

Question 38**(15 marks)**

A tablet used to reduce the effects of indigestion contained a mixture of sodium hydrogencarbonate and sodium carbonate.

Five tablets were crushed and dissolved in distilled water, which was added to a volumetric flask and the volume made up to 250.0 mL.

Aliquots (25.00 mL) of the solution were transferred to conical flasks and titrated against a 0.0955 mol L⁻¹ solution of hydrochloric acid.

The masses of sodium hydrogencarbonate and sodium carbonate in each tablet were found to be:

- sodium hydrogencarbonate – 106.5 mg
- sodium carbonate – 187.5 mg.

(a) Calculate the average titre that would have been obtained to produce these results. Use the following molar masses in your calculation:

- $M(\text{NaHCO}_3) = 84.008 \text{ g mol}^{-1}$
- $M(\text{Na}_2\text{CO}_3) = 105.99 \text{ g mol}^{-1}$.

(8 marks)

- (b) Hydrochloric acid must be standardised against a primary standard before it can be used in titrations such as the one described in part (a). List **three** properties of substances suitable for use as primary standards. (3 marks)

One: _____

Two: _____

Three: _____

- (c) Methyl orange, which changes colour between a pH of 3.1 and a pH of 4.4, was chosen as the indicator for this reaction. Justify, with the aid of an equation, the selection of this indicator for the titration. (4 marks)

