Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) (i) **M1**

High (temperature) OR Increase (the temperature)

*If **M1** is incorrect **CE = 0** for the clip*

*If **M1** is blank, mark on and seek to **credit the correct information in the text***

M2

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

M3 depends on correct M2 and must refer to temperature / heat

M3** depends on a correct statement for **M2

At high temperature, the (position of) equilibrium shifts / moves left to right to oppose the increase in temperature

*For **M3**, the position of equilibrium shifts / moves*

to absorb heat OR

to lower the temperature OR

to cool down the reaction

3

(ii) **M1**

The reaction gets to equilibrium faster / in less time
OR
Produces a small yield faster / in less time
OR
Increases the rate (of reaction / of attainment of equilibrium)

Mark independently

M2

High pressure leads to **one** of the following

- more particles / molecules in a given volume
- particles / they are closer together
- higher concentration of particles / molecules

AND

- more collisions in a given time / increased collision frequency

*Penalise **M2** for reference to increased energy of the particles*

2

(iii) **M1** Increase in / more / large(r) / big(ger) surface area / surface sites

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Mark independently

*For **M1** accept Éan increase in surface"*

M2 increase in / more successful / productive / effective collisions (in a given time) (on the surface of the catalyst / with the nickel)

*For **M2** not simply "more collisions"*

Ignore "the chance or likelihood" of collisions

2

(b) **M1**

No effect / None

*If **M1** is incorrect **CE = 0** for the clip*

*If **M1** is blank, mark on and seek to **credit the correct information in the text***

M2 requires a correct M1

Equal / same number / amount of moles / molecules / particles on either side of the equation

OR

2 moles / molecules / particles on the left and 2 moles / molecules / particles on the right

M2** depends on a correct statement for **M1

*In **M2 not** "atoms"*

2

[9]

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Q2.

(a) $K_c = \dfrac{[SO_3]^2}{[SO_2]^2[O_2]}$

Penalise ( ) in this part but can score units; mark on in (b)

If K_c expression wrong no marks in this part but can score M1 & M3 in (b)

1

units = $mol^{-1}\ dm^3$

1

(b) $[O_2] = \dfrac{[SO_3]^2}{[SO_2]^2 K_c}$ or $\dfrac{(0.072/1.4)^2}{(0.055/1.4)^2 \times 27.9}$ or $\dfrac{(0.072)^2}{(0.055)^2 \times 27.9}$

Correct answer scores three marks

Ignore ( ) in this part

Penalise contradiction in M1

M1

1

0.061(4)

If K_c expression wrong in (a) can score M1 here for rearrangement of their K_c & M3 for multiplication by 1.4

M2

mol O_2 = 0.0614 × 1.4 = 0.086 (allow 0.085−0.087)

If K_c or rearrangement wrong here score only M3 for multiplication by 1.4

1

M3 = correct answer of (M2 × 1.4)

M3

1

(c) (i) No effect **OR** none **OR** no change **OR** stays the same

1

(ii) Effect: Increase or more SO_3

Increase or more SO_3

If wrong effect, no further marks, but M2 and M3 are independent of each other

M1

1

Fewer mole(cule)s on RHS
or 3 moles to 2 moles
or (eqm shifts) to side with fewer moles
(V^3 or) residual V decreases in numerator of K_c expression

M2

1

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Equilibrium moves / shifts to reduce the pressure /
oppose the increase in pressure

to keep K_c *constant,*

ratio $\frac{(\text{mol } SO_3)^2}{(\text{mol } SO_2)^2(\text{mol } O_2)}$

must increase

Allow to oppose the change only if increase pressure mentioned

M3
1

[9]

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