

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Mark Schemes

Q1.

(a) Decrease 1

Increasing pressure moves equilibrium to the side of least moles i.e. backward reaction 1

To oppose the increase in pressure or to decrease the pressure 1

(b) A catalyst speeds up the rate of the forward and backward reaction 1

By the same amount 1

(c) $\Delta H = -111 - (-75 - 242)$ 1

206 (kJ mol⁻¹) 1

(d) $\Delta S = 3 \times 131 + 198 - (186 + 189) = 216 \text{ J K}^{-1} \text{ mol}^{-1}$ 1

$\Delta G = \Delta H - T\Delta S$ 1

$0 = 206 - T \frac{216}{1000}$ 1

$T = 953.7 \text{ or } 954 \text{ K}$ 1

$T = 681 \text{ (}^\circ\text{C)}$
If the value given in the question is used then the answer is 283 (°C) 1

[12]

Q2.

(a) $\Delta S = 238 + 189 - 214 - 3 \times 131 = -180 \text{ J K}^{-1} \text{ mol}^{-1}$

1

$$\Delta G = \Delta H - T\Delta S$$

1

$$= -49 - \frac{523 \times (-180)}{1000}$$

1

$$= +45.1 \text{ kJ mol}^{-1}$$

Units essential

1

(b) When $\Delta G = 0$, $\Delta H = T\Delta S$ therefore $T = \Delta H / \Delta S$

1

$$= -49 \times 1000 / -180 = 272 \text{ (K)}$$

Mark consequentially to ΔS in part (a)

1

(c) Diagram marks

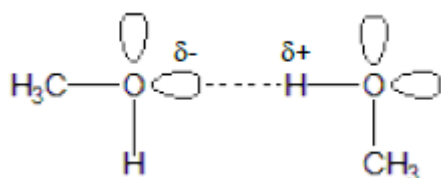


Diagram of a molecule showing O–H bond and two lone pairs on each oxygen

1

Labels on diagram showing $\delta+$ and $\delta-$ charges

Allow explanation of position of $\delta+$ and $\delta-$ charges on H and O

1

Diagram showing $\delta+$ hydrogen on one molecule attracted to lone pair on a second molecule

1

Explanation mark

Hydrogen bonding (the name mentioned) is a strong enough force (to hold methanol molecules together in a liquid)

1

[10]