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

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Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) Top line $Cs^+(g) + e^- + I(g)$ **1**

Lower line $Cs(s) + \frac{1}{2}I_2(s)$ **1**

(b) $79 + \times + 376 - 314 = -337 + 585$ **1**

So enthalpy change = 107 (kJ mol^{-1})
Allow I mark for -107 (kJ mol^{-1})
Allow answer to 2sf or more **1**

(c) (Almost/Mostly) purely/ perfectly ionic
If ionic not mentioned, allow no/little covalent bonding/character
Penalise references to atoms/molecules
Ignore electronegativity **1**

(d) **M1** $\Delta S = [(82.8 + \frac{1}{2} \times 117) - 130] = \underline{11.3}$ (J K^{-1} mol^{-1})
***M1** Correct entropy change value* **1**

M2 $\Delta G = \Delta H - T\Delta S$
***M2** equation or equation with numbers* **1**

M3 $\Delta G = 337 - 298 \times 11.3 \times 10^{-3}$ OR $337000 - 298 \times 11.3$
***M3** for converting units:*
ΔS into kJK^{-1} mol^{-1} or ΔH into J mol^{-1} **1**

M4 ΔG = (+)334 $\underline{kJ\ mol^{-1}}$ or 334000 $\underline{J\ mol^{-1}}$
***M4** answer with correct units*
*Any negative answer loses **M4*** **1**

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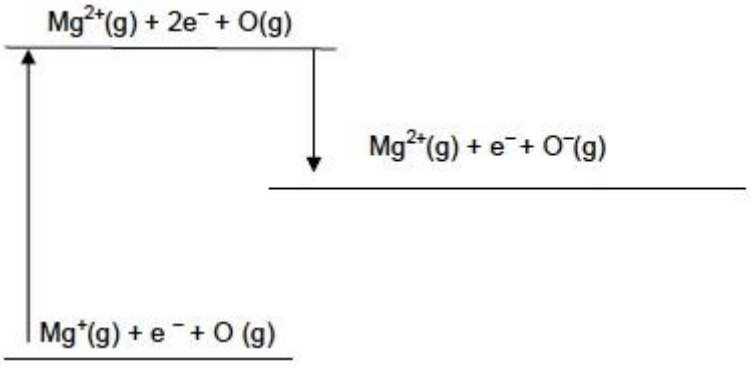
Q2.

(a)



One mark for each level with correct state symbols

1
1
1

(b) $\Delta_f H = \Delta_a H$ (Mg) + ½ $\Delta_{BD} H$ (O_2) + $\Delta_{1st\ IE} H$ (Mg) + $\Delta_{2nd\ IE} H$ (Mg) +

1

$\Delta_{1st\ EA} H$ (O) + $\Delta_{2nd\ EA} H$(O) + $\Delta_{LE} H$ (MgO)

$-602 = 150 + (½ \times 496) + 736 + 1450 - 142 + 844 + \Delta_{LE} H$ (MgO)

1

$\Delta_{LE} H$ (MgO) = -3888 / -3890 ($kJ\ mol^{-1}$)

Allow answers to 2sf or more
1 mark for +3888 or +3890
1 mark for -4136 or -4140 (not 496 × ½)

1

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Q3.

(a) (ΔS = Σ(*S products*) - Σ(*S reactants*))

= [(4 × 211) + (6 × 189)] - [(4 × 193) + (5 × 205)] = (1978 – 1797)

1

181 (J K^{-1} mol^{-1})

1

(b) ($\Delta G = \Delta H - T\Delta S$) = - 905 - (600 + 273) × 181 × 10^{-3}

If answer to (a) is incorrect, mark consequentially:

- 905 - (873 × (a) × 10^{-3})

1

ΔG = - 1063 / -1060 (kJ mol^{-1})

If alternative value of ΔS = 211 used, answer = -1089 (kJ mol^{-1})

1

(c) ΔG becomes more negative/less positive

Ignore increase/decrease/larger/smaller ΔG

1

The entropy change / ΔS is positive / $T\Delta S$ gets bigger / $-T\Delta S$ gets more negative.

Consequential on wrong (a)

If candidate does a calculation in (a) to produce ΔS negative then allow ΔG becomes less negative or more positive

1

(d) Reactant(s) adsorbed onto the (platinum surface) / (platinum) provides a surface / active sites

1

Reaction (on the surface) or bond breaking(weakening) / bond making occurs (on the surface)

1

Desorption (of the product) or wtte

1

(e) (Oxidation state changes from) -3 to +2 OR (+) 5

1

(f) $2NH_3 + 2O_2 \rightarrow N_2O + 3H_2O$

Allow multiples

Ignore state symbols

1

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