(b) In one titration, 20.0 mL samples of the household ammonia solution were titrated with a standard HCl solution.

(i) (1) Name the glassware used to deliver the HCl solution.

_____ (1 mark)

(2) Identify the solution used to rinse this glassware immediately before use.

_____ (1 mark)

(ii) A series of titrations were performed, and the results that were obtained are shown in the table below:

Titration Number	Titre Value (mL)
1	17.95
2	17.80
3	17.70
4	17.55
5	17.40

Using the information about ammonia given above, suggest an explanation for the continuing decrease in titre values.

_____

_____

_____

_____ (2 marks)

Credit will be given for the correct use of significant figures in answers to part (c). (1 mark)

(c) A different procedure was then followed, as summarised below:

Step 1 A volume of 25.0 mL of the household ammonia solution was made up to 250.00 mL.

Step 2 A 20.00 mL aliquot was taken and immediately added to 50.00 mL of 0.1000 mol L^{-1} HCl solution. An equation for the reaction that occurred is shown below:

$$NH_3 + HCl \longrightarrow NH_4Cl$$

Step 3 Unreacted acid was titrated with sodium hydroxide solution. A volume of 7.70 mL of 0.1302 mol L^{-1} sodium hydroxide solution was required. An equation for the reaction that occurred is shown below.

$$HCl + NaOH \longrightarrow NaCl + H_2O$$

(i) Calculate the number of moles of HCl that were added to the diluted ammonia solution in Step 2.

(2 marks)

(ii) Calculate the number of moles of HCl that reacted with sodium hydroxide in Step 3.

(2 marks)

(iii) Calculate the number of moles of HCl that reacted with ammonia in Step 2.

(1 mark)

(iv) Calculate the number of moles of ammonia in the 20.00 mL aliquot that was titrated in Step 2.

(1 mark)

(v) Hence calculate the number of moles of ammonia in the 250.0 mL of diluted ammonia solution.

(2 marks)

(vi) Hence calculate the %w/v of ammonia in the household ammonia solution.

(3 marks)

TOTAL: 17 marks