

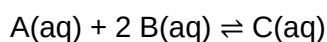
Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Q1.

A and **B** react together to form an equilibrium mixture.



An aqueous solution containing 0.25 mol of **A** is added to an aqueous solution containing 0.25 mol of **B**.

When equilibrium is reached, the mixture contains 0.015 mol of **C**.

- (a) Calculate the amount of **A** and the amount of **B**, in moles, in the equilibrium mixture.

Amount of **A** _____ mol

Amount of **B** _____ mol

(2)

- (b) At a different temperature, another equilibrium mixture contains 0.30 mol of **A**, 0.25 mol of **B** and 0.020 mol of **C** in 350 cm³ of solution.

Calculate the value of the equilibrium constant K_c

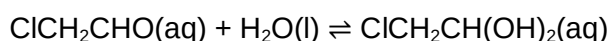
Deduce the units of K_c

K_c _____

Units _____

(4)

When an excess of water is added to chloroethanal, an equilibrium mixture is formed.



An expression for an equilibrium constant (K) for the reaction under these conditions is

$$K = \frac{[\text{ClCH}_2\text{CH}(\text{OH})_2]}{[\text{ClCH}_2\text{CHO}]}$$

- (c) Suggest why an expression for K can be written without the concentration of water.

(1)

- (d) Distilled water is added to 4.71 g of chloroethanal ($M_r = 78.5$) to make 50.0 cm^3 of solution. The mixture is allowed to reach equilibrium.

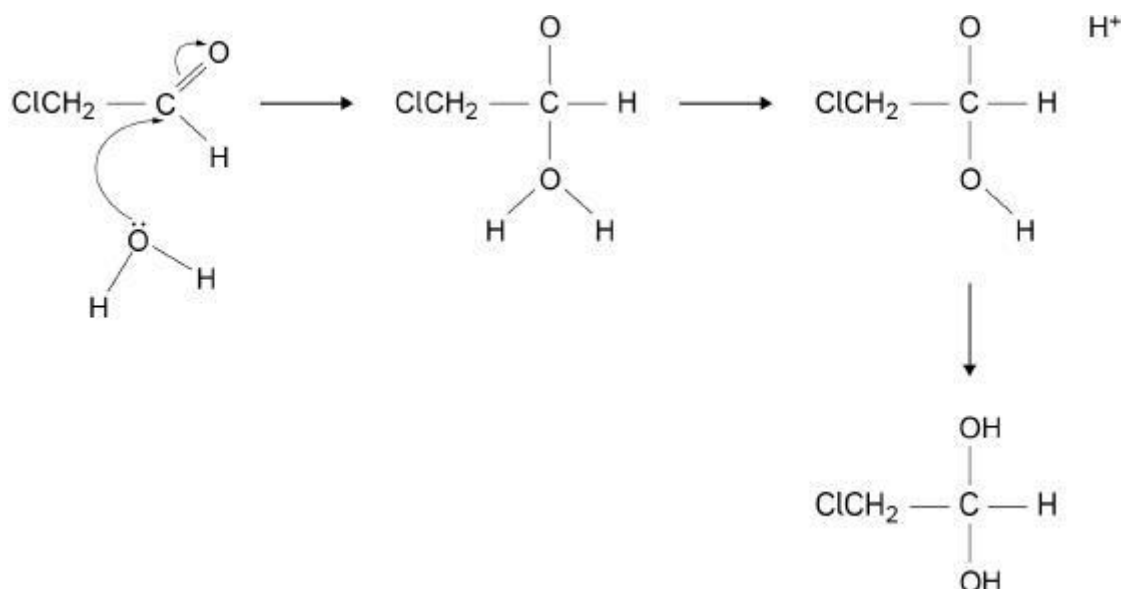
The value of the equilibrium constant (K) is 37.0

Calculate the equilibrium concentration, in mol dm^{-3} , of $\text{ClCH}_2\text{CH}(\text{OH})_2$

Concentration _____ mol dm^{-3}

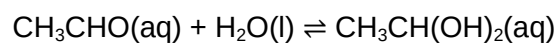
(5)

- (e) The figure below shows an incomplete nucleophilic addition mechanism for the reaction of water with chloroethanal.



Complete the mechanism in the figure by adding **two** curly arrows, all relevant charges and any lone pairs of electrons involved.

- (f) When an excess of water is added to ethanal a similar nucleophilic addition reaction occurs.



Suggest why this reaction is slower than the reaction in part (e).

(3)

(Total 18 marks)