Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(a) **M1**
$\Delta_f H = \Delta_a H$ (Sr) + $2\Delta_a H$ (Cl) + $\Delta_{1st\ IE} H$ (Sr) + $\Delta_{2nd\ IE} H$ (Sr) + $2\Delta_{EA} H$ (Cl) + $\Delta_{LE} H$ (Sr)

Or

$-828 = 164 + (2 \times 121) + 548 + 1060 + (2 \times \Delta_{EA} H) + (-2112)$

1

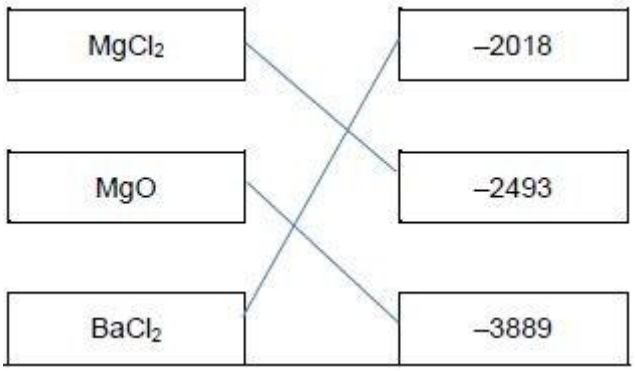
M2 $2 \times \Delta_{EA} H = -730$

1

M3 $\Delta_{EA} H = -365$ (kJ mol^{-1})
*Allow **M3** = **M2**÷2*
(+) 365, –304.5, and –730 = 2 marks
(+) 304.5, (+) 730 and –609 = 1 mark
(+) 609 = 0 marks 1

1

(b)



All three lines must be shown

1

(c) (Has) covalent character or partial covalent bonding (as well as ionic bonding)
*Allow chloride **ion** has been polarised or chloride **ion** distorted*
Ignore not perfectly ionic
Ignore ions are not spheres
Do not allow references to molecules or ions with covalent character
Do not allow it is covalently bonded alone

1

(d) **M1** (From Li^+ to K^+) size (of ion) increases OR charge density (of ion) decreases

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M1 *Allow K+ has more shells or larger distance between nucleus and outer electrons or larger ionic radius*

Do not allow atomic radius or molecules

1

M2 (Electrostatic) attraction between metal ion and $O^{\delta-}$ of water decreases or attraction between lone pair on O and + ion decreases

M2 *Not dependent on* ***M1***

Allow converse arguments

1

(e) **M1** $\Delta_{sol}H = \Delta_{LEdissociation}H + \Delta_{hyd}H\ (Ca^{2+}) + 2x\ \Delta_{hyd}H\ (Br^{-})$
or
M1 $-110 = 2176 + (-1650) + 2x\ \Delta_{hyd}H\ (Br^{-})$

1

M2 $(2x\ \Delta_{hyd}H\ (Br^{-})) = -636$

1

M3 $\Delta_{hyd}H\ (Br^{-}) = -318\ (kJ\ mol^{-1})$

Allow ***M3*** *=* ***M2*** *÷ 2*

(+)1858, (+)318 and –636 = 2 marks

+3716, –1858 and (+)636 = 1 mark

–3716 = 0 marks

1

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Q2.

(a) **M1** $\Delta H = (-201 + -242) - (-394)$

1

M2 $\Delta H = -49$ (kJ mol^{-1})

Allow consequential marking

***M2** 1 mark for ΔH = +49 (kJ mol^{-1})*

1

M3 $\Delta S = \underline{-180}$ (J K^{-1} mol^{-1})

1

M4 $\underline{\Delta G = \Delta H - T\Delta S}$

M4** Recall this equation. If **M4** incorrect cannot score **M6

1

M5 $\Delta G = -49 - \left(890 \times \frac{-180}{1000}\right)$ or **M3**÷1000

***M5** Conversion of ΔS into kJ mol^{-1}*

$\Delta G =$ ***M2*** $- \frac{(890 \times M3)}{1000}$

1

M6 $\Delta G = 111$ (kJ mol^{-1})

*If ΔS not converted to kJ in **M5**, answer is +160151 kJ mol^{-1} = 5 marks*

1

(b) **M1** ΔH = intercept of y axis = 145 (kJ mol^{-1})

***M1** Value between 144 and 146 kJ mol^{-1}*

1

M2 Gradient = $-\Delta S$ or a negative value

1

M3 Gradient x 1000

1

M4 $\Delta S = +167$ to $+173$ (J K^{-1} mol^{-1})

***M4** +0.167 to +0.173 scores 2 for ΔS*

−167 to −173 scores 2 for ΔS

−0.167 to −0.173 scores 1 for ΔS

1

(c) <u>Above</u> 845 K reaction becomes (thermodynamically) feasible OR <u>Below</u> 845 K reaction is not (thermodynamically) feasible

Allow 845 to 860

1

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