MOLE CONCEPT

FOUNDATION BUILDER (OBJECTIVE)

1. **(D)**

2. **(D)**

3. **(B)**

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

5. **(D)**

6. **(C)**

7. **(A)**

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

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

Hence NO.

8. **(A)**

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

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

9. **(A)**
1 mole contains Avogadro number of atoms.

10. **(A)**

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

Number of atoms = $0.05 \times 2 \times 6.02 \times 10^{23}$.
= 6.02×10^{22} .

11. **(D)**

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

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

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

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

12. **(C)**

Number of gms of $H_2SO_4 = 0.25 \times 98 = 24.5$

13. **(D)**

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

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

14. **(D)**

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

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

15. **(A)**

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

16. **(C)**

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

17. **(B)**

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

[B]

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

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

$\therefore$ Protons = $2N_A \times 10 = 20\,N_A$

[C]

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

[A]

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

$\therefore$ $wt = 10^{-3} \times mol.wt = 10^{-3} M_0\,g = M_0\,mg$

[B]

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

$\therefore$ [A]

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

Hence [D]

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

[C]

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

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

[B]

26. $n_C = 0.5 \times 6 = 3$ $\therefore$ wt = 36 g

[D]

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

$\therefore$ [C]

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

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

[D]

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

$\therefore$ $nH_2O = 5 \times 0.01 \Rightarrow \text{molecules} = 0.05\,N_A$

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

$\therefore$ [A]

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

$\therefore$ atom = $0.12\,N_A \Rightarrow$ [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. $n_{total} = \frac{4.4}{44} + \frac{2.24}{22.4} = 0.2$ $\quad \therefore$ molecules = $0.2N_A$

[B]

37. [D]

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

[B]

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

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

[A]

40. Say $n_{Mg_3(PO_4)_2} = n$; then $n_O = 8n$

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

[B]

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

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 VD = 100

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

$w_{metal} = 29\,g$

[A]

45. (D)

$\underset{1}{CaCO_3} \xrightarrow{\Delta} \underset{1}{CaO} + \underset{1}{CO_2}$

Quantity of limes tones = wt. of one mole mole of $CaCO_3$

= 100 kg

46. (A)

Moles of $H_2S = 2$

Moles of $SO_2 = \frac{11.2}{22.4} = 0.5$

$$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$$

moles 1 2 3 2

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

(L.R.)

47. **(C)**

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

Moles $2H_3PO_4 + 3Mg(OH)_2 \rightarrow Mg_3(PO_4)_2 + 6H_2O$

Moles 2 3 1 6

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

Weight of $H_3PO_4 = \frac{2\times 1.724}{3}\times 98 = 112.6g$

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

[D]

49. $W_O = 3.6769 - 2.0769 = 1.6g$

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

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

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

[A]

50. $Ag_2CO_3 \xrightarrow{\Delta} 2Ag$

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

[A]

51. $n_{CO_2} = 2\times n_{C_2H_5OH} = 2$

$\therefore W_{CO_2} = 2\times 44 = 88\,g$

Hence [D]

52. $KClO_3 \xrightarrow{\Delta} KCl + {}^3\!/_2\,O_2$

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

[C]

53. $n_{Fe} = \frac{2}{3}\times n_{H_2O} = \frac{2}{3}$ $\therefore W_{iron} = \frac{2}{3}\times 56 = 37.39$

[A]

54. $n_{CaCO_3} = n_{CaO} = \frac{1.62}{56} = n_{CaCl_2} = 0.0289$

$$\% \text{ of } CaCl_2 = \frac{0.0289 \times 111}{10} \times 100 = 32.11\%$$

[B]

55. **(D)**

$$3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$$

Moles	3	2	1	6
	0.5	0.2	$\frac{1 \times 0.2}{2} = 0.1$	
		(L.R.)		

56. $$\underset{\substack{\boxed{0.2}\\ LR}}{Ca(OH)_2} + \underset{0.5}{H_2SO_4} \longrightarrow CaSO_4 + 2H_2O$$

$n_{CaSO_4} = n_{Ca(OH)_2} = 0.2$

[A]

57. $$\underset{5}{A} + \underset{\substack{\boxed{8}\\ LR}}{2B} \longrightarrow C + 3D$$

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

Hence [B]

58. $$n : \underset{\substack{\frac{1350}{27}=50\\ L.R}}{4Al} + \underset{\frac{2400}{12}=200}{3C} \longrightarrow Al_4C_3$$

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

[D]

59. $2A \longrightarrow 2B$

$B \longrightarrow 2C$

$3C \longrightarrow 4D$

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

$= \frac{32}{3}$

[D]

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

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

[C]

61. $$D_{cl_2 \text{ wrt air}} = \frac{D_{cl_2}}{D_{air}} = \frac{M_{cl_2}}{M_{air}} \approx \frac{71}{29}$$

Hence [A]

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

$\therefore D_{\text{oxide wrt } O_2} = \frac{M_{oxide}}{M_{O_2}} = \frac{46}{32} = 1.44$

[B]

63. molality $= \frac{n}{w_{solvent}} \times 1000 \left(\text{urea} : NH_2\underset{\underset{O}{\|}}{C}NH_2 \right)$

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

[B]

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

[D]

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

[A]

66. 1 mole $KMnO_4 \longrightarrow$ 5 moles $FeSO_4$

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

$\Rightarrow V = 10mL$

[D]

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

$\therefore$ 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

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

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

[A]

69. (B)

Molarity of $NO_2CO_3 = \frac{2.65 \times 1000}{106 \times 250} = 0.1$ M.

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

70. $X_{NaCl} = \frac{n_{NaCl}}{n_{NaCl} + n_{H_2O}} = \frac{1}{1 + \frac{1000}{18}} = 0.0177$

[A]

1. $KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2}O_2 \quad , n_{O_2} = \frac{3}{2}$

$2Al + \frac{3}{2}O_2 \longrightarrow Al_2O_3$

$n_{Al_2O_3} = \frac{n_{O_2}}{\frac{3}{2}} = 1$

[A]

2. Consider 1 L solution

$\frac{29}{100} \times (d \times 1000) = \omega_{H_2SO_4} = 3.6 \times 98$

$\therefore$ d = 1.22 g/mL

[A]

3.
$$\begin{array}{llllll} & N_2 & + & 3H_2 & \longrightarrow & 2NH_3 \\ n: & 10 & & \boxed{15}\ (LR) & & - \\ & 10-5 & & - & & 10\,\text{moles} \end{array}$$

$n_{N_2} = 5 \quad n_{H_2} = 0$

[A]

4.
$$\begin{array}{lll} & Fe_2(SO_4)_3 + 3BaCl_2 \longrightarrow 3BaSO_4 + 2FeCl_3 & \\ n: & ? & \frac{1}{2} \end{array}$$

$\frac{n_{BaCl_2}}{3} = \frac{n_{FeCl_3}}{2} \Rightarrow n_{BaCl_2} = \frac{\frac{1}{2}}{2} \times 3 = 0.75\,\text{moles}$

[C]

5. $3CuSO_4 + 2Al \longrightarrow Al_2(SO_4)_3 + 3Cu$

$54g\,Al \xrightarrow{\text{displaces}} 192\,g\,Cu$

$27g\,Al \xrightarrow{\text{displaces}} \omega$

$\therefore \omega = 96g$

[C]

6.
$$\begin{array}{lllllll} CH_4 & + & 2O_2 & \longrightarrow & CO_2 & + & 2H_2O \\ 5 & & \boxed{8} & & - & & - \\ 5-4=1 & & - & & 4 & & 8 \end{array}$$

$\therefore n_{CO_2} = 4$; nCH_4 (remaining) = 1

[A]

7. $C_{10}H_X + nO_2 \longrightarrow 10CO_2 + \left(\frac{X}{2}\right)H_2O$

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

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

$2.5\,\text{moles} \xrightarrow{\text{with}} 32.5\,\text{moles}$

i.e. $10+\frac{x}{4}=\frac{32.5\times1}{2.5}=13$

$\therefore x=(13-10)\times4=12$

[C]

8. $100g\,CaCO_3 \xrightarrow{\text{with}} 2mole\,HCl$

$\omega g \xrightarrow{\text{with}} \left(\frac{25L}{1000}\right)\times0.75M\,HCl$

$\therefore \omega=0.9375g$

[D]

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

$\therefore Molarity=\frac{2.125\times1000}{143.5\times25}=0.59$

[B]

10. $2X \xrightarrow{\text{with}} 3\times16g$ Oxygen

$1g \xrightarrow{\text{with}} 0.16g$ Oxygen

$\therefore X=\frac{3\times16}{0.16\times2}=150$

[D]

11. $2Al+\frac{3}{2}O_2 \longrightarrow Al_2O_3$

n: n $1/2$

$2\times27g\,Al \xrightarrow{\text{with}} \frac{3}{2}mole\,O_2$

$\omega \xrightarrow{\text{with}} 1/2\,mole$

$\omega=\frac{2\times27}{3}=18g$

[D]

12. $n_{BaSO_4}=n_{SO_2}=n_S$ (POAC on S)

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

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

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

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

$\therefore n_2=\frac{0.56-103\times0.00516}{16}=0.00178$

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

[B]

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

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

Hence [A]

15. Total atoms $= 200 + 0.05 \times N_A + 10^{-20} \times N_A$

$\approx 0.05\, N_A = 3 \times 10^{22}$

[C]

16. Mol. Wt of $A_2B_3 = 150 + 96 = 246$

$\therefore$ For 5 mol, (246×5)g = 1.23 kg

[C]

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

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

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

[C]

21. $n_{CO_2} = n$, say. Then $n_O = 2n = \frac{8}{16} \Rightarrow n = \frac{1}{4}$

$\therefore$ [D]

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

Hence [A]

23. [D] 1 gram molecule: 44 g

1 molecule of CO_2 = 44 amu

24. $n_H = n \times 2 + 2n \times 4 = 10n$

$n_C = 2n \times 1 = 2n$

$\therefore n_C : n_H = 1 : 5$

[A]

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

Hence [D]

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

[D]

27. $\boxed{\begin{array}{l} 12g\ H_2O \\ 45g\ silica \\ 43g\ others \end{array}} \xrightarrow{\Delta} \boxed{\begin{array}{l} 8\%\ H_2O \\ 45g\ silica \\ 43g\ others \end{array}}$

100g original 'w' grams

8 % of w = water

i.e. 92 % of w = silica others

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

$\therefore \%$ 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. $0.014\% \times mol.wt = 2 \times at.wt\ of\ N$

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)

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

x = 9%

31. (B)

32. (C)

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

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

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

$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

1	2	1
1	0.05 (L.R.)	$\frac{0.05 \times 1}{2} = 0.025$

33. (A)

Moles of $CuSO_4 = \frac{1.595}{1595} = 0.01$

Weight of solvent = 100 – 1.595 = 98.505

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

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

34. **(B)**

(A) atoms of $O_2 = \frac{2 \times 8}{32} \times 6.022 \times 10^{23} \sim 3 \times 10^{23}$

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

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

(D) atoms of $F_2 = \frac{19}{19} \times 6.022 \times 10^{23} \simeq 1 \times 10^{23}$

35. **(C)**

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

36. **(C)**

Auogaduos 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 comphon $= \frac{25 \times 10^{-3}}{10 \times 12 + 16 + 16} = 0.164 \times 10^{-3}$

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 = $27/27 = 1$

$$2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$$

Moles	2	2	2	2	3
Given	1 (L.R.)	excess			$\frac{3\times1}{2} = 1.5$

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

WINDOW TO JEE MAIN

1. (A)

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

$V_{solution}$ is affected by Temperatuere.

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)

$$\text{Molarity} = \frac{\frac{6.02\times10^{20}}{N_A}}{0.1} = 0.01$$

6. (C)

7. (C)

V = 1 L

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

$n_{soluble}$ = 2.05

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

= 1020 – 123 = 897 g

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

8. (B)

9. (B)

V = 1L

$n_{soluble}$ = 3.6

$w_{soluble} = 3.6 \times 98 = 352.8$

$w_{total} = \frac{352.8}{29} \times 100 = 1216.55\,g$

$$\text{density} = \frac{1216.55}{1000}$$

= 1.22 g/ml

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

14. (A)

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

$\therefore$ In 4 g of hydrogen

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

[Here species = 2 because hydrogen is present as H_2]
In 71 g of chlorine = $2N_A$

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

In 127 g of iodine,

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

In 48 g of magnesium,

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 D_2O
In it,

Number of $p^+ = 1 \times 2 + 8 = 10$

Number of $e^- = 1 \times 2 + 8 = 10$

Number of $n^0 = 1 \times 2 + 8 = 10$

($\because$ D have1 n^0 because it is actually, ${}_1H^2$)

16. (d)
18 g H_2O contains 2 g H
$\therefore$ 0.72 g H_2O contains 0.08 g H.
44 g CO_2 contains 12 g C
$\therefore$ 3.08 g CO_2 contains 0.84 g C

$\therefore\ C : H = \frac{0.84}{12} : \frac{0.08}{1} = 0.07 : 0.08 = 7 : 8$

$\therefore$ Empirical formula = C_7H_8

17. (c)
3 M solution means 3 moles of solute (NaCl) are present in 1000 L of solution.
Mass of solution = volume of solution $\times$ density
$= 1000 \times 1.252$
= 1252 g
Mass of solute = No. of mole $\times$ molar mass of NaCl
$= 3 \times 58.5\text{g}$
= 175.5 g
Mass of solvent = (1252 – 175.5)g
= 1076.5 g
= 1.076 kg

$$\text{Molality} = \frac{\text{moles of solute}}{\text{mass of solvent (in kg)}}$$

$$= \frac{3}{1.076} = 2.79\text{m}$$

18. (a)

Final concentration, $M = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

$= \frac{10 \times 2 + 200 \times 0.5}{200 + 10}$

$= \frac{20 + 100}{210}$

$= \frac{120}{210} = 0.57\,M$

FOUNDATION BUILDER (SUBJECTIVE)

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

2. $n_{CH_4} = \frac{1.6}{16} = 0.1\,\text{moles} = 6 \times 10^{22}$ molecules

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

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

3. $n_{H_2O} = \frac{18\,g}{18\,g/mol} = 1\,\text{mole}$

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

$\therefore$ 1 mole contains $10N_A$ electrons.

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

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

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

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

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

$\therefore \omega_{CO_2,\text{remaining}} = 200 - 73.5 = 126.5\,mg$

$\therefore n_{CO_2} = \frac{126.5 \times 10^{-3}}{44} = 0.002875$

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

9. $n_O = n_{SO_2} \times 2 = \frac{3.2\times10^{-3}}{64}\times 2 = 10^{-4}$ moles

$n_S = n_{Na_2S_2O_3.5H_2O} \times 2 = 2\times5\times10^{-3} = 10^{-2}$

$\therefore n_O : n_S = \frac{10^{-4}}{10^{-2}} = 0.01$

10. $n_O = 3\times n_{NaNO_3} + 2\times n_{NO_2}$

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

$n_N = n_{NaNO_3} + n_{NO_2} = 10\times10^{-3} + \frac{1}{6}$

= 0.01 + 0.166

= 0.176

11. $t(s) = \frac{6\times10^{23}}{10^6} = 6\times10^{17}$ s

$t(hr) = \frac{6\times10^{17}}{3600} = 1.67\times10^{14}$

$t(yr) = \frac{1.67\times10^{14}}{24\times365} = 1.9\times10^{10}$ years

12. atomic wt = $6.644\times10^{-23}\times6\times10^{23}$
= 40 g/mol

$\therefore n = \frac{40\times1000\,g}{40\,g/mol} = 1000$ moles

13. $n_C = \frac{10^{-6}\,g}{12g/mol}$

No. of atoms = $n_C \times 6\times10^{23} = 5\times10^{16}$

14. r = 0.1 inch = 0.254 cm

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

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

$= \frac{4}{3}\pi\times(0.254)^3\times7.75 = 0.532\,g$

$\omega_{Fe} = \frac{85.6}{100}\times0.532\,g = 0.455\,g$

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

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

$\therefore \omega_{starch} = \frac{3100}{0.086} = 3.6\times10^4$

16. $V_{NH_3} = n_{NH_3}\times22.4\,L$

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

17. $n_{O_2} = \frac{PV}{RT} = \frac{1\times1}{0.0821\times273} = 0.04464$

$\therefore n_{moleculs} = n_{O_2} \times N_A = 2.69\times10^{22}$

18. $O_3 \;+\; O_2 \longrightarrow 600\,mL$

$V ml \;\; (600 - V)\,mL$

$$\frac{V}{22400}\times48 + \frac{(600-V)}{22400}\times32 = 1g$$

$\therefore$ V = 200 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

$\therefore K_2MnP_2$

20. Say $n_O = n$

Then $n_H = 15n$

And $n_C = \frac{70}{100}\times15n = 10.5n$

$\therefore C_{10.5}H_{15}O$ or $C_{21}H_{30}O_2$ is empirical formula

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

$\therefore C_{21}H_{30}O_2$

21. $9.03\times10^{20} \xrightarrow{\text{weight}} 0.311\,g$

$6.02\times10^{23} \xrightarrow{\text{weight}} \text{mol.wt.}$

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

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

22. $\omega_C = \frac{58.97}{100}\times102 = 59.9 \Rightarrow n_C = 5$

$\omega_H = \frac{13.81}{100}\times102 = 14.08 \Rightarrow n_H = 14$

$\omega_N = \frac{27.42}{100}\times102 = 27.97 \Rightarrow n_N = 2$

$\therefore C_5H_{14}N_2$

23. $\omega_C = \frac{12}{44}\times\omega_{CO_2} = \frac{12}{44}\times0.9482 = 0.2586$

$\therefore n_C = 0.02155$

$\omega_H = \frac{2}{18} \times \omega_{H_2O} = 0.02154$

$\therefore n_H = 0.02154$

$n_C : n_H = 1:1 \quad \therefore CH$

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

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

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

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

$\therefore$ 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 mol. NO_2 + (1 – x) mol. N_2O_4) = 76.6 g

$\therefore x \times 46 + (1 - x) \times 92 = 76.6$

$x = \frac{15.4}{46} = n_{NO_2}$ in 1 mole = 0.335

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

$\therefore n_{NO_2}$ in 100 $= 0.335 \times n_{mix}$

= 0.437

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

Consider 1L of solvent

C_2H_5OH
mol.wt = 46

n = 8

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

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

27. $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 \uparrow + H_2O \uparrow$

$Na_2CO_3 \xrightarrow{\Delta}$ no effect

$2 \times (84\,g)\, NaHCO_3 \xrightarrow{loses} 62g\,(CO_2 + H_2O)$

$\omega_g \xrightarrow{loses} 0.124$

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

$\%$ of $NaHCO_3 = \frac{0.336 \times 100}{2} = 16.8\%$

and $Na_2CO_3 = 100 - 16.8 = 83.2\%$

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	$\frac{4.95}{16} = 0.309$	$\frac{0.309}{0.309} = 1$

$$C_{20}H_{25} = N_3O$$

$$\% \quad \text{of C atoms} = \frac{20}{49} \times 100$$
$$= 40.816\%$$

29. $$2CH_3CHO + O_2 \rightarrow 2CH_3COOH$$

ω : 20g 10g

n : $\frac{20}{44} = 0.45$ $\frac{10}{32} = 0.31$

L.R

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

$\omega_{CH_3COOH} = 27.27g.$

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

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

(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

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

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

$\therefore n_1 = 0.193$ 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

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

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

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

$$\omega_{product} = \left(\frac{10}{63.5}\right)\times[63.5+124+54]$$
$$= 38.03g$$

34. $AgNO_3 \quad + \quad NaCl \rightarrow \quad AgCl\downarrow \quad + \quad NaNO_3$

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

$= 0.03394$ $\qquad$ $= 0.08$

L.R.

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

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

35. $\underset{n_1}{CaCO_3} \xrightarrow{\Delta} \underset{n_1}{CaO} + CO_2\downarrow$

$MgCO_3 \xrightarrow{\Delta} \underset{n_2}{MgO} + CO_2\downarrow$

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

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

$n_1 = 0.01$

$n_2 = 0.01$

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

36. $Cl_2 + 2KOH \rightarrow KCl + KClO + H_2O$

$3KClO \rightarrow 2KCl + KClO_3$

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

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

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

37. POAC on Cl (eventually on completion)

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

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

$= 3.5 moles$

38. 1g $KClO_3$

n_1 moles $\rightarrow KCl + O_2$

n_2 moles $\rightarrow KClO_4 + KCl$

$n_{O_2} = \frac{3}{2}\times n_1 = \frac{146.8}{22400} \Rightarrow n_1 = 0.00437$

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

$$n_{KClO_4} = \frac{3}{4} n_2 = 0.00284$$

$$\omega_{resiude} = 1g - \omega_{O_2} = 0.79029g$$

$$\therefore \%KClO_4 = \frac{0.00284(39 + 35.5 + 64)}{0.79} \times 100$$

$$= 49.789\%$$

39. $(CH_3)_x\ AlCl_y \rightarrow \times CH_4 + yCl^-$

$$Cl^- + AgNO_3 \rightarrow AgCl \downarrow + NO_3^-$$

1. $n_{CH_4} = x.n_{(CH_3)_x\ AlCl_y}$

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

2. $n_{AgCl} = n_{Cl^-} = y.n_{(CH_3)_x\ AlCl_y}$

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

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

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

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

40. $KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2} O_2$ (1)

6.125g

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (2)

$H_2 + \frac{1}{2} O_2 \rightarrow H_2O$ (3)

in (1),

$$n_{O_2} = \frac{3}{2} \times n_{KClO_3} = 0.075$$

in (3),

$$n_{H_2} = 2 \times n_{O_2} = 0.15$$

in (2),

$$n_{Zn} = n_{H_2} = 0.15$$

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

41. (A): B,

(B): A,

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

42. $C + O_2 \rightarrow \underset{n_1}{CO}, \underset{n_2}{CO_2}$

POAC on C

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

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

$\Rightarrow n_2 = 1.25 - 1 = 0.25$

and $n_1 = 0.75$

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

43. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

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

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

$= 6.125 g/L$

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

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

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

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

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

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

$= 1.2475 g$

47. $M_1V_1 + M_2V_2 = M_3V_3$

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

$= 0.35 \text{Molar}$

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

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

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 $n_{C_6H_6} = 0.8$

$\therefore \text{molality} = \frac{n_{I_2}}{\omega_{C_6H_6}} \times 1000$

$= \frac{0.2}{0.8 \times 78} \times 1000 = 3.205 m.$

50. Consider 1L solution.

$\omega t_{solution} = 1000 \times 1.06 = 10609.$

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

$$\text{Molailty} = \frac{n_{KCl}}{V_{solution}^{(mL)}} \times 1000$$

$$= \frac{106/74.5 \times 1000}{1000} = 1.4228M$$

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

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

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

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

52. Consider 1L of solution,

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

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

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

$$\text{molality} = \frac{n_{ethanol}}{\omega_{solvent}} \times 1000$$

$$= \frac{8}{(1025-368)} \times 1000$$

$$= 12.176 molal$$

53. $2SO_2 + O_2 \rightarrow 2SO_3$

$nSO_2 = nSO_3 \Rightarrow nSO_3 = 5$

54. $4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$

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

So moles of $Fe_2O_3 = \frac{1}{2} \times 2.5$

55. $n_{NH_3} = n_{HCl} = \frac{146}{36.5} = 4$

Wt $NH_3 = 4 \times 17 = 68\,g$

56. $2H_2 + O_2 \rightarrow 2H_2O$

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

LR

wt H_2O formed $= 0.90625 \times 2 \times 18 = 32.625\,g$

wt H_2 left $= (3 - (0.90625 \times 2)) \times 2 = 2.1325\,g$

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

$w = 226g$

58. $\underset{n_1}{AgCl} + \underset{n_2}{AgBr}$

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

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

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

$$= 4.856\%$$

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

59. $(COOH)_2 \xrightarrow[H_2SO_4]{\Delta} CO_2 + H_2O\,(\text{unbalanced})$

$$POAC\ ^{n}C = ^{n}CO_2 \times 1 = ^{n}(COOH) \times 2 = \frac{10}{90} \times 2 = \frac{2}{9}$$

$$\therefore ^{V}CO_2 = \frac{2}{9} \times 22.4L = 4.977L$$

60. acid is H_3A. salt is Ag_3A

$1\text{mole}\,Ag_3A \rightarrow 3\text{mole}\,Ag$

$$\therefore n_{Ag_3A} = \frac{n_{Ag}}{3} = \frac{0.37/108}{3} = 0.00114$$

$$\therefore \frac{0.607}{\text{mol.wt of } Ag_3A} = 0.00114$$

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

$$\therefore A = 207$$

$$\therefore \text{wt of } H_3A = 210$$

GET EQUIPPED FOR JEE ADVANCE

ONE OPTION CORRECT

1. $N_2 \quad + \quad 3H_2 \quad \rightarrow \quad 2NH_3$

	N_2	$3H_2$	$2NH_3$
say, wt:	$14x$	$3x$	
$t = o$	$\frac{14x}{28} = \frac{x}{2}$	$\frac{3x}{2}$	–
$t = t$	$\frac{x}{2} - y$	$\frac{3x}{2} - 3y$	$2y$

NH_3 was 40% by mol.

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

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

$$X_{N_2} = \frac{(x/2-y)}{(2x-2y)} = \frac{\left[\frac{x/y}{2}-1\right]}{2[x/y-1]}$$

$$= \frac{1.75-1}{2(2.5)} = \frac{0.75}{5}$$

$$= 0.15$$

(A)

2. $n(A) = n(B)$

$\therefore M_A \times n(A) = 1.4g$ and $M_B \times n(B) = 0.8$

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

(C)

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

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

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

$\therefore 128g$ metal with $16g\ O$

i.e. M_2O

(B)

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

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

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

(A)

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

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

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

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

(C)

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

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

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

(C)

7. $I_2 + Cl_2 \rightarrow \underset{n_1}{ICl}, \underset{n_2}{ICl_3}$

POAC on I

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

POAC on Cl

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

$\because n_1:n_2=1:1$

(A)

8. $FeSO_4:n_1 \Rightarrow SO_4^{2-}=n_1$ and $Fe^{2+}=n_1$

$Fe_2(SO_4)_3:n_2 \Rightarrow SO_4^{2-}=3n_2$ and $Fe^{3+}=2n_2$

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

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

(D)

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

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

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

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

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

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

(D)

10. At mass $=N_A\times$ mass of an atom

$$=6\times10^{23}\times3.98\times10^{-23}=24g$$

(C)

11. $Fe_2\left[Fe(CN)_6\right]$

$$\frac{\omega_{Fe}}{\omega_C}=\frac{3\times56}{6\times12}=\frac{7}{3}$$

(C)

12. obvious (D)

13. obvious (B)

14. 1gatom $\Rightarrow$ 1mole of atom $-$ 14g.

(A)

15. $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

$n_{HCl} = 2 \times n_{Na_2CO_3} = V_{HCl} \times M_{HCl}$

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

(B)

16. They must have same mol. wt.

(C)

17. $= \frac{V_{2\,micron\,sphere}}{V_{20\overset{0}{A}sphere}} = \frac{4/3\,\pi \times \left(2 \times 10^{-6}\right)^3}{4/3\,\pi \times \left(2 \times 10^{-9}\right)^3} = 10^9$

(A)

18. $KClO_3 \xrightarrow{\Delta} KCl + \frac{3}{2}O_2$

$n_{KClO_3} = \frac{n_{o_2}}{3/2} = \frac{0.1}{3/2} = \frac{2}{30}$

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

(B)

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

$\therefore \omega_{BaCl_2.2H_2O} = (137 + 71 + 36) \times 6.5 \times 10^{-4} = 0.1586g$

$\omega_{BaCl_2} = (137 + 71) \times 6.5 \times 10^{-4} = 0.1352g$

(A)

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

$\Rightarrow V = 102.941mL$

(B)

21. $\omega t = \frac{11.5}{M_{C_6H_5COOK}} \times \frac{100}{71} \times M_{C_6H_5CH_3} = 9.31g$

22. $CuSO_4.5H_2O = n_1, \; MgSO_4.7H_2O = n_2$

total $\omega t = 5g$ and anhydrous $3g$

$\therefore 249.5n_1 + 246n_2 = 5$

and $159.5n_1 + 120n_2 = 3$

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

$\Rightarrow \omega_{CuSO_4.7H_2O.} = 3.729g$

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

(C)

23. $C_7H_6O_3 + C_4H_6O_3 \rightarrow C_9H_8O_4 + C_2H_4O_2$

$\omega : 2g \quad 4g$

$n : \underset{L.R}{0.0144} \quad 0.039 \quad 0.01449$

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

$= 2.69$

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

(A)

24. $2XI_3 + 3Cl_2 \rightarrow 2XCl_3 + 3I_2$

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

$\Rightarrow M = 138.88 = 139$

(B)

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

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

(B)

26. in 10 mL $CuCl_2 = n_1$, and $CuBr_2 = n_2$

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

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

and $(2n_1 + 2n_2)188 = 1.005g$

then $n_1 = 0.00115$ and $\omega_{cuBr_2} = 0.35g$

$\therefore 25\%$ and 58%

(A)

27. $n_{XH_4} = 2n$ and $n_{X_2H_6} = n$, say

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

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

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

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

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

(A)

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

$$\therefore 0.0105 \times \frac{42.5}{1000} = n_{AgNO_3}$$
$$= 0.00446$$
$$n_{AgNO_3} = n_{\underset{n_1}{\underset{\downarrow}{NaBr}}} + 2n_{\underset{n_2}{\underset{\downarrow}{Na_2SO_4}}}$$
$$\therefore n_1 + 2n_2 = 0.00446$$
also, $n_1 \times 103 + n_2 \times 142 = 2/5\left(\omega t \text{ of } {}^{1}\!/_{5}{}^{th} \text{ portion}\right)$

29. Let acid be HA

Salt: $BaA_2.2H_2O$

$$BaA_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HA$$

$$\therefore \frac{4.29}{137 + 2A + 36} = \frac{21.64}{1000} \times 0.477$$
$\therefore A = 121$ $\therefore HA = 122$

30. total moles =n (say)

$$0.15n = moles\ of\ CH_3COOH$$
$$\therefore 0.15n \times 60 + 0.85n \times 18 = 30$$
$$\therefore n = \frac{30}{9 + 15.3} = 1.234$$
$$\therefore {}^{n}NaOH = {}^{n}CH_3COOH = 0.15n = 0.18519$$
$$\therefore V_{NaOH} = 18.5L[B]$$

31. $\underset{n_1\ moles}{C_2H_6} + 3.5O_2 \longrightarrow 2CO_2 + 3H_2O$

$$\underset{n_2\ moles}{C_2H_4} + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$
$$n_1 + n_2 = \frac{PV}{RT} = \frac{1 \times 40}{0.0821 \times 400} = 1.218$$
also $3.5n_1 + 3n_2 = n_{O_2} = \frac{130}{32} = 4.06$
$$\therefore n_1 = 0.817$$
$$n_2 = 0.401$$
$\therefore \%C_2H_4 = 33\%$ and $C_2H_6 = 67\%[A]$

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. $V_{molecule} = \frac{\sqrt{3}}{4}\left(100\,\overset{\circ}{A}\right)^2 \times 300\,\overset{\circ}{A}$

$=1.299\times10^{-24}$

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

$= 6\times10^{23}\times1.299\times10^{-24}\times1.2\times10^{3}\, kg/m^3$

$= 939\,kg$ (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 $= \frac{474}{1250}\times100 = 37.92\%$

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

(C) molality of $Na^+ = \frac{n}{w_{solvent}}\times1000$

$= \frac{3\times2}{(1250-474)}\times1000 = 7.73$

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

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

(A) and (B)

3. [A] : $32\,g$ [B] $\frac{1}{2}\times64 = 32\,g$ [D] : $32\,g$

4. $Ca(NO_3)_2 + Na_2C_2O_4 \longrightarrow CaC_2O_4 + 2NaNO_3$

	$Ca(NO_3)_2$	$Na_2C_2O_4$	CaC_2O_4	$2NaNO_3$
millimoles :	6	3	-	-
	3	LR	3	6

[A],[C],[D]

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

$w_{CaCO_3} = 0.02\times100 = 2g$

$w_{CaCl_2} = 0.02\times111 = 2.22\,g$

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

[A, C]

6. $n_{NaCl} = 100\,m\,moles$; ${}^{n}HCl = 300\,m\,moles$

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

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

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

$\therefore [A],[C]$

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

8. 3 mole NH_3

$w_H = 3\times14 = 42\,g$

$W_N = 3\times14 = 42\,g$

molecule $= 3\times N_a = 18\times10^{23}$

atoms $= 4\times3\times N_A = 72\times10^{23}$

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

9. Obvious : [A], [B]

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

14. Hence [C], [D]

Mol. Wt $= \frac{14}{11.2}\times22.4 = 28$

Match the following

1. (I) wt % of C $= \frac{13\times12}{407}\times100 = 38.33\%$ (P)

(II) wt % of H $= \frac{6}{407}\times100 = 1.47\%$ (A)

(III) wt of H: wt of $Cl = 6:6\times35.5$ (C)

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

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

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

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

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

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

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

Total =0.12 M

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

(P), (S)

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

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

(S)

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

[P], [Q]

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

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

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

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

[R]

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

$w_{SO_2} = 32g$

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

(B) $^nH_2 = 1/2 \therefore V_{H_2} = 11.2L$

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

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

[P], [Q], [R]

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

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

$wt = 32g$ [S]

<u>COMPREHENSION TYPE</u>

Passage 1

1. wt of 1 atom $= 1\text{amu} = 1.66 \times 10^{-24}\text{g.}$ (C)

2. $n_S = n_{H_2SO_4} = 100 \therefore \text{wt} = 3200\text{g.}$ (A)

3. $\frac{3.4}{100} \times (\text{M}) = \omega_s = 2 \times 32 \Rightarrow \text{M} = 1882.3$ (B)

4. $C + O_2 \rightarrow n_C = n_C = n_{O_2} = 1$

$\Rightarrow V_{O_2} = \frac{20}{100} \times V_{air} = 22.4C \Rightarrow V_{air} = 112L$ (B)

Passage – 2

1. Consider 1 L.

$n_{KOH} = 6.9 \Rightarrow \omega_{KOH} = 6.9 \times 56 = 386.4$

$\frac{30}{100} \times \omega_{solu} = 386.4 \Rightarrow \omega_{solu} = 1288g$

$\therefore d = 1.2889 g/mL.$ (A)

2. $\frac{134}{1000} \times M_{H_2SO_4} \times 2 = n_{NH_3} = \frac{PV}{RT} = \frac{0.2 \times 2}{0.0821 \times 303}$

$\Rightarrow M_{H_2SO_4} = 0.06$ (C)

3. $\frac{1600 \times 0.205}{1600 + V} = 0.2 \Rightarrow V = 40mL$ (A)

4. $\frac{n_{H_2S}}{1} = \frac{n_{H_2SO_4}}{5} \Rightarrow n_{H_2SO_4} = \frac{5 \times 34}{34} = 5$

$\therefore V \times 0.2 = 5 \Rightarrow V = 25L$ (A)

Passage – 3

1. $m_{H_2O} = \frac{18g}{6 \times 10^{23}} = 3 \times 10^{-23} g$ (D)

2. Avogadro's law. (A)

3. obvious Mass is 16amu. (C)

4. obvious (A)

Passage – 4

1. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

$n : \frac{5.77}{170}$ $\quad \frac{4.77}{58.5}$ $\quad n_{AgCl} = 0.0339$

$= 0.0339$ $\quad = 0.081$ $\quad \therefore wt = 4.88g$

L.R (A)

2. $\therefore \omega_{H_2SO_4} = 0.12 \times 98 = 11.7g$ (A)

INTEGER

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

$\therefore 5$ moles.

2. $n_{CO_2} = \frac{132}{44} = 3$

$n_C = 3$

3. MCl_X : say. mol.wt $= (M + 106.5)$

$$n_{Cl^-} = \left(n_{MCl_x}\right)\times\left(X\right) = \frac{0.22x}{\left(M+106.5x\right)}$$

$$n_{Cl^-} = n_{Ag} = \frac{0.51}{\left(170\right)} = 3\times10^{-3}$$

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

$$\therefore \frac{0.22\times x}{\left(112+106.5x\right)} = 3\times10^{-3} \therefore x = 3$$

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

5. $$\frac{x\times5+20\times2}{x+20} = 2.6 \Rightarrow 5x+40 = 2.6x+52$$

6. $$C_nH_{2n+2} + \left(n+\frac{n+1}{2}\right)O_2 \rightarrow nCO_2 + \left(n+1\right)H_2O$$

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

7. $$n = \frac{\omega}{\text{mol.wt}} = \frac{1440}{60\times12} = 2$$

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

9. $$\frac{0.25}{100}\times89600 = \omega_{Fe} = n\times56 \Rightarrow n = 4$$

10. $CO_2 \rightarrow C_6H_{10}O_5$

$$1g \text{ algae} \xrightarrow[+1g\,\text{strach}]{} 2g \text{ algae}$$

1g strach

POAC on carbon

$$n_{CO_2}\times1 = n_{(C_6H_{10}O_5)_n}\times6n$$

$$= \frac{1}{162n}\times6n = \frac{1}{27}$$

$$\therefore \text{time} = \frac{1/27}{4.7\times10^{-3}} = 8$$

EXPERTISE ATTAINERS

1. POAC on Co

$$n_{Co_3O_4}\times3 = n_{Co}\times1$$

$$\Rightarrow n_{Co} = \frac{0.2125\times3}{\left(177+64\right)} \quad \therefore \omega_{Co} = n_{Co}\times59 = 0.156\,g$$

$$n_{PPt}\times1 = n_{Co}$$

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

2. (a) $\frac{90}{100}\times 0.5\,g\,Fe \rightarrow Fe_2O_3(n_1)$

$\frac{10}{100}\times 0.5_g\,Fe \longrightarrow Fe_3O_4(n_2)$

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

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

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

(b) $0.5g\,Fe \longrightarrow Fe_2O_3(n)$

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

$\Rightarrow \omega_{Fe_2}O_3 = 0.7142\,g$

3. (i) $^{n}AgNO_3 = ^{n}{}_{AgCl} = ^{n}\underset{(n_1)}{NaCl} + ^{n}\underset{(n_2)}{HCl}$

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

(ii) NaCl is not affected

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

$\Rightarrow n_2 = 0.009345$

$\therefore n_1 = 0.0856$

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

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

4. $C_xH_yCl_z + O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}Cl_2$

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

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

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

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

$C_2H_4Cl_2$

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

$\underset{n_1}{N_2}, \underset{n_2}{NO_2}, \underset{n_3}{N_2O_4}$

$n_1 + n_2 + n_3 = 1$

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

$\left(N_2O_4 \xrightarrow{\Delta} 2NO_2\right)$

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

New Average mol. Wt $= 39.57$

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

$\therefore n_3 = 0.4$

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

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

also $n_1 + n_2 + n_3 = 1$

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

Solving (1) and (2),

$n_1 = 0.5$, and $n_2 = 0.1$

$\therefore 5:1:4$

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

$\therefore w_{NaHSO_3} = 9.139\,g$

$${}^{n}I^-\ \text{in}\ 1^{st} = {}^{n}\ IO_3^- = \frac{5.8}{198}$$

$$\frac{{}^{n}IO_3^-}{1} = \frac{{}^{n}I^-}{5} \Rightarrow {}^{n}\ IO_3^- = 0.00586$$

$M_{NaIO_3} = 5.8/(198)$

$$\therefore V = \frac{{}^{n}IO_3^-}{M_{IO_3^-}} = 0.2L = 200\,mL$$

7. $AgNO_3 + KI \rightarrow KNO_3 + AgI$

$2KI + KIO_3 + 6HCl \rightarrow 3ICl + 3KCl + 3H_2O$

$$\frac{M_{KI}\times V_{KI}}{2} = \frac{{}^{n}KIO_3}{1} \Rightarrow \frac{M_{KI}\times 20}{2} = \frac{30\times\frac{1}{10}}{1}$$

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

Now, $\frac{{}^{n}KI,\text{excess}}{2} = \frac{{}^{n}KIO_3}{1} \Rightarrow {}^{n}\ KI,\text{excess} = 10\,m\,mole$

Original KI $= 50\times 0.3 = 15\,m\,mole$

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

$\therefore {}^{n}AgNO_3 = {}^{n}\ KI(\text{used}) = 5mmole \Rightarrow w\,(AgNO_3) = 0.85\,g$

$\therefore$ purity $= 85\%$

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

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

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

$\Rightarrow$ x = 20%

9. Let NaCl = w gms

$\Rightarrow$ kCl = (118 – w) gms

POAC on Cl

$$\frac{w}{M_{Nacl}} + \frac{0.118 - w}{M_{kCl}} = \frac{0.2451}{M_{Agcl}}$$

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

w = 0.0338 gm

Nacl = 0.0338 gm kcl = 0.0842 gm

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

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

POAC on Na; moles of $Na_2O \times 2$

= moles of NaCl$\times$ 1

$\Rightarrow$ $n_{Na_2O} = \left(\frac{5.777 \times 10^{-4}}{2}\right)$; $n_{k_2O} = \left(\frac{1.13 \times 10^{-3}}{2}\right)$

Weight of $Na_2O = \frac{5.777 \times 10^{-4}}{2} \times 62 = 0.01gm$

Weight of $k_2o = \frac{1.13 \times 10^{-3}}{2} \times 94 = 0.1062$

% Na_2O = 3.58%. % k_2o = 10.62 %

10. C_xH_y

$$C_xH_y + (x + y/x)o_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$$

POAC on carbon

$5 \times x = (\text{vol.of } CO_2) \times 1$

Now 1 vol. of CO_2 = 10 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) = ml 15 (given)

$\Rightarrow$ y = 4

$\therefore$ formula = C_2H_4

11. (a)

$$CO_2 + C \longrightarrow 2CO$$

POAC on carbon

Let CO = x l

CO_2 = (1 – x) l

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

$\Rightarrow$ 2 – x = 1.6 = 1

x = 0.4 l & (1 – x)0.6 L

(b)

The molecular formula = M_3N_2

% 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. $C_2H_5 \xrightarrow[90\%\,\text{yield}]{\text{monobromination}} \text{pat1} \longrightarrow 85\%\,\text{yeild}\,C_4H_{10}\,(55\text{gm})$

POAC on carbon

$$\left(\frac{x}{2\times12+6\times1}\right)\times2=\frac{90}{100}\times\frac{85}{100}=\left(\frac{55}{4\times12+10\times1}\right)\times4=1$$

x = 74.37 gms

$$\Rightarrow \quad V=\frac{74.37}{30}\times22.4L=55.53L$$

WINDOW TO JEE ADVANCED

INTEGER TYPE

2. (4)

Boltzmann constant, $k=\frac{R}{N_A}$ or $R = k\times N_A$

$=1.380\times10^{-23}\times6.023\times10^{23}$

$= 8.31174\ J\ K^{-1} \approx\ 8.312$

Hence, no. of significant figures is 4

3. (8)

Mass of 1 L solvent = $0.4\,g\,mL^{-1}\times10^3\,mL$

= 400 g = 0.4 kg

So molality $(m)=\frac{\text{Mole of solute}}{\text{Mass of solvent (kg)}}=\frac{3.2}{0.4}$

= 8 m