

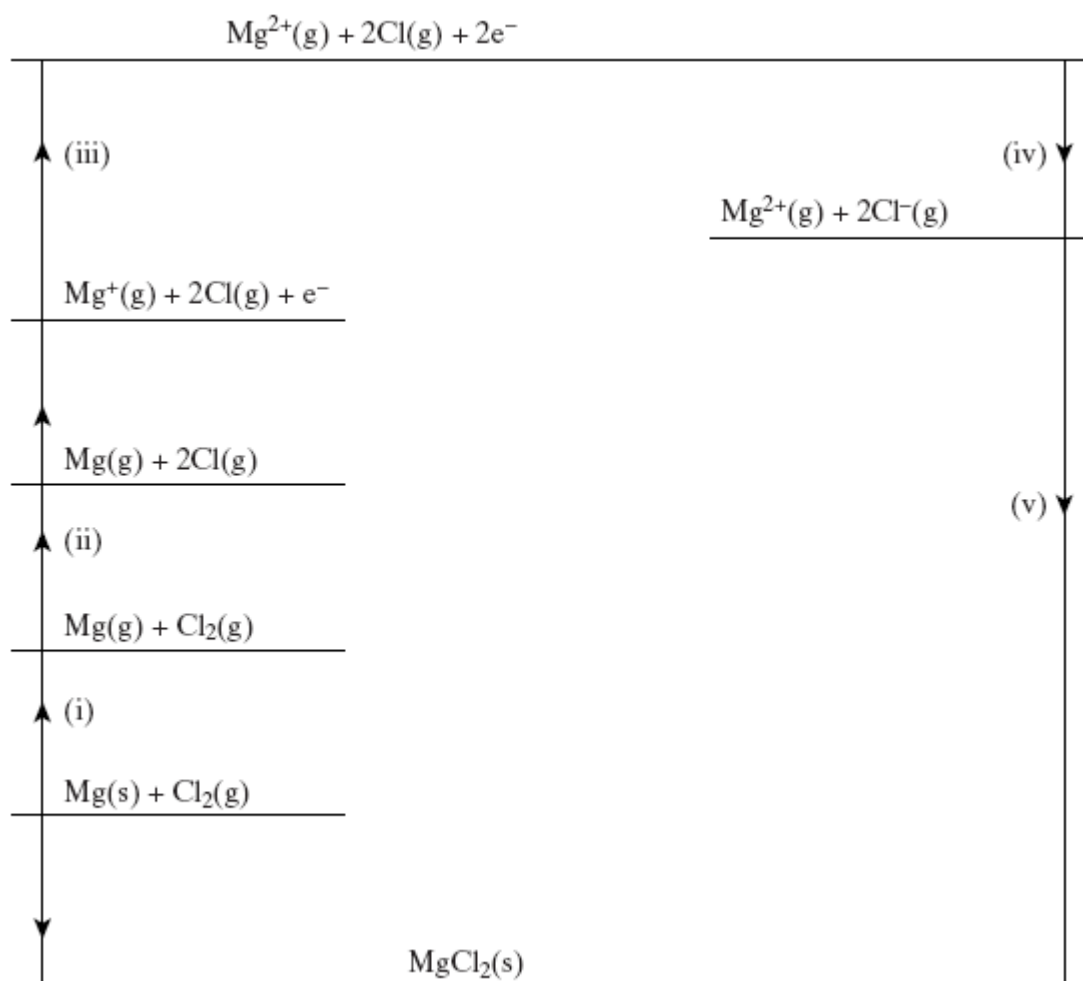
Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Q1.

- (a) A Born–Haber cycle for the formation of magnesium(II) chloride is shown below.



Taking care to note the direction of the indicated enthalpy change and the number of moles of species involved, give each of the enthalpy changes (i) to (v) above.

Enthalpy change (i) _____

Enthalpy change (ii) _____

Enthalpy change (iii) _____

Enthalpy change (iv) _____

Enthalpy change (v) _____

(5)

- (b) Write an equation for the decomposition of MgCl(s) into $\text{MgCl}_2\text{(s)}$ and Mg(s) and use the following data to calculate a value for the enthalpy change of this reaction.

$$\Delta H_f^\ominus \text{MgCl(s)} = -113 \text{ kJ mol}^{-1}$$

$$\Delta H_f^\ominus \text{MgCl}_2\text{(s)} = -653 \text{ kJ mol}^{-1}$$

Equation _____

Calculation _____

(4)

- (c) Use the data below to calculate a value for the molar enthalpy of a solution of $\text{MgCl}_2\text{(s)}$.

$$\text{Lattice formation enthalpy of MgCl}_2\text{(s)} = -2502 \text{ kJ mol}^{-1}$$

$$\Delta H_{\text{hydration}}^\ominus \text{ of Mg}^{2+}\text{(g)} = -1920 \text{ kJ mol}^{-1}$$

$$\Delta H_{\text{hydration}}^\ominus \text{ of Cl}^-\text{(g)} = -364 \text{ kJ mol}^{-1}$$

(3)

(Total 12 marks)

Q2.

Chlorine is formed in a reversible reaction as shown by the equation



- (a) Use the data below to calculate the standard enthalpy change, $\Delta H^\ominus$, and the standard entropy change, $\Delta S^\ominus$, for this reaction.

Substance	HCl(g)	O ₂ (g)	Cl ₂ (g)	H ₂ O(g)
$\Delta H_f^\ominus / \text{kJ mol}^{-1}$	-92	0	0	-242
$S^\ominus / \text{J K}^{-1} \text{mol}^{-1}$	187	205	223	189

Standard enthalpy change, $\Delta H^\ominus$ _____

Standard entropy change, $\Delta S^\ominus$ _____

(6)

- (b) The data below apply to a different gas phase reversible reaction.

Standard enthalpy change, $\Delta H^\ominus = +208 \text{ kJ mol}^{-1}$

Standard entropy change, $\Delta S^\ominus = +253 \text{ J K}^{-1} \text{mol}^{-1}$

- (i) Deduce the effect of an increase in temperature on the position of the equilibrium in this reaction. Use Le Chatelier's principle to explain your answer.

Effect _____

Explanation _____

- (ii) Calculate the minimum temperature at which this reaction is feasible.
