Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(a) Moles SO_2 eqbm (=6.08/64.1 = 0.0949) so moles O_2 eqbm = 0.0474

1

Mass of oxygen (= 0.0474 × 32(.0)) = 1.52 g

Allow 0.0475

*Allow **M1** × 32*

1

(b) **M1**: Mole fraction SO_3 = 0.15
Mole fraction SO_2 = 0.57
Mole fraction O_2 = 0.28

*Accept fractions for **M1***

1

M2 $K_p = \frac{(pSO_2)^2 \times (pO_2)}{(pSO_3)^2}$ $\left(= \frac{(\lambda SO_2)^2 P^2 \times (\lambda O_2) P}{(\lambda SO_3)^2 P^2} \right)$

Do not accept [ ]

λ = mole fraction

1

M3 $P = \frac{K_p \times (\lambda SO_3)^2}{(\lambda SO_2)^2 \times (\lambda O_2)}$ or $\frac{K_p \times (0.15)^2}{(0.57)^2 \times (0.28)}$

***M3** is for rearrangement with or without numbers*

*If incorrect rearrangement allow correct **M1** and **M2** only*

1

M4 P = 1.91×10^5 (Pa) Allow range 1.88×10^5 to 1.94×10^5

1

(c) **M1** Kp is higher at higher temperature or converse

1

M2 At higher temperature more dissociation occurs / more products are formed / equilibrium shifts to the right/forward direction

***M2**: Allow converse arguments*

M2** dependent on **M1

1

(d) $(\sqrt{3.94 \times 10^4}$ Pa) = 198.5

1

$Pa^{1/2}$ or $Pa^{0.5}$

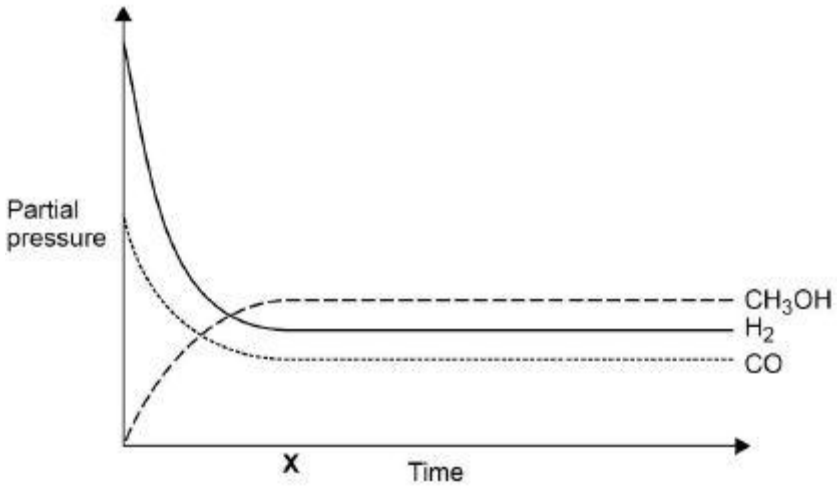
Allow 198 – 198.5 (answer is 198.49)
*If $\sqrt{7.62 \times 10^5} = 873$ then lose **M1** but allow **M2***

1

[10]

Q2.

(a)



X must be on or just below line of x axis

1

(b) **M1** Equilibrium n(H_2) = 0.24

1

M2 Total number of moles = 0.47

1

M3 Mole fraction of H_2 = 0.51(1) or $\frac{0.24}{0.47}$

***M3** Allow mole fraction of H_2 = $\frac{M1}{M2}$*

1

M4 Partial pressure of hydrogen = 5310 or 5.31 x 10^3 kPa

***M4** Allow Partial pressure of hydrogen = **M3** x 1.04 × 10^4*

1

(c) **M1** $K_p = \frac{ppCH_3OH}{ppH_2^2 \times ppCO}$ OR $\frac{pCH_3OH}{pH_2^2 \times pCO}$

Do not allow square brackets

1

Pa^{-2} or kPa^{-2}

Allow any pressure to power of $^{-2}$

1

(d) **M1** Increases

1

M2 No effect

1

(e) **M1** No effect

1

M2 Increases rate of forward and backward reaction equally/by the same amount OR catalyst does not affect position of equilibrium

***M2** Allow Catalyst does not appear in the K_p expression*

***M2** Allow Only temperature affects Kp*

Ignore Catalysts increase the rate of reaction or rate at which equilibrium is reached 1

1

[11]