Mole Concept Booklet Solution
Foundation builder

1. $A : n_H = 4 \times \frac{169}{169} = 4$; $B : n_H = 4 \times \frac{31.2}{76} = 1.64$

   $C : n_H = 22 \times \frac{34.2}{342} = 2.2$; $D : n_H = 12 \times \frac{136}{180} = 2.4$

   Hence [A]

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

   [B]

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

   Hence in 36 ml, $n_{H_2O} = \frac{369}{189/mol} = 2mols$

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

   [C]

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

   [A]

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

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

   [B]

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

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

   [C]

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

   $\therefore$ For 5 mol, $(246 \times 5)_g$ = 1.23 kg

   [C]

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

   $\therefore$ [A]

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

   Hence [A]

10. $A:10N_A$; $B:11\times\frac{200}{342}=6.43N_A$; $C=\frac{144}{48}N_A\times3=9N_A$

$D:2.5\times3N_A=7.5N_A$.

Hence [A]

11. [D] obvious

12. $A:\frac{1}{44}\times3N_A$; $B:\frac{1}{114}\times26N_A$; $C:\frac{1}{30}\times8N_A$; $D:\frac{1}{26}\times2N_A$

Hence [A]

13. $\frac{9.2}{46}\times2=n\times1\Rightarrow n=0.4$ $\therefore$ $wt=0.4\times30=12g$

[A]

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

[C]

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

$\therefore$ $total\,\bar{e}s=2\,N_A\times32=64\,N_A$

[B]

16. $n_C=0.5\times6=3$ $\therefore$ wt = 36 g

[D]

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

$\therefore$ [C]

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

$\therefore$ no. of $\bar{e}s=10\times10\,N_A=100\,N_A$

[D]

19. $n_{Na_2S_2O_3\cdot5H_2O}=\frac{2.48}{248}=0.01$

$\therefore$ $nH_2O=5\times0.01$ $\Rightarrow$ molecules $=0.05\,N_A$

[c]

20. $n_{Ag}=\frac{90}{100}\times\frac{10}{108}=\frac{1}{12}\Rightarrow$ atom $=\frac{1}{12}N_A=5\times10^{22}$

[c]

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

$\therefore$ [D]

22. $A : 0.2 \times 14\,g = 2.8\,g$; $B : \frac{3 \times 10^{23}}{6 \times 10^{23}} \times 12\,g = 69$; 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. $n_{H_2O} = 18 \times 333$ = 9. Hence [B]

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

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

$\therefore$ [C]

28. $n_{N_3} = \frac{4.2}{14} = 0.3$. $\therefore$ total = $0.3 \times 8N_A = 2.4N_A$

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

$\therefore$ atom = $0.12\,N_A \Rightarrow$ [D]

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

Each contain (12 + 6 + 24) protons

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

[B]

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

[B]

32. [D]

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

[B]

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

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

[A]

35. Say $n_{Mg_3}\left(PO_4\right)_2 = n$; then $^{n}O = 8n$

$\therefore$ 8n = 0.25 $\Rightarrow n == \frac{0.25}{8} = 3.125\times10^{-2}$

[B]

36. $\frac{69.98}{100}\times Mol.wt = 21\times12 \Rightarrow mol.wt = 360$

[D]

37. $$\boxed{\begin{matrix}12g\,H_2O\\45g\,silica\\43g\,others\end{matrix}} \xrightarrow{\Delta} \boxed{\begin{matrix}8\%\,H_2O\\45g\,silica\\43g\,others\end{matrix}}$$

$100g\,original$ $\quad$ $'w'grams$

80 % of w = water

i.e. 92 % of w = silica others

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

$\therefore\%\,of\,silica = \frac{45}{95.65}\times100 = 47\%$

[D]

38. M_3N_2 . 28 % nitrogen

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

[C]

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

[D]

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

Hence [B]

41. Same as question 39. [C]

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

Hence I_2O_5. [C]

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

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]

44. mol. Wt = 2 VD = 100

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

$w_{metal} = 29\,g$

[A]

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

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

[C]

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

Hence [A]

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

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

[B]

48. $n_{H_2O} = n_{CH_3OH} \times 2 = 4$ $\quad\quad \therefore\ wt = 4 \times 18 = 729$

[D]

49. Say ‘x’ g. $\frac{x}{60+x} = \frac{20}{100} \Rightarrow x = 15$

[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 = $\dfrac{48\,g}{122.5} \times 100 = 39.18$

[C]

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

[A]

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

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

[B]

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

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

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

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

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

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

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

[B]

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

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

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

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

[A]

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

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

[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. $3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6NaCl$

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

$nBa_3(PO_4)_2 = \frac{n_{Na_3PO_4}}{2} = 0.1$

[D]

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

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

[A]

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

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

Hence [B]

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

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

[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

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

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

[A]

69. $2X \xrightarrow{with} 3\times 16g$ Oxygen

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

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

[D]

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

[A]

71. $$2Al+\frac{3}{2}O_2 \longrightarrow Al_2O_3$$

n: $\quad n \quad 1/2$

$2\times 27g\,Al \xrightarrow{with} \frac{3}{2}mole\,O_2$

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

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

[D]

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

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

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

[A]

73. Consider 1 c solution

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

$\therefore$ d = 1.22 g/mL

[A]

74.

	N_2	+	$3H_2$	$\longrightarrow$	$2NH_3$
n:	10		$\boxed{15}$ LR		–
	$10-5$		–		10 moles
			$n_{N_2} = 5$		$n_{H_2} = 0$

[A]

75. $Fe_2(SO_4)_3 + 3BaCl_2 \longrightarrow 3BaSO_4 + 2FeCl_3$

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

$\frac{n_{BaCl_2}}{3} = \frac{n_{feCl_3}}{2} \Rightarrow nBaCl_2 = \frac{1/2}{2} \times 3 = 0.75 \text{ moles}$

[C]

76. $3CuSO_4 + 2Al \longrightarrow Al_2(SO_4)_3 + 3Cu$

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

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

$\therefore \omega = 96g$

[C]

77.

CH_4	+	$2O_2$	$\longrightarrow$	CO_2	+	$2H_2O$
5		$\boxed{8}$		–		–
5 – 4 = 1		–		4		8

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

[A]

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

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

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

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

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

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

[A]

79. $100\text{g}\, CaCO_3 \xrightarrow{\text{with}} 2\text{mole}\, HCl$

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

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

[D]

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

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

[B]

FOUNDATION BUILDER (SUBJECTIVE)

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

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

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

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

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

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

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

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

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

5. Atomic mass $= n_A \times$ mass of one atom

$$= 6\times10^{23}\times6.64\times10^{-23}\ g = 40\ g$$

6. no. of atoms $= \dfrac{wt}{\text{wt of one atom}} = \dfrac{1}{3.98\times10^{-23}}$

$$= 2.5\times10^{22}$$

7. $\omega_{removed} = 10^{21}\times44\ amu = 7.35\times10^{-2}\ g$

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

$\therefore n_{CO_2} = \dfrac{126.5\times10^{-3}}{44} = 0.002875$

8. $1\ mole\ N^{3-}\ \ \therefore charge = n_A\times3e = 2.88\times10^{5}C$

9. $n_O = n_{SO_2}\times2 = \dfrac{3.2\times10^{-3}}{64}\times2 = 10^{-4}$ moles

$n_S = n_{Na_2S_2O_3.5H_2O}\times2 = 2\times5\times10^{-3} = 10^{-2}$

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

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

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

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

$= 0.01 + 0.166$

$= 0.176$

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

$t(nr) = \dfrac{6\times10^{17}}{3600} = 1.67\times10^{14}$

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

12. atomic wt $= 6.644\times10^{-23}\times6\times10^{23}$

= 40 g/mol

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

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

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

14. r = 0.1 inch = 0.254 cm

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

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

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

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

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

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

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

16. $V_{NH_3} = n_{NH_3} \times 22.4 L$

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

17. $n_{O_2} = \frac{\rho V}{RT} = \frac{\left(7.6 \times 10^{-10} / 760\right) \times 1}{1/12 \times 273} = \frac{10^{-12}}{22.75}$

$\therefore n_{moleculs} = n_{O_2} \times n_A = \frac{60}{22.75} \times 10^{10} = 2.6 \times 10^{10}$

18. $O_3 + O_2 \longrightarrow 600 mL$

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

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

$\therefore$ 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

$\therefore k_2 Mn P_2$

20. Say $n_O = n$

Then $n_H = 15n$

And $n_C = \frac{70}{100} \times 15n = 10.5n$

$\therefore C_{10.5}H_{15}O$ 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. $9.03 \times 10^{20} \xrightarrow{\text{weight}} 0.311g$

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

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

$\Rightarrow 131.3 + 19n = 2.7.3 \Rightarrow n = 4$

22. $\omega_C = \frac{58.97}{100} \times 102 = 59.9 \Rightarrow n_C = 5$

$\omega_H = \frac{13.81}{100} \times 102 = 14.08 \Rightarrow n_H = 14$

$\omega_N = \frac{27.42}{100} \times 102 = 27.97 \Rightarrow n_N = 2$

$\therefore C_5H_{14}N_2$

23. $\omega_C = \frac{12}{44} \times \omega_{CO_2} = \frac{12}{44} \times 0.9482 = 0.2586$

$\therefore n_C = 0.02155$

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

$\therefore n_H = 0.02154$

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

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

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

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

$\therefore \frac{\omega_{CO}}{58.9} = n_{CO} = \frac{1}{15.9} \times \frac{12}{100} \times 1610.7 = 3.28$

$\therefore$ 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

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

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

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

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

$$= 0.437$$

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

Consider 1L of solvent $\boxed{\frac{C_2H_5OH}{\text{mol.wt} = 46}}$

N = 8

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

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

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

$$Na_2CO_3 \xrightarrow{\Delta} \text{no effect}$$

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

$$\omega_g \xrightarrow{\text{loses}} 0.124$$

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

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

$$\text{and } Na_2CO_3 = 100 - 16.8 = 83.2\%$$

28. $$Al + 2HCl \longrightarrow AlCl_3 + \tfrac{3}{2} H_2$$

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

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

n_2 moles $\qquad\qquad n_2$ moles

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

$$n_{H_2} = \frac{3}{2} n_1 + n_2 = \frac{\rho V}{RT} = \frac{0.92 \times 1.2}{0.0821 \times 273}$$

$$= 0.04926$$

$$\approx 0.05$$

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

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

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

and $\omega_{Al} = 0.546759$

and $\omega_{Mg} = 0.453259$

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

ω: 20g 10g

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

L.R

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

$\omega_{CN_3COOH} = 27.27g.$

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

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

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

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

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

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

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

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

$\%CH_4 = \frac{\omega_{CH_4} \times 100}{5} = \frac{16n_1 \times 100}{5} = 60\%.\%Cl2H_4 = 40\%$

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. $n_{Cu} = n_{Cu}\left(NO_3\right)_2.3H_2O \text{ (POAC on Cu)}$

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

$= 38.03g$

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

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

$= 0.0394 \qquad = 0.08$

L.R.

$n_{AgCl} = n_{AgNO_3} = 0.033$

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

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

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

$n_1 \times 100 + n_2 84 = 1.84 \quad n_1 = 0.01$

$n_2 56 + n_2 40 = 0.96 \quad n_2 = 0.01$

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

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

$3\underbrace{KCl}O \rightarrow 2KCl + \underbrace{KClO}_3$

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

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

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

37. POAC on Cl (eventually on completion)

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

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

$$= 3.5 \text{moles}$$

38. 1g $KClO_3$ → (n_1 moles) $KCl + O_2$; → (n_2 moles) $KClO_4 + KCl$

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

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

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

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

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

$$= 49.789\%$$

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

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

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

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

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

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

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

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

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

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

6.125g

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

$H_2 + 1/2\, O_2 \rightarrow H_2O$ (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, obviously

(B): A, obviously

I: $n_C = \frac{7}{2} \times n_B = \frac{7}{2}$.

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

$$\frac{n_{NaOH}}{2} = n_{H_2SO_4} = \left(\frac{15}{1000}\right)\times\frac{1}{10}\times\frac{1}{2} = 7.5\times10^{-4}$$

$$\therefore \text{strength} = \frac{\omega_{H_2SO_4}}{V_{H_2SO_4}(mL)}\times1000$$

$$= 6.125g/L$$

44. $$\text{Molarity} = \frac{n}{V(mL)}\times1000 = \frac{10\times10^{-3}}{100}\times10^{-3} = 0.1M$$

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

45. $$n_{SO_4^{2-}} = n_{H_2SO_4} = \left(\frac{100}{1000}\right)\times0.001M = 10^{-4}$$

$$\therefore \text{no. of iom} = n_{SO_4^{-2}}\times n_A = 6\times10^{19}$$

46. $$n_{CuSO_4.5H_2O} = n_{Cu^{2+}} = 0.5\times0.01 = 5\times10^{-3}$$

$$\text{weight} = n\times\text{mol.wt} = 5\times10^{-3}\times249.5$$

$$= 1.2475g$$

47. $$M_1V_1 + M_2V_2 = M_3V_3$$

$$\therefore M_{final} = M_3 = \frac{50\times0.5+75\times0.25}{50+75}$$

$$= 0.35\text{Molar}$$

48. $$\text{Molality} = \frac{n}{\omega_{solvent}}\times1000$$

$$= \frac{3/30}{250}\times1000 = 0.4\text{molal}$$

49. $$\frac{n_{I_2}}{n_{I_2}+n_{C_6}H_6} = 0.2$$

Say, we have 1 mole mix.

Then, $n_{I_2} = 0.2$ and $n_{C_6}H_6 = 0.8$

$$\therefore \text{molality} = \frac{n_{I_2}}{\omega_{C_6}H_6}\times1000$$

$$= \frac{0.2}{0.8\times78}\times1000 = 3.205m.$$

50. Consider 1L solution.

$$\omega t_{solution} = 1000\times1.06 = 10609.$$

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

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

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

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. $2SO_2 + O_2 \rightarrow 2SO_3$

$nSO_2 = nSO_3 \Rightarrow nSO_3 = 5$

Page 53 of booklet missing. Q 54 50 63

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

$1 mole Ag_3A \rightarrow 3 mole Ag$

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

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

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

$\therefore A = 207$

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

GET EQUIPPED

ONLY ONE OPTION

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

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

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

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

NH_3 was 40% by mol.

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

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

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

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

$= 0.15$

(A)

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

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

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

(C)

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

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

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

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

i.e. H_2O

(B)

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

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

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

(A)

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

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

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

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

<u>POAC on I</u>

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

$n_2 = 0.1$

POAC on Cl

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

$\because n_1 : n_2 = 1:1$

(A)

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

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

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

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

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

(D)

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

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

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

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

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

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

(D)

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

$= 6 \times 10^{23} \times 3.98 \times 10^{-23} = 24g$

(C)

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

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

(C)

12. obvious (D)

13. obvious (B)

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

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

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

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

(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. $CuSO_4.5H_2O : n,\ MgSO_4.7H_2O : n_2$

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

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

and $n_1 \times 159 + 120n_2 = 3$

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

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

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

(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 $= 0.01449 \times M_{C_aH_8O_4}$

$= 2.69$

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

(A)

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

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

$\Rightarrow M = 138.88 = 139$

(B)

25. $n = \frac{\text{no.of molecular}}{N_A} = \frac{(500\text{cm}^2/0.21\text{nm}^2)}{6\times10^{23}} = V \times \text{Molarity}$

$\text{i.e.} V = \frac{n}{(4.24/256)} = 2.395\times10^{-5}\,\text{L}.$

(B)

26. in 10 mL $CuCl_2 : n$, and $CuBr_2 : n_2$

$n_{AgBr} = 2n_2$ and $n_{AgCl} = 2n,$

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

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

$n_x = m_{XH_4} + (n_{X_2H_6X2}) = 4n$

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

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

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

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: $BaA_2.2H_2O$

$BaA_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HA$

$^{n}H_2SO_4 + H_2SO_4 \longrightarrow BaSO_4 + 2HA$

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

$\therefore A = 121$ $\qquad\qquad \therefore HA = 122$

30. total moles =n (say)

$0.15n = ^{n} CH_3XCOOH$ and $85^{n} = ^{n} H_2O$

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

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

$\therefore ^{n}NaOH = ^{n}CH_3COOH = 0.15n = 0.18519$

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

31. $\underset{n_1 \, moles}{C_2H_6} + 3.50_2 \longrightarrow 2CO_2 + 3H_2O$

$C_2H_4 + \underset{n_2 \, moles}{3O_2} \longrightarrow 2CO_2 + 2H_2O$

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

also $3.5n_1 + 3n_2 = n_{O_2} = \frac{130}{32} = 4.06$

$\therefore n_1 = 0.817$

$n_2 = 0.401$

$\therefore \%C_2H_4 = 333\%$ 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. $V_{molecule} = \frac{\sqrt{3}}{4}\left(100\,\overset{\circ}{A}\right)^2 \times 300\,\overset{\circ}{A}$

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

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

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

$= 939\, kg$ (B)

One and more than one right

1. 3 moles in 1L $(1250\, g)$

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

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

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

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

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

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

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

(A) and (B)

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

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

millimoles :	6	3	-	-
	3	LR	3	6

[A],[C],[D]

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

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

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

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

[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 $\left({}^nH = 4\right)$

8. 3 mole NH_3

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

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

molecule $= 3_{NA} = 18\times10^{23}$

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

n: 5m 5m - -

5 millimoles in 100 ml

Hence [C] and [D]

14. Hence [C], [D]

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

Match the following

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

(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]

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

[S]

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

$\left[H^{+}\right]=\frac{1}{200}\times1000=5\,M$

$\left[SO_4{}^{2-}\right]=\frac{1/2}{200}\times1000=2.5M$

[R]

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

$w_{SO_2}=32\,g$

total atoms $=\frac{1}{2}\times2\times N_A$

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

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

(C) no. of atoms $=0.5\times3\times N_A=1.5\,N_A$

[P], [Q], [R]

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

Atoms $=12\times10^{23}$

$wt=32\,g$ [S]

COMPREHENSION

Passage 1

1. wt of 1 atom $=1\text{amu}=1.66\times10^{-24}\text{g}.$ (C)

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

3. $\frac{3.4}{100}\times(M)=\omega_s=2\times32\Rightarrow M=1882.3$ (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.

$n_{KOH}=6.9\Rightarrow\omega_{KOH}=6.9\times56=386.4$

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

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

2. $\frac{134}{1000}\times m_{H_2SO_4}\times2=n_{NH_3}=\frac{PV}{RT}=\frac{0.2\times2}{0.0821\times303}$

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

3. $\frac{1600\times0.205}{1600+V}=0.2\Rightarrow V=40mL$ ()

4. $\frac{n_{H_2S}}{1}=\frac{n_{H_2SO_4}}{5}\Rightarrow n_{H_2SO_4}=\frac{5\times34}{34}=5$

$\therefore V\times0.2=5\Rightarrow V=25L$ (A)

Passage – 3

1. $m_{H_2O}=\frac{18g}{6\times10^{23}}=3\times10^{-23}g$ (D)

2. Avogadro’s law. (A)

3. obvious Mass is 16amu. (C)

4. obvious (A)

Passage – 4

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

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

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

L.R (A)

2. repeated passage 2, Q-2

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

INTEGER

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

$\therefore 5$ moles.

2. $10.5 \times 10^3 kg/m^3 \quad \therefore mass = 10.5 \times 10^3 \times 10^{-12}$

$= 1.05 \times 10^{-8} kg$

$\therefore n_{A_g} = \frac{1.05 \times 10^{-5}}{108} \Rightarrow atom = n_{Ag} \times n_A$

$\approx 5.83 \times 10^{16}$

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

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

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

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

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

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

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

6. $C_nH_{2n+2} + \left(n + \frac{n+1}{2}\right)O_2 \rightarrow n_{CO_2} + (n+1)H_2O$

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

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

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

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

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

$$1g\,a\,lg\,ac\xrightarrow[+1g\,strach]{}2g\,a\,lg\,ac$$

1g strach

POAC on carbon

$$n_{CO_2}\times 1=n_{C_6H_{10}O_5}\times 6$$

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

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

EXPERTISE ATTAINERS

1. POAC on Co

$$n_{CO_3O_4}\times 3=n_{CO}\times 1$$

$$\Rightarrow {}^{n}CO=\frac{0.2125\times 3}{(177+64)}\ \therefore\ \omega_{CO}=n_{C_0}\times 59=0.156\,g$$

$${}^{n}PPt\times 1={}^{n}\ Co$$

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

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

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

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

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

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

(b) $$0.59\,Fe\longrightarrow Fe_2O_3(n)$$

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

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

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

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

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

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

4. $C_xH_yCl_z + O_2 \longrightarrow xCO_2 + \dfrac{4}{2}H_2O + \dfrac{Z}{2}Cl_2$

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

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

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

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

C_2H_4Cl

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 Angular mol. Wt $= 39.57 =$

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

$\therefore n_3 = 0.4$

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

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

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

$\therefore\ {}^{n}AgNO_3 = {}^{n}\ KI(used) = 5M.mole \Rightarrow w\ AgNO_3 = 0.85\,g$

$\therefore\ purity = 85\%$