

MOLE CONCEPT (MAIN)

FOUNDATION BUILDER (OBJECTIVE)

1. (D)

2. (D)

3. (B)

4. (A)

(Most stable isotope of carbon)

5. (D)

6. (C)

7. (A)

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

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

Hence NO.

8. (A)

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

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

9. (A)

1 mole contains Avogadro number of atoms.

10. (A)

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

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

11. (D)

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

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

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

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

12. (C)

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

13. (D)

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

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

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)

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

19. (C)

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

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

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

20. (A)

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

21. (B)

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

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

22. (A)

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

23. (D)

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

Hence [D]

24. (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)
 $n_C = 0.5 \times 6 = 3 \quad \therefore \text{wt} = 36 \text{ g}$
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)
 $n_{Na_2S_2O_3 \cdot 5H_2O} = \frac{2.48}{248} = 0.01$
 $\therefore n_{H_2O} = 5 \times 0.01 \Rightarrow \text{molecules} = 0.05 N_A$
30. (C)
 $n_{Ag} = \frac{90}{100} \times \frac{10}{108} = \frac{1}{12} \Rightarrow \text{atom} = \frac{1}{12} N_A = 5 \times 10^{22}$
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)
 $n_{N^{3-}} = \frac{4.2}{14} = 0.3$. \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 = $0.12 N_A \Rightarrow [D]$
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, $n_{\text{C}} = 5 \quad \therefore$ twice = 10 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)

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

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

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

45. (C)

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

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

46. (A)

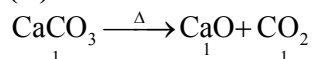
$$D_{\text{Cl}_2 \text{ wrt air}} = \frac{D_{\text{Cl}_2}}{D_{\text{air}}} = \frac{M_{\text{Cl}_2}}{M_{\text{air}}} \approx \frac{71}{29}$$

47. (B)

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

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

48. (D)

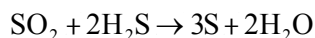


Quantity of limes tones = wt. of one mole mole of CaCO_3
= 100 kg

49. (A)

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

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



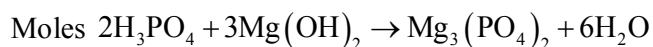
moles 1 2 3 2

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

(L.R.)

50. (C)

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



Moles 2 3 1 6

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

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

51. (D)

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

52. (A)

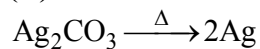
$$W_{\text{O}} = 3.6769 - 2.0769 = 1.6\text{g}$$

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

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

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

53. (A)



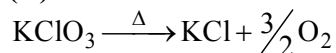
$$\therefore W_{\text{Ag}} = \frac{2.7}{(216+60)} \times 2 \times 108 = 2.11\text{g}$$

54. (D)

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

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

55. (C)



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

56. (A)

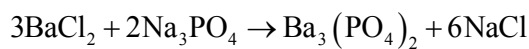
$$n_{\text{Fe}} = \frac{2}{3} \times n_{\text{H}_2\text{O}} = \frac{2}{3} \quad \therefore W_{\text{iron}} = \frac{2}{3} \times 56 = 37.39$$

57. (B)

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

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

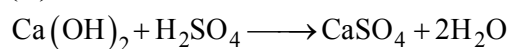
58. (D)



Moles	3	2	1	6
	0.5	0.2	$\frac{1 \times 0.2}{2} = 0.1$	

(L.R.)

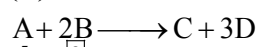
59. (A)



$$\frac{0.2}{\text{LR}} \quad 0.5$$

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

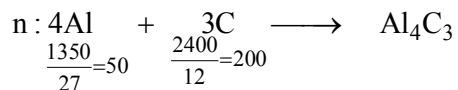
60. (B)



$$\frac{5}{\text{LR}} \quad \frac{8}{\text{LR}}$$

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

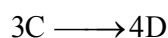
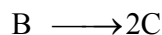
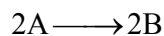
61. (D)



L.R

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

62. (D)



$$\begin{aligned} \therefore n_D &= n_A \times \frac{2}{2} \times \frac{2}{1} \times \frac{4}{3} \\ &= \frac{32}{3} \end{aligned}$$

63. (B)

$$\begin{aligned} \text{molality} &= \frac{n}{w_{\text{solvent}}} \times 1000 \left(\text{urea : } \begin{array}{c} \text{NH}_2 \text{ C NH}_2 \\ \parallel \\ \text{O} \end{array} \right) \\ &= \frac{18/60}{(1500 \times 1.052 - 18)} \times 1000 = 0.192 \end{aligned}$$

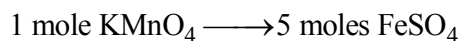
64. (D)

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

65. (A)

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

66. (D)



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

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

67. (B)

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

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

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)

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

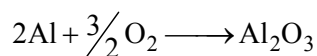
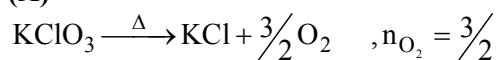
$$\text{After dilution of 10 mL solution} = \frac{0.1 \times 10}{1000} = 0.001 \text{ M}$$

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)



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

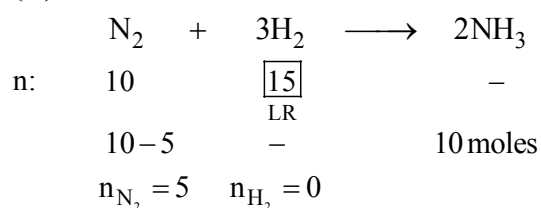
2. (A)

Consider 1 L solution

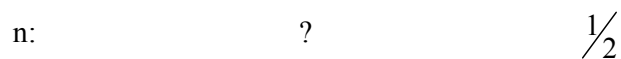
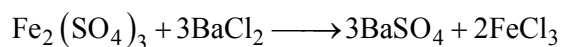
$$\frac{29}{100} \times (d \times 1000) = \omega_{\text{H}_2\text{SO}_4} = 3.6 \times 98$$

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

3. (A)

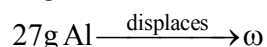
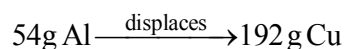
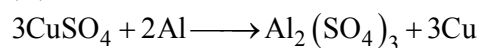


4. (C)

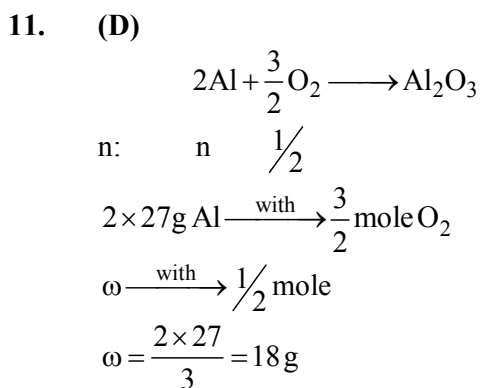
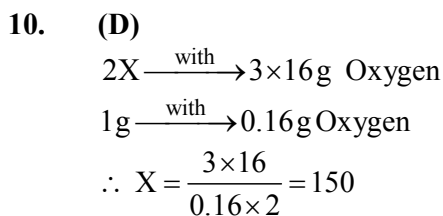
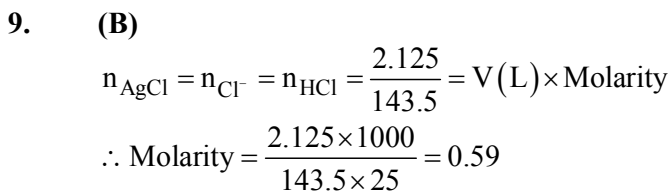
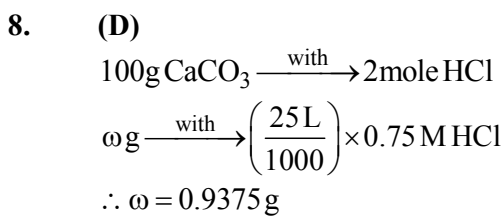
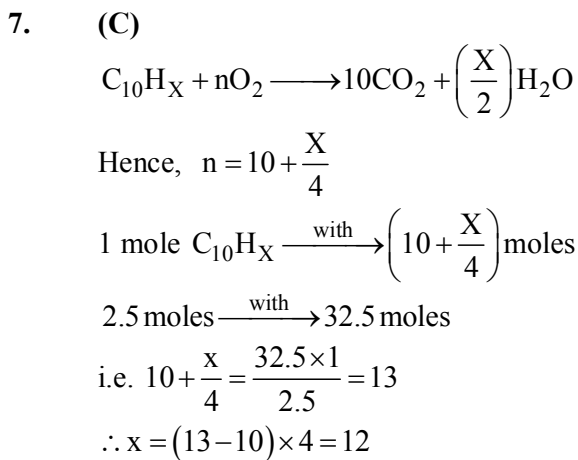
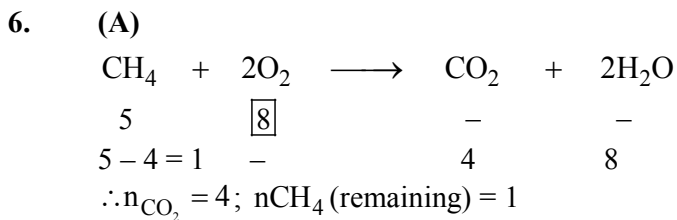


$$\frac{n_{\text{BaCl}_2}}{3} = \frac{n_{\text{FeCl}_3}}{2} \Rightarrow n_{\text{BaCl}_2} = \frac{1}{2} \times 3 = 0.75 \text{ moles}$$

5. (C)



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



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)

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

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)

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

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

Hence [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)

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

24. (A)

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

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

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

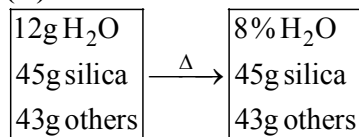
25. (D)

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

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)

M₃N₂. 28 % nitrogen

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

29. (D)

0.014% × mol.wt = 2 × 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)

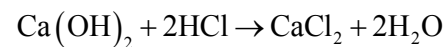
$$A. A. M = \text{Mole fraction of } O^{18} \times 18 + \text{Mole fraction of } O^{16} \times 16$$

32. (C)

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

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

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



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

(L.R.)

33. (A)

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

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

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

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

34. (B)

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

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

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

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

35. (C)

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

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)

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

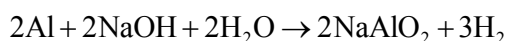
$$\text{Moles of Ag}_2\text{S required} = \frac{1}{107 \times 2}$$

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

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

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.)

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

WINDOW TO JEE MAIN

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)

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

$$\frac{3}{4} : \frac{1}{1} : \frac{1}{4}$$

$$3 : 4 : 1$$

Empirical formula = C_3H_4N

Empirical formula mass = $36 + 4 + 14$
= 54

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

Molecular formula = $C_3H_4N \times 2$
= $C_6H_8N_2$

4. (D)



$$\frac{\text{no. of moles of } H_2}{\text{no. of moles of B}} = \frac{3}{2}$$

$$\text{No. of moles of } H_2 = \frac{3}{2} \times \frac{21.6}{10.8} = 3$$

$$\text{Volume of } H_2 = 3 \times 22.4 \text{ L} = 67.2 \text{ L}$$

5. (B)

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

6. (C)

Refer theory

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)

$$\frac{\text{no. of moles of oxygen atom}}{\text{no. of moles of } Mg_3(PO_4)_2} = \frac{8}{1}$$

$$\text{No. of moles of } Mg_3(PO_4)_2 = \frac{0.25}{8}$$

$$= 0.03125$$

9. (A)

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

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

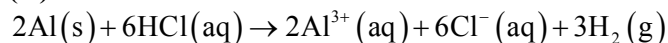
$$W_{\text{soluble}} = 3.6 \times 98 = 352.8$$

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

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

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

10. (C)



Per mole of HCl, no. of moles of

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

$$\text{Volume of H}_2 \text{ at STP} = \frac{1}{2} \times 22.4$$

$$= 11.2\text{L}$$

11. (B)

Molality = 5.2 m.

i.e. if wt. of H₂O = 1000 gm

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)

$$\text{Volume of solution} = \frac{(1000 + 120)}{1.15} \text{ ml}$$

$$= \frac{1120}{1.15} \text{ ml}$$

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

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 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,
 Number of p^+ = $1 \times 2 + 8 = 10$
 Number of e^- = $1 \times 2 + 8 = 10$
 Number of n^0 = $1 \times 2 + 8 = 10$
 (\because D have 1 n^0 because it is actually, ${}_1H^2$)
16. **(D)**
 18 g H_2O contains 2 g H
 \therefore 0.72 g H_2O contains 0.08 g H.
 44 g CO_2 contains 12 g C
 \therefore 3.08 g CO_2 contains 0.84 g C
 \therefore C : H = $\frac{0.84}{12} : \frac{0.08}{1} = 0.07 : 0.08 = 7 : 8$
 \therefore Empirical formula = C_7H_8
17. **(C)**
 3 M solution means 3 moles of solute (NaCl) are present in 1000 L of solution.
 Mass of solution = volume of solution \times density
 $= 1000 \times 1.252$
 $= 1252$ g
 Mass of solute = No. of mole \times molar mass of NaCl
 $= 3 \times 58.5$ g
 $= 175.5$ g
 Mass of solvent = $(1252 - 175.5)$ g
 $= 1076.5$ g
 $= 1.076$ kg
 Molality = $\frac{\text{moles of solute}}{\text{mass of solvent (in kg)}}$
 $= \frac{3}{1.076} = 2.79$ m
18. **(A)**
 Final concentration, $M = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$
 $= \frac{10 \times 2 + 200 \times 0.5}{200 + 10}$
 $= \frac{20 + 100}{210}$
 $= \frac{120}{210} = 0.57$ M
19. **(B)**
 $\frac{N_{O_2}}{N_{N_2}} = \frac{n_{O_2}}{n_{N_2}} = \frac{W_{O_2}/M_{O_2}}{W_{N_2}/M_{N_2}} = \frac{W_{O_2}}{W_{N_2}} \times \frac{M_{N_2}}{M_{O_2}} = \frac{1}{4} \times \frac{28}{32}$
 $= \frac{7}{32}$
20. **(B)**
 $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

$$\begin{array}{lll}
 20.8\text{gm} & 4.9\text{gm} & 0.05 \text{ mole} \\
 = \frac{20.8}{208} \text{ mole} & = \frac{4.9}{98} \text{ mole} & = 0.05 \times 233\text{gm} \\
 = 0.1\text{mole} & = 0.05\text{mole} & = 11.65\text{gm}
 \end{array}$$

21. (B)

$$\begin{aligned}
 \text{Volume of solution} &= \frac{1000+120}{1.12} \text{ ml} \\
 &= 1000\text{ml}
 \end{aligned}$$

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

22. (D)

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

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

23. (A)

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

$$\begin{aligned}
 &= (0.6 - 0.042) \times 50 \times 10^{-3} \\
 &= 9 \times 10^{-4} \text{ mole}
 \end{aligned}$$

$$\begin{aligned}
 \text{Wt. absorbed by} &= 9 \times 10^{-4} \times 64\text{gm} \\
 3\text{gm} &= 0.054\text{gm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Wt. absorbed per gram} &= \frac{0.054}{3} = 0.018\text{gm} \\
 &= 18\text{mg}
 \end{aligned}$$

24. (C)



$$\begin{array}{lll}
 \frac{6}{60} \text{ mole} & 1 \text{ mole} & 0.036 \\
 = 0.1\text{mole} & & \text{mole}
 \end{array}$$

C is limiting reagent

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

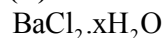
$$\text{Wt. of } \text{AB}_2\text{C}_3 \text{ formed} = 4.8\text{gm}$$

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

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

$$x = 50$$

25. (B)



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

$$208 + 18x = 122x$$

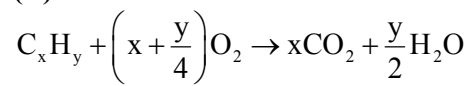
$$x = 2$$

26. (B)

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

$$x = 400$$

27. (B)



$$5 \qquad 25$$

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

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

