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)**
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 $C_{60}H_{122} = 60 \times 12 + 122 = 842.$
Weight of a molecule = $\frac{842}{6.022 \times 10^{23}} = 1.39 \times 10^{-21}$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)**
Moles of $N_2 = \frac{1.4}{28} = 0.05.$
Number of atoms = $0.05 \times 2 \times 6.02 \times 10^{23}$.
= 6.02×10^{22} .

11. **(D)**
(A) $\frac{22.4 \times 10^3}{22400} \times N_A = 6.022 \times 10^{23}$
(B) $\frac{22}{44} \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$
(C) $\frac{11.2}{22.4} \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$
(D) $0.1 \times 6.022 \times 10^{23} = 6.022 \times 10^{22}$

12. **(C)**
Number of gms of $H_2SO_4 = 0.25 \times 98 = 24.5$

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 = $100 \times 6.022 \times 10^{23}$ = 6.022×10^{25}.

15. **(A)**

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

16. **(C)**

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

17. **(B)**

18. **(B)**

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

19. **(C)**

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

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

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

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

[A]

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

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

[B]

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

$\therefore$ [A]

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

Hence [D]

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

[C]

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

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

[B]

26. $n_C = 0.5 \times 6 = 3$ $\therefore$ wt = 36 g

[D]

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

$\therefore$ [C]

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

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

[D]

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

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

[c]

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

[c]

31. $n_{H_2O} = \frac{18 \times 333}{54 + (96 \times 3) + (18 \times 18)}$ = 9. Hence [B]

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

$\therefore$ [C]

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

$\therefore$ [A]

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

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

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

Each contain (12 + 6 + 24) protons

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

[B]

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

[B]

37. [D]

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

[B]

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

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

[A]

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

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

[B]

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

Hence [B]

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

[C]

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

Hence I_2O_5. [C]

44. mol. Wt = 2 VD = 100

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

$w_{metal} = 29\,g$

[A]

45. **(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

46. **(A)**

Moles of $H_2S = 2$

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

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

moles	1	2	3	2
given	0.5 (L.R.)	2	$x = \frac{3 \times 0.5}{1} = 1.5$	

47. **(C)**

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

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

Moles 2 3 1 6

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

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

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

[D]

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

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

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

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

[A]

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

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

[A]

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

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

Hence [D]

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

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

[C]

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

[A]

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

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

[B]

55. **(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.)		

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

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

[A]

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

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

Hence [B]

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

L.R

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

[D]

59. $2A \longrightarrow 2B$

$B \longrightarrow 2C$

$3C \longrightarrow 4D$

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

$= \frac{32}{3}$

[D]

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

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

[C]

61. $D_{cl_2 \text{ wrt air}} = \frac{D_{cl_2}}{D_{air}} = \frac{M_{cl_2}}{M_{air}} \approx \frac{71}{29}$

Hence [A]

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

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

[B]

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

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

[B]

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

[D]

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

[A]

66. $1 \text{ mole } KMnO_4 \longrightarrow 5 \text{ moles } FeSO_4$

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

$\Rightarrow V = 10 mL$

[D]

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

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

[B]

68. 3 molal $\Rightarrow$ 3 mole NaOH in 1000g solvent

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

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

[A]

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

[A]

GET EQUIPPED FOR JEE MAINS

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

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

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

[A]

2. 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

[A]

3. $N_2 \quad + \quad 3H_2 \longrightarrow 2NH_3$

n: $\quad 10 \quad \boxed{15}_{LR} \quad -$

$10-5$ $-$ $10\,\text{moles}$

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

[A]

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

n: ? $1/2$

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

[C]

5. $3CuSO_4+2Al\longrightarrow Al_2(SO_4)_3+3Cu$

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

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

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

[C]

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

5 $\boxed{8}$ $-$ $-$

5 – 4 = 1 $-$ 4 8

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

[A]

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

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

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

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

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

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

[C]

8. $100\text{g }CaCO_3\xrightarrow{\text{with}}2\text{mole HCl}$

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

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

[D]

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

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

[B]

10. $2X \xrightarrow{\text{with}} 3 \times 16\,g \text{ Oxygen}$

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

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

[D]

11. $2Al + \frac{3}{2}O_2 \longrightarrow Al_2O_3$

n: n $1/2$

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

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

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

[D]

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

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

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

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

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

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

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

[B]

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

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

Hence [A]

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

$\approx 0.05\,N_A \;=\; 3\times10^{22}$

[C]

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

$\therefore$ For 5 mol, $(246\times5)\,g$ = 1.23 kg

[C]

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

$D: 2.5\times3N_A = 7.5N_A$.

Hence [A]

18. [D] obvious

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

Hence [A]

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

[C]

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

$\therefore$ [D]

22. $A: 0.2\times14\,g = 2.8g;\; B:\frac{3\times10^{23}}{6\times10^{23}}\times12\,g = 6g$; C : 32 g ; D : 7 g.

Hence [A]

23. [D] 1 gram molecule: 44 g

1 molecule of CO_2 = 44 amu

24. $n_H = n\times2 + 2n\times4 = 10n$

$n_C = 2n\times1 = 2n$

$\therefore n_C : n_H = 1:5$

[A]

25. Total charge = $1\times N_A\times3e = 3N_Ae$ coulomb

Hence [D]

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

[D]

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

100goriginal 'w'grams

8 % of w = water

i.e. 92 % of w = silica others

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

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

[D]

28. M_3N_2. 28 % nitrogen

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

[C]

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

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

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

[D]

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

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)**

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

Weight of solvent = 100 – 1.595 = 98.505

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

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

34. **(B)**

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

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

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

(D) 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)**

Auogaduos hypothesis

37. **(A)**

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. **(A)**

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

Number of atoms $= 0.164 \times 10^{-3} \times 6.022 \times 10^{23}$.

$= 9.9 \times 10^{19}$

39. **(D)**

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

40. **(B)**

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

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

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

Mass of ore required = $\frac{1.1495}{1.34} \times 100 = 85.78$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			$\frac{3\times1}{2} = 1.5$
	(L.R.)				

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

WINDOW TO JEE MAINS

1. (A)

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

$V_{solution}$ is affected by Temperatuere.

2. (C)

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

No. of atoms = 10 N_A

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

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

3. (A) 4. (D)

5. (B)

$$\text{Molarity} = \frac{\frac{6.02\times10^{20}}{N_A}}{0.1} = 0.01$$

6. (C)

7. (C)

V = 1 L

$W_{total} = 1\times1.02\times1000 = 1020\,g$

$n_{soluble}$ = 2.05

$W_{total} = \frac{352.8}{29}\times100 = 1216.55\,g$

= 1020 – 123 = 897 g

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

8. (B)

9. (B)

V = 1L

$n_{soluble}$ = 3.6

$w_{soluble} = 3.6\times98 = 352.8$

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

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

= 1.22 g/ml

10. (C) 11. (B) 12. (C) 13. (C)

14. (A)

Number of atoms $= \frac{weight}{atomic\ weight} \times N_A \times species$

$\therefore$ In 4 g of hydrogen

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 = $2N_A$

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

In 127 g of iodine,

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

In 48 g of magnesium,

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 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

$= 1000 \times 1.252$

= 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

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

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

18. (a)

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

$$= \frac{10 \times 2 + 200 \times 0.5}{200 + 10}$$

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

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