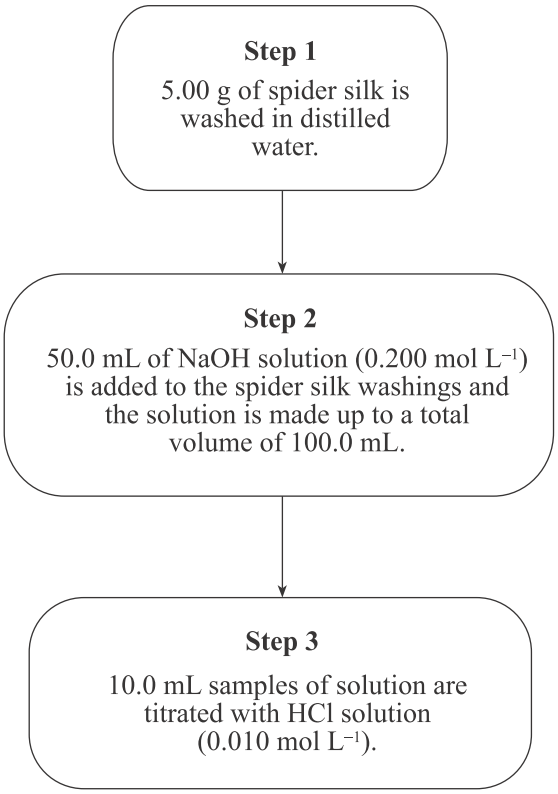
Credit will be given for the correct use of significant figures in answers to part (b). (1 mark)

(b) In nature, spider silk is protected by a coating of a solution that contains a weak monoprotic acid. This makes the silk weakly acidic.

The following procedure was used to determine the percentage, by mass, of monoprotic acid in .00 g of spider silk.



(i) Calculate the number of moles of NaOH added to the spider silk washings in Step .

(marks)

(ii) Excess NaOH remained after the reaction in Step 3 was complete. In Step 4, 10.0 mL samples of solution were titrated with HCl to determine the number of moles of NaOH present.

The equation for the titration reaction in Step 4 is shown below:

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

In one titration 42.0 mL of HCl was needed to neutralise the NaOH in one 10.0 mL sample.

(1) Calculate the number of moles of HCl needed to neutralise the NaOH in Step 4.

(2 marks)

(1) Hence state the number of moles of NaOH in the 10.0 mL sample titrated in Step 4.

(1 mark)

(1) Hence calculate the total number of moles of excess NaOH that remained after the reaction with the spider silk washings in Step 3.

(1 mark)

(4) Calculate the number of moles of NaOH that reacted with the spider silk washings in Step 3.

(1 mark)

(1) The average molar mass of the weak monoprotic acid in spider silk is 112.1 g mol^{-1}.

Calculate the percentage, by mass, of the monoprotic acid in the 2.00 g of spider silk.

(2 marks)