Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Chemical Equilibria, Le Chatelier's Principle And Kc

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Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

(a) 3 minutes

M2 dependent on M1 or near miss

1

(At equilibrium, $rate_{fwd}$ = $rate_{back}$ so) concentrations (of O_2 and SO_3) remain constant

Not concentrations are the same/equal

Allow (after this point) gradient is zero / curve flattens out

1

(b) Sketch begins at origin and goes up until 3 mins

1

Levels off at 0.3 mol dm^{-3}

Mark Independently

1

(c) T_2 (Not worth a mark alone)

T_1, CE=0

Equilibrium has moved / shifted to RHS/forward in endothermic direction

Both RHS / forward and endothermic needed

1

Equilibrium has opposed the increase in T / Equilibrium moves to decrease the T

Not just to oppose the change

1

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Q2.

(a) **M1** no effect (on yield)

CE = 0 if yield changes

1

M2 increases rate / speed of both / forward and reverse reactions <u>equally / by the same amount</u>

*If no reference to effect on yield, could still score **M2***

Ignore reference to no change in position of equilibrium, and reference to lowering activation energies

***M2** allow changes rate of both / forward and reverse reactions <u>equally / by the same amount</u>*

1

(b) $(K_c =) \dfrac{[CH_3OH]}{[CO][H_2]^2}$

Must be square brackets

Ignore state symbols

Ignore units

1

(c) **M1** divides moles by volume (0.250 or $\frac{250}{1000}$)

M2 $K_c = \dfrac{\frac{0.0610}{0.250}}{\left[\frac{0.340}{0.250}\right]\left[\frac{0.190}{0.250}\right]^2} \left(= \dfrac{0.244}{1.36 \times 0.76^2}\right)$

1

M3 0.311

1

*Correct answer scores 3; **M3** to at least 2sf (0.3106159 …); ignore units*

*Allow ECF from **M1** to **M2** if an attempt to calculate concentration has been made by dividing by some factor of 250 cm^3*

*Allow ECF from **M2** to M3 for use of an expression containing each reagent in a correctly substituted K_c expression*

If volume not used, then allow M3 only for 4.97 (4.96985 … to at least 2sf)

1

(d) **M1** $\frac{1}{\text{Answer to (c)}}$ = 3.22

***M1** to at least 2sf (0.31 gives 3.2(258))*

***M1** = 1.21 if alternative answer to 8.3 used*

*If an error was made in 8.3, but the candidate produced an answer in 8.4 that did fit the inverted calculation from 8.3, then candidate could score **M1***

1

M2 $mol^2\ dm^{-6}$

(if volumes are not used, then candidate would get 0.20(12.)

1

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Q3.

(a) Initial amount of A = 6.4×10^{-3}

If M1 wrong can score max 3

M1

Equ A = $6.4 \times 10^{-3} - 2x \therefore x = 1.25 \times 10^{-3}$

If incorrect x can score max 3

M2

B = $9.5 \times 10^{-3} - x = 8.25 \times 10^{-3}$

Allow 2 or more sig figs

M3

C = $2.8 \times 10^{-2} + 3x = 0.0318$

M4

D = $x = 1.25 \times 10^{-3}$

M5

(b) $K_c = \dfrac{[C]^3[D]}{[A]^2[B]}$

Penalise ( ) but mark on in (b) & (c)

1

Units = mol dm^{-3}

If K_c wrong no mark for units

1

(c) M1 for correct rearrangement $[A]^2 = \dfrac{[C]^3[D]}{K_c[B]}$ or $[A] = \sqrt{\dfrac{[C]^3[D]}{K_c[B]}}$

If K_c wrong in (b) can score 1 for dividing by correct volume

M1

M2 for division of mol of B, C and D by correct volume

If K_c correct but incorrect rearrangement can score 1 for dividing by correct volume

M2

$$[A]^2 = \frac{[1.05/0.5]^3[0.076/0.5]}{116 \times [0.21/0.5]}$$

M3 for final answer: [A] = 0.17 (must be 2 sfs)

M3

(d) (All) conc fall: (ignore dilution)

OR K_c = mole ratio × 1/V

1

Equm moves to side with more moles

If vol increases, mole ratio must increase

1

To oppose the decrease in conc

To keep K_c constant

If only conc of A falls CE=0

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If pressure falls CE=0

1

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