

A Level Chemistry B (Salters)
H433/01 Fundamentals of chemistry

Question Set 26

- 1 (a) Magnesium sulfate, MgSO_4 , has a variety of uses in agriculture and in medicine. It exists in the solid state as a hydrated salt, $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$. In order to find the value of x in the formula, a student follows the procedure below.

A known mass of magnesium sulfate crystals is dissolved in water. Aqueous sodium carbonate is added to precipitate magnesium carbonate, MgCO_3 .

Describe how the student would use the results of the experiment to find a value for x .

Suggest possible sources of inaccuracy and how they might be overcome.

[6]

- (b) The student looks up the enthalpy change of solution for anhydrous magnesium sulfate and finds it is $-84.00 \text{ kJ mol}^{-1}$.

The student measures the enthalpy change of solution of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ by adding it to water and measuring the temperature change.

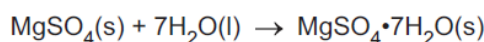
The student's results are shown in the table.

Solute	Mass of solute dissolved/g	Mass of solution/g	Initial temperature of water/ $^{\circ}\text{C}$	Final temperature of water/ $^{\circ}\text{C}$
$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}(\text{s})$	9.7	50.0	18.0	15.0

Calculate $\Delta_{\text{sol}}H$ for $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in kJ mol^{-1} .

Assume the specific heat capacity of the solution is the same as that of water.

Use your answer, with the $\Delta_{\text{sol}}H$ for the anhydrous salt and draw an appropriate cycle to find a value for Δ_rH for the reaction shown below.

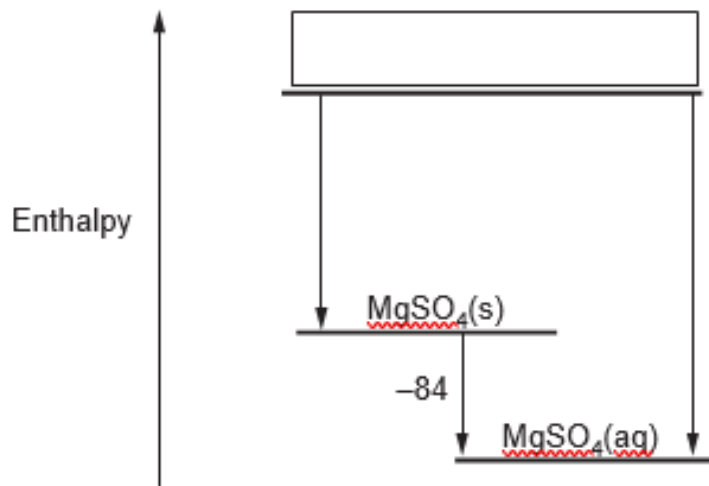


$$\Delta_rH = \dots\dots\dots \text{ kJ mol}^{-1} \quad [4]$$

- (c) $\Delta_{\text{hyd}}H$ values for the ions in magnesium sulfate are given in the table below.

Ion	$\Delta_{\text{hyd}}H/\text{kJ mol}^{-1}$
Mg^{2+}	-1922
SO_4^{2-}	-1099

Fill in the missing species in the box and use the diagram to calculate $\Delta_{\text{LE}}H$ for magnesium sulfate.



$\Delta_{LE}H = \dots\dots\dots \text{kJ mol}^{-1}$

[2]

(d) Strontium sulfate is much less soluble than magnesium sulfate.

Use ideas of hydration enthalpy to suggest an explanation.

[2]

Total Marks for Question Set 26: 14

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