7. (d) For $NaOH$, $M = N$

$N_1V_1 = 100ml \times 1N = 100ml(N)$

For H_2SO_4, $N_2V_2 = 10ml \times 10N = 100ml(N)$

Hence, $N_1V_1 = N_2V_2$.

10. (b) 1 mole of CH_4 contains 4 mole of hydrogen atom *i.e.* $4g$ atom of hydrogen.

11. (a) $Na_2\overset{+2}{S}O_3 + I_2 \rightarrow Na_2\overset{+2.5}{S_4}O_6 + NaI$

$n = 2 \times 0.5 = 1$

$E = \frac{M}{n-\text{factor}} = \frac{M}{1} = M$

12. (b) $E = \frac{M}{5}$

13. (a) Atomic mass $= \frac{10 \times 19 + 81 \times 11}{100} = \frac{190 + 891}{100} = \frac{1081}{100}$

$= 10.81$

14. (c) $0.1M$ $AgNO_3$ will react with $0.1M$ $NaCl$ to form $0.1M\ NaNO_3$. But as the volume doubled, conc. of $NO_3^- = \frac{0.1}{2} = 0.05M$.

16. (c) wt. of metallic chloride $= 74.5$

wt. of chlorine = 35.5

$\therefore$ wt. of metal $= 74.5 - 35.5 = 39$

Equivalent weight of metal $= \frac{\text{weight of metal}}{\text{weight of chlorine}} \times 35.5$

$= \frac{39}{35.5} \times 35.5 = 39$

17. (a) $\because$ $5.8L$ of gas has mass $= 7.5gm$

$\therefore 22.4L$ " " " $= \frac{7.5}{5.8} \times 22.4 = 28.96$

So molecular weight = 29

So, molecular formula of compound is NO

18. (d) $\because$ $17gm$ NH_3 contains 6×10^{23} molecules of NH_3

$\therefore$ $4.25gm$ NH_3 contains $= \frac{6 \times 10^{23}}{17} \times 4.25$

$\therefore$ No. of atoms $= \frac{6 \times 10^{23} \times 4.25}{17} \times 4 = 6 \times 10^{23}$.

19. (a) $\because$ $1L$ of gas at S.T.P. weight $1.16g$

$\therefore$ $22.4\ L$ of gas at S.T.P. weight $= 22.4 \times 1.16$

$= 25.984 \approx 26$

This molecular weight indicates that given compound is C_2H_2.

20. (a) Molecular weight $= 2 \times V.D = 2 \times 11.2 = 22.4$

$\because$ $22.4gm$ of gas occupies $22.4L$ at S.T.P.

$\therefore$ $11.2gm$ of gas occupies $\frac{22.4}{22.4} \times 11.2 = 11.2L$.

21. (b) Equivalent weight $= \frac{\text{Molecular weight}}{\text{Valency}}$

Molecular weight of $\begin{matrix} COOH \\ | \\ COOH \end{matrix} \cdot 2H_2O = \frac{126}{2} = 63$.

22. (b) Valency of the element $= \frac{2 \times V.D}{E + 35.5} = \frac{2 \times 59.25}{4 + 35.5}$

$= \frac{118.50}{39.5} = 3$.

23. (d) Molarity $= \frac{W(gm) \times 1000}{V(ml) \times \text{molecular weight}}$

$0.25 = \frac{1.25 \times 1000}{25 \times \text{molecular weight}}$

$\therefore$ Molecular weight $= \frac{1.25 \times 1000}{0.25 \times 25} = 200$.

24. (c) Let weight of metal oxide = $100gm$

Weight of oxygen = $32gm$

$\therefore$ weight of metal $= 100 - 32 = 68gm$

Equivalent weight of oxide $= \frac{\text{wt. of metal}}{\text{wt. of oxygen}} \times 8$

$= \frac{68}{32} \times 8 = 17$.

25. (a) 6×10^{23} molecules has mass $= 18gm$

1 molecules has mass $= \frac{18}{6 \times 10^{23}} = 3 \times 10^{-23} gm$

$= 3 \times 10^{-26} kg$.

26. (a) Choice (a) is P_4S_3

$\because$ $\frac{31 \times 4}{(124)} gm$ P is present in $220gm$ P_4S_3

$\therefore$ $1.24gm$ P is present in = $\frac{220}{124} \times 1.24 = 2.2gm$

27. (c) Number of moles of $A = \frac{x}{40}$

Number of atoms of $A = \frac{x}{40} \times \text{Avogadro no.} = y$ (say)

Or $x = \frac{40y}{\text{Avogadro no.}}$

Number of moles of $B = \frac{2x}{80}$

Number of atoms of B

$= \frac{2x}{80} \times \text{Av.no.} = \frac{2}{80} \times \frac{40y}{\text{Av.no.}} \times \text{Av.no.} = y$

28. (d) $BaCO_3 \rightarrow BaO + CO_2 \uparrow$

Molecular weight of $BaCO_3 = 137 + 12 + 3 \times 16 = 197$

$\because$ $197gm$ produces $22.4L$ at S.T.P.

$\therefore$ $9.85gm$ produces $\frac{22.4}{197} \times 9.85 = 1.12L$ at S.T.P.

29. (a) 14 gm N^{3-} ions have $= 8N_A$ valence electrons

4.2gm of N^{3-} ions have $= \frac{8N_A \times 4.2}{14} = 2.4N_A$

30. (c) [$\because$ Molecular weight of $CuSO_4.5H_2O$
$= 63.5 + 32 + 64 + 90 = 249.5$]

6×10^{23} molecules has weight $= 249.5gm$

1×10^{22} molecules has weight $= \frac{249.5 \times 1 \times 10^{22}}{6 \times 10^{23}}$

$= 41.58 \times 10^{-1}$

$= 4.158$

31. (a) (I) 1 molecule of oxygen

$\because$ 6×10^{23} molecule has mass $= 32gm$

$\therefore$ 1 molecule of O_2 has mass $= \frac{32}{6 \times 10^{23}}$

$= 5.3 \times 10^{-23} gm$

(II) 1 atom of nitrogen

$\because$ $2 \times 6 \times 10^{23}$ atoms of N_2 has mass = 28gm

$\therefore$ 1 atom of N_2 has mass $= \frac{28}{2 \times 6 \times 10^{23}}$

$= 2.3 \times 10^{-23} gm$

(III) $1 \times 10^{-10} g$ molecular weight of oxygen

g atomic weight $= 2 \times 1 \times 10^{-10} = 2 \times 10^{-10} g$

(IV) $1 \times 10^{-10} g$ atomic weight of copper

So, order of increasing masses $II < I < III < IV$.

32. (d) $\frac{\text{wt. of metal hydroxide}}{\text{wt. of metal oxide}} = \frac{EM + EOH^-}{EM + EO^-}$

$= \frac{1.520}{0.995} = \frac{x + 17}{x + 8}$

$= 1.520x + 1.520 \times 8 = 0.995x + 0.995 \times 17$

$1.520x + 12.160 = 0.995x + 16.915$

or $0.525x = 4.755$

$x = \frac{4.755}{0.525} = 9$.

33. (b) One ion carries $3 \times 1.6 \times 10^{-19}$ $coulomb$

Then 1 gm ion N^{3-} (1 mole) carries

$= 3 \times 1.6 \times 10^{-19} \times 6.02 \times 10^{23}$

$= 2.89 \times 10^5$ $coulomb$

34. (a) $\frac{C_P}{C_V} = 1.4$ so, given gas is diatomic

11.2L $= 3.01 \times 10^{23}$ molecules

$\therefore$ No. of atoms $= 3.01 \times 10^{23} \times 2 = 6.023 \times 10^{23}$ *atoms*

36. (b) The acid is dibasic.

Molecular weight of $H_3PO_3 = 3 + 31 + 48 = 82$

$\therefore$ Equivalent weight $= \frac{\text{Molecular weight}}{\text{Basicity}} = \frac{82}{2} = 41$.

37. (b) $\because$ 22400 ml at NTP has 6.023×10^{23} molecule

$\therefore$ 1 ml at NTP has $= \frac{6.023 \times 10^{23}}{22400}$

$= 0.0002688 \times 10^{23} = 2.69 \times 10^{19}$.

38. (c) Sp. heat × atomic wt.= 6.4

0.16 × atomic wt.= 6.4

Atomic wt. $= \frac{6.4}{0.16} = 40$.

39. (a) Molecular weight of $C_{60}H_{122} = 12 \times 60 + 122 \times 1$

$= 720 + 122 = 842$

$\because$ 6×10^{23} molecule $C_{60}H_{122}$ has mass = 842gm

$\therefore$ 1 molecule $C_{60}H_{122}$ has mass $\frac{842}{6 \times 10^{23}}$

$= 140.333 \times 10^{-23} gm = 1.4 \times 10^{-21} gm$.

40. (b) $C_2H_4 + 2O_2 \rightarrow 2CO_2 + 2H_2O$

$\because$ 28gm C_2H_4 requires 64gm oxygen

$\therefore$ 2.8×10^3 gm C_2H_4 requires $= \frac{64}{28} \times 2.8 \times 10^3 gm$

$= 6.4 \times 10^3 gm$ = 6.4kg.

41. (c) 2.5 molal NH_4OH means 2.5 moles of NH_3 in 1000g H_2O (1000cc of solution)

Hence, 100cc solution of NH_3 requires = 0.25 mole

$= 0.25 \times 22.4L = 5.6L$.

42. (d) $d = \frac{M}{V}$; $1 = \frac{M}{V}$ or $M = V$; 18gm = 18ml

6×10^{23} molecule of water has volume =18cc

1 molecule of water has volume $= \frac{18}{6 \times 10^{23}}$

$= 3 \times 10^{-23} cm^3$.

43. (a) 100gm caffeine has 28.9gm nitrogen

194gm caffeine has = $\frac{28.9}{100} \times 194 = 56.06gm$

$\therefore$ No. of atoms in caffeine $= \frac{56.06}{14} \approx 4$.

44. (d) Molecular weight of $(CHCOO)_2Fe = 170$

Fe present in 100mg of $(CHCOO)_2Fe$

$= \frac{56}{170} \times 100mg = 32.9mg$

This is present in 400mg of capsule

% of Fe in capsule $= \frac{32.9}{400} \times 100 = 8.2$.

45. (d) 1 atom has mass $= 10.86 \times 10^{-26} kg$

$= 10.86 \times 10^{-23}\ gm$

6.023×10^{23} atoms has mass

$= 10.86 \times 10^{-23} \times 6.023 \times 10^{23} = 65.40 gm$

This is the atomic weight of *Zn*.

46. (b) $\because$ 1mole $(COOH)_2 \,.\, 2H_2O$ has $96gm$ oxygen

$\therefore$ 0.3 mole $(COOH)_2 \,.\, 2H_2O$ has $96 \times 0.3 = 28.8 gm$

$\therefore$ No. of gram atoms of oxygen $= \dfrac{28.8}{16} = 1.8$.

47. (c) Equimolecular proportion means both gases occupied equal volume $= \dfrac{2.24}{2} = 1.12L$

For CH_4:

22.4L CH_4 has mass $= 16gm$

1.12L CH_4 has mass $= \dfrac{16}{22.4} \times 1.12 = 0.8gm$.

For C_2H_6

22.4L C_2H_6 has mass = 30gm

1.12L C_2H_6 has mass $= \dfrac{30}{22.4} \times 1.12 = \dfrac{3.0}{2} gm = 1.5gm$

Total mass $= 1.5gm + 0.8gm = 2.3gm$.

48. (c) Let wt. of metal oxide = 100gm

wt. of metal = 53gm

wt. of oxygen = 47gm

Equivalent weight of oxygen $= \dfrac{\text{wt. of metal}}{\text{wt. of oxygen}} \times 8$

$= \dfrac{53}{47} \times 8 = 9.02$

Valency $= \dfrac{2 \times V.D}{E + 35.5} = \dfrac{2 \times 66}{9 + 35.5} = \dfrac{132}{44.5} = 2.96 \approx 3$

$\therefore$ Atomic weight $=$ Equivalent weight $\times$ Valency

$= 9.02 \times 3 = 27.06$

49. (b) One gram of hydrogen combines with 80gm of bromine.

So, equivalent weight of bromine = 80gm

$\because$ 4gm of bromine combines with 1gm of *Ca*

$\therefore$ 80gm of bromine combines with $= \dfrac{1}{4} \times 80 = 20$.

50. (b) $\overset{+2}{Mn}SO_4 \rightarrow \overset{+4}{Mn}O_2$

Change of valency $= 4 - 2 = 2$

$\therefore$ Equivalent weight $= \dfrac{M}{2}$.

51. (a) $\underset{\substack{2ml \\ 100ml}}{2PH_3} \rightarrow \underset{\text{(solid)}}{2P} + \underset{\substack{3ml \\ 150ml}}{3H_2}$

Increase in volume $= 150ml - 100ml = 50ml$ increase.

52. (b) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

$\because$ 24g *Mg* evolves 22.4L H_2 at STP

$\therefore$ 12g *Mg* evolves H_2 at STP $\dfrac{22.4}{24} \times 12$

=11.2L at STP.

53. (b) (a) 2gm atom of nitrogen = 28gm

(b) 6×10^{23} atoms of *C* has mass $= 12gm$

3×10^{23} atoms of *C* has mass $= \dfrac{12 \times 3 \times 10^{23}}{6 \times 10^{23}} = 6gm$

(c) 1mole of *S* has mass = 32gm

(d) 7.0gm of *Ag*

So, lowest mass = 6gm of *C*.

54. (c) 1mole of any gas at STP occupies 22.4L.

55. (b) $\because$ 22400cc of gas at STP has 6×10^{23} molecules

$\therefore$ 1.12 $\times 10^{-7}$ of gas at STP has $\dfrac{6 \times 10^{23} \times 1.12 \times 10^{-7}}{22400}$

$= .03 \times 10^{14} = 3 \times 10^{12}$.

56. (a) $\because$ 2.24L of gas has mass = 4.4gm

$\therefore$ 22.4L of gas has mass $= \dfrac{4.4}{2.24} \times 22.4 = 44$

So given gas is CO_2 because CO_2 has molecular mass=44.

57. (d) 1L of air =210cc O_2

22400cc = 1 mole

$210\ cc = \dfrac{1}{22400} \times 210 = 0.0093$.

58. (d) $\because$ 22.4L of a gas at STP has no. of molecules

$= 6.023 \times 10^{23}$

$\therefore$ 8.96L of a gas at STP has no. of molecules

$= \dfrac{6.02 \times 10^{23} \times 8.96}{22.4} = 2.408 \times 10^{23} = 24.08 \times 10^{22}$.

59. (a) Given equivalent weight of metal = 9

Vapour density of metal chloride = 59.25

$\therefore$ molecular weight of metal chloride

$= 2 \times V.D = 2 \times 59.25 = 118.5$

$\therefore$ valency of metal

$= \dfrac{\text{molecular weight of metal chloride}}{\text{equivalnet weight of metal } + 35.5}$

Valency of metal $= \dfrac{118.5}{9 + 35.5} = \dfrac{118.5}{44.5} = 2.66$

Therefore atomic weight of the metal

=equivalent weight $\times$ valency

$= 9 \times 2.66 = 23.9$

60. (d) The density of gas $= \dfrac{\text{molecular wt. of metal}}{\text{volume}}$

$= \dfrac{45}{22.4} = 2\ gm\ litre^{-1}$

61. (c) Equivalent weight of bivalent metal = 37.2

$\therefore$ Atomic weight of metal $= 37.2 \times 2 = 74.4$

$\therefore$ Formula of chloride $= MCl_2$

Hence, molecular weight of chloride

$(MCl_2) = 74.4 + 2 \times 35.5 = 145.4$

62. (c) As we know that

Equivalent weight $= \dfrac{\text{weight of metal}}{\text{weight of oxygen}} \times 8$

$= \frac{32}{0.4} \times 8 = 64$

Vapour density $= \frac{\text{mol. wt}}{2}$

Mol. wt $= 2 \times V.D = 2 \times 32 = 64$

As we know that $n = \frac{\text{mol. wt}}{\text{eq. wt}} = \frac{64}{64} = 1$

Suppose, the formula of metal oxide be M_2O_n. Hence the formula of metal oxide $= M_2O$.

63. (b) Molecular weight of NH_3 is 17

According to the mole concept

$17\,gm\ \ NH_3$ has molecules $= 6.02 \times 10^{23}$

$\therefore 1\,gm\ \ NH_3$ has molecules $= \frac{6.02 \times 10^{23}}{17}$

$\therefore\ 4.25\,gm\ \ NH_3$ has molecules

$= \frac{6.02 \times 10^{23} \times 4.25}{17} = 1.5 \times 10^{23}\ molecule$

The mole concept

1. (a) $16g\ O_2$ has no. of moles $= \frac{16}{32} = \frac{1}{2}$

$14g\ N_2$ has no. of moles $= \frac{14}{28} = \frac{1}{2}$

No. of moles are same, so no. of molecules are same.

2. (b) $Na_2SO_4 \cdot 10H_2O\ = 2 \times 23 + 32 + 4 \times 16 + 10 \times 18$

$= 46 + 32 + 64 + 180 = 322gm$

$322gm\ \ Na_2SO_4.10H_2O$ contains = 224 gm oxygen

$32.2gm\ \ Na_2SO_4.10H_2O$ contains

$= \frac{32.2 \times 224}{322} = 22.4\ gm$

3. (b) Molarity $= \frac{W(gm) \times 1000}{\text{molecular wt.} \times \text{V}(ml.)}$

$= \frac{2.65 \times 1000}{106 \times 250} = 0.1M$

$10\,ml$ of this solution is diluted to $1000\,ml$ $N_1V_1 = N_2V_2$

$10 \times 0.1 = 1000 \times x$

$x = \frac{0.1 \times 10}{1000} = 0.001M$.

4. (c) According to definition of molar solution → A molar solution is one that contains one mole of a solute in one litre of the solution.

5. (a) $44g$ of CO_2 has $2 \times 6 \times 10^{23}$ atoms of oxygen

$4.4g$ *of* CO_2 has $= \frac{12 \times 10^{23}}{44} \times 4.4$

$= 1.2 \times 10^{23}$ atoms.

6. (b) $44g\ CO_2$ occupies $22.4L$ at STP

$4.4g\ CO_2$ occupies $= \frac{22.4}{44} \times 4.4 = 2.24L$.

7. (a) Density $= \frac{\text{Mass}}{\text{Volume}}$; $1 = \frac{g}{ml}$ or $g = ml$

$0.0018ml = 0.0018gm$

No. of moles $= \frac{\text{weight}}{\text{Molecularweight}} = \frac{0.0018}{18} = 1 \times 10^{-4}$

$\therefore$ No. of water molecules $= 6.023 \times 10^{23} \times 1 \times 10^{-4}$

$= 6.023 \times 10^{19}$.

8. (c) $Ca_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Ca(OH)_2$

9. (d) Amount of gold $= 19.7kg\ = 19.7 \times 1000gm = 19700gm$

No. of moles $= \frac{19700}{197} = 100$

$\therefore$ No. of atoms $= 100 \times 6.023 \times 10^{23}$

$= 6.023 \times 10^{25}$ atoms.

10. (c) $\because$ $100gm\ CaCO_3 = 6.023 \times 10^{23}$ molecules

$\therefore$ $10gm\ \ CaCO_3 = \frac{6.023 \times 10^{23}}{100} \times 10$

$= 6.023 \times 10^{22}$ molecule

1 molecule of $CaCO_3 = 50$ protons

6.023×10^{22} molecule of $CaCO_3 = 50 \times 6.023 \times 10^{22}$

$= 3.0115 \times 10^{24}$

11. (b) $16gm$ of CH_4 = 1mole $= 6.023 \times 10^{23}$ molecules.

12. (c) According to avogadro's hypothesis equal volumes of all gases under similar conditions of temperature and pressure contains equal no. of molecules.

14. (d) $d = \frac{M}{V}$ (d = density, M = mass, V = volume)

Since $d = 1$

So, $M = V$

$18gm = 18ml$

$18ml = N_A$ molecules (N_A = avogadro's no.)

$1000ml = \frac{N_A}{18} \times 1000 = 55555\ N_A$

15. (a) This is fact.

16. (a) $\because$ 3 moles of oxygen is that in 1 mole of $BaCO_3$

$\therefore$ 1.5 moles of oxygen is that in mole of $BaCO_3$

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

17. (b) The no. of molecules present in $1ml$ of gas at STP is known as Laschmidt number.

$22400ml$ of gas has total no. of molecules

$= 6.023 \times 10^{23}$

1ml of gas has total no. of molecules $= \frac{6.023\times 10^{23}}{22400}$

$= 2.69\times 10^{19}$.

18. (b) $\because$ $2gm$ of hydrogen $= 6.02\times 10^{23}$ molecules

$\therefore$ $1gm$ of hydrogen

$= \frac{6.02\times 10^{23}}{2} = 3.01\times 10^{23}$ molecule.

19. (a) Molecular weight of SO_2Cl_2

$= 32+32+2\times 35.5 = 135gm$

$\because$ 135 gm of SO_2Cl_2 = $1gm$ molecule

$\therefore$ $13.5gm$ of SO_2Cl_2 $= \frac{1}{135}\times 13.5 = 0.1$.

20. (a) (a) $34gm$ of water

$\because$ $18gm$ H_2O $= 6.023\times 10^{23}$ molecule

$\therefore$ $34gm$ H_2O $= \frac{6.023\times 10^{23}}{18}\times 34$

$= 11.37\times 10^{23}$ mole

(b) $28gm$ of CO_2

$\because$ $44gm$ $CO_2 = 6\times 10^{23}$ molecules

$\therefore$ $28gm$ CO_2 $= \frac{6\times 10^{23}}{44}\times 28 = 3.8\times 10^{23}$

(c) $46gm$ of CH_3OH

$\because$ $32gm$ $CH_3OH = 6\times 10^{23}$ molecules

$\therefore$ $46gm$ $CH_3OH = \frac{6\times 10^{23}}{32}\times 46 = 8.625\times 10^{23}$

(d) $\because$ $108gm$ of $N_2O_5 = 6\times 10^{23}$ molecules

$\therefore$ $54gm$ of $N_2O_5 = \frac{6\times 10^{23}}{108}\times 54 = 3\times 10^{23}$ molecules.

21. (b) Sodium oxide $\rightarrow Na_2O$

Molecular weight = 46 +16 = 62

$62gm$ of Na_2O = 1 mole

$620gm$ of Na_2O = 10 mole.

22. (b) $2gm$ of oxygen contains atom $= \frac{2}{16} = \frac{1}{8}$ mole

also $4g$ of sulphur $= \frac{4}{32} = \frac{1}{8}$ mole.

23. (c) Molarity = mole/litre

$\because$ $1cc$ contains $1.17gm$

$\therefore$ $1000cc$ contains $1170gm$ $\frac{1170gm}{\text{Mol.wt.}}$

$= \frac{1170}{36.5} = 32.05 mole/litre$ (Mol. wt. of HCl=36.5)

24. (a) 1 mole of sucrose contains 6.023×10^{23} molecules

$\because$ 1 molecule of sucrose has 45 atoms

$\therefore$ 6.023×10^{23} molecule of sucrose has

$45\times 6.023\times 10^{23}$ atoms/mole

25. (a) wt of $CO_2 = 44$

mol wt of $CO_2 = 44$

No. of molecule $= \frac{\text{wt.of } CO_2}{mol\ wt\ of\ CO_2}\times 6.02\times 10^{23}$

$= \frac{44}{44}\times 6.02\times 10^{23} = 6.02\times 10^{23}$

26. (c) No. of atoms in one molecule

= no. of moles $\times 6.022\times 10^{23}$

$= 1.4\times 6.022\times 10^{23} = 8.432\times 10^{23}$

27. (d) As we know that four sodium atom are present in sodium ferrocyanide $[Na_4Fe(CN)_6]$

Hence, number of Na atoms = No. of moles $\times$ number of atom $\times$ Avogadro's number

$2\times 4\times 6.023\times 10^{23} = 48\times 10^{23}$

Percentage composition & Molecular formula

1. (a) $\because$ $40gm$ $NaOH$ contains $16gm$ of oxygen

$\therefore$ $100gm$ of $NaOH$ contains $\frac{16}{40}\times 100$ =40% oxygen.

2. (a) Urea- $NH_2-CO-NH_2$

$\because$ $60gm$ of urea contains $28gm$ of nitrogen

$\therefore$ $100gm$ of urea contains $\frac{28}{60}\times 100 = 46.66$.

3. (b) Based on facts.

4. (d) $C = 24gm$, $H = 4gm$, $O = 32gm$

So, Molecular formula $= C_2H_4O_2$

So, Empirical formula $= CH_2O$

(Simplest formula).

5. (a) $\because$ 0.0835 mole of compound contains $1gm$ of hydrogen

$\therefore$ $1gm$ mole of compound contain $= \frac{1}{0.0835} = 11.97$

=$12gm$ of hydrogen.

12 gm of H_2 is present in $C_2H_{12}O_6$

6. (b) Empirical formula of an acid is CH_2O_2

$(\text{Empirical formula})_n$ = Molecular formula

n = whole no. multiple *i.e.* 1,2,3,4.............

If $n = 1$ molecular formula CH_2O_2.

7. (b) Glucose - $C_6H_{12}O_6$

Ratio of C, H and O $= 1:2:1$

In acetic acid $CH_3-\underset{\underset{O}{\|}}{C}-O-H$

Ratio of C, H and O $1:2:1$.

Chemical stoichiometry

1. (c) $N = \frac{W(gm)\times 1000}{V\times \text{Eq.wt.}}$

$1500ml$ of $0.1N$ HCl = $150ml$ (N)

$1 = \frac{W(gm)\times 1000}{150\times 40}$, W (gm) $= \frac{150\times 40}{1000} = 6gm$.

2. (c) $N_1V_1 = N_2V_2$; $\frac{1}{2}\times 200 = \frac{1}{10}\times V_2$; $V_2 = 1000ml$

Volume of water added $= 1000 - 200 = 800ml$.

3. (a) $2Ag_2CO_3 \xrightarrow{\Delta} 4Ag + 2CO_2 + O_2$

$2\times 276\,gm \qquad 4\times 108\,gm$

$\because$ $2\times 276gm$ of Ag_2CO_3 gives $4\times 108\,gm$

$\therefore$ $1gm$ of Ag_2CO_3 gives $= \frac{4\times 108}{2\times 276}$

$\therefore$ $2.76\,gm$ of Ag_2CO_3 gives

$\frac{4\times 108\times 2.76}{2\times 276} = 2.16\,gm$

4. (c)

$$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$$

$t=0 \quad 1 \quad 1 \quad 0 \quad 0$

$t=t \quad 1-4x \quad 1-5x \quad 4x \quad 6x$

Oxygen is limiting reagent

So, $X = \frac{1}{5} = 0.2$ all oxygen consumed

Left $NH_3 = 1 - 4\times 0.2 = 0.2$.

5. (c) $\because$ $100gm$ *Hb* contain = $0.33gm$ *Fe*

$\therefore$ $67200gm$ *Hb* = $\frac{67200\times 0.33}{100}\,gm\,Fe$

gm atom of *Fe* = $\frac{672\times 0.33}{56} = 4$.

6. (c) $\underset{132}{(NH_4)_2SO_4} \equiv 2NH_3 \equiv \underset{2(36.5)=73\,gm}{2HCl}$

$73\,g\,HCl \equiv 132\,g(NH_4)_2SO_4$

$292\,g\,HCl = 528\,g(NH_4)_2SO_4$

7. (c) $\underset{2(36+1+31+64)=264}{2(NH_4)_2HPO_4} \equiv \underset{62+80=142}{P_2O_5}$

% of $P_2O_5 = \frac{\text{wt. of } P_2O_5}{\text{wt of salt}}\times 100$

$= \frac{142}{264}\times 100 = 53.78\%$.

8. (b) $2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3$

According to equation $\frac{3}{2}$ mole of O_2 combines with 2 mole *Al*.

2 mole *Al* = $54gm$

9. (a) $0.5gm$ *Se* $\rightarrow 100gm$ peroxidase anhydrous enzyme

$78.4gm$ *Se* $\rightarrow \frac{100\times 78.4}{0.5} = 1.568\times 10^4$

Minimum m.w. $\rightarrow$ molecule at least contain one selenium.

10. (d) $H_2O + \underset{27\,gm}{Al} + NaOH \rightarrow NaAlO_2 + \underset{\frac{3}{2}\times 22.4=33.6\,L}{\frac{3}{2}H_2}$

11. (c) In $Fe(CNS)_3.3H_2O$

% of $H_2O = \frac{3\times 18}{284}\times 100 = 19\%$.

12. (d) $5S + 5O_2 \rightarrow 5SO_2$; $5\,O_2 \equiv 5\,SO_2$; $5\times 64 = 320gm$.

13. (d) H_3PO_4 is tribasic so $N = 3M = 3\times 1 = 3$.

14. (b) H_2SO_4 is dibasic $N = 2M = 2\times 2 = 4$.

15. (a) For Dibasic acid $E = \frac{M}{2} = \frac{200}{2} = 100$

$N = \frac{W\times 1000}{E\times V(\text{in } ml)}$

$\frac{1}{10} = \frac{W\times 1000}{100\times 100} = W = 1gm$.

16. (b) $N = \frac{10\times \text{sp. gr. of the solution}\times \text{wt.\% of solute}\times \text{Mol.wt.}}{\text{Molecular wt. of solute}\times \text{Eq. wt.}}$

$N = \frac{10\times 1.71\times 80\times 98}{98\times 49} = 27.9$

18. (c) $2KMnO_4 + 3H_2SO_4 \rightarrow$

$K_2SO_4 + 2MnSO_4 + 3H_2O + [O]$

$2FeSO_4 + H_2SO_4 + [O] \rightarrow Fe_2(SO_4)_3 + H_2O]\times 5$
[Mohr–salt]

$2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \rightarrow$

$K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$

Mohr-salt reducing agent $KMnO_4/H^+ \rightarrow$ oxidising agent

19. (d) Atomic weight = Equivalent weight × Valency

$= 8.9\times 3 = 26.7\left(\text{Valency} = \frac{26.89}{8.9} \approx 3\right)$.

20. (c) $MW = 2\times V.D. = 2\times 22 = 44$.

21. (d) $2\overset{+7}{KMnO_4} + 3H_2SO_4 \rightarrow K_2SO_4 + 2\overset{+2}{MnSO_4} + 3H_2O + 5[O]$

Change by 5

$\text{Eq. wt.} = \frac{\text{Mol.wt.}}{5}$

22. (c) Dibasic acid *NaOH;* $N_1V_1 = N_2V_2$

$\frac{W}{E}\times 1000 = \frac{1}{10}\times 25$; $\frac{0.16}{E}\times 1000 = \frac{25}{10}$

$M = 2\times E = 2\times 64 = 128$.

23. (d) *NaOH* *HCl*

$N_1V_1 = N_2V_2$; $20\times \frac{1}{10} = \frac{1}{20}\times V$; $V = 40ml.$

24. (a) $NV = N_1V_1 + N_2V_2$

$0.2\times 2 = 0.5x + 0.1(2-x)$

$0.4 = 0.5x + 0.2 - 0.1x$

$0.2 = 0.4x$

$x = \frac{1}{2}L = 0.5L$

25. (d) $NV = N_1V_1 + N_2V_2 + N_3V_3$

$N \times 1000 = 1 \times 5 + \frac{1}{2} \times 20 + \frac{1}{3} \times 30 = 5 + 10 + 10 = 25$

$N = 0.025 = \frac{N}{40}$.

26. (b) $NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)}$

$t = 0$	$20ml$	$40ml$	0
$t=t$	0	$20\,ml$	solid

Final volume = $20ml$.

27. (b) $KMnO_4$ Oxalic acid

$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$; $\frac{20 \times 0.1}{2} = \frac{M_2V_2}{5}$; $M_2V_2 = 5$.

28. (b) Acidic medium $E = \frac{M}{5} = \frac{158}{5} = 31.6gm$.

29. (c) 0.1 M $AgNO_3$ will react with 0.1 M $NaCl$ to form 0.1 M $NaNO_3$. But as the volume is doubled, conc. of $NO_3^- = \frac{0.1}{2} = 0.05\,M$

30. (a) Acid base

$N_1V_1 = N_2V_2$; $N_1 \times 30 = 0.2 \times 15$; $N_1 = 0.1N$

31. (b) (I) Phenopthalein indicate partial neutralisation of $Na_2CO_3 \rightarrow NaHCO_3$

Meq. of Na_2CO_3 + Meq. of $NaOH$ = Meq. of HCl

$\frac{W}{E} \times 1000 + \frac{W}{E} \times 1000 = NV$

(Suppose $Na_2CO_3 = a\,gm$, $NaOH = b\,gm$)

$\frac{a}{106} \times 1000 + \frac{b}{40} \times 1000 = 300 \times 0.1$ .....(1)

(II) Methyl orange indicate complete neutralisation

HCl HCl

$N_1V_1 = N_2V_2$, $25 \times 0.2 = 0.1 \times V_2$ so $V_2 = 50ml$ excess

$\therefore$ $\frac{a}{53} \times 1000 + \frac{b}{40} \times 1000 = 350 \times 0.1$ .....(2)

From (1) and (2) b =1gm.

32. (c) From solution of (31)

From equation (1)

$a = Na_2CO_3 = 0.53gm$.

33. (b) $(H_2SO_4)\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}(NaOH)$

$\frac{1 \times V_1}{1} = \frac{1 \times 10}{2}$; $V_1 = 5ml$.

34. (c) Atom in highest oxidation state can oxidize iodide to liberate I_2 which is volumetrically measured by iodometric titration using hypo.

$2I^- \rightarrow I_2$

$Pb^{+2} \rightarrow$ Lowest oxidation state can not oxidise iodide to I_2.

35. (d) $KMnO_4$ = Mohr salt

$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$; $\frac{0.1 \times 10}{1} = \frac{M_2V_2}{5}$; $M_2V_2 = 5$.

36. (d) The equivalent weight of $H_3PO_4 = \frac{\text{molecular weight}}{2}$

$\because$ mole wt of H_3PO_4 = 3 + 31 + 64 = 98

$\therefore$ $\frac{98}{2} = 49$

37. (b) $Ba(OH)_2 + CO_2 \rightarrow BaCO_3 + H_2O$

Atomic wt. of $BaCO_3$ = $137 + 12 + 16 \times 3$ = 197

No. of mole $= \frac{\text{wt. of substance}}{\text{mol wt.}}$

$\because$ 1 mole of $Ba(OH)_2$ gives 1 mole of $BaCO_3$

$\therefore$ .205 mole of $Ba(OH)_2$ will give .205 mole of $BaCO_3$

$\therefore$ wt. of 0.205 mole of $BaCO_3$ will be

$.205 \times 197 = 40.385gm \approx 40.5\,gm$

38. (d) $N_1 = 0.5N \rightarrow 10mg$ per mL

$N_2 = \frac{10 \times 10^{-3}\,gm}{40 \times 1} \times 1000$ =0.25N

$V_1 = 500ml$, $V_2 = ?$

$N_1V_1 = N_2V_2$; $0.5 \times 500 = 0.25 \times V_2$

$V_2 = 1000mL$ final volume water added = 1000 – 500 = 500mL.

39. (a) eq. of $KMnO_4$ = eq. of $Fe(C_2O_4)$

$x \times 5 = 1 \times 3$

$x = 0.6$

40. (b)

Element	At.wt.	Mole	Ratio	Empirical formula
C =86%	12	7.1	1	CH_2
H =14%	1	14	2	Beleongs to alkene C_nH_{2n}

41. (b) $AgNO_3 \equiv 2Ag^+ + \underset{(H_2S)}{S^{2-}} \rightarrow Ag_2S$

$\because$ 2 mole $\rightarrow$ 1 mole [100×1 =100 millimole]

$\therefore$ 100 miliimole $\rightarrow$ 50 millimole H_2S required

$CuSO_4 \equiv Cu^{+2} + \underset{(H_2S)}{S^{2-}} \rightarrow CuS$

$\because$ 1 mole $\rightarrow$ 1 mole [100×1=100 millimole]

$\therefore$ 100 millimole $\rightarrow$ 100 millimole H_2S required

Ratio $\frac{50}{100} = \frac{1}{2}$.

42. (c) At room temperature $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

t =0	50ml	50ml	0
t =t	50 – 2x =0	50 – x 25$gases$	2x (50)liquid

In this case H_2 is limiting reagent

x = 25ml

At 110°C $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$ $V_{gas} = 75\,ml$

t =t	0	25ml	50ml

43. (c) $\overset{+2}{CuSO_4} + 2KI \rightarrow K_2SO_4 + \overset{+2}{CuI_2}$; $2\overset{+2}{CuI_2} \rightarrow \overset{+1}{CuI_2} + I_2$

$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

Eq. wt. Of $CuSO_4.5H_2O = \text{Mol.wt.} = 250$

100 *ml* of 0.1 *N* hypo ≡ 100 *ml* of 0.1 *N* $CuSO_4.5H_2O$

$= \frac{250 \times 0.1 \times 100}{100} = 2.5\ gm$

44. (d) $HNO_3 + KOH \rightarrow KNO_3 + H_2O$

$\frac{12.6}{63} = 0.2$ mole; $HNO_3 \equiv KOH$

0.2 mole ≡ 0.2 mole

$0.2 \times 56 = 11.2 gm$.

45. (a) Isobutane and *n*-butane $[C_4H_{10}]$ have same molecular formula; $C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

For 58*gm* of C_4H_{10} 208 *gm* O_2 is required then for 5 *kg* of

C_4H_{10} $O_2 = \frac{5 \times 208}{58} = 17.9\ kg$

46. (b) $n = \frac{16.8}{22.4} = 0.75$ mole of H_2 and O_2

$\underset{2:1}{2H_2O \rightarrow 2H_2 + O_2}$ $0.75 < \begin{matrix} 0.25 \\ 0.25 \end{matrix} \begin{matrix} O_2 \\ H_2 \end{matrix}$

2 mole H_2 – 2 mole H_2O

0.5 mole H_2 – 0.5 mole H_2O = 9*gm*.

47. (a) ∵ 3*ml* (*O*) → 1*ml* O_3

30*ml* (*O*) → 10*ml* O_3

$x = \frac{150 \times 10}{100} = 15 ml$

V of O_2 + *V* of $O_3 = 135 + 10 = 145 ml$

Turpentine oil absorb ozone.

48. (a) 50% *HCl* itself means 50*gm* *HCl* react with 100*gm* sample

% Purity $= \frac{50}{100} \times 100 = 50\%$.

49. (a) $AgNO_3 + HCl \rightarrow AgCl + HNO_3$

$\frac{30}{170}$ $\frac{500 \times 0.2}{1000}$

t =0 0.176 mole 0.1 mole limiting =14.345*gm*

t =*t* 0.076 mole 0 0.1mole

50. (d) $KMnO_4$ $FeSO_4$

$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$; $M_1V_1 = \frac{n_1}{n_2}M_2V_2$

$= \frac{2}{10} \times 10 \times \frac{1}{10} = \frac{1}{5} = 0.2$

For (d), $M_1V_1 = 0.02 \times 10 = \frac{1}{5}$

51. (c) $\underset{1\text{ mol.}}{ROH} + CH_3MgI \rightarrow \underset{1\text{ mol}=22400\ cc}{CH_4} + Mg < \begin{matrix} OR \\ I \end{matrix}$

1.12 *mL* is obtained from 4.12 *mg*

∴ 22400 *mL* will be obtained from

$\frac{4.12}{1.12} \times 22400 mg = 84.2\ g$

52. (b)

Element	%(a)	At.wt.(b)	a/b	Ratio
X	50	10	5	2
Y	50	20	2.5	1

Simplest formula $= X_2Y$

53. (a) $A_3(BC_4)_2 = 3 \times 2 + [5 + (-2 \times 4)]_2 = 0$.

54. (b) $\underset{10gm}{CaCO_3} \rightarrow CaO + CO_2$

90% pure 9*gm* $= \frac{9}{100}$ mole

$CaCO_3 \equiv CO_2 = 0.09$ mole

At NTP Vol. $CO_2 = 0.09 \times 22.4 = 2.016 L$.

55. (b) $Cd^{+2} + S^{2-} \rightarrow CdS$

20×1= 20

$Cu^{+2} + S^{2-} \rightarrow CuS$

20×0.5 =10

Ratio = 2 : 1

56. (b) $Mg^{+2} \equiv H_2$

$n = \frac{12gm}{24gm} = \frac{1}{2}$ mole of H_2

57. (a) $\underset{1\text{mole}}{Mg} + \underset{0.5\text{mole}}{\frac{1}{2}O_2} \rightarrow MgO$

0.5 mole of oxygen react with 1 mole of *Mg*

1.5 mole of oxygen react with $\frac{1.5}{0.5} = 3$ mole

$24 \times 3 = 72 gm$.

58. (c) $\underset{100\ g}{CaCO_3} + \underset{2N}{2HCl} \rightarrow CaCl_2 + \underset{44\ g}{CO_2} + H_2O$

100 *g* $CaCO_3$ with 2 *N HCl* gives 44 *g* CO_2

100 *g* $CaCO_3$ with 1 *N HCl* gives 22 *g* CO_2

Critical Thinking Questions

2. (b) H_2O contains *H* and *O* in a fixed ratio by mass. It illustrates the law of constant composition.

3. (b) 100 *g* of *ZnSO*$_4$ crystals are obtained from =22.65*g Zn*

1*g* of *ZnSO*$_4$ crystals will be obtained from $= \frac{22.65}{100} g\ Zn$

20 *g* of *ZnSO*$_4$ crystals obtained from $= \frac{22.65}{100} \times 20 = 4.53\ g$

4. (a) If same volume is occupied by the gas, the no. of molecules are same, so no. of moles are same.

1 mole of N_2 gas $= 2 \times 14 = 28 gm$

1 mole of CO gas $=12+16=28gm$

5. (c) Heat capacity of water per gram $=\frac{75}{18}=4.17$

$Q = mST$

$1000=100\times 4.17\times t$

$t=\frac{1000}{100\times 4.17}=2.4\,K$.

6. (b) $\because$ 8gm sulphur is present in 100gm of substance

$\therefore$ 32gm sulphur will present $=\frac{100}{8}\times 32=400$.

7. (b) (a) 6.023×10^{23} molecules of CO_2

No. of atoms $=3\times 6.023\times 10^{21}=18.069\times 10^{21}$ atoms

(b) 22.4L of CO_2

No. of atoms $=6.023\times 10^{23}\times 3=18.069\times 10^{23}$ atoms

(c) 0.44gm of CO_2

No. of moles $=\frac{0.44}{44}=\frac{1}{100}\times 6.023\times 10^{23}$ moles

$=6.023\times 10^{21}$ moles $=3\times 6.023\times 10^{21}$ atoms

18.069×10^{21} atoms

8. (b) It is about 22.4L.

9. (a) 200mg of CO_2 $=200\times 10^{-3}=0.2gm$

44gm of CO_2 $=6\times 10^{23}$ molecules

0.2gm of CO_2 $=\frac{6\times 10^{23}}{44}\times 0.2=0.0272\times 10^{23}$

$=2.72\times 10^{21}$ molecule

Now 10^{21} molecule are removed.

So remaining molecules $=2.72\times 10^{21}-10^{21}$

$=10^{21}(2.72-1)=1.72\times 10^{21}$ molecules

Now, 6.023×10^{23} molecules = 1mole

1.72×10^{21} molecules $=\frac{1\times 1.72\times 10^{21}}{6.023\times 10^{23}}=0.285\times 10^{-2}$

$=2.85\times 10^{-3}$.

10. (d) $2K_2Cr_2O_4+2HCl\rightarrow K_2Cr_2O_7+2KCl+H_2O$

11. (a) Meq of $Mg^{+2}\equiv$ Meq of washing soda

$\frac{W}{E}\times 1000=Mg^{+2}$; $EW=\frac{24}{2}=12$

$\frac{12\times 10^{-3}}{12}\times 1000=1$.

12. (c) $\underbrace{\underset{+12/\text{twoatom}}{K_2Cr_2O_7}+4H_2SO_4\rightarrow K_2SO_4+\underset{+6/\text{twoatom}}{Cr_2(SO_4)_3}}_{\text{Change by 6}}+4H_2O+3[O]$

$$\text{Eq.wt.}=\frac{\text{Mol.wt.}}{6}$$

13. (a) $KMnO_4$ = Mohr salt

$\frac{M_1V_1}{1}=\frac{M_2V_2}{5}=\left[\frac{W}{M\times V}\times 1000\right]\times\frac{V_2}{5}$

$\left[\frac{W\times 1000}{58\times 1000}\right]\times 18=\frac{3.92\times 1000}{392\times 1000}\times\frac{20}{5}$ W=3.476gm/L.

14. (d) Volume m of HCl neutralised by $NaOH$ = (Caustic soda) = V_1

$N_1V_1=N_2V_2$; $0.1\times V_1=0.2\times 30$; $V_1=60ml$

V total (HCl) = 100ml

V_1 = 60ml

40ml

40ml 0.1N HCl is now neutralised by KOH (0.25N) $\rightarrow$

(HCl) $N_1V_1=N_2V_2$ (KOH)

$0.1\times 40=0.25\times V_2$; $V_2=16ml$.

15. (c) $BCl_3+3[H]\rightarrow B+3HCl$

$BCl_3+\frac{3}{2}H_2\rightarrow B+3HCl$; $B=\frac{21.6}{10.8}=2$ mole

$B\equiv\frac{3}{2}H_2$

1mole $\equiv\frac{3}{2}$ mole ; 2 mole – 3 mole

$V=3\times 22.4=67.2L$.

16. (c) $n=\frac{W}{M}=\frac{V}{22400}$; $\frac{W}{16}=\frac{112}{22400}$; $W=0.08gm$.

17. (a) $\%C=\frac{12}{44}\times\frac{W_{CO_2}}{W}\times 100=\frac{12}{44}\times\frac{2.63}{0.858}\times 100=83.6\%$

$\%H=\frac{2}{18}\times\frac{W_{H_2O}}{W}\times 100=\frac{2}{18}\times\frac{1.28}{.858}\times 100=16.4\%$

	%(a)	At.wt.(b)	a/b	Ratio	
C	83.6	12	6.96	1	× 3
H	16.4	1	16.4	2.3	7

$C_3H_7=12\times 3+7=43gm$.

18. (b) $\underset{+4}{SO_2}+2H_2O\rightarrow\underset{0}{S}+2H_2O_2$

$EW=\frac{M}{4}=\frac{64}{4}=16$; Twice $16\times 2=32$

Assertion & Reason

1. (e) We know that from the reaction $H_2+Cl_2\rightarrow 2HCl$ that the ratio of the volume of gaseous reactants and products is in agreement with their molar ratio. The ratio of $H_2:Cl_2:HCl$ volumes is $1:1:2$ which is the same as their molar ratio. Thus volume of gas is directly related to the number of moles. Therefore, the assertion is false but reason is true.

2. (e) We know that molecular weight of substance is calculated by adding the atomic weight of atoms present in one molecules. We also know that molecular weight of oxygen (O_2) =2x (Atomic weight of oxygen) $=2\times 16=32\,a.m.u.$ Atomic weight of oxygen is 16, because it is 16 times heavier than1/12th of carbon atom. Therefore assertion is false but reason is true.

3. (c) According to Dalton's atomic theory atoms can neither be created nor destroyed and according to berzelius hypothesis, under similar condition of temperature and pressure equal volumes of all gases contain equal no. of atom. Therefore assertion is true but reason is false.

4. (e) One mole of any substance corresponding to 6.023×10^{23} entities is respective of its weight.

Molecular weight of $SO_2 = 32+2\times16 = 64gm$.

Molecular weight of $O_2 = 16\times2 = 32gm$.

$\therefore$ Molecular weight of SO_2 is double to that of O_2.

5. (d) 1.231 has four significant figures all no. from left to right are counted, starting with the first digit that is not zero for calculating the no. of significant figure.

6. (d) Molar volume (at NTP) = 22.4L

Now 22.4L of $N_2 =$ volume occupied by one mole of $N_2 = 28gm = 6.023\times10^{23}$ molecules.

Similarly, $O_2 = 2\times16 = 32gm$,

$32gm = 6.023\times10^{23}$ molecules = 22.4L

$\therefore$ $22.4L = 6.023\times10^{23}$ or $5.6L = \dfrac{6.023\times10^{23}\times5.6}{22.4}$

$= \dfrac{1}{4}\times6.023\times10^{23}$

According to avagadro's hypothesis equal volume of all gases contain equal no. of molecules under similar condition of temperature and pressure.

7. (a) For universally accepted atomic mass unit in 1961, C-12 was selected as standard. However the new symbol used is 'u' (unified mass) in place of *amu.*

8. (c) Vapour density of $B = \dfrac{M}{2}$,

Vapour density of $A = 4\times\dfrac{M}{4} = 2M$

Molecular mass of $A = 2\times2M = 4M$.

9. (a) Pure water always contains hydrogen and oxygen in the ratio $1:8$ by mass. This is in accordance with the law of constant composition.

10. (b) The number of moles of a solute present in litre of solution is known is as molarity (M).

The total no. of molecules of reactants present in a balanced chemical equation is known as molecularity. For example,

$PCl_5 \rightarrow PCl_3 + Cl_2$ (Unimolecular)

$2HCl \rightarrow H_2 + I_2$ (Bimolecular)

$\therefore$ Molarity and molecularity are used in different sense.

11. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

12. (e) Equivalent wt. of Cu in $CuO = \dfrac{63.6}{2} = \dfrac{\text{At.wt.}}{\text{Valency}}$ =31.8

Equivalent wt. of Cu in $Cu_2O = \dfrac{63.6}{1}$ =63.6

(Valency of Cu =1).

13. (e) Mass spectrometer is the instrument used for the determination of accurate atomic mass and the relative abundance of the isotopes.

14. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

15. (a) Example of isomorphous compounds are K_2SO_3, K_2CrO_4, K_2SeO_4 (valency of S, Cr, Se = 6) and $ZnSO_4 . 7H_2O, MgSO_4 . 7H_2O, FeSO_4 . 7H_2O$ (valency of Zn, Mg, Fe =2).

16. (b) No. of atoms present in a molecules of a gaseous element is called atomicity.

For example, O_2 has two atoms and hence its atomicity is 2.

17. (a) 12gm of C-12 contain 6.023×10^{23} atom

$\therefore$ $\dfrac{12}{6.023}\times10^{-23} = 1.66\times10^{-24}$.