

MOLE CONCEPT (ADVANCED)

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)

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

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

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

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

12. (C)

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

13. (D)

$$\text{Moles of H}_2 = \frac{1}{2} = 0.5$$

$$\text{Volume of H}_2 \text{ in l} = 0.5 \times 22.4 = 11.2 \text{ l}.$$

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. (B) $W_H = 3 \times 3 = 9 \text{ g}$ $W_N = 3 \times 14 = 42 \text{ g}$

19. (C)

In one H₂O molecule: 10 proton, 8 neutrons, 10 electrons

$$\text{Hence in 36 ml, } n_{\text{H}_2\text{O}} = \frac{36 \text{ g}}{18 \text{ g/mol}} = 2 \text{ mols}$$

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

20. (A)

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

21. (B)

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

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

22. (A)

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

23. (D)

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

24. (C)

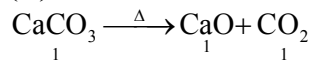
$$\frac{52 \text{ amu}}{4 \text{ amu}} = 13$$

25. (B)
One ion contains: $7 + 24 + 1 = 32 \bar{e}$
 \therefore total \bar{e} s = $2 N_A \times 32 = 64 N_A$
26. (D)
 $n_C = 0.5 \times 6 = 3 \quad \therefore$ wt = 36 g
27. (C)
A: $\frac{28}{44}$; B: $\frac{46}{46}$; C: $\frac{36}{18}$; D: $\frac{54}{108}$
28. (D)
 $n_{H_2O} = \frac{180}{18} = 10$
 \therefore no. of \bar{e} s = $10 \times 10 N_A = 100 N_A$
29. (C)
 $n_{Na_2S_2O_3 \cdot 5H_2O} = \frac{2.48}{248} = 0.01$
 $\therefore n_{H_2O} = 5 \times 0.01 \Rightarrow$ molecules = $0.05 N_A$
30. (C)
 $n_{Ag} = \frac{90}{100} \times \frac{10}{108} = \frac{1}{12} \Rightarrow$ atom = $\frac{1}{12} N_A = 5 \times 10^{22}$
31. (B)
 $n_{H_2O} = \frac{18 \times 333}{54 + (96 \times 3) + (18 \times 18)} = 9.$
32. (C)
 $n_{H_2O} = \frac{0.018}{18} = 10^{-3}$. Hence, molecules = $10^{-3} N_A$
33. (A)
 $n_{N^{3-}} = \frac{4.2}{14} = 0.3. \quad \therefore$ total = $0.3 \times 8 N_A = 2.4 N_A$
34. (D)
 $n_C = 12 \times n_{C_{12}H_{22}O_{11}} = 12 \times \frac{3.42}{342} = 0.12$
 \therefore atom = $0.12 N_A \Rightarrow$
35. (B)
 $n_{MgCO_3} = \frac{8.4}{84} = 0.1$
Each contain (12 + 6 + 24) protons
Hence, total = $0.1 \times 42 N_A = 2.5 \times 10^{24}$

36. (B)
 $n_{\text{total}} = \frac{4.4}{44} + \frac{2.24}{22.4} = 0.2 \quad \therefore \text{molecules} = 0.2N_A$
37. (D)
 (i) $\frac{1}{1000} \times \frac{14}{58}$
 (ii) $\frac{1}{1000} \times \frac{2}{28}$
 (iii) $\frac{1}{1000} \times \frac{1}{23}$
 (iv) 1ml \approx 1g water
 $\frac{1}{18} \times 3$
38. (B)
 $n_{\text{gas}} = \frac{w}{\text{mol.wt.}} = \frac{w}{3a}$
39. (A)
 $n_{\text{Fe}} = \frac{558.5}{55.85} = 10 \text{ moles}$
 In 60 g carbon, $n_{\text{C}} = 5 \quad \therefore \text{twice} = 10 \text{ moles}$
40. (B)
 Say $n_{\text{Mg}_3(\text{PO}_4)_2} = n$; then $n_{\text{O}} = 8n$
 $\therefore 8n = 0.25 \Rightarrow n = \frac{0.25}{8} = 3.125 \times 10^{-2}$
41. (B)
 $n_x : n_y = \frac{(w/2)}{10} : \frac{(w/2)}{20} = 2 : 1$
42. (C)
 $\frac{X}{100} \times (46 + 96 + 180) = 180 \Rightarrow X = 55.9$
43. (C)
 $n_{\text{I}} : n_{\text{O}} = \frac{25.4}{127} : \frac{8}{16} = \frac{1}{5} : \frac{1}{2} = 2 : 5$
 Hence I_2O_5 .
44. (A)
 mol. Wt = 2 VD = 100
 $w_{\text{chlorine}} = \frac{71}{100} \times 100 = 71 \text{g}$
 $w_{\text{metal}} = 29 \text{g}$

45.

(D)



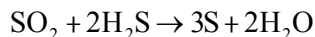
Quantity of limes tones = wt. of one mole mole of CaCO_3
= 100 kg

46.

(A)

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

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



moles 1 2 3 2

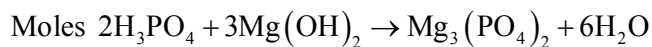
$$\text{given } 0.5 \quad 2 \quad x = \frac{3 \times 0.5}{1} = 1.5$$

(L.R.)

47.

(C)

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



Moles 2 3 1 6

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

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

48.

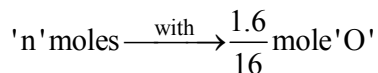
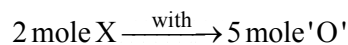
(D)

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

49.

(A)

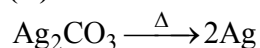
$$W_{\text{O}} = 3.6769 - 2.0769 = 1.6\text{g}$$



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

50.

(A)



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

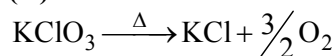
51.

$$\text{(D)} n_{\text{CO}_2} = 2 \times n_{\text{C}_2\text{H}_5\text{OH}} = 2$$

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

52.

(C)



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

53. (A)

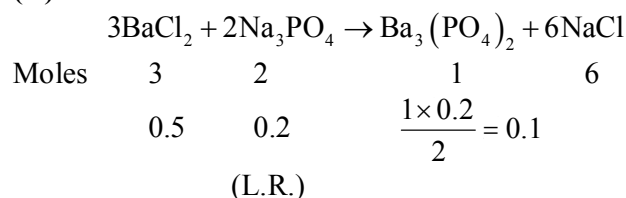
$$n_{\text{Fe}} = \frac{2}{3} \times n_{\text{H}_2\text{O}} = \frac{2}{3} \quad \therefore W_{\text{iron}} = \frac{2}{3} \times 56 = 37.39$$

54. (B)

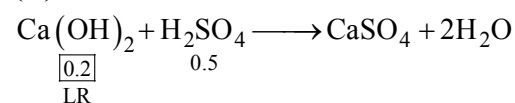
$$n_{\text{CaCO}_3} = n_{\text{CaO}} = \frac{1.62}{56} = n_{\text{CaCl}_2} = 0.0289$$

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

55. (D)

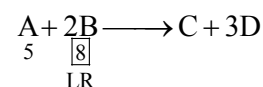


56. (A)



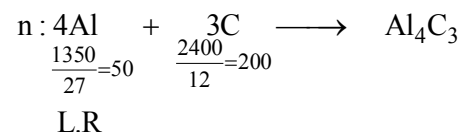
$$n_{\text{CaSO}_4} = n_{\text{Ca}(\text{OH})_2} = 0.2$$

57. (B)



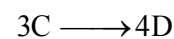
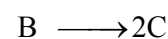
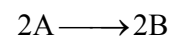
$$n_{\text{C}} = \frac{n_{\text{B}}}{2} = 4; \quad n_{\text{D}} = 3 \times \frac{n_{\text{B}}}{2} = 12$$

58. (D)



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

59. (D)



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

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

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

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

61. (A)

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

62. (B)

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

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

63. (B)

$$\text{molality} = \frac{n}{w_{\text{solvent}}} \times 1000 \left(\text{urea : } \begin{array}{c} \text{NH}_2 \text{C} \text{NH}_2 \\ \parallel \\ \text{O} \end{array} \right)$$

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

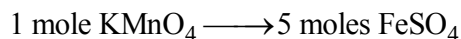
64. (D)

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

65. (A)

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

66. (D)



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

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

67. (B)

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

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

68. (A)

3 molal \Rightarrow 3 mole NaOH in 1000g solvent

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

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

69. (B)

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

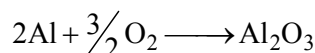
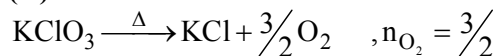
$$\text{After dilution of 10 mL solution} = \frac{0.1 \times 10}{1000} = 0.001 \text{ M}$$

70. (A)

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

GET EQUIPPED FOR JEE MAIN

1. (A)



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

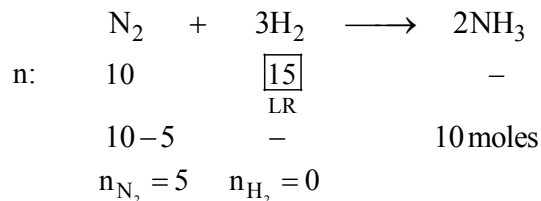
2. (A)

Consider 1 L solution

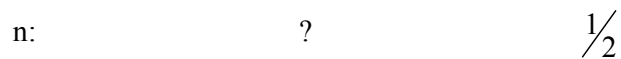
$$\frac{29}{100} \times (d \times 1000) = \omega_{\text{H}_2\text{SO}_4} = 3.6 \times 98$$

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

3. (A)

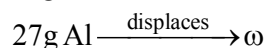
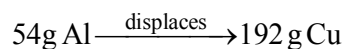
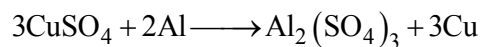


4. (C) $\text{Fe}_2(\text{SO}_4)_3 + 3\text{BaCl}_2 \longrightarrow 3\text{BaSO}_4 + 2\text{FeCl}_3$



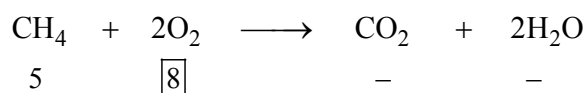
$$\frac{n_{\text{BaCl}_2}}{3} = \frac{n_{\text{FeCl}_3}}{2} \Rightarrow n_{\text{BaCl}_2} = \frac{1}{2} \times 3 = 0.75 \text{ moles}$$

5. (C)



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

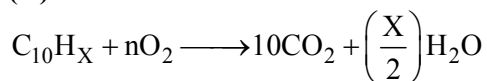
6. (A)



$$5 - 4 = 1 \quad - \quad 4 \quad 8$$

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

7. (C)



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

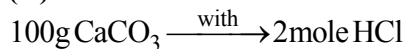
$$1 \text{ mole } \text{C}_{10}\text{H}_x \xrightarrow{\text{with}} \left(10 + \frac{x}{4}\right) \text{ moles}$$

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

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

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

8. (D)



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

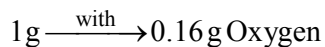
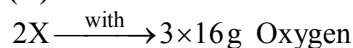
$$\therefore \omega = 0.9375 \text{ g}$$

9. (B)

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

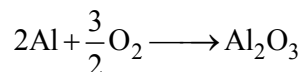
$$\therefore \text{Molarity} = \frac{2.125 \times 1000}{143.5 \times 25} = 0.59$$

10. (D)

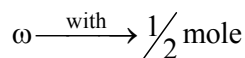
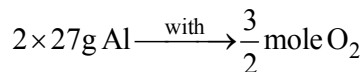


$$\therefore X = \frac{3 \times 16}{0.16 \times 2} = 150$$

11. (D)



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



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

12. (D)

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

$$= \frac{8}{32} = \frac{1}{4}$$

13. (B)

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

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

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

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

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

14. (A)

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

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

15. (C)

$$\begin{aligned} \text{Total atoms} &= 200 + 0.05 \times N_{\text{A}} + 10^{-20} \times N_{\text{A}} \\ &\approx 0.05 N_{\text{A}} = 3 \times 10^{22} \end{aligned}$$

16. (C)

$$\text{Mol. Wt of } \text{A}_2\text{B}_3 = 150 + 96 = 246$$

$$\therefore \text{ For 5 mol, } (246 \times 5)\text{g} = 1.23 \text{ kg}$$

17. (A)

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

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

18. (D)

$$\text{(i) } 5\text{g} \quad \text{(ii) } \frac{60}{106.5} \times 35.5 \quad \text{(iii) } 0.1 \times 35.5 \quad \text{(iv) } 0.5 \times 71$$

19. (A)

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

20. (C)

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

21. (D)

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

22. (A)

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

23. (D)

1 gram molecule: 44 g
1 molecule of $\text{CO}_2 = 44 \text{ amu}$

24. (A)

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

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

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

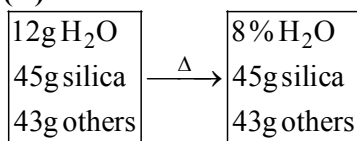
25. (D)

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

26. (D)

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

27. (D)



100g original 'w' grams

8 % of w = water

i.e. 92 % of w = silica others

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

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

28. (C)

M_3N_2 . 28 % nitrogen

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

29. (D)

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

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

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

30. (A)

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

$$x = 9\%$$

31. (B)

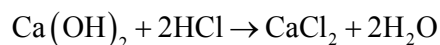
$$A. A. M = \text{Mole fraction of } O^{18} \times 18 + \text{Mole fraction of } O^{16} \times 16$$

32. (C)

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

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

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



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

(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)

$$\begin{array}{cccc} X & Y & X & Y \\ \frac{20}{10} & : & \frac{80}{200} & \\ 1 & : & 2 & \end{array} \quad \therefore XY_2$$

36. (C)

Avogadro hypothesis

37. (A)

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

$$\begin{aligned} \text{Number of magnesium atoms} &= 0.00335 \times 6.022 \times 10^{23} \\ &= 2.01 \times 10^{21} \text{ atoms.} \end{aligned}$$

38. (D)

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

$$\begin{aligned} \text{Number of atoms} &= 0.164 \times 10^{-3} \times 6.022 \times 10^{23} \times 27 \text{ (1 Molecule has 27 atoms).} \\ &= 2.67 \times 10^{21} \end{aligned}$$

39. (D)

$$\text{Moles of } e^- = 52 + 2 = 54.$$

40. (B)

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

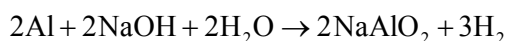
$$\text{Moles of Ag}_2\text{S required} = \frac{1}{107 \times 2}$$

$$\text{Mass of Ag}_2\text{S} = \frac{(107 \times 2 + 32)}{107 \times 2} = 1.1495$$

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

41. (D)

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



Moles	2	2	2	2	3	
Given	1	excess				$\frac{3 \times 1}{2} = 1.5$

(L.R.)

$$\text{Vol. of H}_2 \text{ evolved} = 1.5 \times 22.4 = 33.6 \text{ L.}$$

FOUNDATION BUILDER (SUBJECTIVE)

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

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

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

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

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

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

\therefore 1 mole contains $10N_A$ electrons.

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

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

5. Gram atomic mass = $N_A \times$ mass of one atom

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

Atomic mass = 40

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

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

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

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

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

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

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

$$13. \quad n_{\text{C}} = \frac{10^{-6} \text{ g}}{12 \text{ g/mol}} \\ \text{No. of atoms} = n_{\text{C}} \times 6 \times 10^{23} = 5 \times 10^{16}$$

$$14. \quad r = 0.1 \text{ inch} = 0.254 \text{ cm} \\ \omega_{\text{Fe}} = \frac{85.6}{100} \times \omega_{\text{ball}}$$

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

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

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

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

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

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

16. $V_{\text{NH}_3} = n_{\text{NH}_3} \times 22.7 \text{ L}$

$$= \frac{3.4}{17} \times 22.7 = 4.54 \text{ L}$$

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

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

18. $\text{O}_3 + \text{O}_2 \longrightarrow 600 \text{ mL}$

V ml (600 - V) 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

$\therefore \text{K}_2\text{Mn P}_2$

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

Then $n_{\text{H}} = 15n$

And $n_{\text{C}} = \frac{70}{100} \times 15n = 10.5n$

$\therefore \text{C}_{10.5}\text{H}_{15}\text{O}$ or $\text{C}_{21}\text{H}_{30}\text{O}_2$ is empirical formula

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

$\therefore \text{C}_{21}\text{H}_{30}\text{O}_2$

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

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

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

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

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

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

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

$$\therefore \text{C}_5\text{H}_{14}\text{N}_2$$

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

$$\therefore n_C = 0.02155$$

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

$$\therefore n_H = 0.02154$$

$$n_C : n_H = 1 : 1 \quad \therefore \text{CH}$$

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

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

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

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

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

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

25. Mol. Wt = wt of 1 mole mix = 2VD = 76.6

$$(x \text{ mol. NO}_2 + (1 - x) \text{ mol. N}_2\text{O}_4) = 76.6 \text{ g}$$

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

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

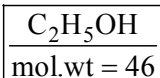
$$n_{\text{mix}} \text{ in } 100 \text{ g} = \frac{100}{76.6}$$

$$\therefore n_{\text{NO}_2} \text{ in } 100 = 0.335 \times n_{\text{mix}}$$

$$= 0.437$$

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

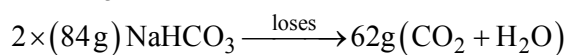
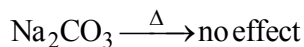
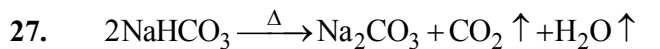
Consider 1L of solvent



$$n = 8$$

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

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



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

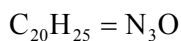
$\therefore \omega = \frac{0.124}{62} \times 168 = 0.336 \text{ g}$

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

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

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



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



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

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

L.R

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

$\omega_{\text{CH}_3\text{COOH}} = 27.27\text{g}$

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

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

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

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

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

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

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

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

$$\% \text{CH}_4 = \frac{\omega_{\text{CH}_4} \times 100}{5} = \frac{16n_1 \times 100}{5} = 60\%$$

$$\% \text{C}_2\text{H}_4 = 40\%$$

32. POAC on carbon

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

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

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

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

$$= 38.03\text{g}$$

34. $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} \downarrow + \text{NaNO}_3$

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

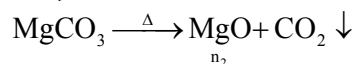
$$= 0.03394 \quad = 0.08$$

L.R.

$$n_{\text{AgCl}} = n_{\text{AgNO}_3} = 0.03394$$

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

35. $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2 \downarrow$



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

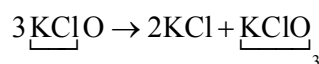
$$n_1 \times 56 + n_2 \times 40 = 0.96$$

$$n_1 = 0.01$$

$$n_2 = 0.01$$

$$\therefore \% \text{CaCO}_3 = \frac{0.01 \times 100}{1.84} \times 100 = 54.35\%$$

36. $\text{Cl}_2 + 2\text{KOH} \rightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$



$$n_{\text{KClO}_4} = n_{\text{Cl}_2} \times \frac{1}{1} \times \frac{1}{3} \times \frac{3}{4} = \frac{n_{\text{Cl}_2}}{4}$$

$$\Rightarrow n_{\text{Cl}_2} = 4 \times \frac{1385}{(39 + 35.5 + 64)} = 40$$

$$\Rightarrow \omega_{\text{Cl}_2} = 40 \times 71 = 2840\text{g}$$

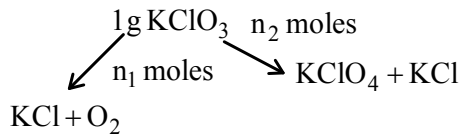
37. POAC on Cl (eventually on completion)

$$n_{\text{Cl}_2} \times 2 = n_{\text{KCl}} \times 1 + n_{\text{KClO}_4}$$

$$\Rightarrow n_{\text{KCl}} = \frac{142}{71} \times 2 - \frac{n_{\text{Cl}_2}}{4} = 4 - 0.5$$

$$= 3.5 \text{ moles}$$

38.



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

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

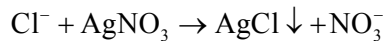
$$n_{\text{KClO}_4} = \frac{3}{4} n_2 = 0.00284$$

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

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

$$= 49.789\%$$

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



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

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

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

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

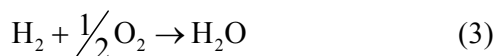
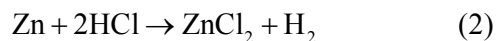
$$1 \div 2 \Rightarrow \frac{x}{y} = 1.99 = 2$$

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

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

40. $\text{KClO}_3 \xrightarrow{\Delta} \text{KCl} + \frac{3}{2} \text{O}_2$ (1)

6.125g



in (1),

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

in (3),

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

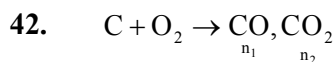
in (2),

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

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

41. (A): B,
(B): A,

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



POAC on C

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

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

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

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

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



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

$$\therefore \text{strength} = \frac{w_{H_2SO_4}}{V_{H_2SO_4} (\text{mL})} \times 1000 \\ = 6.125g/L$$

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

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

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

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

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

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

47. $M_1V_1 + M_2V_2 = M_3V_3$

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

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

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

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.

$$w_{\text{solution}} = 1000 \times 1.06 = 1060 \text{ g.}$$

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

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

51. 30% $\text{NH}_3 \Rightarrow 70\%$ water.

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

$$\text{i.e. } w_{\text{solution}} = \frac{100}{70} \times 105 = 150 \text{ g}$$

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

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

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

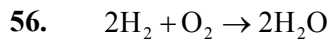
54. $4\text{FeS}_2 + 11\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 + 8\text{SO}_2$

$$\frac{600}{120} = 5 \quad \frac{800}{32} = 25$$

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

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

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



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

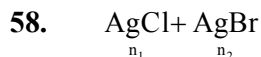
LR

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

$$\text{wt H}_2 \text{ left} = (3 - (0.90625 \times 2)) \times 2 = 2.375 \text{ g}$$

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

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



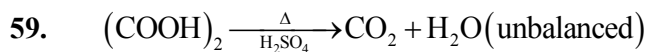
$$\frac{\% \text{Ag}}{100} = \frac{(n_1 + n_2) 108}{n_1 \times 143.5 + n_2 \times 188} = \frac{60.94}{100}$$

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

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

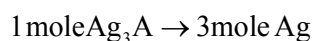
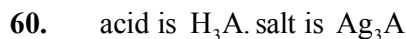
$$= 4.856\%$$

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



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

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



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

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

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

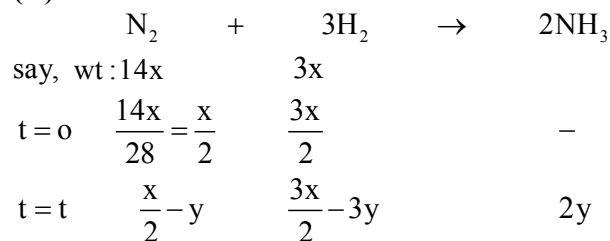
$$\therefore \text{A} = 207$$

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

GET EQUIPPED FOR JEE ADVANCE

ONE OPTION CORRECT

1. (A)



NH_3 was 40% by mol.

$$\begin{aligned} \text{i.e. } 2y &= \frac{40}{100} \left(\frac{x}{2} - y + \frac{3x}{2} - 3y + 2y \right) \\ \Rightarrow 5y &= 2x - 2y \Rightarrow y = \frac{2x}{7} \Rightarrow \frac{x}{y} = 3.5 \end{aligned}$$

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

2. (C)

$$\begin{aligned} n(\text{A}) &= n(\text{B}) \\ \therefore M_{\text{A}} \times n(\text{A}) &= 1.4\text{g and } M_{\text{B}} \times n(\text{B}) = 0.8 \\ \therefore \frac{M_{\text{B}}}{M_{\text{A}}} &= \frac{0.8}{1.4} = 0.57. \end{aligned}$$

3. (B)

$$\begin{aligned} 3.2\text{g metal} &\xrightarrow{\text{with}} 0.4\text{g oxygen} \\ 64\text{g metal} &\rightarrow \omega_{\text{g}} \text{ oxygen} \\ \omega &= \frac{64}{3.2} \times 0.4 = 8\text{g} \\ \therefore &128\text{g metal with } 16\text{g O} \\ \text{i.e. } &M_2\text{O} \end{aligned}$$

4. (A)

$$\begin{aligned} 4M \times \xrightarrow{\text{with}} &96\text{g O. (since } X_4O_6) \\ 5.72\text{g} \times \xrightarrow{\text{with}} &4.28\text{g O} \\ \therefore M_{\text{X}} &= \frac{5.72 \times 6 \times 16}{4 \times 4.28} = 32 \end{aligned}$$

5. (C)

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

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

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

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

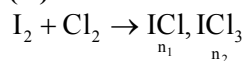
6. (C)

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

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

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

7. (A)



POAC on I

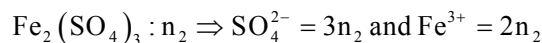
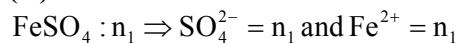
$$n(\text{I}) = \frac{25.4}{127} = n_1 + n_2$$

POAC on Cl

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

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

8. (D)



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

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

9. (D)

0.36M : V_1 say and 0.15M : V_2 say

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

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

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

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

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

10. (C)

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

11. (C)

$$\begin{aligned}\text{Fe}_2[\text{Fe}(\text{CN})_6] \\ \frac{\omega_{\text{Fe}}}{\omega_{\text{C}}} &= \frac{3 \times 56}{6 \times 12} = \frac{7}{3}\end{aligned}$$

12. (D)

$$\begin{aligned}\text{(i) } 12\text{g} \quad \text{(ii) } 13\text{g} \quad \text{(iii) } 9 \times 17\text{g} \\ \text{(iv) } 80 \text{ g-molecule} &= 80 \text{ Moles} \\ &= 80 \times 98 \\ &= 7840\text{g}\end{aligned}$$

13. (B)

$$6 : 4$$

14. (A)

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

15. (B)

$$\begin{aligned}\text{Na}_2\text{CO}_3 + 2\text{HCl} &\rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 \\ n_{\text{HCl}} &= 2 \times n_{\text{Na}_2\text{CO}_3} = V_{\text{HCl}} \times M_{\text{HCl}} \\ \Rightarrow V \times 3 &= 2 \times \frac{1.431}{106} \Rightarrow V = 9\text{mL.}\end{aligned}$$

16. (C)

They must have same mol. wt.

17. (A)

$$\begin{aligned} &= \frac{V_{2\text{micron sphere}}}{V_{20\text{Å sphere}}} = \frac{\frac{4}{3}\pi \times (2 \times 10^{-6})^3}{\frac{4}{3}\pi \times (2 \times 10^{-9})^3} = 10^9\end{aligned}$$

18. (B)

$$\begin{aligned}\text{KClO}_3 &\xrightarrow{\Delta} \text{KCl} + \frac{3}{2}\text{O}_2 \\ n_{\text{KClO}_3} &= \frac{n_{\text{O}_2}}{\frac{3}{2}} = \frac{0.1}{\frac{3}{2}} = \frac{2}{30} \\ \% \text{purity} &= \frac{\frac{2}{30} \times (122.5)}{10} \times 100 = 81.66\%\end{aligned}$$

19. (A)

$$\begin{aligned}n &= \frac{V(\text{ml}) \times m}{1000} = \frac{1 \times 0.65}{1000} = 6.5 \times 10^{-4} \text{ moles} \\ \therefore \omega_{\text{BaCl}_2 \cdot 2\text{H}_2\text{O}} &= (137 + 71 + 36) \times 6.5 \times 10^{-4} = 0.1586\text{g}\end{aligned}$$

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

20. (B)

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

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

21. (B)

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

22. (C)

$$\text{CuSO}_4 \cdot 5\text{H}_2\text{O} = n_1, \text{MgSO}_4 \cdot 7\text{H}_2\text{O} = n_2$$

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

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

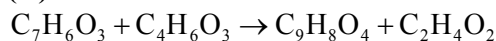
$$\text{and } 159.5n_1 + 120n_2 = 3$$

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

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

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

23. (A)



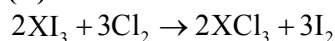
$$\omega : 2\text{g} \quad 4\text{g}$$

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

$$\text{theoretical yield} = 0.01449 \times M_{\text{C}_9\text{H}_8\text{O}_4} = 2.69$$

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

24. (B)



$$n_{\text{XI}_3} = n_{\text{XCl}_3} \Rightarrow \frac{0.5}{(M + 381)} = \frac{0.236}{(M + 106.5)}$$

$$\Rightarrow M = 138.88 = 139$$

25. (B)

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

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

26. (A)

in 10 mL $\text{CuCl}_2 = n_1$, and $\text{CuBr}_2 = n_2$

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

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

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

then $n_1 = 0.00115$ and $\omega_{\text{CuBr}_2} = 0.35\text{g}$

$\therefore 25\%$ and 58%

27. (A)

$n_{\text{XH}_4} = 2n$ and $n_{\text{X}_2\text{H}_6} = n$, say

$$n_x = n_{\text{XH}_4} + (n_{\text{X}_2\text{H}_6} \times 2) = 4n$$

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

28. (B)

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

$$\therefore 0.0105 \times \frac{42.5}{1000} = n_{\text{AgNO}_3}$$
$$= 0.00446$$

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

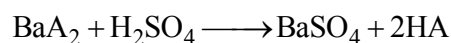
$$\therefore n_1 + 2n_2 = 0.00446$$

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

29. (A)

Let acid be HA

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



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

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

30. (B)

total moles = n (say)

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

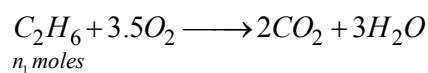
$$\therefore 0.15n \times 60 + 0.85n \times 18 = 30$$

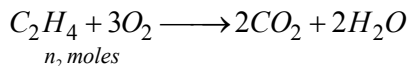
$$\therefore n = \frac{30}{9 + 15.3} = 1.234$$

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

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

31. (A)





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

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

$$\therefore n_1 = 0.817$$

$$n_2 = 0.401$$

$$\therefore \%C_2H_4 = 33\% \text{ and } C_2H_6 = 67\% [A]$$

32. (A)

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

33. (B)

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

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

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

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

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

More than one correct

1. (ABD)

3 moles in 1L (1250 g)

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

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

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

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

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

2. (AB)

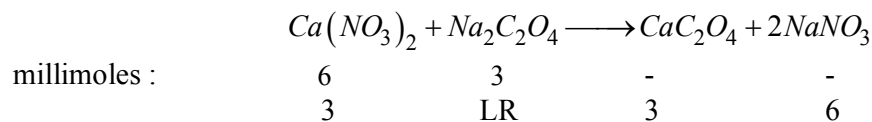
mol. wt = wt of 22.4 L = 28.896 g

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

3. (ABD)

$$[A] : 32 \text{ g} \qquad [B] \frac{1}{2} \times 64 = 32 \text{ g} \qquad [D] : 32 \text{ g}$$

4. (ACD)



5. (AC)

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

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

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

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

6. (AC)

$$n_{NaCl} = 100 \text{ m moles} ; n_{HCl} = 300 \text{ m moles}$$

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

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

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

7. (ABD)

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

8. (ABCD)

3 mole NH_3

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

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

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

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

9. (AB)

Obvious :

10. (BC)

obvious others depend on volume

11. (CD)



$$50 \times 0.1 \qquad 50 \times 0.1$$

Final conc. Of NaCl

$$= \frac{50 \times 0.1}{100}$$

$$= 0.05M$$

Solutions is neutral so

$$[H^+] = 10^{-7}$$

12. (BC)

$$\text{Mass of one molecule} = \frac{MM}{N_A}$$

$$\text{NO of Mole} = \frac{\text{No of molecules}}{N_A}$$

13. (AD)

$$\begin{aligned} 100 \times 0.05 \\ = 200 \times 0.025 \end{aligned}$$

14. (CD)

Hence

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

Match the following

1. I - P, II - A, III - C, IV - E

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

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

$$\text{(III) wt of H: wt of Cl} = 6 : 6 \times 35.5 \quad (\text{C})$$

$$\text{(IV) mo. of C: O} = 13 : 2 \quad (\text{E})$$

2. a - S, b - S, c - Q, d - R

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

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

$$\text{(c) } M = 2VD = 32(Q)$$

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

3. a - PS, b - S, c - PQ, d - R

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

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

Total = 0.12 M

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

(P), (S)

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

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

(S)

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

[P], [Q]

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

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

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

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

[R]

4. A- p ,r,s B-p, C- p,q,r, D-s

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

$$w_{SO_2} = 32g$$

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

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

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

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

[P], [Q], [R]

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

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

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

COMPREHENSION TYPE

Passage 1

1. (C)

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

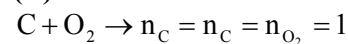
2. (A)

$$n_s = n_{H_2SO_4} = 100 \therefore \text{wt} = 3200g.$$

3. (B)

$$\frac{3.4}{100} \times (M) = w_s = 2 \times 32 \Rightarrow M = 1882.3$$

4. (B)



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

Passage – 2

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

Passage – 3

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

Passage – 4

1. (A)
 $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
 $n: \frac{5.77}{170} \quad \frac{4.77}{58.5} \quad n_{\text{AgCl}} = 0.0339$
 $= 0.0339 \quad = 0.081 \quad \therefore \text{wt} = 4.88\text{g}$
2. (A)
 $\therefore w_{\text{H}_2\text{SO}_4} = 0.12 \times 98 = 11.7\text{g}$

INTEGER

1. (5)
0.5 mole N^{3-} . N^{3-} has $10e^-$.

∴ 5 moles.

2. (3)

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

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

3. (3)

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

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

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

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

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

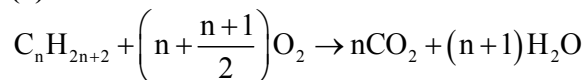
4. (4)

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

5. (5)

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

6. (2)



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

7. (2)

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

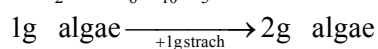
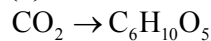
8. (6)

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

9. (4)

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

10. (8)



lgstrach

POAC on carbon

$$\begin{aligned}n_{\text{CO}_2} \times 1 &= n_{(\text{C}_6\text{H}_{10}\text{O}_5)_n} \times 6n \\ &= \frac{1}{162n} \times 6n = \frac{1}{27} \\ \therefore \text{time} &= \frac{1/27}{4.7 \times 10^{-3}} = 8\end{aligned}$$

EXPERTISE ATTAINERS

1. (0.156 g), (1.172 g)

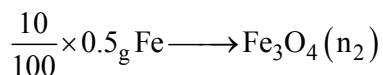
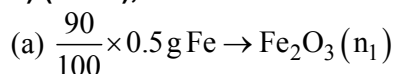
POAC on Co

$$\begin{aligned}n_{\text{Co}_3\text{O}_4} \times 3 &= n_{\text{Co}} \times 1 \\ \Rightarrow n_{\text{Co}} &= \frac{0.2125 \times 3}{(177 + 64)} \quad \therefore \omega_{\text{Co}} = n_{\text{Co}} \times 59 = 0.156 \text{ g}\end{aligned}$$

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

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

2. a) (0.712),

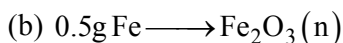


$$n_1 \times 2 = \frac{0.45}{56} \Rightarrow n_1 = 0.04$$

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

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

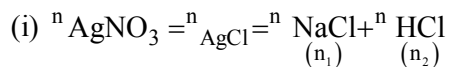
b) (0.714)



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

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

3. (53.5)



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

(ii) NaCl is not affected

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

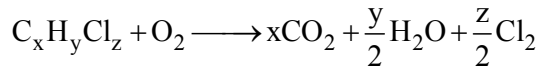
$$\Rightarrow n_2 = 0.009345$$

$$\therefore n_1 = 0.0856$$

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

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

4. (C₂H₄Cl₂)

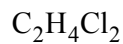


$$\left(\frac{0.22}{12x + y + 35.5Z} \right) \times (x) = {}^n CO_2 = \frac{0.195}{44} \dots\dots(1)$$

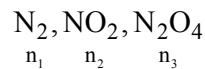
$$\left(\frac{0.22}{12x + y + 35.5z} \right) \times \left(\frac{y}{2} \right) = {}^n H_2O = \frac{0.0804}{18} \dots\dots(2)$$

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

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

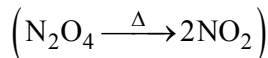


5. Consider 1 mole mix (wt = 55.4)



$$\begin{matrix} n_1 & n_2 & n_3 \\ n_1 + n_2 + n_3 = 1 \end{matrix}$$

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),
 $n_1 = 0.5$, and $n_2 = 0.1$
 $\therefore 5 : 1 : 4$

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

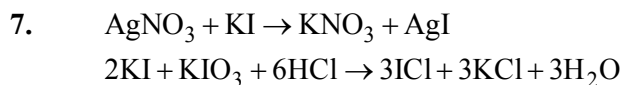
$$\therefore w_{NaHSO_3} = 9.139 \text{ g}$$

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

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

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

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



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

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

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

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

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

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

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

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
 $\Rightarrow \text{KCl} = (118 - w)$ 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 $\text{NaCl} \times 1$

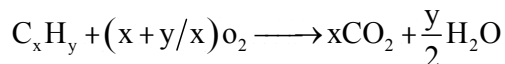
$$\Rightarrow n_{\text{Na}_2\text{O}} = \left(\frac{5.777 \times 10^{-4}}{2} \right); \quad n_{\text{K}_2\text{O}} = \left(\frac{1.13 \times 10^{-3}}{2} \right)$$

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

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

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

10. C_xH_y



POAC on carbon

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

Now 1 vol. of $CO_2 = 10 \text{ mL}$ (that obtained by KOH)

$$\Rightarrow x = 2$$

Vol. of O_2 reactionary = 15 ml

Vol. of O_2 reacted = 15 ml

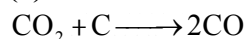
\Rightarrow 1 ml of C_xH_y react with $(2 + y/x)$ ml O_2

\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 $CO = x \text{ l}$

$$CO_2 = (1 - x) \text{ l}$$

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

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

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

(b)

The molecular formula = M_3N_2

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

Where $x = \text{atomic wt of metal}$

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

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

POAC on carbon

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

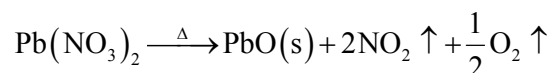
$$x = 74.37 \text{ gms}$$

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

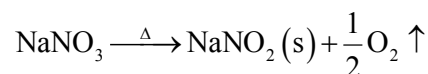
13. (1.7 g)

Heating below 600°C converts $Pb(NO_3)_2$ into PbO but to

$NaNO_3$ into $NaNO_2$ as:



MW: 330 222



MW: 85 69

$$\text{Weight loss} = 5 \times \frac{28}{100} = 1.4\text{g}$$

$$\Rightarrow \text{Weight of residue left} = 5 - 1.4 = 3.6\text{g}$$

Now, let the original mixture contain x g of $\text{Pb}(\text{NO}_3)_2$

\therefore 330g $\text{Pb}(\text{NO}_3)_2$ gives 222g PbO

\therefore x g $\text{Pb}(\text{NO}_3)_2$ will give $\frac{222x}{330}$ g PbO

Similarly, 85g NaNO_3 gives 69g NaNO_2

$$\Rightarrow (5-x)\text{g } \text{NaNO}_3 \text{ will give } \frac{69(5-x)}{85} \text{g } \text{NaNO}_2$$

$$\Rightarrow \text{Residue} : \frac{222x}{330} + \frac{69(5-x)}{85} = 3.6\text{g}$$

Solving for x gives, $x = 3.3$ g $\text{Pb}(\text{NO}_3)_2$

$$\text{NaNO}_3 = 1.7\text{g}.$$

14. Molarity of solution = 0.25 M molality = 0.24 m Mole fraction of $\text{Na}_2\text{SO}_4 = 4.3 \times 10^{-3}$

Molar mass of Glauber salt ($\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$)

$$= 23 \times 2 + 32 + 64 + 10 \times 10 \times 18 = 322\text{g}$$

\Rightarrow mole of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ in 1.0 L solution

$$= \frac{80.575}{322} = 0.25$$

\Rightarrow molarity of solution = 0.25M

Also, weight of 1.0 L solution = 1077.2g

Weight of Na_2SO_4 in 1.0 L solution = $0.25 \times 142 = 35.5$ g

\Rightarrow weight of water in 1.0 L solution = $1077.2 - 35.5$

$$= 1041.7\text{g}$$

$$\Rightarrow \text{molality} = \frac{0.25}{1041.7} \times 1000 = \mathbf{0.24\text{m}}$$

15. $0.5 \times 10^{-18} \text{ m}^2$

Initial millimol of $\text{CH}_3\text{COOH} = 100 \times 0.5 = 50$

Millimol of CH_3COOH remaining after adsorption

$$= 100 \times 0.49 = 49$$

\Rightarrow millimol of CH_3COOH adsorbed = $50 - 49 = 1$

\Rightarrow number of molecules of CH_3COOH adsorbed

$$= \frac{1}{1000} \times 6.023 \times 10^{23}$$

$$= 6.023 \times 10^{20}$$

$$\Rightarrow \text{area covered up by one molecule} = \frac{3.01 \times 10^2}{6.02 \times 10^{20}} \\ = 5 \times 10^{-19} \text{ m}^2$$

16. (2)

Partial pressure of $\text{N}_2 = 0.001 \text{ atm}$,

$T = 298\text{K}$, $V = 2.46 \text{ dm}^3$

From ideal gas law: $pV = nRT$

$$n(\text{N}_2) = \frac{pV}{RT} = \frac{0.001 \times 2.46}{0.082 \times 298} = 10^{-7}$$

$$\Rightarrow \text{No. of molecules of } \text{N}_2 = 6.023 \times 10^{23} \times 10^{-7} \\ = 6.023 \times 10^{16}$$

$$\text{Now, total surface sites available} = 6.023 \times 10^{14} \times 1000 \\ = 6.023 \times 10^{17}$$

$$\text{Surface sites used in adsorption} = \frac{20}{100} \times 6.023 \times 10^{17} \\ = 2 \times 6.023 \times 10^{16}$$

$$\Rightarrow \text{Sites occupied per molecules} = \frac{\text{Number of sites}}{\text{Number of molecules}} \\ = \frac{2 \times 6.023 \times 10^{16}}{6.023 \times 10^{16}} = 2$$

WINDOW TO JEE MAIN

1. (A)

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

V_{solution} is affected by Temperature.

2. (C)

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

No. of atoms = $10 N_A$

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

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

3. (A)

Mole ratio of	C	:	H	:	N
	$\frac{9}{12}$:	$\frac{1}{1}$:	$\frac{3.5}{14}$
	$\frac{3}{4}$:	$\frac{1}{1}$:	$\frac{1}{4}$
	3	:	4	:	1

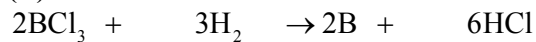
$$\text{Empirical formula} = \text{C}_3\text{H}_4\text{N}$$

$$\text{Empirical formula mass} = 36 + 4 + 14 \\ = 54$$

$$n = \frac{108}{54} = 2$$

$$\begin{aligned} \text{Molecular formula} &= \text{C}_3\text{H}_4\text{N} \times 2 \\ &= \text{C}_6\text{H}_8\text{N}_2 \end{aligned}$$

4. (D)



$$\frac{\text{no. of moles of H}_2}{\text{no. of moles of B}} = \frac{3}{2}$$

$$\text{No. of moles of H}_2 = \frac{3}{2} \times \frac{21.6}{10.8} = 3$$

$$\text{Volume of H}_2 = 3 \times 22.4 \text{ L} = 67.2 \text{ L (Molar volume of any gas at N.T.P = 22.4 L)}$$

5. (B)

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

6. (C)

1 mole is defined as number of atoms present in 12 g C and i.e. 6.022×10^{23} .

Since this number remains unchanged, mass of 1 mole substance will remain unchanged.

7. (C)

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

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

$$N_{\text{solute}} = 2.05$$

$$W_{\text{SOLUTE}} = 2.05 \times 60 = 123$$

$$W_{\text{solvent}} = 1020 - 123 = 897 \text{ g}$$

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

8. (B)

$$\frac{\text{no. of moles of oxygen atom}}{\text{no. of moles of Mg}_3(\text{PO}_4)_2} = \frac{8}{1}$$

$$\begin{aligned} \text{No. of moles of Mg}_3(\text{PO}_4)_2 &= \frac{0.25}{8} \\ &= 0.03125 \end{aligned}$$

9. (A)

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

$$N_{\text{solute}} = 3.6$$

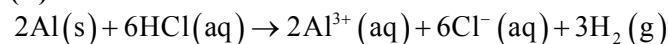
$$W_{\text{solute}} = 3.6 \times 98 = 352.8$$

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

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

$$= 1.22 \text{ g/ml}$$

10. (C)



Per mole of HCl, no. of moles of

$$\text{H}_2 \text{ formed} = \frac{1}{2}$$

$$\begin{aligned} \text{Volume of H}_2 \text{ at STP} &= \frac{1}{2} \times 22.4 \text{ (Old data NTP)} \\ &= 11.2\text{L} \end{aligned}$$

11. (B)

Molality = 5.2 m .

i.e. if wt. of H₂O = 1000gm

then no. of moles of CH₃OH = 5.2

$$X_{\text{CH}_3\text{OH}} = \frac{5.2}{5.2 + \frac{1000}{18}} = 0.0856$$

12. (C)

$$\begin{aligned} \text{Volume of solution} &= \frac{(1000+120)}{1.15} \text{ ml} \\ &= \frac{1120}{1.15} \text{ ml} \end{aligned}$$

$$\text{Molarity} = \frac{120 \times 1.15 \times 1000}{60 \times 1120} = 2.05\text{M}$$

13. (C)

$$\text{Molarity} = \frac{(750 \times 0.5) + (250 \times 2)}{750 + 250} = 0.875\text{M}$$

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 70 g of chlorine = 2N_A

$$\text{Number of atoms} = \frac{70}{71} \times N_A \times 2 \approx 2N_A$$

[Here chlorine is taken as Cl₂]

In 127 g of iodine,

$$\text{Number of atoms} = \frac{127}{254} \times N_A \times 2 = N_A$$

[Here iodine is taken as I₂]

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,

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

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

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

(\because D has 1 n^0 because it is actually, ${}^1\text{H}^2$)

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

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

\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

$$= 1000 \times 1.252$$

$$= 1252 \text{ g}$$

Mass of solute = No. of mole \times molar mass of NaCl

$$= 3 \times 58.5 \text{ g}$$

$$= 175.5 \text{ g}$$

Mass of solvent = (1252 – 175.5)g

$$= 1076.5 \text{ g}$$

$$= 1.076 \text{ kg}$$

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

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

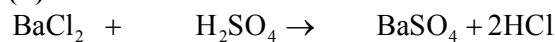
18. (A)

$$\begin{aligned} \text{Final concentration, } M &= \frac{M_1 V_1 + M_2 V_2}{V_1 + V_2} \\ &= \frac{10 \times 2 + 200 \times 0.5}{200 + 10} \\ &= \frac{20 + 100}{210} \\ &= \frac{120}{210} = 0.57 \text{ M} \end{aligned}$$

19. (B)

$$\begin{aligned} \frac{N_{\text{O}_2}}{N_{\text{N}_2}} &= \frac{n_{\text{O}_2}}{n_{\text{N}_2}} = \frac{W_{\text{O}_2}/M_{\text{O}_2}}{W_{\text{N}_2}/M_{\text{N}_2}} = \frac{W_{\text{O}_2}}{W_{\text{N}_2}} \times \frac{M_{\text{N}_2}}{M_{\text{O}_2}} = \frac{1}{4} \times \frac{28}{32} \\ &= \frac{7}{32} \end{aligned}$$

20. (B)



$$20.8 \text{ gm} \quad 4.9 \text{ gm} \quad 0.05 \text{ mole}$$

$$= \frac{20.8}{208} \text{ mole} \quad = \frac{4.9}{98} \text{ mole} \quad = 0.05 \times 233 \text{ gm}$$

$$= 0.1 \text{ mole} \quad = 0.05 \text{ mole} \quad = 11.65 \text{ gm}$$

21. (B)

$$\text{Volume of solution} = \frac{1000+120}{1.12} \text{ ml}$$
$$= 1000 \text{ ml}$$

$$\text{Molarity} = \frac{120 \times 1000}{60 \times 1000} = 2 \text{ M}$$

22. (D)

$$\text{Molecular mass of compound} = 16 \times 2 = 32 \text{ gm}$$

$$\% \text{ of H in } \text{N}_2\text{H}_4 = \frac{4}{32} \times 100$$
$$12.5\%$$

23. (A)

No. of moles of acetic acid adsorbed by 3gm charcoal

$$= (0.6 - 0.042) \times 50 \times 10^{-3}$$

$$= 9 \times 10^{-4} \text{ mole}$$

$$\text{Wt. adsorbed by} = 9 \times 10^{-4} \times 60 \text{ gm}$$

$$3 \text{ gm} = 0.054 \text{ gm}$$

$$\text{Wt. adsorbed per gram} = \frac{0.054}{3} = 0.018 \text{ gm}$$

$$= 18 \text{ mg}$$

24. (C)



$$= \frac{6}{60} \text{ mole} \quad 1 \text{ mole} \quad 0.036 \text{ mole}$$

$$= 0.1 \text{ mole}$$

C is limiting reagent

$$\text{No. of moles of } \text{AB}_2\text{C}_3 \text{ formed} = 0.012$$

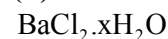
$$\text{Wt. of } \text{AB}_2\text{C}_3 \text{ formed} = 4.8 \text{ gm}$$

$$\text{Molecular wt. of } \text{AB}_2\text{C}_3 = \frac{4.8}{0.012} = 400$$

$$60 + 2x + (3 \times 80) = 400$$

$$x = 50$$

25. (B)



$$\frac{18x}{208+18x} = \frac{9}{61}$$

$$208+18x = 122x$$

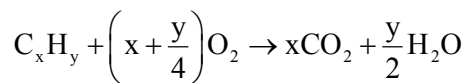
$$x = 2$$

26. (B)

$$8 = \frac{1 \times 32}{x} \times 100$$

$$x = 400$$

27. (B)



$$5 \qquad 25$$

$$\frac{x + \frac{y}{4}}{1} = \frac{25}{5} = 5$$

$$x + \frac{y}{4} = 5$$



WINDOW TO JEE ADVANCED

1. (C)

$$\frac{\text{Weight of a compound in gram (w)}}{\text{Molar mass (M)}} = \text{Number of moles (n)}$$

$$= \frac{\text{Number of molecules (N)}}{\text{Avogadro number (N}_A\text{)}}$$

$$\Rightarrow \frac{w(O_2)}{32} = \frac{N(O_2)}{N_A} \quad \dots\dots (i)$$

$$\text{And } \frac{w(N_2)}{28} = \frac{N(N_2)}{N_A} \quad \dots\dots (ii)$$

Dividing Eq. (i) by Eq. (ii) gives

$$\frac{N(O_2)}{N(N_2)} = \frac{w(O_2)}{w(N_2)} \times \frac{28}{32} = \frac{1}{4} \times \frac{28}{32} = \frac{7}{32}$$

2. (A)

In a neutral atom, atomic number represents the number of protons inside the nucleus and equal number of electrons around it. Therefore, the number of total electrons in molecule of CO_2 ,

$$\begin{aligned} &= \text{electrons present in one carbon atom} \\ &+ 2 \times \text{electrons present in one oxygen atom.} \\ &= 6 + 2 \times 8 = 22 \end{aligned}$$

3. (A)

Number of molecules present in 36g of water

$$= \frac{36}{18} \times N_A = 2N_A$$

Number of molecules present in 28g of CO

$$= \frac{28}{28} \times N_A = N_A$$

Number of molecules present in 46g of C_2H_5OH

$$= \frac{46}{46} \times N_A = N_A$$

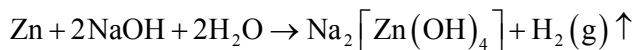
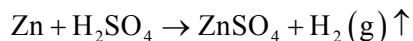
Number of molecules present in 54g of N_2O_5

$$= \frac{54}{108} \times N_A = 0.5N_A$$

Here N_A is Avogadro's number. Hence, 36 g of water contain the largest ($2N_A$) number of molecules.

4. (A)

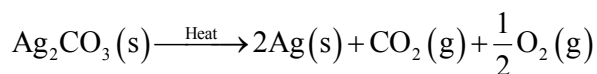
The balanced chemical reaction of zinc with sulphuric acid and NaOH are



Since one mole of $\text{H}_2(\text{g})$ is produced per mole of zinc with both sulphuric acid and NaOH respectively, hydrogen gas is produced in the molar ratio of 1 : 1 in the above reactions.

5. (A)

Unlike other metal carbonates that usually decomposes into metal oxides liberating carbon dioxide, silver carbonate on heating decomposes into elemental silver liberating mixture of carbon dioxide and oxygen gas as



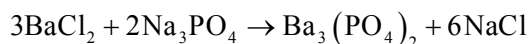
$$\text{MW} = 276\text{g} \qquad 2 \times 108 = 216\text{g}$$

Hence, 2.76g of Ag_2CO_3 on heating will give

$$\frac{216}{276} \times 2.76 = 2.16\text{g Ag as residue.}$$

6. (D)

The balanced chemical reaction is



In this reaction, 3 moles of BaCl_2 combines with 2 moles of Na_3PO_4 . Hence, 0.5 mole of BaCl_2 require

$$\frac{2}{3} \times 0.5 = 0.33 \text{ mole of } \text{Na}_3\text{PO}_4$$

Since available Na_3PO_4 (0.2 mole) is less than required mole (0.33), it is the limiting reactant and would determine the amount of product $\text{Ba}_3(\text{PO}_4)_2$

\therefore 2 moles of Na_3PO_4 gives 1 mole $\text{Ba}_3(\text{PO}_4)_2$

$$\begin{aligned} \therefore 0.2 \text{ mole of } \text{Na}_3\text{PO}_4 \text{ would give } & \frac{1}{2} \times 0.2 \\ & = 0.1 \text{ mole } \text{Ba}_3(\text{PO}_4)_2 \end{aligned}$$

7. (A)

Molality of a solution is defined as number of moles of solute present in 1.0kg (1000 g) of solvent.

8. (D)

Molality is defined in terms of weight, hence independent of temperature. Remaining three concentration units are defined in terms of volume of solution, they depends on temperature.

9. (D)

Mass of an electron = 9.108×10^{-31} kg

$$\therefore 9.108 \times 10^{-31} \text{ kg} = 1.0 \text{ electron}$$

FILL IN THE BLANKS

1. (C-12 isotope)

Carbon -12 isotope. According to modern atomic mass unit, one atomic mass unit (amu) is defined as one – twelfth of mass of an atom of C – 12 isotope, ie,

$$1 \text{ amu (u)} = \frac{1}{12} \times \text{weight of an atom of C – 12 isotope.}$$

2. (6.023×10^{24})

Considering density of water to be 1.0g/mL, 18mL of water is 18 g (1.0 mol) of water and it contain Avogadro number of molecules. Also one molecule of water contain

$$2 \text{ (one from each H atom)} + 8 \text{ (from oxygen atom)} \\ = 10 \text{ electrons.}$$

$$\Rightarrow 1.0 \text{ mole of H}_2\text{O contain} = 10 \times 6.023 \times 10^{23} \\ = 6.023 \times 10^{24} \text{ electrons.}$$

3. (0.4 m)

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution in litre}} \\ = \frac{\text{Weight of solute}}{\text{Molar mass}} \times \frac{1000}{\text{Volume in mL}} \\ = \frac{3}{30} \times \frac{1000}{250} = 0.4\text{M}$$

4. (4.14g)

$$\text{Molar mass of CuSO}_4 \cdot 5\text{H}_2\text{O} \\ = 63.5 + 32 + 4 \times 16 + 5 \times 18 \\ = 249.5 \text{ g}$$

Also, molar mass represents mass of Avogadro number of molecules in gram unit, therefore,

$$\therefore 6.023 \times 10^{23} \text{ molecules of CuSO}_4 \cdot 5\text{H}_2\text{O weigh 249.5 g}$$

$$\therefore 10^{22} \text{ molecules will weigh } \frac{249.5}{6.023 \times 10^{23}} \times 10^{22} = 4.14\text{g}$$

INTEGER TYPE

1. (8)

$$\% \text{ by mass} = 29.2$$

$$M = \frac{\text{Moles of solute}}{\text{Vol. of solution (ml)}} \times 1000 \\ = \frac{29.2 \times 1.25}{36.5 \times 100} \times 1000 = 10$$

$$M_1 V_1 = M_2 V_2$$

$$10 \times V = 0.4 \times 200 \quad \Rightarrow V = 8 \text{ ml.}$$

2. (4)

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

$$= 1.380 \times 10^{-23} \times 6.023 \times 10^{23}$$

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

Hence, no. of significant figures is 4

3. (8)

$$\begin{aligned}\text{Mass of 1 L solvent} &= 0.4 \text{ g mL}^{-1} \times 10^3 \text{ mL} \\ &= 400 \text{ g} = 0.4 \text{ kg}\end{aligned}$$

$$\begin{aligned}\text{So molality } (m) &= \frac{\text{Mole of solute}}{\text{Mass of solvent (kg)}} = \frac{3.2}{0.4} \\ &= 8 \text{ m}\end{aligned}$$

4. (9)

$$m(\text{molality}) = M(\text{molarity})$$

$$\frac{0.1}{\left(\frac{0.9M_{\text{solvent}}}{1000}\right)} = \frac{0.1}{\left(\frac{0.1M_{\text{solute}} + 0.9M_{\text{solvent}}}{2 \times 1000}\right)}$$

$$\frac{1}{9M_{\text{solvent}}} = \frac{2}{M_{\text{solute}} + 9M_{\text{solvent}}}$$

$$\frac{M_{\text{solute}}}{M_{\text{solvent}}} = 9$$