1 What is a buffer solution?

resists changes in pH when small amounts of acid or alkali added

2 A student has 50 cm^3 of an aqueous mixture of 0.200 mol dm^{-3} methanoic acid and 0.500 mol dm^{-3} sodium methanoate. Calculate the pH of this mixture. (pK_a of methanoic acid is 3.75)

$$K_a = \frac{[H^+][A^-]}{[HA]} \quad \therefore \quad [H^+] = \frac{K_a\,[HA]}{[A^-]} = \frac{10^{-3.75} \times 0.200}{0.500} = 7.11 \times 10^{-5}$$

$$pH = -\log[H^+] = -\log 7.11 \times 10^{-5} = 4.15$$

3 1.0 cm^3 of 0.500 mol dm^{-3} sodium hydroxide (aq) is added to the mixture in **2**. Calculate the pH of this mixture.

At start: mol HA = $0.200 \times \frac{50}{1000} = 0.0100$

mol A^- = $0.500 \times \frac{50}{1000} = 0.0250$

mol OH^- = $0.500 \times \frac{1.0}{1000} = 0.00050$

	HA	+ OH^-	→ A^-	+ H_2O
start	0.0100	0.00050	0.0250	
end	0.0095	none	0.0255	lots

$$K_a = \frac{[H^+][A^-]}{[HA]} \quad \therefore \quad [H^+] = \frac{K_a\,[HA]}{[A^-]} = \frac{10^{-3.75}\,[\frac{0.0095}{\frac{51}{1000}}]}{[\frac{0.0255}{\frac{51}{1000}}]} = 6.62 \times 10^{-5}$$

$$pH = -\log[H^+] = -\log 6.62 \times 10^{-5} = 4.18$$

4 Explain why the pH hardly changed in part **3** when the sodium hydroxide is added to the mixture.

when OH^- added, it reacts with some HA to form some more A^-

as moles of HA and moles of A^- is significantly greater than the moles of OH^- added, the ratio of $\frac{[HA]}{[A^-]}$ remains almost constant