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) ΔH(solution) = LE + Σ(hydration enthalpies) / correct cycle
AgF_2 or other wrong formula CE = 0
Ignore state symbols in cycle
1

LE = -20 -(-464 + -506)
1

= (+) 950 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

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

Ignore lack of state symbols

Penalise incorrect state symbols

1

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

1

$Mg^{2+}(g) + O^{2-}(g)$

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) LE MgO = 602 + 150 + 736 + 1450 + 248 – 142 + 844

Note use of 124 instead of 248 CE=0

1

= +3888 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) $\Delta G = \Delta H - T\Delta S$

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

T

1

ΔS = (–602 – (–570)) × 1000/ 298

1

= –107 J K^{-1} mol^{-1} / –0.107 kJ K^{-1} 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]