QUESTION 10

Aspirin is a common pain-relieving drug. The following procedure was used to determine the percentage, by mass, of aspirin in aspirin tablets:

Step 1 Four aspirin tablets, each of mass 300.0 mg, were crushed and added to 30.0 mL of 1.0 mol L^{-1} NaOH solution. Excess NaOH remained after the reaction was complete.

Step 2 The excess NaOH was titrated with 0.50 mol L^{-1} H_2SO_4 solution from a burette.

(a) Suggest a reason why the aspirin tablets were crushed in Step 1.

_____ (1 mark)

(b) The burette used in this titration was prepared carefully, to ensure that the results were accurate.

State two steps that would have been followed in the preparation of the burette, and state why each step was necessary to ensure accuracy.

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_____ (4 marks)

(c) Bromothymol blue was used as an indicator for the titration. Bromothymol blue is yellow in acidic solution and blue in basic solution.

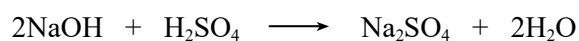State the colour that would indicate the end-point of the titration.

_____ (1 mark)

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

(d) (i) Calculate the number of moles of NaOH solution added to the aspirin tablets in Step 1.

(2 marks)

6

(ii) The equation for the titration reaction in Step 2 is shown below:

$$2NaOH \ + \ H_2SO_4 \ \longrightarrow \ Na_2SO_4 \ + \ 2H_2O$$

In one titration 23.7 mL of H_2SO_4 was required to react completely with the excess NaOH.

(1) Calculate the number of moles of H_2SO_4 needed to neutralise the excess NaOH.

(2 marks)

(2) Hence calculate the number of moles of excess NaOH.

(1 mark)

(3) Hence calculate the number of moles of NaOH that reacted with the aspirin tablets in Step 1.

(1 mark)

(iii) Aspirin reacts with NaOH in a 1:1 mole ratio.

Use this information to calculate the total mass of aspirin in the tablets and hence the percentage, by mass, of aspirin in the tablets. The molar mass of aspirin is 180.17 g mol^{-1}.

(3 marks)

TOTAL: 16 marks

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