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/mol dm^{-3}
iodic(V) acid, HIO_3(aq)	1.78×10^{-1}
propanoic acid, C_2H_5COOH(aq)	1.35×10^{-5}
hydrocyanic acid, HCN(aq)	6.17×10^{-10}

Table 1.1

Calculate the pH of 0.0800 mol dm^{-3} C_2H_5COOH (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 mol dm^{-3} NaOH(aq) to 25.0 cm^3 of 0.0800 mol dm^{-3} C_2H_5COOH(aq) and monitors the pH throughout.

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

(ii) Calculate the pH of the final solution.
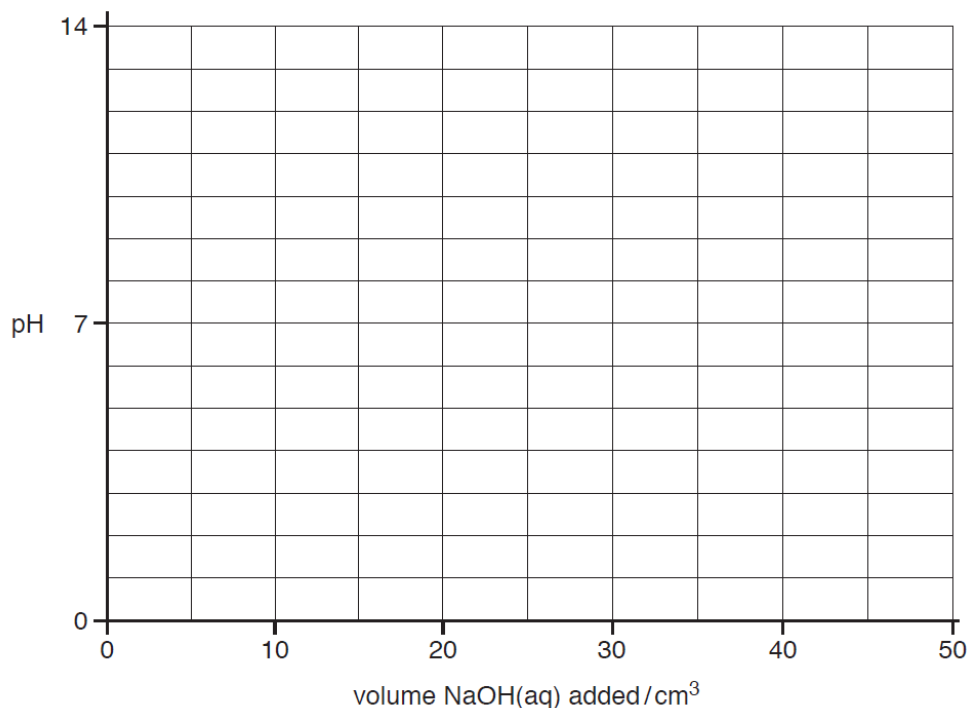
Give your answer to **2** decimal places.

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 mol dm^{-3} NaOH(aq) to 25.0 cm^3 of 0.0800 mol dm^{-3} C_2H_5COOH(aq).

[3]

volume NaOH(aq) added / cm³

(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 $C_2H_5COOH(aq)$ 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 mol dm^{-3} HIO$_3$(aq). The student assumes that theequilibrium concentration of HIO$_3$(aq) is the same as the initial concentration of HIO$_3$(aq).

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

Explain why the measured pH is different from the calculated pH. **[1]**

Total Marks for Question Set 19: 14