Section A

Answer **all** questions in the spaces provided.

1 This question is about magnesium oxide. Use data from the table below, where appropriate, to answer the following questions.

	$\Delta H^{\ominus}$/ kJ mol^{-1}
First electron affinity of oxygen (formation of $O^-(g)$ from $O(g)$)	–142
Second electron affinity of oxygen (formation of $O^{2-}(g)$ from $O^-(g)$)	+844
Atomisation enthalpy of oxygen	+248

1 (a) Define the term *enthalpy of lattice dissociation.*

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(3 marks)

1 (b) In terms of the forces acting on particles, suggest **one** reason why the first electron affinity of oxygen is an exothermic process.

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(1 mark)

(Extra space) ....

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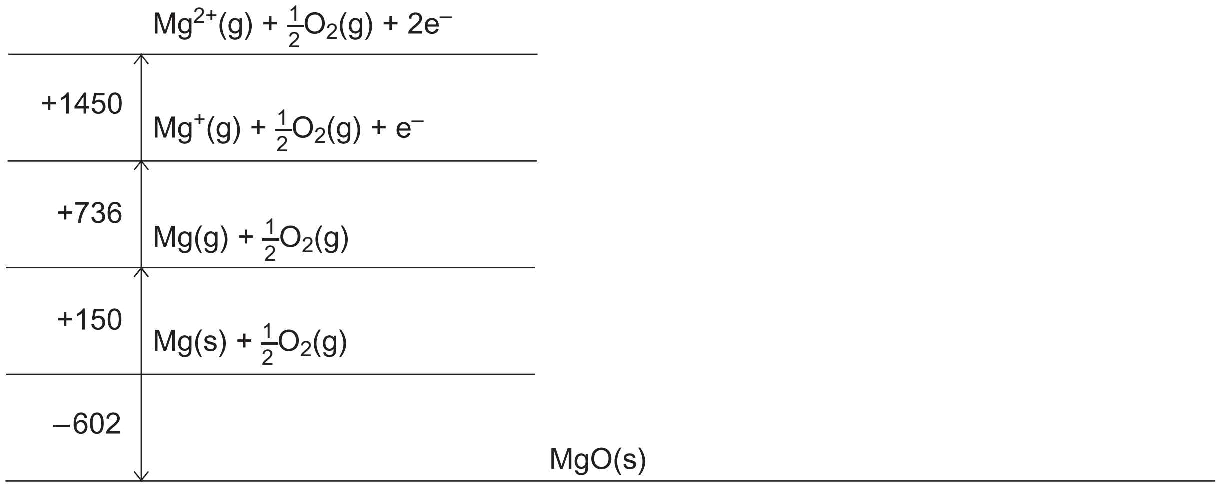
1 (c) Complete the Born–Haber cycle for magnesium oxide by drawing the missing energy levels, symbols and arrows.
The standard enthalpy change values are given in kJ mol^{-1}.



(4 marks)

1 (d) Use your Born–Haber cycle from part **(c)** to calculate a value for the enthalpy of lattice dissociation for magnesium oxide.

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(2 marks)

Question 1 continues on the next page

Turn over ▶

1 (e) The standard free-energy change for the formation of magnesium oxide from magnesium and oxygen, $\Delta G_f^\ominus = -570$ kJ mol^{-1}.
Suggest **one** reason why a sample of magnesium appears to be stable in air at room temperature, despite this negative value for $\Delta G_f^\ominus$.

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(1 mark)

(Extra space) ....

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1 (f) Use the value of $\Delta G_f^\ominus$ given in part **(e)** and the value of $\Delta H_f^\ominus$ from part **(c)** to calculate a value for the entropy change $\Delta S^\ominus$ when one mole of magnesium oxide is formed from magnesium and oxygen at 298 K. Give the units of $\Delta S^\ominus$.

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(3 marks)

(Extra space) ....

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1 (g) In terms of the reactants and products and their physical states, account for the sign of the entropy change that you calculated in part **(f)**.

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(2 marks)

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