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

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Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) Heat (energy) change at constant pressure
Ignore conditions even if wrong
Ignore energy change
1

(b) M2 $Ca^{2+}(g) + 2\ e^- + Cl_2(g)$
Alternative M2 $Ca^+(g) + e^- + 2\ Cl(g)$
1

M3 $Ca^{2+}(g) + 2\ Cl^-(g)$
1

M1 $Ca(s) + Cl_2(g)$
1

(c) M1 –795 + LE = 193 + 590 +1150 + (**2** x 121) + (**2** x –364)
Numbers and factors used correctly from cycle
1

M2 LE = (+) 2242 (kJ mol^{-1})
Rearrangement to calculate LE
If one or both factors of 2 missing award 1 mark for (+) 2485, (+)2121 or (+)2606 (kJ mol^{-1})
Allow 1 mark for – 2242 (kJ mol^{-1})
1

(d) $MgCl_2(s) \rightarrow Mg^{2+}(aq) + 2\ Cl^-(aq)$
Allow $MgCl_2(s) \rightleftharpoons Mg^{2+}(aq) + 2\ Cl^-(aq)$
Allow $MgCl_2(s) + aq \rightleftharpoons Mg^{2+}(aq) + 2\ Cl^-(aq)$
1

(e) M1 ΔH soln $MgCl_2$ = ΔH latt diss+ ΔH hyd Mg^{2+} + **2**ΔH hyd Cl^-
OR 2493 –1920 + (**2** x –364)
M1 for expression with or without numbers
1

M2 = – 155 (kJ mol^{-1})
M2 for answer
If factor of 2 missing for ΔH hyd Cl^-, allow 1 mark for 209
1

(f) M1 Ca^{2+} (ion) bigger/lower charge to size ratio (than Mg^{2+})
Allow converse answers

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M1 Do not accept Ca^{2+} is a bigger atom/molecule
M1 Allow Ca^{2+} has more shells/ more distance of outer e to nucleus
Ignore more shielding

1

M2 weaker attraction/bond to ($O^{\delta-}$ in) water

1

[11]

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Q2.

(a) CO_2 / gas is more disordered (than solid)

Allow answers based on carbon

Ignore CO_2 is a gas and C is a solid

1

(b) 0 K

Units essential

*Allow absolute zero **OR** –273 ^oC*

1

(c) M1 $\Delta H = (\mathbf{3} \times -394) - (-1669 \times \mathbf{2})$

M1 correct expression

1

M2 = 2156 (kJ mol^{-1})

M2 if –2156 seen allow 1 mark out M1 and M2

1

M3 $\Delta S = (28 \times \mathbf{4} + 214 \times \mathbf{3}) - (51 \times \mathbf{2} + 6 \times \mathbf{3})$

M3 correct expression

1

M4 = 634 (J K^{-1} mol^{-1})

M4 if – 634 allow 1 mark from M4 and M4

1

M5 $\Delta G = \Delta H - T\Delta S$ or $\Delta H = T\Delta S$ or $T = \Delta H \div \Delta S$

M5 expression or rearranged expression or with numbers

1

M6 ΔS = 0.634 kJ K^{-1} mol^{-1}

M6 ΔS = M4 ÷ 1000

1

M7 $T = \frac{2156}{0.634}$ = 3400 to 3401 (K)

M7 = M2 ÷ M6 but must be a positive answer

1

[9]

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