Q1. (a) (i) Draw a fully-labelled Born–Haber cycle for the formation of solid barium chloride, $BaCl_2$, from its elements. Include state symbols for all species involved.

(ii) Use your Born–Haber cycle and the standard enthalpy data given below to calculate a value for the electron affinity of chlorine.

Enthalpy of atomisation of barium	+180 kJ mol^{-1}
Enthalpy of atomisation of chlorine	+122 kJ mol^{-1}
Enthalpy of formation of barium chloride	–859 kJ mol^{-1}
First ionisation enthalpy of barium	+503 kJ mol^{-1}
Second ionisation enthalpy of barium	+965 kJ mol^{-1}
Lattice formation enthalpy of barium chloride	–2056 kJ mol^{-1}

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(9)

(b) Use data from part (a)(ii) and the entropy data given below to calculate the lowest temperature at which the following reaction becomes feasible.

$BaCl_2(s) \rightarrow Ba(s) + Cl_2(g)$

	$BaCl_2(s)$	Ba(s)	$Cl_2(g)$
$S^{\ominus}$ / J K^{-1} mol^{-1}	124	63	223

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(4)
(Total 13 marks)

Q2. Which one of the following has the most covalent character?

A MgF_2

B $MgBr_2$

C AlF_3

D $AlBr_3$

(Total 1 mark)

Q3. Which one of the following has the most covalent character?

A MgF_2

B $MgBr_2$

C AlF_3

D $AlBr_3$

(Total 1 mark)