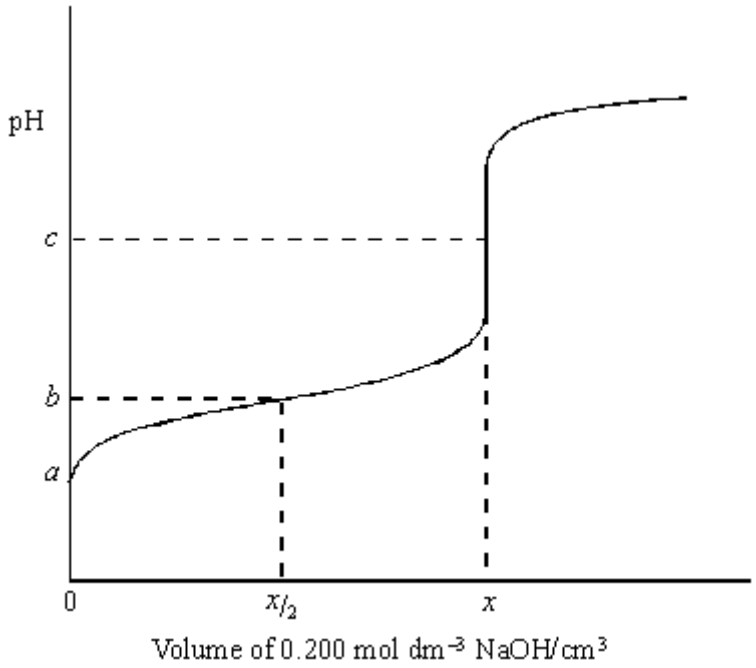
Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

The sketch below shows the change in pH when a 0.200 mol dm^{-3} solution of sodium hydroxide is added from a burette to 25.0 cm^3 of a 0.150 mol dm^{-3} solution of the weak acid HA at 25 °C.



(a) The volume of sodium hydroxide solution added at the equivalence point is x cm^3. Calculate the value of x.

_____

_____

_____

(2)

(b) (i) Define the term pH.

_____

(ii) The pH at the equivalence point is c. Suggest a value for c.

_____

(iii) Identify a suitable indicator for detecting the equivalence point of the titration.

_____

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(3)

(c) The value of K_c for the weak acid HA at 25 °C is 2.75×10^{-5} mol dm^{-3}.

(i) Explain the term *weak* as applied to the acid HA.

_____

(ii) Write an expression for K_a for the acid HA.

_____

(iii) Calculate the pH of the 0.150 mol dm^{-3} solution of acid HA before any sodium hydroxide is added, i.e. the pH at point *a*.

_____

_____

_____

_____

_____

(5)

(d) Calculate the pH of the solution formed when $\frac{x}{2}$ cm^3 of the 0.200 mol dm^{-3} solution of sodium hydroxide are added to 25.0 cm^3 of the 0.150 mol dm^{-3} solution of HA, i.e. the pH at point *b*.

_____

_____

_____

(3)

(Total 13 marks)

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Q2.

Iodine and propanone react in acid solution according to the equation

$$I_2 + CH_3COCH_3 \rightarrow CH_3COCH_2I + HI$$

The rate equation for the reaction is found to be

$$\text{rate} = k\,[CH_3COCH_3][H^+]$$

(a) Deduce the order of reaction with respect to iodine and the overall order of reaction.

Order with respect to iodine _____

Overall order _____

(2)

(b) At the start of the experiment, the rate of reaction was found to be 2.00×10^{-5} mol dm^{-3} s^{-1} when the concentrations of the reactants were as shown below.

Reactant	Concentration / mol dm^{-3}
CH_3COCH_3	1.50
I_2	2.00×10^{-2}
H^+	3.00×10^{-2}

Use these data to calculate a value for the rate constant and deduce its units.

Rate constant _____

_____

_____

Units _____

(3)

(c) How can you tell that H^+ acts as a catalyst in this reaction?

_____

_____

_____

(2)

(d) Calculate the initial rate of reaction if the experiment were to be repeated at the same temperature and with the same concentrations of iodine and propanone as in part (b) but at a pH of 1.25

_____

_____

_____

_____

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_____

_____

(3)

(Total 10 marks)

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