Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

(a) Total amount of gas at equilibrium = 4.00 mol

Mole fraction of H_2 = 0.23

Accept fractions

2

(b) (The amount in) moles of products is the same as reactants (so the units (of partial pressure) cancel out)

Allow equal moles/molecules/particles on both sides (so units cancel)

1

(c) The amount decreases.

1

(d)

M1 $K_p = \frac{p(CH_3CH_2OH)}{p(C_2H_4)\,p(H_2O)}$

M1 allow p or pp for partial pressure; round brackets not necessary BUT penalise square brackets.

M2 = $\frac{0.0321\times6000}{(0.645\times6000)\times(0.323\times6000)} = \frac{192.6}{3870\times1938}$

M2 allow correct use of 6000 to calculate partial pressure

M3 $K_p = 2.56 \times 10^{-5}$

M3 Allow 2.57×10^{-5}

M4 kPa^{-1}

4

(e) No effect

1

[9]

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Q2.

(a) **M1** mol P = 0.0145 + (2 × 0.0115) = 0.0375

M2 $[P] = \frac{M1}{0.025} = 1.50 \text{ mol dm}^{-3}$

ECF from incorrect M1

2

(b)

M1 $K_c = \frac{[R][S]^3}{[P]^2[Q]}$

M1 Must be square brackets in expression

M2 $K_c = \frac{\left(\frac{0.0115}{0.045}\right)\left(\frac{0.0345}{0.045}\right)^3}{\left(\frac{0.0145}{0.045}\right)^2\left(\frac{0.0275}{0.045}\right)}$ or $= \frac{(0.256)(0.767)^3}{(0.322)^2(0.611)}$

M2 Inserts values and divides by volume in dm^3

M3 = 1.81 to 1.82

M3 Evaluates expression
If no use of volume lose M2 but can score M3 for 0.0817

M4 units mol dm^{-3}

M4 Allow consequential to their expression

4

(c) **M1** <u>equilibrium</u> shifts to side with most moles

M2 to oppose decrease in concentration of all reactants and products / dilution of everything

Allow
M2 oppose the decrease in concentration of S

OR

M1 K_c is expressed as a function of concentrations and concentration equals amount over volume.

$K_c = RS^3/P^2Q \times 1/V$ (where R,S etc are amounts)
So, if V increases R and S must increase relative to P and Q to keep K_c constant

M2 If Volume increases the amount of **R** and **S** must increase in order to keep K_c constant.

2

[8]

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