Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Thermodynamics

Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Q1.

The table below gives some values of standard enthalpy changes. Use these values to answer the questions.

Name of enthalpy change	$\Delta H^{\ominus}$ /kJ mol^{-1}
Enthalpy of atomisation of chlorine	+121
Electron affinity of chlorine	–364
Enthalpy of atomisation of silver	+289
First ionisation enthalpy of silver	+732
Enthalpy of formation of silver chloride	–127

(a) Calculate the bond enthalpy of a Cl–Cl bond.

_____

(1)

(b) Explain why the bond enthalpy of a Cl–Cl bond is greater than that of a Br–Br bond.

_____

_____

_____

_____

(2)

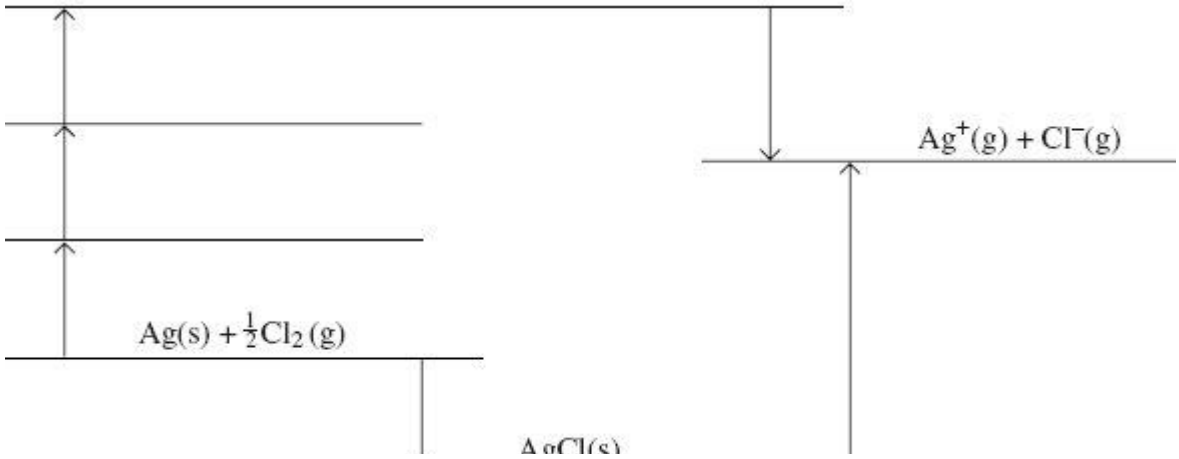
(c) Suggest why the electron affinity of chlorine is an exothermic change.

_____

_____

(1)

(d) The diagram below is an incomplete Born–Haber cycle for the formation of silver chloride. The diagram is not to scale.



(i) Complete the diagram by writing the appropriate chemical symbols, with state symbols, on each of the three blank lines.

(3)

(ii) Calculate a value for the enthalpy of lattice dissociation for silver chloride.

_____

_____

_____

_____

(2)

(e) The enthalpy of lattice dissociation for silver chloride can also be calculated theoretically assuming a perfect ionic model.

(i) Explain the meaning of the term *perfect ionic model*.

_____

_____

(1)

(ii) State whether you would expect the value of the theoretical enthalpy of lattice dissociation for silver chloride to be greater than, equal to or less than that for silver bromide. Explain your answer.

Theoretical lattice enthalpy for silver chloride _____

Explanation _____

_____

_____

(3)

(iii) Suggest why your answer to part (d) (ii) is greater than the theoretical value for the enthalpy of lattice dissociation for silver chloride.

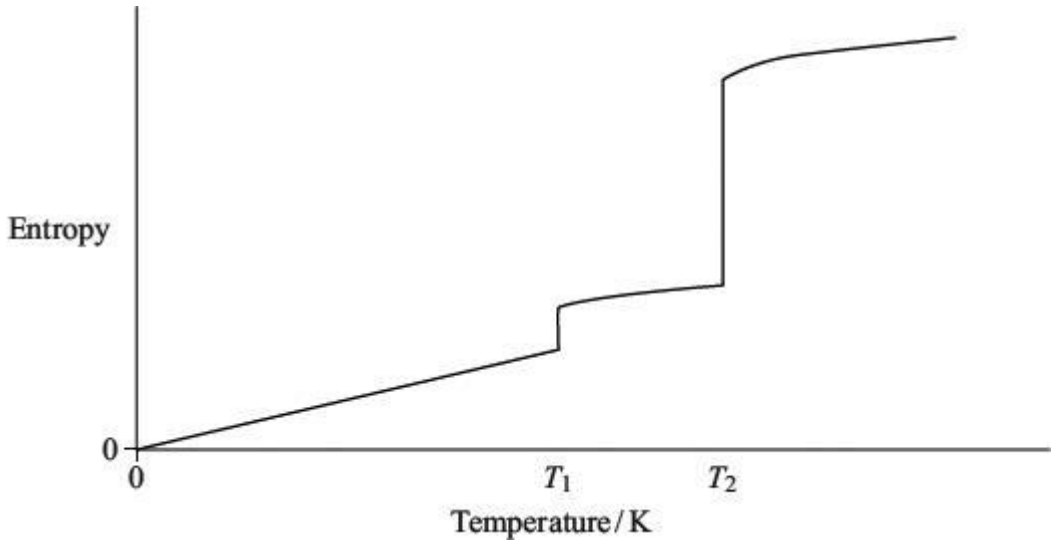
_____

_____

(2)
(Total 15 marks)

Q2.

The sketch graph below shows how the entropy of a sample of water varies with temperature.



(a) Suggest why the entropy of water is zero at 0 K.

_____

(1)

(b) What change of state occurs at temperature T_1?

_____

(1)

(c) Explain why the entropy change, ΔS, at temperature T_2 is much larger than that at temperature T_1.

_____

_____

_____

(2)

(d) It requires 3.49 kJ of heat energy to convert 1.53 g of liquid water into steam at 373 K and 100 kPa.

(i) Use these data to calculate the enthalpy change, ΔH, when 1.00 mol of liquid water forms 1.00 mol of steam at 373 K and 100 kPa.

_____

_____

_____

_____

(ii) Write an expression showing the relationship between free-energy change, ΔG, enthalpy change, ΔH, and entropy change, ΔS.

_____

(iii) For the conversion of liquid water into steam at 373 K and 100 kPa, $\Delta G = 0$ kJ mol^{-1}

Calculate the value of ΔS for the conversion of one mole of water into steam under these conditions. State the units.

(If you have been unable to complete part (d)(i) you should assume that $\Delta H = 45.0$ kJ mol^{-1}. This is not the correct answer.)

Calculation _____

_____

_____

Units _____

(6)

(Total 10 marks)