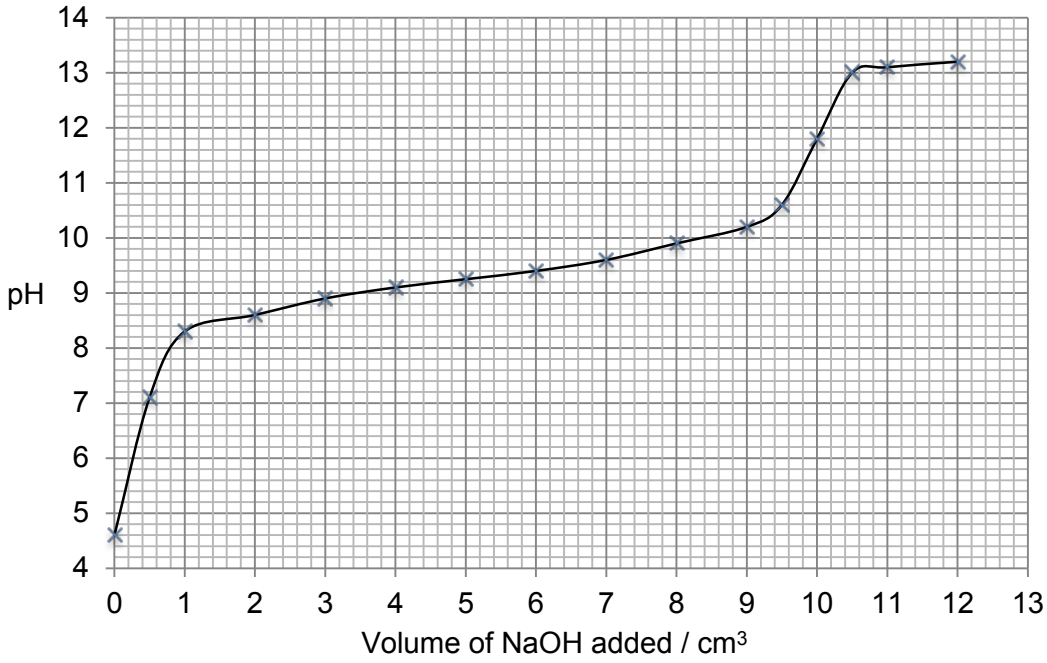
6 Ammonium chloride, when dissolved in water, can act as a weak acid as shown by the following equation.

$$NH_4^+(aq) \rightleftharpoons NH_3(aq) + H^+(aq)$$

Figure 1 shows a graph of data obtained by a student when a solution of sodium hydroxide was added to a solution of ammonium chloride. The pH of the reaction mixture was measured initially and after each addition of the sodium hydroxide solution.

Figure 1



0 6 . 1 Suggest a suitable piece of apparatus that could be used to measure out the sodium hydroxide solution.
Explain why this apparatus is more suitable than a pipette for this purpose.

[2 marks]

Apparatus _____

Explanation _____

_____

_____

0 6 . 2 Use information from the curve in **Figure 1** to explain why the end point of this reaction would be difficult to judge accurately using an indicator.

[2 marks]

0 6 . 3 The pH at the end point of this reaction is 11.8

Use this pH value and the ionic product of water, $K_w = 1.0 \times 10^{-14}$ mol^2 dm^{-6}, to calculate the concentration of hydroxide ions at the end point of the reaction.

[3 marks]

Concentration = _____ mol dm^{-3}

Question 6 continues on the next page

0 6 . 4 The expression for the acid dissociation constant for aqueous ammonium ions is

$$Ka = \frac{[NH^3][H^+]}{[NH_4{}^+]}$$

The initial concentration of the ammonium chloride solution was 2.00 mol dm^{-3}.

Use the pH of this solution, before any sodium hydroxide had been added, to calculate a value for K_a

[3 marks]

K_a = _____ mol dm^{-3}

0 6 . 5 A solution contains equal concentrations of ammonia and ammonium ions.

Use your value of K_a from Question **6.4** to calculate the pH of this solution. Explain your working.

(If you were unable to calculate a value for K_a you may assume that it has the value 4.75×10^{-9} mol dm^{-3}. This is **not** the correct value.)

[2 marks]

pH= _____