Name of the Student:_____
Max. Marks : 28 Marks **Time : 28 Minutes**

Q1.

Some thermodynamic data for fluorine and chlorine are shown in the table.
In the table, X represents the halogen F or Cl.

	Fluorine	**Chlorine**
Electronegativity	4.0	3.0
Electron affinity / kJ mol^{-1}	–348	–364
Enthalpy of atomisation / kJ mol^{-1}	+79	+121
Enthalpy of hydration of $X^-(g)$ / kJ mol^{-1}	–506	–364

(a) Explain the meaning of the term *electron affinity*.

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(2)

(b) Explain why the electronegativity of fluorine is greater than the electronegativity of chlorine.

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(2)

(c) Explain why the hydration enthalpy of the fluoride ion is more negative than the hydration enthalpy of the chloride ion.

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(2)

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(d) The enthalpy of solution for silver fluoride in water is –20 kJ mol^{-1}.

The hydration enthalpy for silver ions is –464 kJ mol^{-1}.

(i) Use these data and data from the table to calculate a value for the lattice enthalpy of dissociation of silver fluoride.

(3)

(ii) Suggest why the entropy change for dissolving silver fluoride in water has a positive value.

(1)

(iii) Explain why the dissolving of silver fluoride in water is always a spontaneous process.

(2)

(Total 12 marks)

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Q2.

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

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

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(3)

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

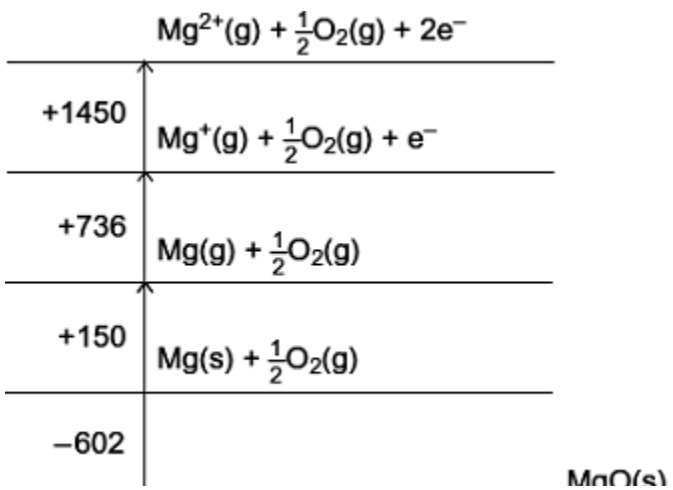
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(1)

(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}.

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(4)

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

(2)

(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 $\Delta G_f^{\ominus}$.

(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 $\Delta S^{\ominus}$.

(3)

(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)

(Total 16 marks)

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