REVISION SHEET 2 – ANSWERS

1. d) $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

3.27g   3.30g

$n = \frac{3.27}{65.4}$ $n = \frac{3.30}{36.5}$

$n = 0.05$ $n = 0.090$ ⟶ $n_{ZnCl} = \frac{1}{2} \times n_{HCl} = \frac{1}{2} \times 0.090 = 0.045$

mass $ZnCl_2$ = n × MM
= 0.045 × 137.5
= **6.19g**

limiting Reagent = HCl

Zn : $\frac{0.05}{\text{coeff}}$ HCl : $\frac{0.090}{\text{coeff}}$

= $\frac{0.05}{1}$ = $\frac{0.090}{2}$

= 0.05   = 0.045

limiting reagent is HCl

2. (b) $N_2 + 3H_2 \longrightarrow 2NH_3$

77.3g   14.2g

$n = \frac{77.3}{28}$ $n = \frac{14.2}{2}$

$n = 2.76$ $n = 7.1$ ⟶ $n_{NH_3} = \frac{2}{3} \times 7.1 = 4.73$

m = n × MM
= 4.73 × 17
= **80.5**

limiting Reagent = H_2

N_2 : $\frac{2.76}{\text{coeff}}$ H_2 = $\frac{7.1}{\text{coeff}}$

= 2.76   = 2.4

Limiting Reagent

3. (d) $SiO_2 + 3C \longrightarrow SiC + 2CO$

but not close to this value.

100g   100g

$n = \frac{100}{53.8}$ $n = \frac{100}{12}$

$n = 1.89$ $n = 8.33$

1.89 moles of SiO_2 would react with 5.67 (1.89×3) moles of C, leaving 2.66 moles of C remaining

L.R Part SiO_2: 1.89/1   C: 8.33/3

SiO_2 is LR   : 1.89   : 2.8

(4) $n_{NiSO_4} = \frac{m}{MM} = \frac{40}{154.7} = \underline{0.259}$

$n_{NiSO_4} = C \times V$ or $V = \frac{n}{C} = \frac{0.259}{0.2}$

$= 1.293$ litres

$= 1.3$ litres

(5) $n_{FeSO_4} = C \times V = 0.90 \times 0.125 = 0.1125$ moles

$n_{FeSO_4} = \frac{m}{MM}$ or $m = n \times MM$

$= 0.1125 \times 151.85$

$= 17.1g.$

(c)

(6) $n_{NH_3} = C \times V = 0.25M \times 0.5L = 0.125$ moles

and $n_{NH_3} = C \times V$ or $V = \frac{n}{C} = \frac{0.125}{12M} = 0.0104 L$

$= 10.4 mL$

(e)

(7) (c) $Ag_2CO_3 + 2 NaOH \longrightarrow Ag_2O + Na_2CO_3 + H_2O$

~~28.5mL~~ 1.0M

0.0285L

$n = C \times V$

$n = 0.0285$

$n_{Ag_2CO_3} = \frac{2}{1} \times n$

$n_{Ag_2CO_3} = 0.057$

$m = n \times MM$

$= 0.057 \times 275.5$

$= 15.7$

(8) (c) $FeCl_{3(aq)} + 3NH_4OH \longrightarrow Fe(OH)_3 + 3NH_4Cl$

34g

$n_{FeCl_3} = \frac{m}{MM} = \frac{34}{162.2}$

$m = n \times MM = 0.63 \times 35$

$= 22.1g$

$n_{FeCl_3} = 0.21 \xrightarrow{n_{NH_4OH} = \frac{3}{1} \times n} n_{NH_4OH} = \frac{3}{1} \times 0.21 = 0.63$

(9) (b) $(NH_4)_2S + CdSO_4 \longrightarrow CdS + (NH_4)_2SO_4$

0.25L, 0.15M   0.12L, 0.053M

$n = C \times V$ $n = C \times V$

$m = n \times MM$

$= 0.0064 \times 144.41$

$= 0.92g$

$n_{(NH_4)_2S} = 0.0375$ $n_{CdSO_4} = 0.0064$ L.R. $\xrightarrow{n_{CdS} = \frac{1}{1} \times n} n_{CdS} = 0.0064$

L. Reagent = 1:1 ratio so lowest amount is L.R = $CdSO_4$ is L.R

(10) $n_{NaCl} = \frac{m}{M.M} = \frac{10.0g}{58.5} = 0.17$ moles

Conc (Molarity) $= \frac{n}{V} = \frac{0.17 \text{ moles}}{0.286 L} = 0.6M$

(d)

(11) MM (CaCOH) = Ca + C + O + H

$= 40.1 + 12 + 16 + 1$

$= 69.1$ g (or amu)

(12) $C_9H_{20} + 14O_2 \longrightarrow 9CO_2 + 10H_2O$

32g

$n = \frac{m}{MM} = \frac{32}{128}$

$n_{C_9H_{20}} = 0.25 \xrightarrow{n_{CO_2} = \frac{9}{1} \times n_{C_9H_{20}}} n_{CO_2} = 2.25$

$m = n \times MM = 2.25 \times 44 = 99g$

(13) mass of Na in r.d.a. $= \frac{100\%}{11\%} \times 270mg$

$= 2,45g$

$n_{Na} = \frac{m}{MM} = \frac{2.45}{23} = 0.107$ moles in r.d.a.

(14) (a) Least number of molecules is the same as saying the least number of moles. (as the number of molecules is $6.23 \times 10^{23} \times$ number of moles)

as $n = \frac{m}{MM}$, apply this to each, a is smallest.

(15) (a) K_2CO_3 MM = 138.2

$\% K = \frac{2 \times 39.1}{138.2} \times 100 = 56.6\%$ $\% C = \frac{12}{138.2} \times 100 = 8.7\%$ $\% O = \frac{3 \times 16}{138.2} \times 100 = 34.7\%$

✓ (= 100%)

(b) $(NH_4)_2O$ MM = 52g

$\% N = \frac{2 \times 14}{52} \times 100 = 53.8\%$ $\% H = \frac{8 \times 1}{52} \times 100 = 15.4\%$ $\% O = \frac{16}{52} \times 100 = 30.8\%$

(16) 63.68% C, 12.38% N, 14.14% O

Molar mass of compound is unknown, let = x

number of C atoms in formula, let = a
number of N atoms in formula, let = b
number of O atoms in forma, let = c
} must be whole numbers.

$\% C = \frac{a \times 12}{x} \times 100$ $\quad \% N = \frac{b \times 14}{x} \times 100$ $\quad \% O = \frac{c \times O}{x} \times 100$

$63.68 = \frac{12a}{x} \times 100$ $\quad 12.38 = \frac{14b}{x} \times 100$

$0.6368 = \frac{12a}{x}$ $\quad 0.1238 = \frac{14b}{x}$

$\frac{0.6368 \times x}{12} = a$ $\quad \frac{0.1238 \times x}{14} = b$

$0.053 \times x = a$ $\quad 0.0088 \times x = b$ $\quad 0.0088 \times x = c$

OR $\quad x = \frac{a}{0.053}$ $\quad x = \frac{b}{0.0088}$ $\quad x = \frac{c}{0.0088}$

3 formulas for the molar mass, but each has a different variable (a, b, c). Lets assume $b = c = 1$, as these formulas (for B & C are the same)

$x = \frac{1}{0.0088} = 113.6\,g$

$\therefore$ for a, $113.6 = \frac{a}{0.053}$

$113.6 \times 0.053 = a$

$6.0 = a$

$\therefore$ $C_6N_1O_1$ or C_6NO

(17) 3 key changes

- Volume changes
- Amount (volume and moles) of water has increased
- Ratio of NaCl to water has decreased

1 key "stay the same"

- amount/moles of NaCl remains the same.

(18)

- The "same molarity" means they have the same ratio of moles of solute to litres of solvent (moles/L)
- (identical) The two solutions ~~#~~ have the same ratio (same relative amounts) of solute to solvent, measured in moles per litre (molarity)
- (different) They have different amounts of solute and solvent, the 400mL sample has twice the solute and twice the solvent of the 200mL sample.

(19)

(a) $C = \frac{n}{V} = \frac{1.457}{1.5} = \underline{\underline{0.97\,M}}$

(b) $n = \frac{m}{MM} = \frac{0.515}{98} = 0.0053$ $\quad C = \frac{n}{V} = \frac{0.0053}{1.0} = \underline{\underline{0.0053\,M}}$

(c) $n = \frac{m}{MM} = \frac{20.54}{213} = 0.097$ $\quad C = \frac{n}{V} = \frac{0.097}{1.575} = \underline{\underline{0.061\,M}}$

(d) $n = \frac{m}{MM} = \frac{2760}{249.55} = 11.06$ $\quad C = \frac{n}{V} = \frac{11.06}{1.45} = \underline{\underline{7.63\,M}}$

(e) $C = \frac{n}{V} = \frac{0.005653}{0.010} = \underline{\underline{0.5653\,M}}$

(f) $n = \frac{m}{MM} = \frac{8.89\times10^{-3}}{75} = 1.19\times10^{-4}$ $\quad C = \frac{n}{V} = \frac{1.19\times10^{-4}}{0.00105} = \underline{\underline{0.113\,M}}$