Atomic, Molecular and Equivalent masses

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

1 molecules has mass $= \frac{18}{6\times10^{23}} = 3 \times 10^{-23}gm$

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

26. (a) Choice (a) is P_4S_3

$\because$ $\frac{\mathbf{31\times4}}{\mathbf{(124)}}\boldsymbol{gm}P$ 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 $A = \frac{x}{40} \times$ Avogadro $\rightleftarrows$ no. $= y$ (say)

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

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

Number of atoms of $B = \frac{2x}{80} \times$ Av. no. $= \frac{2}{80} \times \frac{40y}{\text{Av. no.}} \times$ 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 $= \frac{8N_A\times4.2}{14} = 2.4N_A$

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

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

$\mathbf{1 \times 10^{22}}$ 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

∵ $\mathbf{6 \times 10^{23}}$ molecule has mass $= 32gm$

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

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

(II) 1 atom of nitrogen

∵ $\mathbf{2 \times 6 \times 10^{23}}$atoms of N_2has mass = 28*gm*

∴ 1 atom of N_2has 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) $\frac{\text{wt. of metal hydroxide}}{\text{wt. of metal oxide}} = \frac{EM+EOH^-}{EM+EO^-} = \frac{1.520}{0.995} = \frac{x+17}{x+8}$

$= \mathbf{1.520x + 1.520 \times 8 = 0.995x + 0.995 \times 17}$

$\mathbf{1.520x + 12.160 = 0.995x + 16.915}$

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

∴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 $H_3PO_3 = 3 + 31 + 48 = 82$

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

37. (b) ∵ 22400 *ml* at NTP has 6.023×10^{23}molecule

∴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 $C_{60}H_{122} = 12 \times 60 + 122 \times 1$

$= \mathbf{720 + 122 = 842}$

∵ $\mathbf{6 \times 10^{23}}$molecule $\boldsymbol{C_{60}H_{122}}$has mass = 842*gm*

∴ 1 molecule $\boldsymbol{C_{60}H_{122}}$ has mass $\frac{842}{6\times10^{23}} = 140.333 \times 10^{-23} gm =$

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

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

∵ 28*gm* C_2H_4 requires 64*gm* oxygen

∴ $\boldsymbol{2.8 \times 10^3}$ *gm* C_2H_4 requires $=\frac{\mathbf{64}}{\mathbf{28}} \times \mathbf{2.8 \times 10^3 gm} = \mathbf{6.4 \times 10^3 gm}$ = 6.4*kg*.

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

Hence, 100*cc* 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*; 18*gm* = 18*ml*

$\boldsymbol{6 \times 10^{23}}$ molecule of water has volume =18*cc*

1 molecule of water has volume $= \frac{18}{6\times10^{23}} = 3 \times 10^{-23} cm^3.$

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

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

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

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

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

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

This is present in 400*mg* of capsule

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