.8}{(23 + 127 + 48)} = 0.8788$$

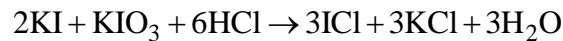
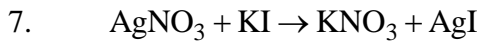
$$\therefore W_{NaHSO_3} = 9.139 \text{ g}$$

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

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

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

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



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

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

$$\text{Now, } \frac{n_{\text{KI, excess}}}{2} = \frac{n_{\text{KIO}_3}}{1} \Rightarrow n_{\text{KI, excess}} = 10\text{ mmole}$$

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

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

$$\therefore n_{\text{AgNO}_3} = n_{\text{KI(used)}} = 5\text{ mmole} \Rightarrow w(\text{AgNO}_3) = 0.85\text{ g}$$

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

8. Let % of boron will at. Wt. $10.0 = x$

Let % of boron will at. Wt. $11.01 = (100 - x)$

$$\frac{(x \times 10.01 + (100 - x) \times 100.01)}{100} = 10.81$$

$$\Rightarrow x = 20\%$$

9. Let $\text{NaCl} = w$ gms

$$\Rightarrow \text{kCl} = (118 - w) \text{ gms}$$

POAC on Cl

$$\frac{w}{M_{\text{NaCl}}} + \frac{0.118 - w}{M_{\text{kCl}}} = \frac{0.2451}{M_{\text{AgCl}}}$$

$$\frac{w}{58.5} + \frac{0.118}{74.5} = \frac{w}{74.5} = \frac{0.2451}{143.5}$$

$$w = 0.0338\text{ gm}$$

$$\text{NaCl} = 0.0338\text{ gm} \quad \text{kCl} = 0.0842\text{ gm}$$

$$n_{\text{nacl}} = 5.777 \times 10^{-4}$$

$$n_{\text{kcl}} = 1.13 \times 10^{-3}$$

POAC on Na; moles of $\text{Na}_2\text{O} \times 2$

= moles of $\text{NaCl} \times 1$

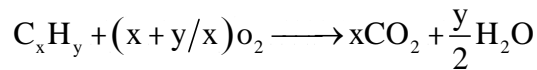
$$\Rightarrow n_{\text{Na}_2\text{O}} = \left(\frac{5.777 \times 10^{-4}}{2} \right); \quad n_{\text{k}_2\text{O}} = \left(\frac{1.13 \times 10^{-3}}{2} \right)$$

$$\text{Weight of Na}_2\text{O} = \frac{5.777 \times 10^{-4}}{2} \times 62 = 0.01 \text{ gm}$$

$$\text{Weight of k}_2\text{O} = \frac{1.13 \times 10^{-3}}{2} \times 94 = 0.1062$$

$$\% \text{ Na}_2\text{O} = 3.58\%. \quad \% \text{ k}_2\text{O} = 10.62 \%$$

10. C_xH_y



POAC on carbon

$$5 \times x = (\text{vol. of CO}_2) \times 1$$

Now 1 vol. of $\text{CO}_2 = 10 \text{ mL}$ (that obtained by KOH)

$$\Rightarrow x = 2$$

Vol. of O_2 reactionary = 15 ml

Vol. of O_2 reacted = 15 ml

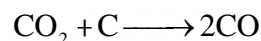
\Rightarrow 1 ml of C_xH_y react with $(2 + y/x)$ ml O_2

\Rightarrow 5 ml of C_xH_y react with $(2 + y/x) = \text{ml } 15$ (given)

$$\Rightarrow y = 4$$

\therefore formula = C_2H_4

11. (a)



POAC on carbon

Let $\text{CO} = x \text{ l}$

$$\text{CO}_2 = (1 - x) \text{ l}$$

$$\Rightarrow x \times 1 + 2(1 - x) = 1.6 \times 1$$

$$\Rightarrow 2 - x = 1.6 = 1$$

$$x = 0.4 \text{ l} \ \& \ (1 - x) 0.6 \text{ L}$$

(b)

The molecular formula = M_3N_2

$$\% \text{ Nitrogen} = \left(\frac{2 \times 14}{3x + 14 \times 2} \right) \times 100 = 28$$

Where $x =$ atomic wt of metal

$$x = \left(\frac{100 - 28}{3} \right) = 24$$

12. $\text{C}_2\text{H}_5 \xrightarrow[90\% \text{ yield}]{\text{monobromination}} \text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{patl}} 85\% \text{ yeild } \text{C}_4\text{H}_{10} \text{ (55gm)}$

POAC on carbon

$$\left(\frac{x}{2 \times 12 + 6 \times 1} \right) \times 2 = \frac{90}{100} \times \frac{85}{100} = \left(\frac{55}{4 \times 12 + 10 \times 1} \right) \times 4 = 1$$

$$x = 74.37 \text{ gms}$$

$$\Rightarrow V = \frac{74.37}{30} \times 22.4\text{L} = 55.53\text{L}$$