

F325 Module 2: HW9

1

This question is about oxides and chlorides.

- (a) Complete the following table about some of the enthalpy changes needed to determine the lattice enthalpy of calcium oxide.

Include the state symbols in equations for any process.

enthalpy change	process
enthalpy change of formation of calcium oxide	$\text{Ca(s)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CaO(s)}$
second ionisation energy of calcium	
	$\frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{O(g)}$
	$\text{O}^-\text{(g)} + \text{e}^- \rightarrow \text{O}^{2-}\text{(g)}$
enthalpy change of atomisation of calcium	

[4]

2

- (a) Complete the following table which shows some of the enthalpy changes needed to calculate the lattice enthalpy of barium oxide.

name of enthalpy change	process
.....	$\text{Ba(s)} \rightarrow \text{Ba(g)}$
first ionisation energy of barium
.....	$\text{O}^-\text{(g)} + \text{e}^- \rightarrow \text{O}^{2-}\text{(g)}$
enthalpy change of formation of barium oxide

[4]

- (b) Suggest why the lattice enthalpy of an ionic solid cannot be measured directly.

.....
 [1]

Use the following enthalpy data to answer the question.

	$\Delta H^\ominus/\text{kJ mol}^{-1}$
$\text{Mg(s)} \longrightarrow \text{Mg(g)}$	+ 150
$\text{Mg(g)} \longrightarrow \text{Mg}^+(\text{g}) + \text{e}^-$	+ 736
$\text{Mg}^+(\text{g}) \longrightarrow \text{Mg}^{2+}(\text{g}) + \text{e}^-$	+ 1450
$\frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{O}(\text{g})$	+ 248
$\text{O}(\text{g}) + \text{e}^- \longrightarrow \text{O}^-(\text{g})$	- 142
$\text{O}^-(\text{g}) + \text{e}^- \longrightarrow \text{O}^{2-}(\text{g})$	+ 844
$\text{Mg(s)} + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{MgO(s)}$	- 602

- (a) Define the term *standard enthalpy of formation*.

.....

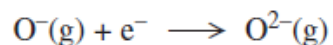
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(3 marks)

- (b) Suggest why the enthalpy change for the process represented by the equation below is endothermic.

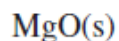
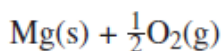
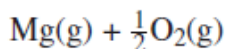
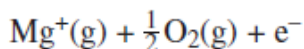
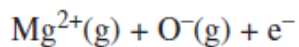
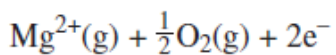
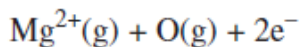
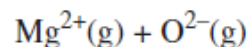


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(1 mark)

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- (c) Use the data from the table and the incomplete Born–Haber cycle below to calculate the standard enthalpy of lattice formation for magnesium oxide.



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(3 marks)

- (d) The enthalpies of lattice formation for calcium oxide and for barium oxide are $-3513 \text{ kJ mol}^{-1}$ and $-3152 \text{ kJ mol}^{-1}$ respectively. Suggest why the lattice enthalpy for CaO is more negative than that for BaO

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(2 marks)