

Name of the Student: _____

Max. Marks : 28 Marks

Time : 28 Minutes

Mark Schemes

Q1.

- (a) Enthalpy change/heat energy change when one mole of gaseous atoms
Allow explanation with an equation that includes state symbols 1
- Form (one mole of) gaseous negative ions (with a single charge)
If ionisation/ionisation energy implied, CE=0 for both marks
Ignore conditions 1
- (b) Fluorine (atom) is smaller than chlorine/shielding is less/ outer electrons closer to nucleus
Fluorine molecules/ions/charge density CE=0 for both marks 1
- (Bond pair of) electrons attracted more strongly to the nucleus/protons 1
- (c) Fluoride (ions) smaller (than chloride) / have larger charge density
Any reference to electronegativity CE=0 1
- So (negative charge) attracts (δ^+ hydrogen on) water more strongly
Allow H on water, do not allow O on water
Allow F^- hydrogen bonds to water, chloride ion does not
Mark independently 1
- (d) (i) $\Delta H(\text{solution}) = LE + \Sigma(\text{hydration enthalpies})$ / correct cycle
 AgF_2 or other wrong formula CE = 0
Ignore state symbols in cycle 1
- $LE = -20 -(-464 + -506)$ 1
- $= (+) 950 \text{ kJ mol}^{-1}$
Ignore no units, penalise M3 for wrong units
-950 scores max 1 mark out of 3
990 loses M3 but M1 and M2 may be correct
808 is transfer error (AE) scores 2 marks
848 max 1 if M1 correct
1456 CE=0 (results from AgF_2)

1

- (ii) There is an increase in the number of particles / more disorder / less order
Allow incorrect formulae and numbers provided number increases
Do not penalise reference to atoms/molecules
Ignore incorrect reference to liquid rather than solution

1

- (iii) Entropy change is positive/entropy increases and enthalpy change negative/exothermic

1

So ΔG is (always) negative

1

[12]

Q2.

- (a) Enthalpy change when 1 mol of an (ionic) compound/lattice (under standard conditions)

Allow heat energy change

1

Is dissociated/broken/separated into its (component) ions

1

The ions being in the gaseous state (at infinite separation)

Mark independently. Ignore any conditions.

1

- (b) There is an attractive force between the nucleus of an O atom and an external electron.

Allow any statement that implies attraction between the nucleus and an electron

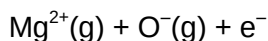
1

- (c) $\text{Mg}^{2+}(\text{g}) + \text{O}(\text{g}) + 2\text{e}^{-}$

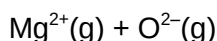
Ignore lack of state symbols

Penalise incorrect state symbols

1



1



1

First new level for Mg^{2+} and O above last on L

*If levels are not correct allow if steps are in correct order
with arrows in the correct direction and correct ΔH values*

1

Next level for Mg^{2+} and O^{-} below that

Next level for Mg^{2+} and O^{2-} above that and also above that for Mg^{2+} and O

Allow +124

Allow M4 with incorrect number of electrons

- (d) $\text{LE MgO} = 602 + 150 + 736 + 1450 + 248 - 142 + 844$

Note use of 124 instead of 248 CE=0

1

$$= +3888 \text{ kJ mol}^{-1}$$

Allow 1 for -3888

Allow no units

Penalise wrong units

1

- (e) Forms a protective layer/barrier of MgO / MgO prevents oxygen attacking Mg

Allow activation energy is (very) high

Allow reaction (very) slow

1

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

$$\Delta S = \frac{(\Delta H - \Delta G)}{T}$$

T

1

$$\Delta S = (-602 - (-570)) \times 1000 / 298$$

1

$$= -107 \text{ J K}^{-1} \text{ mol}^{-1} / -0.107 \text{ kJ K}^{-1} \text{ mol}^{-1}$$

If units not correct or missing, lose mark

Allow -107 to -108

+107 with correct units scores max 1/3

1

- (g) 1 mol of solid and 0.5 mol of gas reactants form 1 mol solid products

Decrease in number of moles (of gas/species)

Allow gas converted into solid

Numbers of moles/species, if given, must be correct

1

System becomes more ordered

Allow consequential provided ΔS is -ve in 1(f)

If ΔS is +ve in 1(f) can only score M1

1

[16]