

A level Chemistry A

H432/01 Periodic table, elements and physical chemistry

Question Set 19

1. (a) This question is about weak acids.

The K_a values of three weak acids are shown in **Table 1.1**.

Weak acid	$K_a / \text{mol dm}^{-3}$
iodic(V) acid, $\text{HIO}_3(\text{aq})$	1.78×10^{-1}
propanoic acid, $\text{C}_2\text{H}_5\text{COOH}(\text{aq})$	1.35×10^{-5}
hydrocyanic acid, $\text{HCN}(\text{aq})$	6.17×10^{-10}

Table 1.1

Calculate the pH of $0.0800 \text{ mol dm}^{-3}$
 $\text{C}_2\text{H}_5\text{COOH}(\text{aq})$.

Give your answer to **2** decimal places.

pH = **[2]**

(b) (i) A student adds a total of 45.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ $\text{NaOH}(\text{aq})$ to 25.0 cm^3 of $0.0800 \text{ mol dm}^{-3}$ $\text{C}_2\text{H}_5\text{COOH}(\text{aq})$ and monitors the pH throughout.

Show by calculation that 20.0 cm^3 of $\text{NaOH}(\text{aq})$ is required to reach the end point. **[1]**

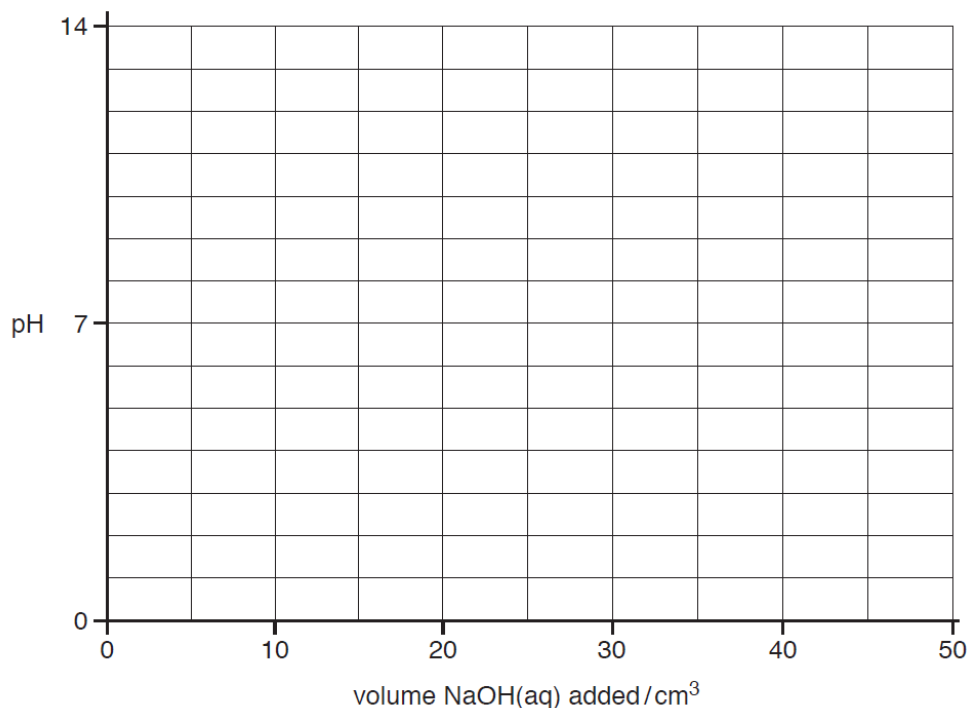
(ii) Calculate the pH of the final solution.

Give your answer to **2** decimal places.

pH = **[4]**

(iii) On the axes below, sketch a pH curve for the pH changes during the addition of 45.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ $\text{NaOH}(\text{aq})$ to 25.0 cm^3 of $0.0800 \text{ mol dm}^{-3}$ $\text{C}_2\text{H}_5\text{COOH}(\text{aq})$.

[3]



(iv) The student considers using the four indicators in **Table 1.2** for the titration.

Indicator	pH range
Cresol red	0.2 – 1.8
Bromophenol blue	3.0 – 4.6
Cresol purple	7.6 – 9.2
Indigo carmine	11.6 – 14.0

Table 1.2

Explain which indicator would be most suitable for the titration.

[1]

(v) The student repeats the experiment starting with 25.0 cm³ of 0.0800 mol dm⁻³ HCN(aq) and adding a total of 45.0 cm³ of 0.100 mol dm⁻³ NaOH(aq).

Predict **one** similarity and **one** difference between the pH curve with C₂H₅COOH(aq) and the pH curve with HCN(aq). Use the information in **Table 1.1**, and your answer to **(b)(iii)**.

Similarity

.....

Difference

.....

[2]

(c) The student calculates the pH of $0.0800 \text{ mol dm}^{-3} \text{ HIO}_3(\text{aq})$. The student assumes that the equilibrium concentration of $\text{HIO}_3(\text{aq})$ is the same as the initial concentration of $\text{HIO}_3(\text{aq})$.

The student measures the pH, and finds that the measured pH value is different from the calculated pH value.

Explain why the measured pH is different from the calculated pH.

[1]

Total Marks for Question Set 19: 14

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