

**Question 1-** Many ionic crystals contain water molecules. These salts are called hydrated crystals.

Most hydrated crystals such as Cobalt chloride can be dehydrated by thermo decomposition



Using the following information and steps, determine the water of crystallisation of  $\text{CoCl}_2$  (find  $x$ )

Experimental results

Mass of hydrated crystals before it was heated = 4.29 g

Mass after heated (dehydrated) = 2.34 g

- Determine the amount of anhydrous  $\text{CoCl}_2$

Molar mass of  $\text{CoCl}_2$  is  $58.9 + 35.5 \times 2 = 129.9 \text{ gmol}^{-1}$

Amount of  $\text{CoCl}_2$  is  $2.34 \text{ g} \div 129.9 \text{ gmol}^{-1} = 0.018014 \text{ mol}$

- Determine the amount of water loss

Mass of hydrated – Mass of anhydrous = Mass of water loss =  $4.29 - 2.34 = 1.95 \text{ g}$

Molar mass of  $\text{H}_2\text{O}$  is  $18 \text{ gmol}^{-1}$

Amount of  $\text{H}_2\text{O}$  is  $1.95 \text{ g} \div 18 \text{ gmol}^{-1} = 0.108333 \text{ mol}$

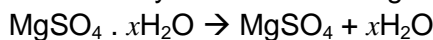
- Determine the molar ratio

The molar ratio between  $\text{CoCl}_2 : \text{H}_2\text{O}$  is  $0.018014 : 0.108333 = \frac{0.018014}{0.018014} : \frac{0.10833}{0.018014} = 1 : 6$

Therefore the formula for hydrated cobalt chloride is  $\text{CoCl}_2 \cdot 6 \text{ H}_2\text{O}$

### Question Two

Using the steps above, determine the water of crystallisation of Magnesium sulphate



Experimental results

Mass of hydrated crystals before it was heated = 1.40 g

Mass after heated (dehydrated) = 0.68 g

- Determine the amount of anhydrous  $\text{MgSO}_4$

Molar mass of  $\text{MgSO}_4$  is  $24.3 + 32 + 16 \times 4 = 120.3 \text{ gmol}^{-1}$

Amount of  $\text{MgSO}_4$  is  $0.68 \text{ g} \div 120.3 \text{ gmol}^{-1} = 0.005653 \text{ mol}$

- Determine the amount of water loss

Mass of hydrated – Mass of anhydrous = Mass of water loss =  $1.40 - 0.68 = 0.72 \text{ g}$

Molar mass of  $\text{H}_2\text{O}$  is  $18 \text{ gmol}^{-1}$

Amount of  $\text{H}_2\text{O}$  is  $0.72 \text{ g} \div 18 \text{ gmol}^{-1} = 0.04 \text{ mol}$

- Determine the molar ratio

The molar ratio between  $\text{MgSO}_4 : \text{H}_2\text{O}$  is  $0.005653 : 0.04 = \frac{0.005653}{0.005653} : \frac{0.04}{0.005653} = 1 : 7$

Therefore the formula for hydrated cobalt chloride is  $\text{MgSO}_4 \cdot 7 \text{ H}_2\text{O}$