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

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Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) $MgCl_2(s) \rightarrow Mg^{2+}(g) + 2Cl^-(g)$

1

(b) The magnesium ion is smaller / has a smaller radius / greater charge density (than the calcium ion)

If not ionic or if molecules / IMF / metallic / covalent / bond pair / electronegativity mentioned, CE = 0

1

Attraction between ions / to the chloride ion stronger

Allow ionic bonds stronger

Do not allow any reference to polarisation or covalent character

Mark independently

1

(c) The oxide ion has a greater charge / charge density than the chloride ion

If not ionic or if molecules / IMF / metallic / covalent / bond pair mentioned, CE = 0

Allow oxide ion smaller than chloride ion

1

So it attracts the magnesium ion more strongly

Allow ionic bonds stronger

Mark independently

1

(d) $\Delta H_{solution} = \Delta H_L + \Sigma\Delta H_{hyd}\ Mg^{2+}$ ions + $\Sigma\Delta H_{hyd}\ Cl^-$ ions

Allow correct cycle

1

$-155 = 2493 + \Delta H_{hyd}\ Mg^{2+}$ ions $- 2 \times 364$

$\Delta H_{hyd}\ Mg^{2+}$ ions $= -155 - 2493 + 728$

1

$= -1920$ (kJ mol^{-1})

Ignore units

Allow max 1 for +1920

Answer of + or −1610, CE = 0

Answer of −2284, CE = 0

1

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(e) Water is polar / O on water has a delta negative charge

Allow <u>O</u> (not water) has lone pairs (can score on diagram)

1

Mg^{2+} ion / $^{+}$ve ion / + charge attracts (negative) O on a water molecule

Allow Mg^{2+} attracts lone pair(s)

M2 must be stated in words (QoL)

Ignore mention of co-ordinate bonds

CE = 0 if O^{2-} or water ionic or H bonding

1

(f) Magnesium oxide reacts with water / forms $Mg(OH)_2$

Allow MgO does not dissolve in water / sparingly soluble / insoluble

1

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Q2.

(a) $\Delta G = \Delta H - T\Delta S$

Ignore ⊖

1

(b) 0.098 or 98

Allow 0.097 to 0.099/97 to 99

Allow 0.1 only if 0.098 shown in working

1

kJ K^{-1} mol^{-1} J K^{-1} mol^{-1}

Allow in any order

Unless slope is approx. 100(90-110) accept only kJ K^{-1} mol^{-1}. If no slope value given, allow either units

1

$-\Delta S/\Delta S$

1

(c) ΔG becomes <u>negative</u>

Mark independently unless ΔG +ve then CE = 0

1

So reaction becomes spontaneous/feasible

Or reaction can occur below this temperature

Or reaction is not feasible above this temperature

1

(d) Ammonia liquefies (so entropy data wrong/different)

Allow any mention of <u>change</u> in state or implied change in state even if incorrect

eg freezing/boiling

1

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