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

Mark Schemes

Q1.

(a) (i) Δ*H* atomisation/sublimation of magnesium

1

(ii) Bond/dissociation enthalpy of Cl-Cl

OR 2 × *H* atomisation of chlorine

1

(iii) Second ionisation enthalpy of magnesium

1

(iv) 2 × electron affinity of chlorine

1

(v) Lattice formation enthalpy of $MgCl_2$

1

(b) Equation $2MgCl(s) \rightarrow MgCl_2(s) + Mg(s)$

State symbols not required but penalise if incorrect

1

Calculation Δ*H* reaction = $\Sigma\Delta H_f$ products – $\Sigma\Delta H_f$ reactants

1

= – 653 – (2 × –133)

1

= – 427 ($kJmol^{-1}$)

Allow +427 to score (1) mark

Other answers; award (1) for a correct Δ H reaction expression

1

(c) Δ*H* soln $MgCl_2$ = – Δ*H* Lat.form. + Δ*H* hyd.Mg^{2+} + 2Δ*H* hyd.Cl^-

1

or cycle
= 2502 – 1920 – (2 × 364)

1

= – 146 ($kJmol^{-1}$)

Allow + 146 to score (1) mark

Other answers; award (1) for a correct ΔH soln $MgCl_2$ expression/cycle

1

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Q2.

(a) *Standard enthalpy change, $\Delta H^{\ominus}$*: $\Delta H_R = \Sigma \Delta H_{f\text{products}} - \Sigma \Delta H_{f\text{reactants}}$ **(1)**
or cycle

$\Delta H_R = (0 + [2 \times -242]) - (4 \times -92)$ **(1)**
$= -484 + 368$
$= -116$ (kJ mol^{-1})
Allow max 1 for +116

Standard entropy change, $\Delta S^{\ominus}$: $\Delta S = \Sigma \Delta H_{f\text{ products}} - \Sigma \Delta H_{f\text{ reactants}}$

$\Delta S = ([2 \times 223] + [2 \times 189]) - (205 + [4 \times 187])$ **(1)**

$= 824 - 953$

$= -129$ (J K^{-1} mol^{-1})
allow max one for +129

6

(b) (i) *Effect*: Equilibrium displaced to right / to products **(1)**
Explanation: Reaction is endothermic **(1)**
Constraint reduced **(1)**
mark separately

(ii) Feasible when $\Delta G \leq 0$ **(1)**

$\Delta G = \Delta H - T\Delta S$ **(1)**

$T = \Delta H / \Delta S = 208 \times 1000$ **(1)** / 253

$= 822$ K **(1)**

7

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