

Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Mark Schemes

Q1.

(a) (i) $3\text{CH}_3\text{OH}$ *Not molecular formula*

1

 $\text{HOCH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$

1

(ii) $\rightarrow 19\text{CO}_2 + 19\text{H}_2\text{O}$ *Or doubled*

1

 $\text{C}_{17}\text{H}_{35}\text{COOCH}_3 + 27\frac{1}{2} \text{ or } 55/2 \text{ O}_2$ *Consequential on correct right-hand side*

1

(b) (i) A0.7

1

Ethanol6.4

1

Water3.6

1

(ii) No effect

If wrong, CE = 0

1

Equal moles on each side of equation **OR** V cancels*Ignore moles of gas*

1

 (iii) M1 $K_c = \frac{[\text{DEM}][\text{H}_2\text{O}]^2}{[\text{A}][\text{C}_2\text{H}_5\text{OH}]^2}$
Must have all brackets but allow ()

1

 (iv) M2 $\frac{2.1 \times (3.4)^2}{0.85 \times (7.2)^2}$

If K_c wrong can only score M4 for units consequential to their K_c working in (b)(iv)

1

M3 0.55 (min 2dp)

1

M4 No units

1

[13]

Q2.

(a) (must state correct effect on yield or rate to score the reason mark)

T effect: higher temp: yield greater or shifts equilibrium to right;

1

effect: higher temp: rate increased;

1

reason: endothermic

OR

more particles have $E > E_a$

1

OR

more successful/productive collisions;

1

P effect: higher pressure: yield less or shifts equilibrium to left;

1

effect: higher pressure: rate increased;

reason: increase in gas moles L to R

OR

greater collision frequency;

(Q of L mark)

1

(b) M1 equilibrium moles of CO = $62.8 - 26.2 = 36.6$

1

M2 equilibrium moles of $H_2 = 146 - 2(26.2) = 93.6$

1

M3 total no moles = $36.6 + 93.3 + 26.2 = 156.4$

1

M4 partial pressure = mole fraction x total pressure

1

M5
$$K_p = \frac{P_{CH_3OH}}{P_{CO} \times P_{H_2}^2}$$

1

M6
$$= \frac{\left(\frac{26.2}{156.4} \times 9.50\right)}{\left(\frac{36.6}{156.4} \times 9.50\right) \times \left(\frac{93.6}{156.4} \times 9.50\right)^2}$$

$$\frac{(0.168 \times 9.5)}{(0.234 \times 9.50) \times (0.598 \times 9.5)^2}$$

$$\frac{(1.59)}{1.5 \times 10^{-14}}$$

1

M7 0.022(1) 2.2(l)×10⁻⁸ 2.2(l)×10⁻¹⁴

1

M8 MPa⁻² kPa⁻² Pa⁻²

1

*If no subtraction lose M1, M2 and M3)
 (If ×2 missed in M2, lose both M2 and M3)
 (If M1 gained but moles of H₂ = 73.2 (i.e. double CO), M2 and M3 lost)
 (If M1 gained but mol H₂ = 2(146 – 26.2), M2 and M3 lost)
 (If M1 and M2 correct but M3 lost for CE, penalise M6 also)
 (M4 can be gained from the numbers in the expression for M6 even if these numbers are wrong)
 (If K_p contains [] lose M5 but then mark on)
 (If chemically wrong expression for K_p, lose M5, M6 and M7 (allow M8 conseq on their K_p))
 (If divided by 9.5, or not used 9.5 at all, lose M6 and M7 (and M4))
 (If tried to convert to kPa and is factor(s) of 10 out, penalise in M6 and allow M8 for kPa⁻²)*

[14]