

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Mark Schemes

Q1.

(a) Decrease 1

Increasing pressure moves equilibrium to the side of least moles i.e. backward reaction 1

To oppose the increase in pressure or to decrease the pressure 1

(b) A catalyst speeds up the rate of the forward and backward reaction 1

By the same amount 1

(c) $\Delta H = -111 - (-75 - 242)$ 1

206 (kJ mol⁻¹) 1

(d) $\Delta S = 3 \times 131 + 198 - (186 + 189) = 216 \text{ J K}^{-1} \text{ mol}^{-1}$ 1

$\Delta G = \Delta H - T\Delta S$ 1

$0 = 206 - T \frac{216}{1000}$ 1

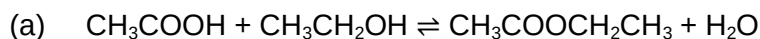
$T = 953.7 \text{ or } 954 \text{ K}$ 1

$T = 681 \text{ (}^\circ\text{C)}$ 1

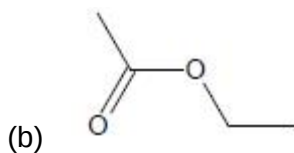
If the value given in the question is used then the answer is 283 (°C)

[12]

Q2.



1



1

(c) A catalyst provides an alternative mechanism for reaction.

1

That has a lower activation energy.

1

(d) K_c expression shown correctly e.g. $K_c = \frac{[\text{ester}][\text{water}]}{[\text{acid}][\text{alcohol}]}$

1

Hence $K_c = 4.07 = x^2 / (0.0435 - x)^2$ (if x = amount of ester/water produced and therefore = amount by which amounts of acid and alcohol decreased).

1

So $\sqrt{4.07} = x^2 / (0.0435 - x)^2$
So $x = 0.0291$ mol.

1

Acid left at equilibrium = $0.0435 - 0.0291 = 0.0144$ mol.

1

Adding acid catalyst = $0.0144 + 2(0.0005) = 0.0154$ mol (adding 2×0.0005 as 0.0005 mol of H_2SO_4 added and catalyst so not used up and dibasic).

1

Volume of alkali needed = $1000 \times 0.0154 / 0.400 = 38.5 \text{ cm}^3$.

1

(e) Test several samples – at least one tested after a week.

1

Check that the result has not changed.

1

[12]