

Q	Part	Sub Part	Marking Guidance	Mark	Comments
1	(a)		$\text{CaF}_2(\text{s}) \rightarrow \text{Ca}^{2+}(\text{g}) + 2\text{F}^{-}(\text{g})$	1	
1	(b)	(i)	Enthalpy change for formation of 1 mol of substance	1	Allow <u>heat energy change</u> , NOT energy
			From its elements	1	
			Reactants and products/all substances in their standard states	1	Or normal states at 298 K, 1 bar (100 kPa)
1	(b)	(ii)	$\text{Ca}(\text{s}) + \text{F}_2(\text{g}) \rightarrow \text{CaF}_2(\text{s})$	1	
1	(b)	(iii)	$\Delta H_f(\text{CaF}_2) = \Delta H_a(\text{Ca}) + 1\text{st IE}(\text{Ca}) + 2^{\text{nd}} \text{IE}(\text{Ca}) + \text{BE}(\text{F}_2) + 2\text{xEA}(\text{F}) - \Delta H_L(\text{CaF}_2)$ $= 193 + 590 + 1150 + 158 + (2 \times -348) - 2602$ $= -1207 \text{ kJ mol}^{-1}$	1 1 1	Or labelled diagram Correct answer scores 3 -842 scores 2 (transfer error) -859 scores 1 only (using one E.A.) Units not required, wrong units lose 1 mark
1	(c)		Electrostatic attraction stronger/ionic bonding stronger/attraction between ions stronger/more energy to separate ions	1	Molecular attraction /atoms/intermolecular forces CE=0
			Because fluoride (ion) smaller than chloride	1	Do not allow F or fluorine
1	(d)	(i)	$\Delta H = \Delta H_L + \Sigma \Delta H_{\text{hyd}} = 2237 - 1650 + (2 \times -364)$ $= -141 \text{ kJ mol}^{-1}$	1 1	Can be on cycle/diagram Correct answer scores 2 Units not required, wrong units lose 1 mark

1	(d)	(ii)	Decreases Reaction exothermic/ ΔH -ve (Equilibrium)shifts to left/backwards (as temperature rises)/ equilibrium opposes the change	1 1 1	If ans to (d)(i) positive allow increases If (d)(i) +ve allow endothermic/ ΔH +ve If (d) (i) +ve allow shifts to right/forwards / equilibrium opposes the change If no answer to (d) (i) assume –ve ΔH used If effect deduced incorrectly from any ΔH CE=0 for these 3 marks
1	(e)		u.v. absorbed: electrons/they move to higher energy (levels)/ electrons excited visible light given out: electrons/they fall back down/move to lower energy (levels)	1 1	Must refer to absorbing u.v. NOT visible light or this must be implied.