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)**

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

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

Hence NO.

8. **(A)**

Molecular weight of $C_{60}H_{122} = 60\times12+122 = 842.$

Weight of a molecule = $\frac{842}{6.022\times10^{23}} = 1.39\times10^{-21}\text{g}$.

9. **(A)**

1 mole contains Avogadro number of atoms.

10. **(A)**

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

Number of atoms = $0.05\times2\times6.02\times10^{23}$.

$= 6.02\times10^{22}$.

11. **(D)**

(A) $\frac{22.4\times10^3}{22400}\times NA = 6.022\times10^{23}$

(B) $\frac{22}{44}\times6.022\times10^{23} = 3.011\times10^{23}$

(C) $\frac{11.2}{22.4}\times6.022\times10^{23} = 3.011\times10^{23}$

(D) $0.1\times6.022\times10^{23} = 6.022\times10^{22}$

12. **(C)**

Number of gms of $H_2SO_4 = 0.25\times98 = 24.5$

13. **(D)**

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

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

14. (D)

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

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

15. (A)

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

16. (C)

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

17. (B)

18. (B)

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

19. (C)

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

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

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

20. (A)

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

21. (B)

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

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

22. (A)

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

23. (D)

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

Hence [D]

24. (C)

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

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)**

$n_C = 0.5 \times 6 = 3$ $\quad\quad$ $\therefore$ 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)**

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

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

30. **(C)**

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

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)**

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

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

36. (B)

$n_{total} = \frac{4.4}{44} + \frac{2.24}{22.4} = 0.2$ $\therefore$ 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 $\simeq$ 1g water

$\frac{1}{18} \times 3$

38. **(B)**

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

39. **(A)**

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

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

40. **(B)**

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

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

41. **(B)**

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

42. **(C)**

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

43. **(C)**

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

Hence I_2O_5.

44. **(A)**

mol. Wt = 2 VD = 100

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

$w_{metal} = 29\,g$

45. **(C)**

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

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

46. **(A)**

$D_{cl_2\ wrt\ air} = \dfrac{D_{cl_2}}{D_{air}} = \dfrac{M_{cl_2}}{M_{air}} \approx \dfrac{71}{29}$

47. **(B)**

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

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

48. **(D)**

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

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

= 100 kg

49. **(A)**

Moles of $H_2S = 2$

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

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

moles 1 2 3 2

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

(L.R.)

50. **(C)**

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

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

Moles 2 3 1 6

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

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

51. **(D)**

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

52. **(A)**

$W_O = 3.6769 - 2.0769 = 1.6g$

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

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

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

53. **(A)**

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

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

54. **(D)**

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

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

55. **(C)**

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

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

56. **(A)**

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

57. **(B)**

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

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

58. **(D)**

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

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

59. **(A)**

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

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

60. **(B)**

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

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

61. **(D)**

$$\underset{\frac{1350}{27}=50}{4Al} + \underset{\frac{2400}{12}=200}{3C} \longrightarrow Al_4C_3$$

L.R

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

62. (D)

$2A \longrightarrow 2B$

$B \longrightarrow 2C$

$3C \longrightarrow 4D$

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

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

63. (B)

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

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

64. (D)

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

65. (A)

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

66. (D)

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

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

$\Rightarrow V = 10mL$

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

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

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

69. (B)

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

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

70. (A)

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

GET EQUIPPED FOR JEE MAIN

1. (A)

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

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

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

2. (A)

Consider 1 L solution

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

$\therefore$ d = 1.22 g/mL

3. (A)

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

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

4. (C)

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

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

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

5. (C)

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

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

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

$\therefore \omega = 96g$

6. **(A)**

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

5 $\quad$ $\boxed{8}$ $\quad$ – $\quad$ –

$5-4=1$ $\quad$ – $\quad$ 4 $\quad$ 8

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

7. **(C)**

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

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

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

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

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

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

8. **(D)**

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

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

$\therefore \omega = 0.9375\,g$

9. **(B)**

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

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

10. **(D)**

$$2X \xrightarrow{\text{with}} 3 \times 16\,g\ \text{Oxygen}$$

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

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

11. **(D)**

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

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

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

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

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

12. (D)

$$n_{BaSO_4} = n_{SO_2} = n_S \text{ (POAC on S)}$$
$$= \frac{8}{32} = \frac{1}{4}$$

13. (B)

$$n_{NaBr} = n_1,\ n_{KBr} = n_2 \text{ (say)}$$
$$n_{AgBr} = n_{Br} = n_1 + n_2 = \frac{0.97}{(108+80)} = 0.00516$$
Also, $n_1 \times (103) + n_2 \times (119) = 0.560$
$$\therefore n_2 = \frac{0.56 - 103 \times 0.00516}{16} = 0.00178$$
$$\therefore W_{KBr} = 119 n_2 = 0.212\,g$$

14. (A)

$$A: n_H = 4 \times \frac{16g}{16g} = 4;\ B: n_H = 4 \times \frac{31.2}{76} = 1.64$$
$$C: n_H = 22 \times \frac{34.2}{342} = 2.2;\ D: n_H = 12 \times \frac{36}{180} = 2.4$$

15. (C)

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

16. (C)

Mol. Wt of $A_2B_3 = 150 + 96 = 246$
$\therefore$ For 5 mol, $(246 \times 5)\,g = 1.23$ kg

17. (A)

$$A: 10N_A;\ B: 11 \times \frac{200}{342} = 6.43 N_A;\ C = \frac{144}{48} N_A \times 3 = 9N_A$$
$$D: 2.5 \times 3N_A = 7.5N_A.$$
Hence [A]

18. (D)

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

19. (A)

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

20. (C)

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

21. **(D)**

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

22. **(A)**

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

23. **(D)**

1 gram molecule: 44 g
1 molecule of CO_2 = 44 amu

24. **(A)**

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

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

$\therefore n_C : n_H = 1 : 5$

25. **(D)**

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

26. **(D)**

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

27. **(D)**

12g H_2O	$\xrightarrow{\Delta}$	8% H_2O
45g silica		45g silica
43g others		43g others

100g original 'w' grams

8 % of w = water

i.e. 92 % of w = silica others

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

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

28. **(C)**

M_3N_2. 28 % nitrogen

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

29. **(D)**

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

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 = Mole fraction of $O^{18}\times 18 +$ Mole fraction of $O^{16}\times 16$

32. (C)

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

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

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

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

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

33. (A)

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

Weight of solvent = 100 – 1.595 = 98.505

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

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

34. (B)

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

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

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

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

35. (C)

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

36. (C)

Avogadro hypothesis

37. (A)

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

Number of magnesium atoms $= 0.00335 \times 6.022 \times 10^{23}$

$= 2.01 \times 10^{21}$ atoms.

38. (D)

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

Number of atoms $= 0.164 \times 10^{-3} \times 6.022 \times 10^{23} \times 27$ (1 Molecule has 27 atoms).

$= 2.67 \times 10^{21}$

39. (D)

Moles of $e^- = 52 + 2 = 54$.

40. (B)

Moles of Ag $= \dfrac{1}{107}$.

Moles of Ag_2S required $= \dfrac{1}{107 \times 2}$

Mass of $Ag_2S = \dfrac{(107 \times 2 + 32)}{107 \times 2} = 1.1495$

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

41. (D)

Moles of Al $= {}^{27}\!/_{27} = 1$

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

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

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

WINDOW TO JEE MAIN

1. (A)

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

$V_{solution}$ is affected by Temperatuere.

2. (C)

$n_{Fe} = \dfrac{560}{56} = 10$

No. of atoms = 10 N_A

In 70 g of N no. of atoms = $\dfrac{70}{14} \times N_A = 5\,N_A$

In 20 g of H no. of atoms = $\dfrac{20}{1} \times N_A = 20\,N_A$

3. (A)

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

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

$$3 : 4 : 1$$

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)**

$2BCl_3 + 3H_2 \rightarrow 2B + 6HCl$

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

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

Volume of $H_2 = 3 \times 22.4\,L = 67.2L$

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 L

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

$n_{soluble}$ = 2.05

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

= 1020 – 123 = 897 g

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

8. **(B)**

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

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

$= 0.03125$

9. **(A)**

V = 1L

$n_{soluble}$ = 3.6

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

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

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

= 1.22 g/ml

10. (C)

$$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$$

Per mole of HCl, no. of moles of

$$H_2 \text{ formed} = \frac{1}{2}$$

$$\text{Volume of } H_2 \text{ at STP} = \frac{1}{2} \times 22.4$$
$$= 11.2L$$

11. (B)

Molality $= 5.2\,m$.

i.e. if wt. of $H_2O = 1000gm$

then no. of moles of $CH_3OH = 5.2$

$$X_{CH_3OH} = \frac{5.2}{5.2 + \frac{1000}{18}} = 0.0856$$

12. (C)

$$\text{Volume of solution} = \frac{(1000 + 120)}{1.15} m\ell$$
$$= \frac{1120}{1.15} m\ell$$

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

13. (C)

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

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,

Number of $p^+ = 1\times2+8=10$

Number of $e^- = 1\times2+8=10$

Number of $n^0 = 1\times2+8=10$

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

16. (D)

18 g H_2O contains 2 g H

$\therefore$ 0.72 g H_2O contains 0.08 g H.

44 g CO_2 contains 12 g C

$\therefore$ 3.08 g CO_2 contains 0.84 g C

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

$\therefore$ Empirical formula = C_7H_8

17. (C)

3 M solution means 3 moles of solute (NaCl) are present in 1000 L of solution.

Mass of solution = volume of solution $\times$ density

$= 1000\times1.252$

= 1252 g

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

$= 3\times58.5\,g$

= 175.5 g

Mass of solvent = (1252 – 175.5)g

= 1076.5 g

= 1.076 kg

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

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

18. (A)

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

$$= \frac{10\times2+200\times0.5}{200+10}$$

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

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

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)

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

20.8gm	4.9gm	$0.05\,\text{mole}$
$=\frac{20.8}{208}\text{mole}$	$=\frac{4.9}{98}\text{mole}$	$=0.05\times 233\text{gm}$
$=0.1\text{mole}$	$=0.05\text{mole}$	$=11.65\text{gm}$

21. (B)

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

$=1000\text{ml}$

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

22. (D)

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

% of H in $N_2H_4=\frac{4}{32}\times 100$

12.5%

23. (A)

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

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

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

Wt. absorbed by $=9\times 10^{-4}\times 64\text{gm}$

3gm $=0.054\text{gm}$

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

$=18\text{mg}$

24. (C)

$A+2B+3C\rightleftharpoons AB_2C_3$

$\frac{6}{60}\text{mole}$	1mole	0.036
$=0.1\text{mole}$		mole

C is limiting reagent

No. of moles of AB_2C_3 formed $=0.012$

Wt. of AB_2C_3 formed $=4.8\text{gm}$

Molecular wt. of $AB_2C_3=\frac{4.8}{0.012}=400$

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

$x=50$

25. (B)

$BaCl_2.xH_2O$

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

$208+18x=122x$

$x=2$

26. **(B)**

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

$$x = 400$$

27. **(B)**

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

5 25

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

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

$$C_3H_8$$