

MOLE CONCEPT

FOUNDATION BUILDER (OBJECTIVE)

1. (D)

2. (D)

3. (B)

4. (A)

Most stable isotope of carbon

5. (D)

6. (C)

Equal volumes of gases have equal number of molecules (not atoms) at same temperature and pressure condition.

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 CO_2 molecules & each molecule of CO_2 has one C atom
So number of C atoms = N_A .

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)

Number of gms of $\text{H}_2\text{SO}_4 = 0.25 \times 98 = 24.5$

13. (D)

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

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

14. (D)

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

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

15. (A)

$$\text{Mass of one molecule of } \text{CO}_2 = \frac{44}{6.02 \times 10^{23}} = 7.31 \times 10^{-23}$$

16. (C)

$$\text{Number of moles of } \text{H}_2 = \frac{0.224}{22.4} = 0.01$$

17. (B)

18. (B)

$$W_{\text{H}} = 3 \times 3 = 9\text{g} \quad W_{\text{N}} = 3 \times 14 = 42\text{g}$$

19. (C)

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

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

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

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

[A]

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

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

[B]

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

\therefore [A]

$$23. \text{A: } 2.5 \times 5N_{\text{A}} = 12.5N_{\text{A}}; \text{B: } 10N_{\text{A}}; \text{C: } 4 \times 3N_{\text{A}} = 12N_{\text{A}}; \text{D: } 1.8 \times 8N_{\text{A}} = 14.4N_{\text{A}}.$$

Hence [D]

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

[C]

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

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

[B]

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

[D]

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

\therefore [C]

$$28. n_{\text{H}_2\text{O}} = \frac{180}{18} = 10$$

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

[D]

$$29. n_{\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}} = \frac{2.48}{248} = 0.01$$

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

[c]

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

[c]

$$31. n_{\text{H}_2\text{O}} = \frac{18 \times 333}{54 + (96 \times 3) + (18 \times 18)} = 9. \text{ Hence [B]}$$

$$32. n_{\text{H}_2\text{O}} = \frac{0.018}{18} = 10^{-3}. \text{ Hence, molecules} = 10^{-3} N_A$$

\therefore [C]

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

\therefore [A]

$$34. \quad n_{\text{C}} = 12 \times n_{\text{C}_{12}\text{H}_{22}\text{O}_{11}} = 12 \times \frac{3.42}{342} = 0.12$$

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

$$35. \quad n_{\text{MgCO}_3} = \frac{8.4}{84} = 0.1$$

Each contain (12 + 6 + 24) protons

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

[B]

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

[B]

37. [D]

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

[B]

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

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

[A]

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

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

[B]

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

Hence [B]

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

[C]

$$43. \quad n_{\text{I}} : n_{\text{O}} = \frac{25.4}{127} : \frac{8}{16} = \frac{1}{5} : \frac{1}{2} = 2 : 5$$

Hence I_2O_5 . [C]

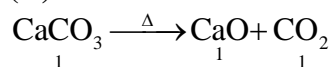
$$44. \quad \text{mol. Wt} = 2 \text{ VD} = 100$$

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

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

[A]

45. (D)

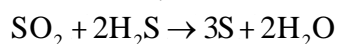


Quantity of limes tones = wt. of one mole mole of CaCO_3
= 100 kg

46. (A)

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

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



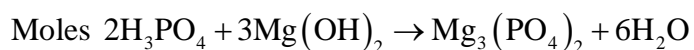
moles 1 2 3 2

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

(L.R.)

47. (C)

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



Moles 2 3 1 6

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

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

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

[D]

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

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

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

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

[A]

50. $\text{Ag}_2\text{CO}_3 \xrightarrow{\Delta} 2\text{Ag}$

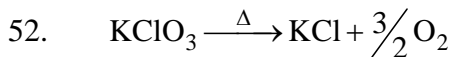
$\therefore W_{\text{Ag}} = \frac{2.7}{(216 + 60)} \times 2 \times 108 = 2.11\text{g}$

[A]

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

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

Hence [D]



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

[C]

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

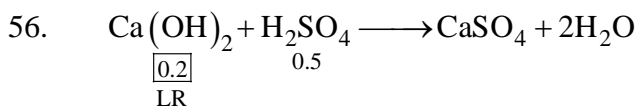
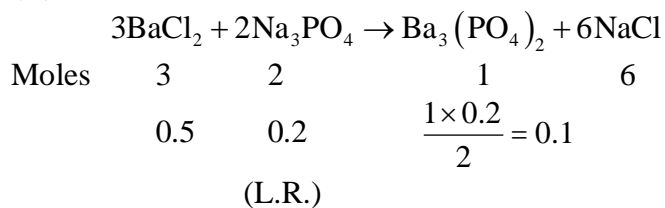
[A]

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

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

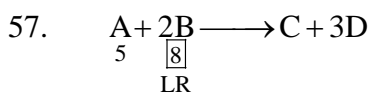
[B]

55. (D)



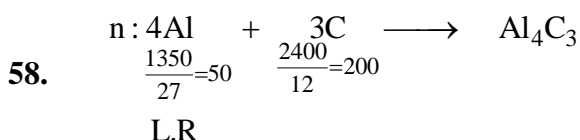
$$n_{\text{CaSO}_4} = n_{\text{Ca}(\text{OH})_2} = 0.2$$

[A]



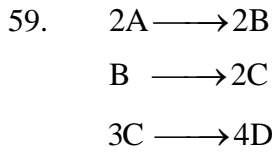
$$n_{\text{C}} = \frac{n_{\text{B}}}{2} = 4; \quad n_{\text{D}} = 3 \times \frac{n_{\text{B}}}{2} = 12$$

Hence [B]



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

[D]



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

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

[D]

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

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

[C]

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

Hence [A]

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

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

[B]

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

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

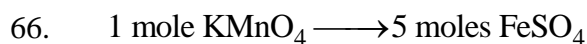
[B]

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

[D]

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

[A]



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

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

[D]

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

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

[B]



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

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

[A]

69. (B)

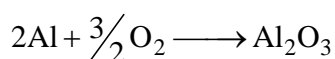
$$\text{Molarity of NO}_2\text{CO}_3 = \frac{2.65 \times 1000}{106 \times 250} = 0.1 \text{ M.}$$

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

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

[A]

GET EQUIPPED FOR JEE MAINS



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

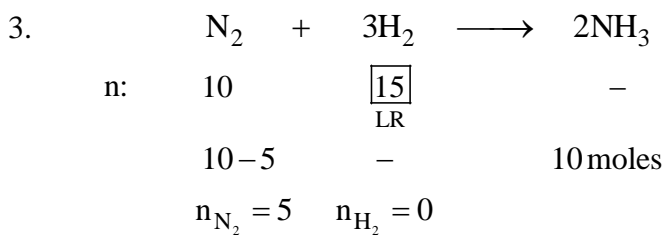
[A]

2. Consider 1 L solution

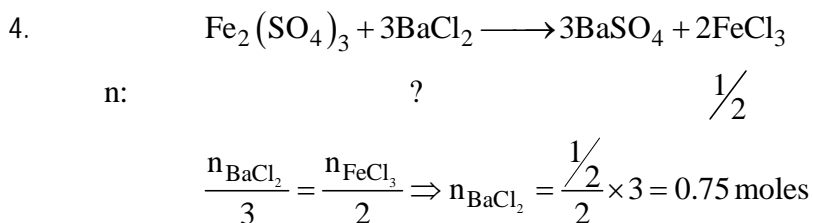
$$\frac{29}{100} \times (d \times 1000) = \omega_{\text{H}_2\text{SO}_4} = 3.6 \times 98$$

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

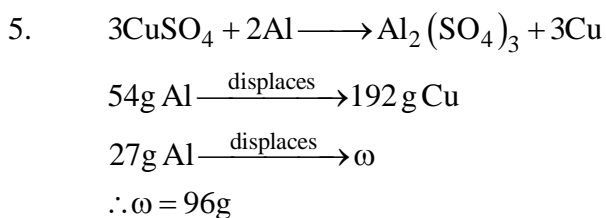
[A]



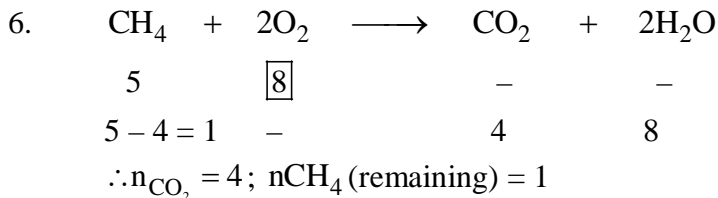
[A]



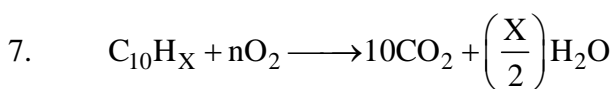
[C]



[C]



[A]



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

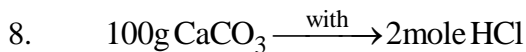
$$1 \text{ mole C}_{10}\text{H}_x \xrightarrow{\text{with}} \left(10 + \frac{x}{4}\right) \text{ moles}$$

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

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

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

[C]



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

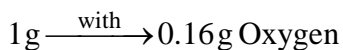
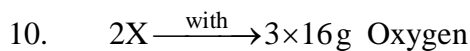
$$\therefore \omega = 0.9375\text{g}$$

[D]

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

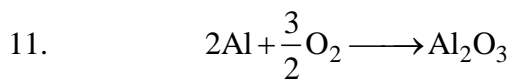
$$\therefore \text{Molarity} = \frac{2.125 \times 1000}{143.5 \times 25} = 0.59$$

[B]

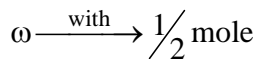
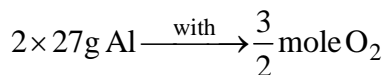


$$\therefore \text{X} = \frac{3 \times 16}{0.16 \times 2} = 150$$

[D]



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



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

[D]

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

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

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

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

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

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

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

[B]

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

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

Hence [A]

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

[C]

$$16. \quad \text{Mol. Wt of } A_2B_3 = 150 + 96 = 246$$

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

[C]

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

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

Hence [A]

18. [D] obvious

$$19. \quad A: \frac{1}{44} \times 3N_A; B: \frac{1}{114} \times 26N_A; C: \frac{1}{30} \times 8N_A; D: \frac{1}{26} \times 2N_A$$

Hence [A]

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

[C]

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

\therefore [D]

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

Hence [A]

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

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

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

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

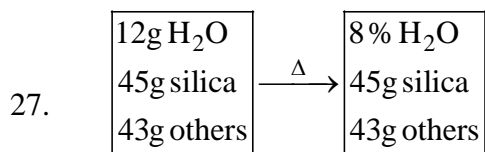
[A]

$$25. \quad \text{Total charge} = 1 \times N_A \times 3e = 3N_A e \text{ coulomb}$$

Hence [D]

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

[D]



100g original 'w' grams

8 % of w = water

i.e. 92 % of w = silica others

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

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

[D]

28. M_3N_2 . 28 % nitrogen

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

[C]

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

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

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

[D]

30. (A)

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

$x = 9\%$

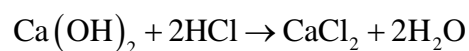
31. (B)

32. (C)

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

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

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



$$\begin{array}{ccc} 1 & 2 & 1 \\ 1 & 0.05 & \frac{0.05 \times 1}{2} = 0.025 \\ & \text{(L.R.)} & \end{array}$$

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)

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

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

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

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

35. (C)

$$\begin{array}{ccc} \text{X} & \text{Y} & \text{X} \quad \text{Y} \\ \frac{20}{10} & : & \frac{80}{200} \quad 1 : 2 \quad \therefore \text{XY}_2 \end{array}$$

36. (C)

Auogaduos 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. (A)

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

$$\begin{aligned} \text{Number of atoms} &= 0.164 \times 10^{-3} \times 6.022 \times 10^{23} \\ &= 9.9 \times 10^{19} \end{aligned}$$

39. (D)

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

40. (B)

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

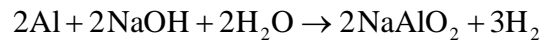
$$\text{Moles of Ag}_2\text{S required} = \frac{1}{107 \times 2}$$

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

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

41. (D)

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



$$\begin{array}{ccccccc} \text{Moles} & & 2 & 2 & 2 & 2 & 3 \end{array}$$

$$\begin{array}{ccccccc} \text{Given} & & 1 & \text{excess} & & & \frac{3 \times 1}{2} = 1.5 \end{array}$$

(L.R.)

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

WINDOW TO JEE MAINS

1. (A)

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

V_{solution} is affected by Temperature.

2. (C)

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

$$\text{No. of atoms} = 10 N_A$$

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

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

3. (A) 4. (D)

5. (B)

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

6. (C)

7. (C)

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

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

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

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

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

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

8. (B)

9. (B)
 $V = 1\text{L}$
 $n_{\text{soluble}} = 3.6$
 $w_{\text{soluble}} = 3.6 \times 98 = 352.8$
 $w_{\text{total}} = \frac{352.8}{29} \times 100 = 1216.55\text{ g}$
 $\text{density} = \frac{1216.55}{1000}$
 $= 1.22\text{ g/ml}$
10. (C) 11. (B) 12. (C) 13. (C)

14. (A)
 $\text{Number of atoms} = \frac{\text{weight}}{\text{atomic weight}} \times N_A \times \text{species}$

\therefore 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 H_2]

In 71 g of chlorine = $2N_A$

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

In 127 g of iodine,

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

In 48 g of magnesium,

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

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

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

15. (b)
 Heavy water is D_2O
 In it,
 $\text{Number of } p^+ = 1 \times 2 + 8 = 10$
 $\text{Number of } e^- = 1 \times 2 + 8 = 10$
 $\text{Number of } n^0 = 1 \times 2 + 8 = 10$
 (\therefore D have 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.
 $\text{Mass of solution} = \text{volume of solution} \times \text{density}$
 $= 1000 \times 1.252$
 $= 1252\text{ g}$
 $\text{Mass of solute} = \text{No. of mole} \times \text{molar mass of NaCl}$
 $= 3 \times 58.5\text{ g}$

$$\begin{aligned} &= 175.5 \text{ g} \\ \text{Mass of solvent} &= (1252 - 175.5)\text{g} \\ &= 1076.5 \text{ g} \\ &= 1.076 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Molality} &= \frac{\text{moles of solute}}{\text{mass of solvent (in kg)}} \\ &= \frac{3}{1.076} = 2.79\text{m} \end{aligned}$$

18. (a)

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