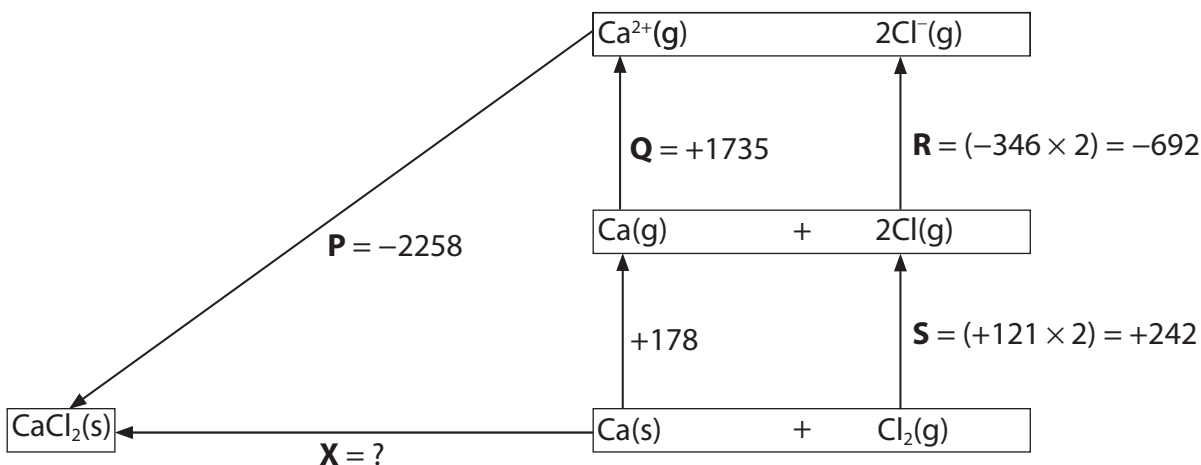


1 What is the equation for the first electron affinity of sulfur?

- A $S(s) + e^- \rightarrow S^-(g)$
- B $S(g) + e^- \rightarrow S^-(g)$
- C $S(s) \rightarrow S^+(g) + e^-$
- D $S(g) \rightarrow S^+(g) + e^-$

(Total for Question = 1 mark)

2 The diagram shows a Born-Haber cycle for calcium chloride. It is not drawn to scale.
All units are in kJ mol^{-1} .



(a) Which enthalpy change is correctly labelled on the diagram?

(1)

- A Enthalpy change for the formation of calcium chloride (**P**).
- B First ionization energy of calcium (**Q**).
- C Electron affinity of chlorine (**R**).
- D Twice the enthalpy change of atomization of chlorine (**S**).

(b) What is the value of **X**, in kJ mol^{-1} ?

(1)

- A** +795
- B** -795
- C** +3721
- D** -3721

(Total for Question = 2 marks)

3 Which of the following data is **not** needed to calculate the lattice energy of sodium chloride when using a Born-Haber cycle?

- A Enthalpy change of formation of sodium chloride.
- B Enthalpy change of atomization of sodium.
- C First ionization energy of chlorine.
- D Electron affinity of chlorine.

(Total for Question = 1 mark)

4 The lattice energy of magnesium oxide is more negative than the lattice energy of magnesium fluoride because

- A oxide ions are larger than fluoride ions.
- B oxide ions are larger than magnesium ions.
- C oxide ions are more highly charged than fluoride ions.
- D there is only one oxide ion but two fluoride ions per magnesium ion.


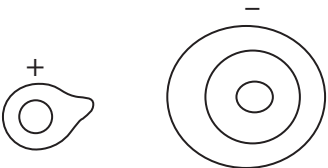
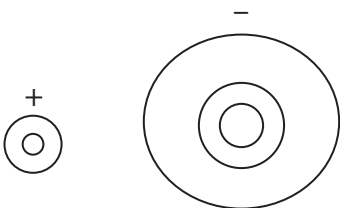
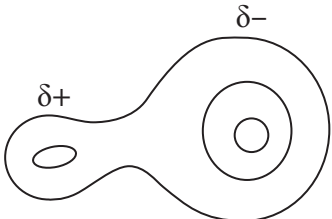
(Total for Question = 1 mark)

5 Which of the following quantities, used in the calculation of the lattice energy of lithium oxide, Li_2O , has a negative value?

- A The enthalpy change of atomization of lithium.
- B The first ionization energy of lithium.
- C The first electron affinity of oxygen.
- D The second electron affinity of oxygen.

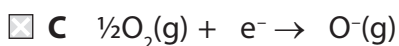
(Total for Question = 1 mark)

6 Which of the diagrams below best represents the shapes of the electron contours in sodium fluoride?

- A 
- B 
- C 
- D 

(Total for Question = 1 mark)

7 Which of the equations below represents the first electron affinity for oxygen?



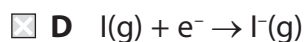
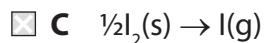
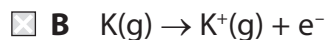
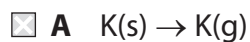
(Total for Question = 1 mark)

8 Which of the following oxides would be expected to have the most exothermic lattice energy?



(Total for Question = 1 mark)

9 In the Born-Haber cycle for potassium iodide, which of the following steps is **exothermic**?



(Total for Question = 1 mark)

10 Magnesium chloride, MgCl_2 , has two lattice energy values quoted in the data booklet. The first is the experimental value, obtained from the Born-Haber cycle, 2526 kJ mol^{-1} ; the second is the theoretical value, 2326 kJ mol^{-1} . Why are the two values different?

- A The cation polarizes the anion leading to some covalent bonding.
- B The anion polarizes the cation leading to some covalent bonding.
- C Magnesium chloride is a covalent substance.
- D The results from the Born-Haber cycle are too inaccurate to be reliable.

(Total for Question 1 mark)

11 Which of the following represents the process occurring when the enthalpy change of atomization of bromine is measured?

- A $\frac{1}{2}\text{Br}_2(\text{l}) \rightarrow \text{Br}(\text{g})$
- B $\frac{1}{2}\text{Br}_2(\text{g}) \rightarrow \text{Br}(\text{g})$
- C $\text{Br}_2(\text{l}) \rightarrow \text{Br}^+(\text{g}) + \text{Br}(\text{g})$
- D $\text{Br}_2(\text{g}) \rightarrow \text{Br}^+(\text{g}) + \text{Br}(\text{g})$

(Total for Question 1 mark)

12 The standard enthalpy changes of formation of some sulfur species are:

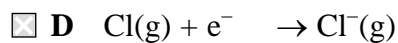
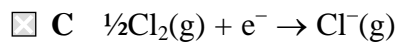
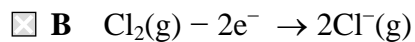
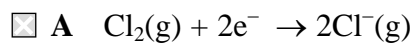
Species	$\Delta H_f^\ominus / \text{kJ mol}^{-1}$
$\text{S}_8(\text{s})$	0
$\text{S}_8(\text{g})$	+103
$\text{S}(\text{g})$	+279

The enthalpy of atomization of sulfur is (in kJ mol^{-1})

- A 103
- B 279
- C 279
- D $(103 \div 8) + 279$

(Total for Question 1 mark)

13 Which of these equations represents the electron affinity of chlorine?



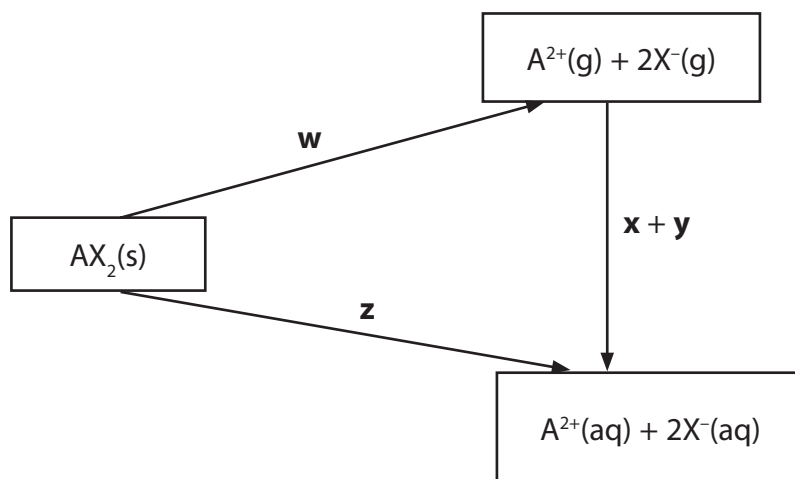
(Total for Question = 1 mark)

14 Which of these ions has the greatest ability to polarize an anion?



(Total for Question = 1 mark)

- 15 The following cycle represents the enthalpy changes **w**, **x**, **y** and **z**, occurring when an ionic solute, $AX_2(s)$, dissolves in water.



Which of the changes is the lattice energy of $AX_2(s)$?

- A $\frac{1}{2} w$
- B $-w$
- C **z**
- D $z - x - y$

(Total for Question = 1 mark)

- 16 The enthalpy change of atomization of iodine is the value of ΔH for the process

- A $I_2(s) \rightarrow I_2(g)$
- B $I_2(s) \rightarrow 2I(g)$
- C $I_2(g) \rightarrow 2I(g)$
- D $\frac{1}{2}I_2(s) \rightarrow I(g)$

(Total for Question 1 mark)

17 The ionic radii in nm of some ions are given below.

Li ⁺	0.074	F	0.133
Ca ²⁺	0.100	Cl	0.180
		O ²⁻	0.140
		S ²⁻	0.185

(a) Which of the following compounds has the most exothermic lattice energy? They all have the same crystal structure.

(1)

- A LiF
- B LiCl
- C CaO
- D CaS

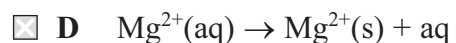
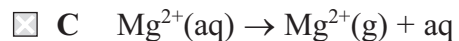
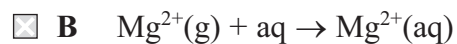
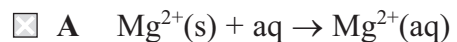
(b) Which of the following compounds will show the greatest difference between the experimental (Born-Haber) lattice energy and that calculated from a purely ionic model?

(1)

- A LiF
- B Li₂O
- C CaO
- D CaS

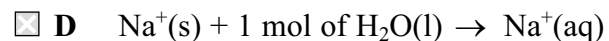
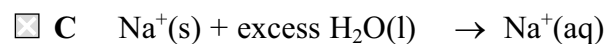
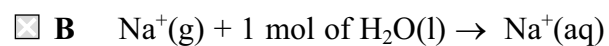
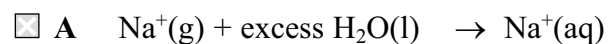
(Total for Question 2 marks)

18 The equation for the enthalpy of hydration for a magnesium ion is



(Total for Question 1 mark)

19 Which reaction has an enthalpy change equal to the enthalpy of hydration of the sodium ion?



(Total for Question 1 mark)