Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) M1 0.176

M2 0.549

M3 0.275

Allow answers to 2 significant figures

3

(b) 21.1 (kPa)

*Allow answer to question **(a)** x 120 and answer in kPa*
Allow 21.6 (kPa)
Answer using given value of 0.380 mol = 45.6(kPa)

1

(c) M1 $K_p = \frac{p(NO)^2 p(O_2)}{p(NO_2)^2}$

M2 $= \frac{K_p \times \text{mol frac } (NO_2)^2}{\text{mol frac } (NO)^2 \times \text{mol frac } (O_2)}$ OR $\frac{59.7 \times (0.31)^2}{(0.46)^2 \times (0.23)}$

M3 = 117.9 (kPa) or 118 (kPa)

*Do **not** allow square brackets*

Rearrangement

3

(d) Decrease

No change

2

(e) M1 Reaction is endothermic OR exothermic in backwards direction

M2 Equilibrium shifts/moves in backwards direction/to the left to raise the temp/oppose the decrease in temp

2

[11]

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Q2.

D

6.87×10^{-4}

[1]

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Q3.

(a) forward and reverse reactions proceeding at equal <u>rates</u>

1

concentrations (of reactants and products) remain constant
or
concentrations (of reactants and products) stay the same

*do **not** accept equal concentrations*
*do **not** accept concentrations are the same*
ignore closed system

1

allow answers in either order

(b) more moles of (gaseous) products (than (gaseous) reactants)
or
more moles on the RHS (than LHS)

allow molecules
*do **not** accept atoms*

1

(c) **M1** (at equilibrium) n(CO) = 0.32 (mol)

1

M2 total number of moles (at equilibrium) = 1.07 (mol)
or mole fraction (CO) = 0.299

1

M3 p (CO) = $\left(=\frac{0.320 \times 250}{1.07}\right)$ = 74.8 (kPa)

M3 = $\frac{M1 \times 250}{M2}$

allow 75 kPa
*an answer of 67.8 (kPa) = **2** marks max*

1

(d) $K_p = \frac{p(CH_3OH)}{p(H_2)^2 p(CO)}$

*do **not** accept square brackets*

1

(e) **M1** $p(H_2)^2 = \frac{p(CH_3OH)}{K_p \times p(CO)}$ **or** $\frac{5.45}{1.15 \times 10^{-6} \times 125}$

rearrangement with/without numbers

1

M2 $p(H_2) = \sqrt{37\,913}$ **or** $p(H_2)^2 = 37\,913$

1

M3 $p(H_2)$ = 194.7 (kPa)

M3 = √M2
allow 195 (kPa)

1

if rearrangement incorrect in M1 allow M3 only
if $p(H_2)$ is not squared in part (d) allow

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$p(H_2) = \frac{p(CH_3OH)}{K_p \times p(CO)}$ *for M1 and 37 913 for M2*
*(max **2**)*

(f) $= \left(\frac{1}{1.15 \times 10^{-6}}\right) = 8.7(0) \times 10^5$
allow 869 565

1

kPa^2

1

[12]

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