Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Q1.

(a) Define the term **electron affinity** for chlorine.

_____

_____

_____

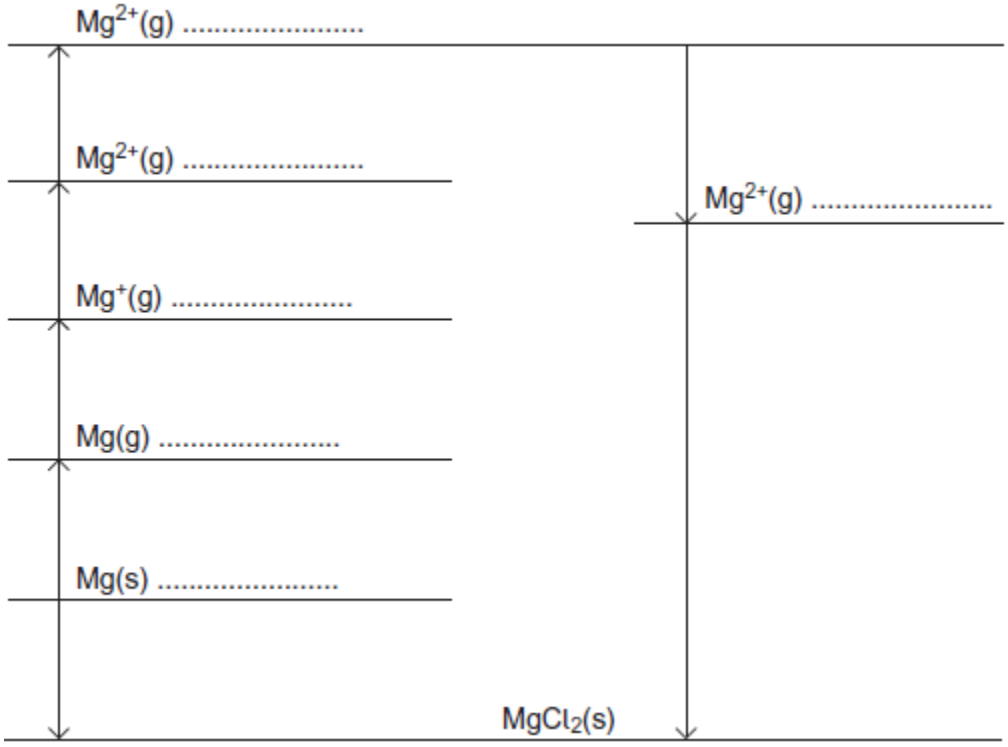
_____

_____

(2)

(b) Complete this Born−Haber cycle for magnesium chloride by giving the missing species on the dotted lines. Include state symbols where appropriate.

The energy levels are **not** drawn to scale.



(6)

(c) **Table 1** contains some enthalpy data.

Table 1

Downloaded from www.merit-minds.com

	Enthalpy change / kJ mol^{-1}
Enthalpy of atomisation of magnesium	+150
Enthalpy of atomisation of chlorine	+121
First ionisation energy of magnesium	+736
Second ionisation energy of magnesium	+1450
Enthalpy of formation of magnesium chloride	−642
Lattice enthalpy of formation of magnesium chloride	−2493

Use your Born−Haber cycle from part (b) and data from **Table 1** to calculate a value for the electron affinity of chlorine.

(3)

(d) **Table 2** contains some more enthalpy data.

Table 2

	Enthalpy change / kJ mol^{-1}
Enthalpy of hydration of Mg^{2+} ions	−1920
Enthalpy of hydration of Na^{+} ions	−406
Enthalpy of hydration of Cl^{-} ions	−364

(i) Explain why there is a difference between the hydration enthalpies of the magnesium and sodium ions.

Downloaded from www.merit-minds.com

(2)

(ii) Use data from **Table 1** and **Table 2** to calculate a value for the enthalpy change when one mole of magnesium chloride dissolves in water.

_____

_____

_____

_____

_____

(2)

(Total 15 marks)

Downloaded from www.merit-minds.com

Q2.

(a) Write an equation for the process that has an enthalpy change equal to the electron affinity of chlorine.

_____

(1)

(b) In terms of electrostatic forces, suggest why the electron affinity of fluorine has a negative value.

_____

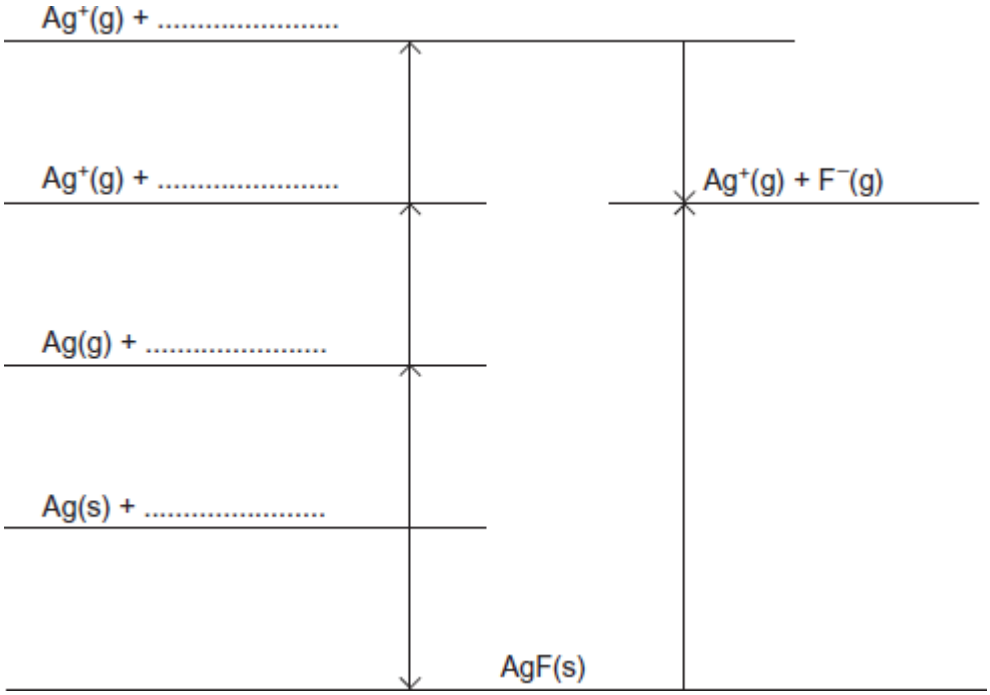
_____

_____

_____

(2)

(c) (i) Complete the Born–Haber cycle for silver fluoride by adding the missing species on the dotted lines.



(3)

(ii) Use the cycle in part (i) and the data in the table to calculate a value, in kJ mol^{-1}, for the bond enthalpy of the fluorine–fluorine bond.

Enthalpy change	**Value / kJ mol^{-1}**
Enthalpy of atomisation for silver	+289
First ionisation energy for silver	+732
Electron affinity for fluorine	–348
Experimental enthalpy of lattice dissociation for silver fluoride	+955

Downloaded from www.merit-minds.com

Enthalpy of formation for silver fluoride	–203

(2)

(d) A theoretical value for enthalpy of lattice dissociation can be calculated using a perfect ionic model.

The theoretical enthalpy of lattice dissociation for silver fluoride is +870 kJ mol^{-1}.

(i) Explain why the theoretical enthalpy of lattice dissociation for silver fluoride is different from the experimental value that can be calculated using a Born–Haber cycle.

(2)

(ii) The theoretical enthalpy of lattice dissociation for silver chloride is +770 kJ mol^{-1}.

Explain why this value is less than the value for silver fluoride.

(2)

(Total 12 marks)

Downloaded from www.merit-minds.com