Question number	Answer	Additional guidance	Marks
10(a)	An explanation that makes reference to the following points: • they get more stable down the group (1) • because the size of the cations increases/charge density of cations decreases (1) • and so carbonate ions are less polarised (1)		**3**
10(b)	• rearrangement of equation (1) • calculation of $\Delta H_{solution}$ (1)	Example of calculation $- 2493 + \Delta H_{solution} = -1920 + (-2 \times 364)$ $\Delta H_{solution} = -155$ (kJ mol^{-1}) Correct sign must be given in final answer Correct answer and sign with no working scores 2 marks	**2**
10(c)(i)	An explanation that makes reference to the following points: • breaking the lattice is endothermic and the hydration of ions is exothermic (1) • (therefore the dissolving of magnesium sulphate is exothermic) because the enthalpy of hydration (of the ions) is greater in magnitude than the lattice energy (of MgSO$_4$) (1)		**2**
10(c)(ii)	• $\Delta G^{\ominus} = - 87 - (298 \times -0.210)$ $= -24(.42)$ (kJ mol^{-1}) (1) • since ΔG is negative the process/reaction is spontaneous/feasible (1)		**2**

Question number	Answer	Additional guidance	Marks
*10(d)	This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content. 	Number of indicative marking points seen in answer	Number of marks awarded for indicative marking points
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6	4
5–4	3
3–2	2
1	1
0	0		Guidance on how the mark scheme should be applied: The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points that is partially structured with some linkages and lines of reasoning scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning). If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).	6

Question number	Answer	Additional guidance	Marks
*10(d) cont.	The following table shows how the marks should be		

	Number of marks awarded for structure of answer and sustained line of reasoning
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout.	2
Answer is partially structured with some linkages and lines of reasoning.	1
Answer has no linkages between points and is unstructured.	0

awarded for structure and lines of reasoning.

Indicative content

($\Delta G^{\ominus}_{solution} = \Delta H^{\ominus}_{solution} - T\Delta S^{\ominus}_{system}$)

- for $BaSO_4$: $\Delta H^{\ominus}_{solution}$ and $-T\Delta S^{\ominus}_{system}$ are both positive (1)

- for $CaSO_4$: $\Delta H^{\ominus}_{solution}$ is negative and $-T\Delta S^{\ominus}_{system}$ is positive (1)

- but the magnitude of $-T\Delta S^{\ominus}_{system}$ is greater than that of $\Delta H^{\ominus}_{solution}$ (1)

- therefore $\Delta G^{\ominus}_{solution}$ for both salts is positive (1)

- when $\Delta G^{\ominus}_{solution}$ is positive the salt is only slightly soluble (1)

- $BaSO_4$ is less soluble than $CaSO_4$ because $\Delta G^{\ominus}_{solution}$ is more positive (1)

(Total for Question 10 = 15 marks)