Question	Marking Guidance	Mark	Comments
1(a)	(Enthalpy change to) break the bond in 1 mol of chlorine (molecules)	1	Allow (enthalpy change to) convert 1 mol of chlorine molecules into atoms Do not allow energy or heat instead of enthalpy, allow heat energy
	To form (2 mol of) gaseous chlorine atoms / free radicals	1	Can score 2 marks for 'Enthalpy change for the reaction': $Cl_2(g) \rightarrow 2Cl(g)$ Equation alone gains M2 only Can only score M2 if 1 mol of chorine molecules used in M1 (otherwise it would be confused with atomisation enthalpy) Any mention of ions, CE = 0
1(b)	(For atomisation) only 1 mol of chlorine atoms, not 2 mol (as in bond enthalpy) is formed / equation showing ½ mol Chlorine giving 1 mol of atoms	1	Allow breaking of one bond gives two atoms Allow the idea that atomisation involves formation of 1 mol of atoms not 2 mol Allow the idea that atomisation of chlorine involves half the amount of molecules of chlorine as does dissociation Any mention of ions, CE = 0
1(c)(i)	$\frac{1}{2}F_2(g) + \frac{1}{2}Cl_2(g) \rightarrow ClF(g)$	1	

1(c)(ii)	$\Delta H = \frac{1}{2}E(F–F) + \frac{1}{2}E(Cl-Cl) – E(Cl-F)$	1	Allow correct cycle
	$E(Cl-F) = \frac{1}{2}E(F–F) + \frac{1}{2}E(Cl-Cl) - \Delta H$		
	$= 79 + 121 – (–56)$		
	$= 256\,(kJ\,mol^{-1})$	1	-256 scores zero
			Ignore units even if wrong
1(c)(iii)	$\frac{1}{2}Cl_2 + 3/2F_2 \rightarrow ClF_3$	1	If equation is doubled CE=0 unless correcr answer gained by /2 at end
			This would score M1
	$\Delta H = \frac{1}{2}E(Cl-Cl) + 3/2E(F–F) - 3E(Cl-F)$		
	$= 121 + 237 – 768$ / (or 3 x value from (c)(ii))	1	This also scores M1 (note = 358 – 768)
	$= –410\,(kJ\,mol^{-1})$	1	If given value of 223 used ans = –311
			Allow 1/3 for +410 and +311
1(c)(iv)	(Bond enthalpy of) <u>Cl-F</u> bond in ClF is different from that in ClF$_3$	1	Allow <u>Cl-F</u> bond (enthalpy) is different in different compounds (QoL)
1(d)	NaCl is ionic / not covalent	1	