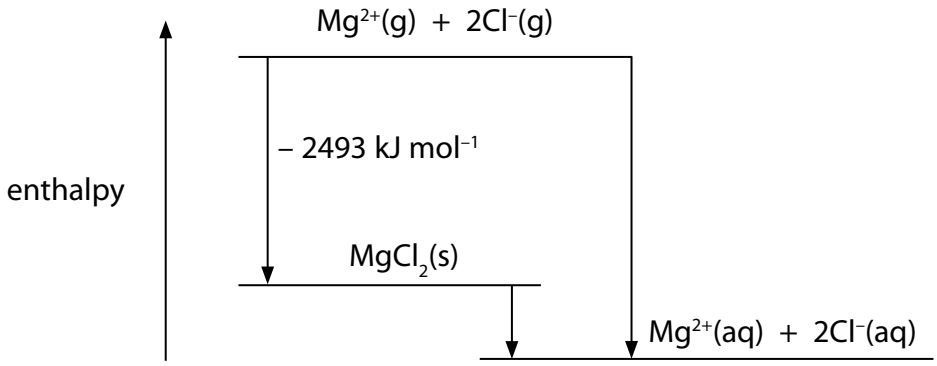
10 This question is about some Group 2 compounds.

(a) Explain the trend in the thermal stability of carbonates in Group 2.

(3)

(b) Magnesium chloride is soluble in water. The enthalpy level diagram for the dissolving of magnesium chloride is



The enthalpy changes of hydration of the ions are:

Mg^{2+} $-1920\ kJ\ mol^{-1}$

Cl^- $-364\ kJ\ mol^{-1}$

Calculate the enthalpy change of solution, $\Delta H_{solution}$, of $MgCl_2(s)$ in $kJ\ mol^{-1}$.

(2)

(c) The table shows some data relating to the dissolving of magnesium sulfate, $MgSO_4$, in water at 298 K.

$\Delta H^{\ominus}_{solution}$ / kJ mol^{-1}	$\Delta S^{\ominus}_{system}$ / J K^{-1} mol^{-1}
–87	–210

(i) Explain why the dissolving of magnesium sulfate in water is exothermic by considering the enthalpy changes involved.

(2)

(ii) Use the data in the table to calculate $\Delta G^{\ominus}$ when magnesium sulfate dissolves in water at 298 K. State the significance of your answer.

(2)

*(d) The table shows some data relating to the dissolving of barium sulfate and calcium sulfate in water at 298 K.

Salt	$\Delta H^{\ominus}_{solution}$ / kJ mol^{-1}	$T\Delta S^{\ominus}_{system}$ / kJ mol^{-1}
$BaSO_4$	+19	–31
$CaSO_4$	– 18	–43

Comment on the relative solubility in water of barium sulfate and calcium sulfate at 298 K, using data from the table.

(6)

(Total for Question 10 = 15 marks)

TOTAL FOR PAPER = 90 MARKS