Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes

Q1.

(a) (i) Mol SO_3 = 5.2

1

Mol SO_2 = 2.8

1

(ii)

$$\frac{[SO_2]^2[O_2]}{[SO_3]^2}$$

Penalise expression containing numbers or V

Allow ( ) but must have all brackets. If brackets missing but otherwise correct, penalise here but mark on

Ignore subsequent correct working

If Kc wrong (wrong powers or upside down etc) can only score M1 in (a)(iv)

1

(iii) mol dm^{-3}

Allow conseq to their wrong Kc

1

(iv) *If Kc wrong in (a)(iv) (wrong powers or upside down etc) can only score M1*

Values from (a)(i)

$$\frac{[2.8/12]^2[1.4/12]}{[5.2/12]^2} \text{ or } \frac{[0.233]^2[0.117]}{[0.433]^2}$$

Alternative values

$$\frac{[2.1/12]^2[1.4/12]}{[5.8/12]^2}$$

1

M1 *For dividing all three by volume – if volume missed or used wrongly, lose M1 & M2 but can score M3 conseq*

M2 *insertion of values (allow conseq use of their wrong values from (a)(i))*
AE (–1) for copying numbers wrongly or swapping two numbers

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1

Values from (a)(i)
M3 = 0.0338 or 0.034
(allow 0.03376 to 0.035)
Min 2 sfs
Ignore units in (a)(iv)
If vol missed score only M3
Values from (a)(i)
0.406 - allow values between 0.40 (if correctly rounded) and 0.41

Alternative values
M3 0.0153 or 0.015
(allow 0.015 to 0.017)
Min 2 sfs
Ignore units in (a)(iv)
from alternative values allow 0.18 to 0.184

1

(b) (i) Increase or more moles (of oxygen) or higher

1

(ii) No change or no effect or none or (remains) same

1

(c) **M1** T_1
If T_2 CE = 0

1

M2 (At Temp,T2, when Kc is lower) Equm/reaction moves to left or towards reagent or towards SO_3 OR moles SO_3 increases

1

M3 This reverse reaction is exothermic,

OR

M3 (forward) reaction is endothermic

M2 if Temp is increased Equm/reaction moves to right or towards product or towards SO_2 OR moles SO_2 increases

OR

M3 (forward) reaction is endothermic

M2 if Temp is decreased Equm/reaction moves to left or towards reagent or towards SO_3 OR moles SO_3 increases

1

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Q2.

(a) (i) $Cu + \mathbf{4}HNO_3 \longrightarrow Cu(NO_3)_2 + \mathbf{2}NO_2 + \mathbf{2}H_2O$

Or multiples

Ignore state symbols

1

(ii) **M1** HNO_3 (+) **5**

M2 NO_2 (+) **4**

Ignore working out

M1 Credit (V)

M2 Credit (IV)

2

(iii) $HNO_3 + H^+ + e^- \longrightarrow NO_2 + H_2O$

OR

$NO_3^- + 2H^+ + e^- \longrightarrow NO_2 + H_2O$

Or multiples

Ignore state symbols

Ignore charge on the electron unless incorrect and accept loss of electron on the RHS

1

(b) (i) **In either order**

M1 Concentration(s) (of reactants and products) remain(s) constant / stay(s) the same / remain(s) the same / do(es) not change

M2 Forward rate = Reverse / backward rate

For M1 accept [ ] for concentration

NOT "equal concentrations" and NOT "concentration(s) is/are the same"

NOT "amount"

Ignore "dynamic" and ignore "speed"

Ignore "closed system"

It is possible to score both marks under the heading of a single feature

2

(ii) **M1**

The (forward) reaction / to the right is endothermic or takes in / absorbs heat

OR

The reverse reaction / to the left is exothermic or gives out / releases heat

M2 depends on correct M1 and must refer to temperature/heat

The equilibrium shifts / moves left to right to oppose the increase in temperature

M2 depends on a correct statement for M1

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For M2, the equilibrium shifts/moves
to absorb the heat OR
to lower the temperature OR
to cool the reaction

2

(iii) **M1 refers to number of moles**

There are fewer moles (of gas) on the left OR more moles (of gas) on the right.
OR there is one mole (of gas) on the left and 2 moles on the right.

M2 depends on correct M1 and must refer to pressure
The equilibrium shifts / moves right to left to oppose the increase in pressure

M2 depends on a correct statement for M1
For M2, the equilibrium shifts/moves to lower the pressure.

2

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