

PAG C6 Titration

Question	Maximum Mark	Mark Awarded
1	5	
2	7	
Total Mark		

1.

Indigestion is caused by excess acid in the stomach. Antacid tablets contain mainly calcium carbonate. The calcium carbonate in an antacid tablet neutralises the excess acid. A group of pupils was asked to carry out an investigation to find

“Which brand of antacid tablet is the best?”

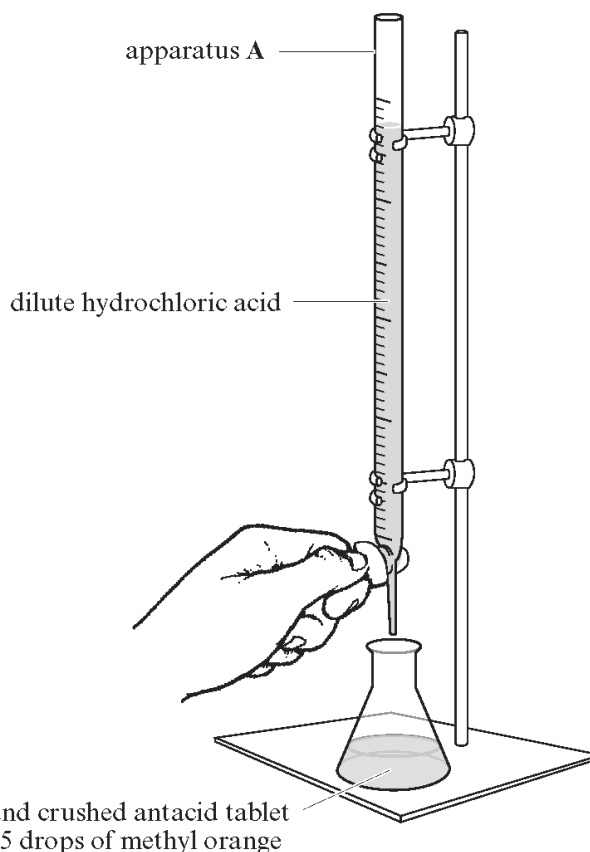
The group was provided with three different tablets, **A**, **B** and **C**, each of equal mass. The apparatus below was used to find out how much dilute hydrochloric acid was needed to react with all the calcium carbonate in each antacid tablet.

Tablet **A** was crushed and added to 50 cm^3 of water in a conical flask. Five drops of methyl orange were then added.

The mixture was titrated with dilute hydrochloric acid. The acid was added 0.5 cm^3 at a time until the methyl orange turned red.

The total volume of acid added was recorded.

This procedure was repeated using tablets **B** and **C**.



The results for each tablet are shown below.

	Tablet		
	A	B	C
Volume of acid needed to neutralise all the calcium carbonate in a single tablet (cm^3)	12.5	13.5	11.0

(a)

burette	measuring cylinder	pipette	gas syringe	test tube
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Choose from the box above the name of apparatus A in the diagram.

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[1]

(b) Give the name for substances, such as methyl orange, which have one colour in acids and a different colour in alkalis.

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[1]

(c) State, giving a reason, how the results could be made more accurate.

[2]

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.....

(d) State, giving a reason, which brand of indigestion tablet is the best.

[1]

.....
.....

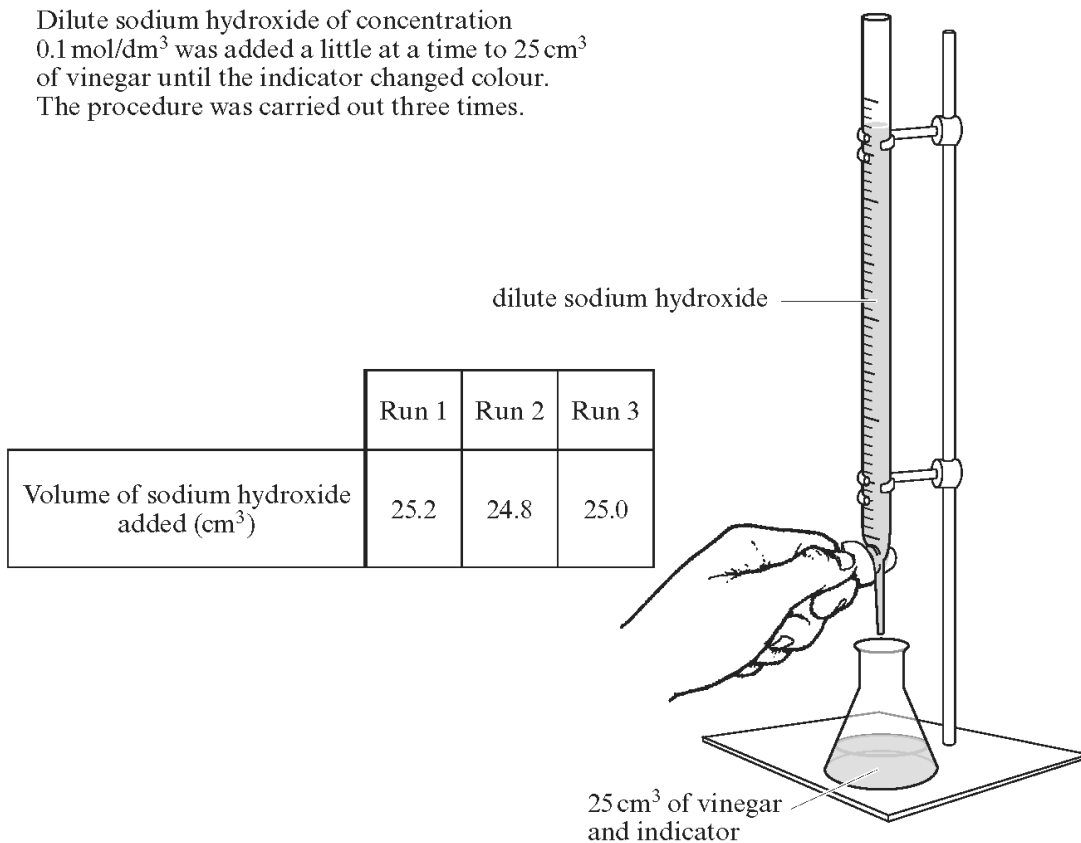
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2.

A food scientist was asked to check the quality of a bottle of vinegar. Vinegar contains ethanoic acid, CH_3COOH .

The apparatus shown was used to find the concentration of ethanoic acid in the vinegar.

Dilute sodium hydroxide of concentration 0.1 mol/dm^3 was added a little at a time to 25 cm^3 of vinegar until the indicator changed colour. The procedure was carried out three times.



(a) Calculate the mean volume of sodium hydroxide needed to neutralise 25 cm^3 of vinegar. [1]

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(b) Ethanoic acid reacts with sodium hydroxide solution according to the equation below.



Using the mean volume of sodium hydroxide from part (a), calculate the concentration of the ethanoic acid in mol/dm³. [3]

Concentration of ethanoic acid = mol/dm³

(c) The label on the vinegar bottle states that it contains 5 g of ethanoic acid, CH₃COOH, in 100 cm³ vinegar.

$$A_r(\text{H}) = 1 \quad A_r(\text{C}) = 12 \quad A_r(\text{O}) = 16$$

(i) Calculate the relative molecular mass, M_r , of ethanoic acid. [1]

$M_r =$

(ii) Using your answers to parts (b) and (c)(i) show whether the information on the label is correct. [2]

.....
.....

7

Marking Scheme

1.

Question Number		Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT						
5		(a)	1	burette			
		(b)	1	indicator(s)			pH indicator universal indicator
		(c)	2	<p>adding smaller volume of acid (at a time) / adding 0.1 cm³ acid (at a time) / <i>accept any volume below 0.5 cm³</i> (1)</p> <p>to obtain the exact end point value / to get the exact volume indicator turns red / changes colour / to get the exact volume when complete neutralisation occurs (1)</p> <p><i>answer must imply a 'better' / more accurate volume reading obtained</i></p>	adding drops (at a time)	repeat readings	
		(d)	1	B need the <i>most</i> acid – both needed		needs lot of acid / more acid	

2.

Question Number		Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT						
	9	(a)	1	25.0	25		
		(b)	3	<p>number of moles NaOH = concentration × volume = 0.1 × 25/1000 = 0.0025 (1)</p> <p>(stoichiometry / equation shows 1:1) 0.0025 mol CH₃COOH : 0.0025 mol NaOH (1)</p> <p>concentration CH₃COOH = number of moles ÷ volume = 0.0025 ÷ 25/1000 = 0.1 (1)</p> <p>– correct answer only (cao) (3) – follow through error (ft)</p>	<p>eV = cV c × 25 = 0.1 × 25 (2)</p> <p>c = $\frac{0.1 \times 25}{25}$ = 0.1</p>		
		(c)	1	60			
		(ii)	2	<p>number of moles = concentration × volume = 0.1 × 100/1000 = 0.01 (1)</p> <p>number of moles = mass / M_r mass = number of moles × M_r = 0.01 × 60 = 0.6 g (∴ label information incorrect) (1)</p>	<p>number of moles in 100cm³ = 0.083 (1)</p> <p>concentration calculated above as 0.1 mol/dm³ – not 0.83 mol/dm³ (1)</p>		