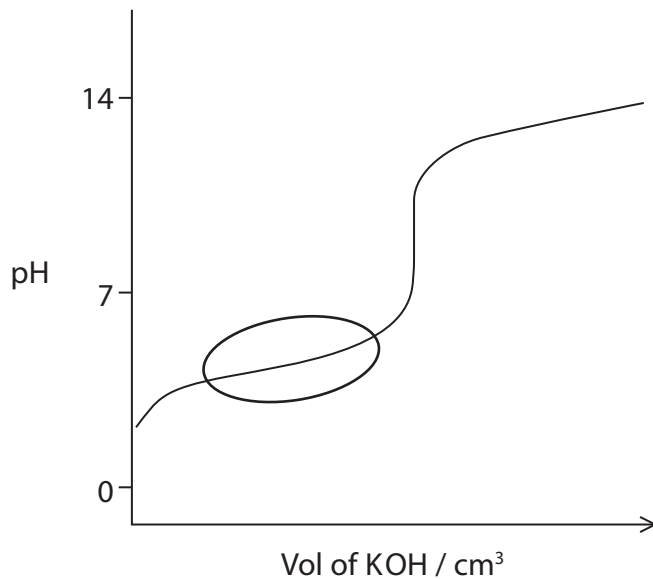


1 A student carried out a titration by adding $0.032 \text{ mol dm}^{-3}$ potassium hydroxide solution to 25.0 cm^3 of $0.024 \text{ mol dm}^{-3}$ propanoic acid. A sketch graph of pH against volume of potassium hydroxide solution added is shown below.



(a) *(i) Describe and explain the behaviour of the solution formed in the region circled on the sketch graph.

(3)

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* (ii) Explain why the pH at the equivalence point of this titration is greater than 7. (3)

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(iii) By considering the amount of excess alkali remaining, calculate the pH of the solution formed when 40 cm³ of 0.032 mol dm⁻³ potassium hydroxide solution has been added to 25.0 cm³ of 0.024 mol dm⁻³ propanoic acid.

$$K_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6} \text{ at } 298 \text{ K}$$

(5)

(b) The student made the following statement:

'The pH of pure water is always 7.0'

Is the student correct? Use the following information to justify your answer.

- $\text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$
- $K_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ at 298 K
- ΔH is positive for the forward reaction in the equilibrium.

(3)

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(Total for Question = 14 marks)