1 Find the pH of 0.20 mol dm^{-3} ethanoic acid. (pK_a = 4.76)

$[H^+]^2 = K_a [HA]$

$[H^+] = \sqrt{K_a [HA]} = \sqrt{10^{-4.76} \times 0.20} = 1.86 \times 10^{-3}$

$pH = -\log[H^+] = -\log 1.86 \times 10^{-3} = 2.73$

2 Find the pH of a mixture of 20.0 cm^3 of 0.20 mol dm^{-3} ethanoic acid and 50.0 cm^3 0.10 mol dm^{-3} sodium hydroxide. (pK_a for ethanoic acid = 4.76)

$\text{mol HA} = 0.20 \times \frac{20.0}{1000} = 0.00400$

$\text{mol } OH^- = 0.10 \times \frac{50.0}{1000} = 0.00500$

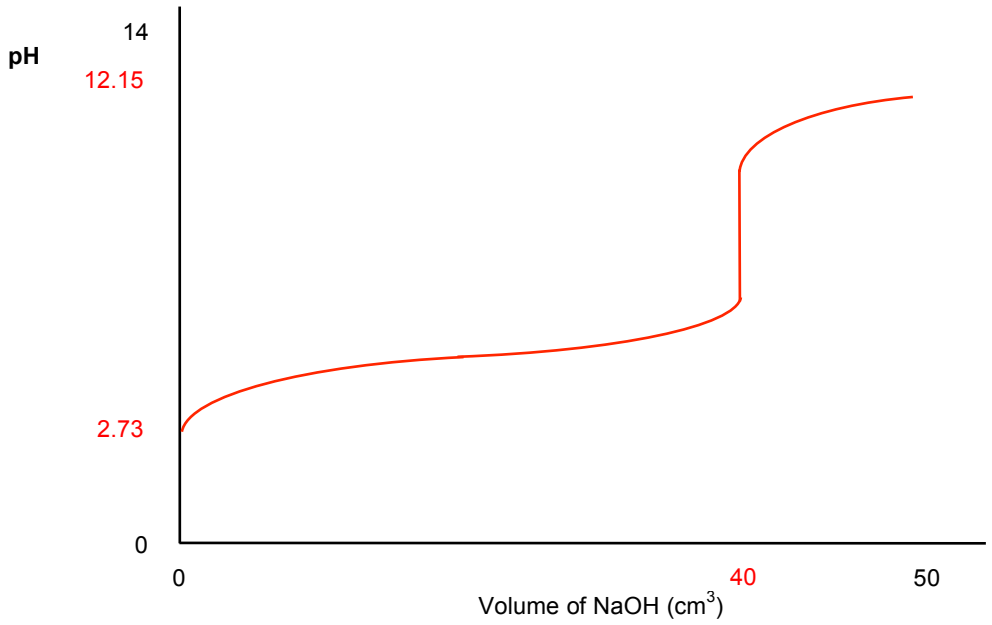
$\text{XS mol } OH^- = 0.00500 - 0.00400 = 0.00100$

$\text{XS mol } [OH^-] = \frac{0.00100}{\frac{70}{1000}} = 0.0143$

$[H^+] = \frac{Kw}{[OH^-]} = \frac{10^{-14}}{0.0143} = 7.0 \times 10^{-13}$

$pH = -\log[H^+] = -\log 7.0 \times 10^{-13} = 12.15$

3 Sketch the pH curve to show how the pH changes as 50.0 cm^3 0.10 mol dm^{-3} sodium hydroxide is added to 20.0 cm^3 of 0.20 mol dm^{-3} ethanoic acid. Mark on the volume of sodium hydroxide needed for equivalence.



4 What is an equivalence point? **when moles of acid = moles of alkali**

5 Estimate the pH at the equivalence point. **pH > 7 (less than 10)**

6 Identify a suitable indicator that changes colour at the equivalence point. **phenolphthalein**