

Higher Chemistry Calculations for the Prelim



1.
$$n(\text{Ag}_2\text{O}) = \frac{m}{\text{GFM}}$$

$$= \frac{46.36}{231.8}$$

$$= \underline{0.2 \text{ mol}}$$

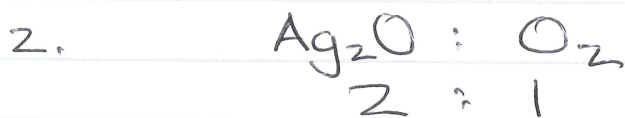
$$m = 46.36 \text{ g}$$

$$\text{GFM} = 231.8 \text{ g}$$

$$\text{Ag}_2\text{O}$$

$$\left\{ \begin{array}{l} 1 \times 16 = 16 \\ 2 \times 107.9 = 215.8 \end{array} \right.$$

$$\underline{231.8}$$



so $0.2 : x \quad x = \underline{0.1 \text{ mol}}$

3.
$$AV = n \times MV$$

$$= 0.1 \times 24$$

$$= \underline{2.4 \text{ l}} \text{ of } \text{O}_2$$



1.
$$n(\text{Zn}) = \frac{m}{\text{GFM}}$$

$$= \frac{6.54}{65.4}$$

$$= \underline{0.1 \text{ mol}}$$

$$m = 6.54 \text{ g}$$

$$\text{GFM} = 65.4 \text{ g}$$



so $0.1 : x \quad x = 0.1 \text{ mol of } \text{H}_2$

3.
$$AV = n \times MV$$

$$= 0.1 \times 24$$

$$= \underline{2.4 \text{ l}} \text{ of } \text{H}_2$$

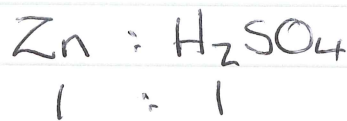


$$\begin{aligned} n(\text{Zn}) &= \frac{m}{\text{GFM}} \\ &= \frac{6.54}{65.4} \\ &= \underline{0.1 \text{ mol}} \end{aligned}$$

$$\begin{aligned} m &= 6.54 \text{ g} \\ \text{GFM} &= 65.4 \text{ g} \end{aligned}$$

$$\begin{aligned} n(\text{H}_2\text{SO}_4) &= CV \\ &= 2 \times 0.025 \\ &= \underline{0.05 \text{ mol}} \end{aligned}$$

$$\begin{aligned} C &= 2 \text{ mol l}^{-1} \\ V &= \frac{25}{1000} = 0.025 \text{ l} \end{aligned}$$

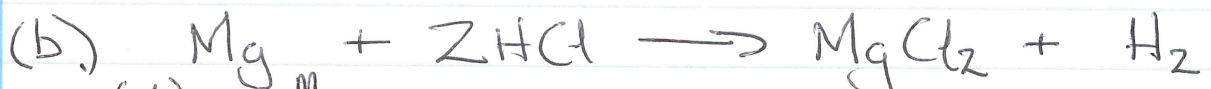


$$\begin{aligned} \text{so } x &: 0.05 \\ x &= 0.05 \end{aligned}$$

\therefore We need 0.05 mol of Zn

We have 0.1 mol of Zn

So Zn is in excess and H_2SO_4 is the limiting reactant.



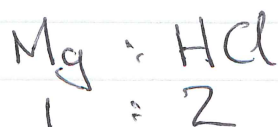
$$\begin{aligned} n(\text{Mg}) &= \frac{m}{\text{GFM}} \\ &= \frac{2.43}{24.3} \end{aligned}$$

$$\begin{aligned} m &= 2.43 \text{ g} \\ \text{GFM} &= 24.3 \text{ g} \end{aligned}$$

$$= \underline{0.1 \text{ mol}}$$

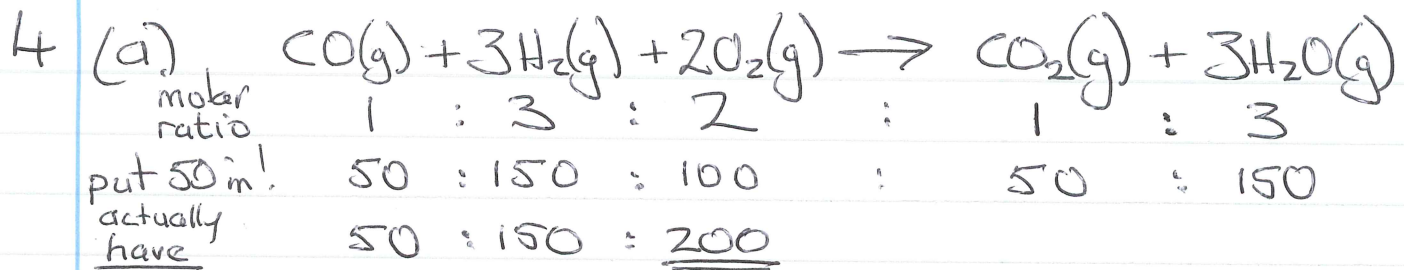
$$\begin{aligned} n(\text{HCl}) &= CV \\ &= 1 \times 0.1 \\ &= \underline{0.1 \text{ mol}} \end{aligned}$$

$$\begin{aligned} C &= 1 \text{ mol l}^{-1} \\ V &= \frac{100}{1000} = 0.1 \text{ l} \end{aligned}$$



$$\text{so } 0.1 : x \quad x = \underline{0.2} \text{ of HCl}$$

\therefore We need 0.2 mol of HCl but only have 0.1 mol.
So HCl is the limiting reactant and Mg is in excess.



So oxygen is in excess with 100 cm^3 remaining

(b) Total final volume =

50 cm ³	CO ₂
150 cm ³	H ₂ O
100 cm ³	excess O ₂
<u>300 cm³</u>	

(c) At room temperature, water would be a liquid so the gas syringe would read only 150 cm³.



Theoretical yield

1. $n(\text{C}_3\text{H}_6) = \frac{m}{\text{GFM}}$

$$= \frac{5.2}{42}$$

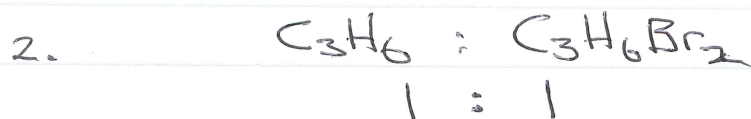
$$= \underline{0.124 \text{ mol}}$$

$m = 5.2\text{ g}$

$\text{GFM} = 42\text{ g}$

C_3H_6

6 × 1 = 6
3 × 12 = 36
<u>42</u>



so 0.124 : x x = 0.124 mol

3. $m(\text{C}_3\text{H}_6\text{Br}_2) = n \times \text{GFM}$

$$= 0.124 \times 201.8$$

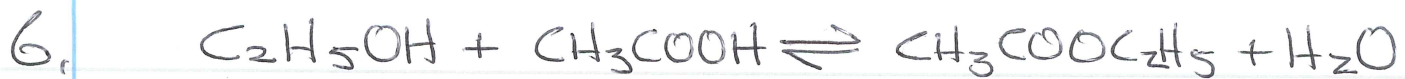
$$= \underline{25.02 \text{ g}}$$

$\text{C}_3\text{H}_6\text{Br}_2$

2 × 79.9 = 159.8
6 × 1 = 6
3 × 12 = 36
<u>201.8</u>

$$\% = \frac{20.4}{25.02} \times 100$$

$$= \underline{\underline{81.52\%}}$$



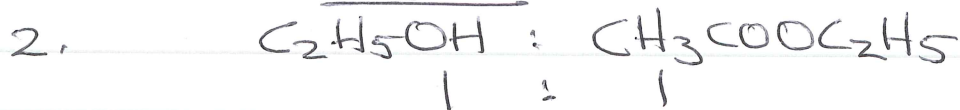
Theoretical

1. $n(C_2H_5OH) = \frac{m}{GFM}$

$= \frac{4.6}{46}$

$= 0.1 \text{ mol}$

$m = 4.6 \text{ g}$
 $GFM = 46 \text{ g}$



so $0.1 : x \quad x = \underline{0.1 \text{ mol}}$

3 $m(CH_3COOC_2H_5) = n \times GFM$

$= 0.1 \times 88$

$= \underline{8.8 \text{ g}}$

Actual = $\frac{\%}{100} \times \text{Theoretical}$

$= \frac{81}{100} \times 8.8$

$= \underline{7.13 \text{ g}}$

7. (a) $E = cm\Delta T$

$= 4.18 \times 0.05 \times 15$

$= 3.135 \text{ kJ}$

$m = \frac{50}{1000} = 0.05 \text{ kg}$

0.24g of ethanol $\rightarrow 3.135 \text{ kJ}$

so $46 \text{ g (GFM)} \rightarrow x$

$0.24x = 46 \times 3.135$

$x = \underline{-600.88 \text{ kJ mol}^{-1}}$

↑
 Insert negative sign since reaction is exothermic. We know this because the water temperature increased.

$$\begin{aligned}
 7. (b) \quad E &= cm\Delta T \\
 &= 4.18 \times 0.1 \times 23.6 \\
 &= \underline{9.8648 \text{ kJ}}
 \end{aligned}$$

$$\begin{aligned}
 m &= \frac{100}{1000} \\
 &= 0.1 \text{ kg.}
 \end{aligned}$$

So $0.18 \text{ g of propanol} \rightarrow 9.8648 \text{ kJ}$
 $60 \text{ g (GFM)} \rightarrow x$

$$\begin{aligned}
 0.18x &= 60 \times 9.8648 \\
 x &= \underline{\underline{-3288.3 \text{ kJ mol}^{-1}}}
 \end{aligned}$$

8. (a) Atom economy = 100% (only one product)

(b) Total mass of reactants

$$\begin{array}{l}
 \text{Fe}_2\text{O}_3 \\
 \begin{array}{l}
 \text{L } 3 \times 16 = 48 \\
 \text{L } 2 \times 55.8 = 111.6 \\
 \hline
 159.6 \text{ g}
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 \text{CO} \\
 \begin{array}{l}
 \text{L } 1 \times 16 = 16 \\
 \text{L } 1 \times 12 = 12 \\
 \hline
 28 \\
 \times 3 \\
 \hline
 84 \text{ g}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 159.6 \\
 + 84 \\
 \hline
 \underline{\underline{243.6 \text{ g}}}
 \end{array}$$

Mass of $2 \times \text{Fe} = 111.6 \text{ g.}$

$$\text{Atom Economy} = \frac{111.6}{243.6} \times 100 = \underline{\underline{45.8\%}}$$

(c) Mass of reactants

$$\begin{aligned}
 1 \times \text{CaCO}_3 &= 100.1 \text{ g} \\
 \text{Mass of CaO} &= 56.1 \text{ g}
 \end{aligned}$$

$$\text{Atom Economy} = \frac{56.1}{100.1} \times 100 = \underline{\underline{56.04\%}}$$