

EXPERIMENT NO. 6

- 2 You will now investigate a different hydrated salt with the formula $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$, where **M** is a Group 2 metal. By heating a sample of $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$ to produce anhydrous MSO_4 you will determine its relative formula mass and hence identify **M**.

FB 4 is the hydrated salt $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$.

(a) Method

- Weigh the crucible with its lid. Record the mass.
- Place between 1.80 g and 2.20 g of **FB 4** in the crucible.
- Reweigh the crucible, its lid and contents and record the mass.
- Without the lid, place the crucible on the pipe-clay triangle and heat gently for approximately 1 minute and then strongly for approximately 4 minutes.
- Place the lid on the crucible and leave it to cool.
- Reweigh the crucible, its lid and contents and record the mass.
- Calculate, and record, the mass of **FB 4**, the mass of residue after heating and the mass of water lost.

mass of crucible + lid /g	42.06
mass of crucible + lid + FB4/g	44.06
mass of crucible + lid + FB4 after heating/g	43.07
mass of FB4 used/g	2.00
mass of residue /g	1.01
mass of water lost/g	0.99

[4]

(b) Calculations

- (i) Calculate the number of moles of water lost when your sample of $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$ was heated.

$$n = \frac{m}{M_r}$$

$$= \frac{0.99}{18}$$

moles of water = 0.0550 mol [1]

- (ii) Write the equation for the reaction that occurs when $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$ is heated. Include state symbols.



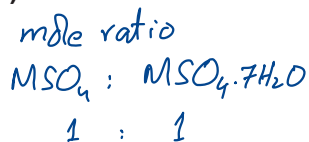
Deduce the number of moles of anhydrous salt, MSO_4 , left after the heating.

mole ratio

$$\begin{array}{l} \text{MSO}_4 : \text{H}_2\text{O} \\ 1 : 7 \\ x : 0.0500 \end{array}$$

moles of MSO_4 = 7.857×10^{-3} mol [1]

(iii) Calculate the relative formula mass, M_r , of $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$.



$$M_r = \frac{m}{n} = \frac{2.00}{7.857 \times 10^{-3}}$$

$$M_r \text{ of } \text{MSO}_4 \cdot 7\text{H}_2\text{O} = \dots 254.6 \dots [1]$$

(iv) Determine the relative atomic mass, A_r , of **M** and hence identify **M**.
Show your working.

$$\begin{aligned} A_r \text{ of } \text{M} &= M_r \text{ of } \text{MSO}_4 \cdot 7\text{H}_2\text{O} - M_r \text{ of } \text{SO}_4 \cdot 7\text{H}_2\text{O} \\ &= 254.6 - 222.1 \\ &= 32.5 \end{aligned}$$

$$A_r = \dots 32.5 \dots$$

$$\text{M is } \dots \text{Ca} \dots [2]$$

(c) (i) In the method used above, the lid was placed on the crucible when the crucible was left to cool.

Explain why the lid was placed on the crucible.

To avoid water/moisture being picked from air. [1]

(ii) Suggest and explain the effect on the calculated value of the relative atomic mass of **M** if the lid had not been placed on the crucible during cooling.

Higher A_r . Less mass of water lost so less moles of water so higher M_r . [1]

[Total: 11]