Question			Answer	Marks	Guidance
19	(a)		$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ ✓ Effervescence **AND** solid dissolves ✓	2	State symbols are required **ALLOW** solid disappears
	(b)		Lattice enthalpy of $MgCl_2$ is more exothermic than $CaCl_2$ … ✓ because magnesium ion/Mg^{2+} is smaller (than calcium ions/Ca^{2+}) **OR** Mg^{2+} has a greater charge density … ✓ … therefore the attraction between Mg^{2+} and Cl^- is greater (than between Ca^{2+} and Cl^-) ✓	3	**ORA** throughout **ALLOW** 'charge density' here **only** **ALLOW** magnesium/Mg is smaller **DO NOT ALLOW** Mg^{2+} has a smaller **atomic** radius **DO NOT ALLOW** chlorine ions **DO NOT ALLOW** Mg has greater attraction **ALLOW** 'attracts with more force' for greater attraction but **DO NOT ALLOW** 'greater force' (could be repulsion)
	(c)	(i)	**F** **B** **G** **E** **D** **FIVE** correct ✓✓✓ **FOUR** correct ✓✓ **THREE** correct ✓	3	**ALLOW** 1450 736 **G** 76 –642 **IF** only one or two correct, award 0 marks.
		(ii)	–642 – (+76 + (2 × 150) + 736 + 1450 + (2 × –349)) ✓ –642 – 1864 = – 2506 ✓ (kJ mol^{-1})	2	**ALLOW** for 1 mark: –2705 (2 x 150 and 2 x 349 not used for Cl) –2356 (2 x 150 not used for Cl) –2855 (2 x 349 not used for Cl) +2506 (wrong sign) **DO NOT ALLOW** any other answers

Question	Answer	Marks	Guidance
(d)*	*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** Describes and explains concisely the trend in reactivity of the halogens **AND** Full observations of redox reactions backed up by at least two equations *There is a well-developed explanation which is clear and logically structured. The observations and equations are relevant to those trends explained.* *Clear and confident knowledge of relevant technical language.* **Level 2 (3–4 marks)** Describes and explains the trend in reactivity of the halogens **AND** Is able to recall a redox reaction by suitable observations and correctly link to an equation *There is an explanation with some structure. The observations and equations are in the most-part relevant to the trend explained.* *Sound grasp of relevant technical language.* **Level 1 (1–2 marks)** Describes the trend in reactivity of the halogens with some attempt at explanation **AND** Is able to recall a redox reaction either by suitable observation or by equation	6	**Indicative scientific points may include:** **Trend in reactivity** • More shells or increasing radius down the group • Increased shielding down the group • More difficult to gain an electron **Observations** • Reaction of Cl_2 or Br_2 with I^-: orange/brown solution **OR** purple in organic • Reaction of Cl_2 with Br^-: yellow solution **OR** orange in organic **Reaction equations** • $Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ • $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ **OR** $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$ • Order of reactivity linked to observations

Question			Answer	Marks	Guidance
			The information about the trend is basic and communicated in an unstructured way. The information is supported by only observation or equation and the relationship to the trend may not be clear. *Basic grasp of relevant technical language* **0 marks** No response or no response worthy of credit.		
			Total	**16**	