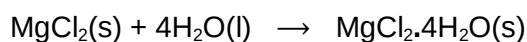


Name of the Student: _____

Max. Marks : 14 Marks

Time : 14 Minutes

Q1.

Anhydrous magnesium chloride, MgCl_2 , can absorb water to form the hydrated salt $\text{MgCl}_2 \cdot 4\text{H}_2\text{O}$ 

- (a) Suggest **one** reason why the enthalpy change for this reaction cannot be determined directly by calorimetry.

(1)

- (b) Some enthalpies of solution are shown in Table 1.

Table 1

Salt	Enthalpy of solution / kJ mol^{-1}
$\text{MgCl}_2(\text{s})$	-155
$\text{MgCl}_2 \cdot 4\text{H}_2\text{O}(\text{s})$	-39

Calculate the enthalpy change for the absorption of water by $\text{MgCl}_2(\text{s})$ to form $\text{MgCl}_2 \cdot 4\text{H}_2\text{O}(\text{s})$.Enthalpy change _____ kJ mol^{-1}

(2)

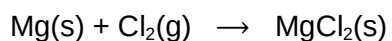
- (c) Describe how you would carry out an experiment to determine the enthalpy of solution of anhydrous magnesium chloride.

You should use about 0.8 g of anhydrous magnesium chloride.

Explain how your results could be used to calculate the enthalpy of solution.

(6)

- (d) Anhydrous magnesium chloride can be formed by direct reaction between its elements.



The free-energy change, ΔG , for this reaction varies with temperature as shown in **Table 2**.

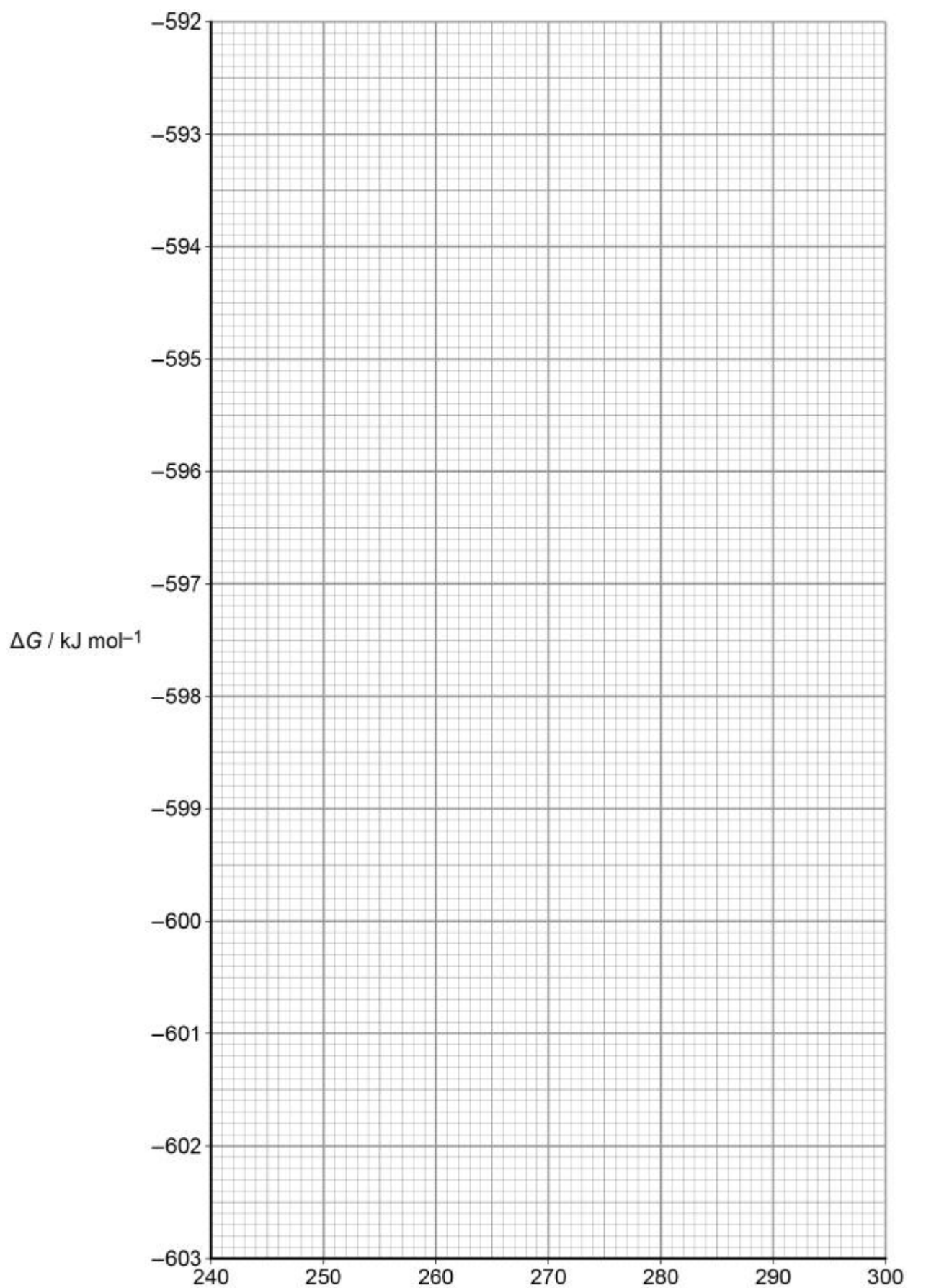
Table 2

T / K	$\Delta G / \text{kJ mol}^{-1}$
298	-592.5
288	-594.2
273	-596.7
260	-598.8
240	-602.2

Use these data to plot a graph of free-energy change against temperature on the grid below.

Calculate the gradient of the line on your graph and hence calculate the entropy change, ΔS , in $\text{J K}^{-1} \text{mol}^{-1}$, for the formation of anhydrous magnesium chloride from its elements.

Show your working.



ΔS _____ $\text{J K}^{-1} \text{mol}^{-1}$

(5)

(Total 14 marks)