

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

- (a) **M1** $\Delta H = (-201 + -242) - (-394)$ 1
- M2** $\Delta H = -49 \text{ (kJ mol}^{-1}\text{)}$
 Allow consequential marking
M2 1 mark for $\Delta H = +49 \text{ (kJ mol}^{-1}\text{)}$ 1
- M3** $\Delta S = -180 \text{ (J K}^{-1} \text{ mol}^{-1}\text{)}$ 1
- M4** $\Delta G = \Delta H - T\Delta S$
M4 Recall this equation. If **M4** incorrect cannot score **M6** 1
- M5** $\Delta G = -49 - \left(\frac{890 \times -180}{1000} \right)$ or **M3** ÷ 1000
M5 Conversion of ΔS into kJ mol^{-1}
 $\Delta G = \text{M2} - \frac{(890 \times \text{M3})}{1000}$ 1
- M6** $\Delta G = 111 \text{ (kJ mol}^{-1}\text{)}$
 If ΔS not converted to kJ in **M5**, answer is $+160151 \text{ kJ mol}^{-1} = 5$ marks 1
- (b) **M1** $\Delta H = \text{intercept of y axis} = 145 \text{ (kJ mol}^{-1}\text{)}$
M1 Value between 144 and 146 kJ mol^{-1} 1
- M2** Gradient = $-\Delta S$ or a negative value 1
- M3** Gradient $\times 1000$ 1
- M4** $\Delta S = +167 \text{ to } +173 \text{ (J K}^{-1} \text{ mol}^{-1}\text{)}$
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) Above 845 K reaction becomes (thermodynamically) feasible OR Below 845 K reaction is not

(thermodynamically) feasible
Allow 845 to 860

1

[11]

Q2.

(a) $(3 \times 612) + (3 \times 348) + (6 \times 412) = 5352$

For LHS

M1

$(6 \times 715) + (6 \times 218) = 5598$

For RHS

M2

$\Delta H_2 = M2 - M1 - 83 = +163 \text{ kJ mol}^{-1}$

M3

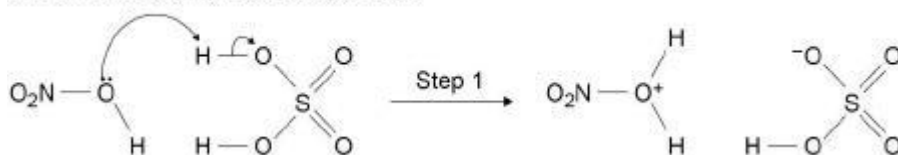
(b) (π) electrons delocalised

1

(c) M1 Electrophilic substitution

1

M2 for a lone pair and two curly arrows



1

M3 for a curly arrow from the bond to the O



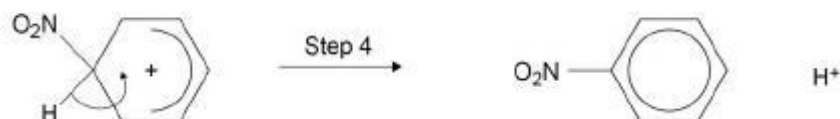
1

M4 for a curly arrow from inside the hexagon to the N or + on the N



1

M5 curly arrow from the bond back into the hexagon



1

[9]