Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

4438093165

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **October/November 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Notes for Use in Qualitative Analysis for this paper are printed on page 12.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **11** printed pages and **1** blank page.

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CAMBRIDGE International Examinations

1 You are going to investigate the nutrient content of soft cheese and apples.

You are provided with three testing solutions.

Benedict's solution
biuret solution
iodine solution

- Add a small amount of distilled water to the soft cheese and stir with the stirring rod so that it loosens and can be poured.
- Label the three test-tubes **A**, **B** and **C**.
- Pour the soft cheese into each of the test-tubes to a depth of about 1 cm.
- A hot water-bath is available if required.

(a) Complete Table 1.1 to show which solution you are going to use for each test and whether heat is needed for the test.

Table 1.1

nutrient tested for	testing solution	heat needed (yes / no)
protein		
reducing sugar		
starch		

[3]

(b) Test your samples of soft cheese as follows.

- In test-tube **A** use Benedict's solution and record in Table 1.2 your observation.
- In test-tube **B** use biuret solution and record in Table 1.2 your observation.
- In test-tube **C** use iodine solution and record in Table 1.2 your observation.

Complete Table 1.2 by stating for each observation if the result is positive or negative for each of the tests carried out on the soft cheese.

Table 1.2

testing solution used	observation	result
Benedict's		
biuret		
iodine		

[3]

(c) From the piece of apple provided, remove the skin and any brown parts on the outside of the flesh. Chop the flesh of the apple into very small pieces and place about 2 cm depth into each of three clean test-tubes, labelled **D**, **E** and **F**. Repeat the procedure in **(b)** using the apple flesh instead of soft cheese.

Complete Table 1.3 by stating for each observation if the result is positive or negative for each of the tests carried out on the apple.

Table 1.3

testing solution used	observation	result
Benedict's		
biuret		
iodine		

[3]

(d) **(i)** Plan an investigation to compare the reducing sugar content of lemon juice and lemonade (lemon soda). In your answer you should suggest the observations that would enable you to state which liquid has the higher concentration of reducing sugar.

....

....

....

....

....

....[3]

(ii) Suggest why it would be difficult to compare the reducing sugar contents if orange juice is used instead of lemon juice in **(d)(i)**.

....[1]

(e) Describe how you could test the apple flesh for the presence of fat.

procedure ....

....

observation for positive result ....

....

[2]

2 You are going to investigate how the concentration of hydrochloric acid affects the speed of reaction between calcium carbonate and hydrochloric acid.

You are provided with marble chips (calcium carbonate) and solution **H** which is hydrochloric acid of concentration 1.00 Q where Q is a unit of concentration.

(a) (i)
- Place limewater in test-tube **J** up to the mark.
- Place solution **H** in test-tube **K** up to the mark.
- Place a delivery tube in the limewater in test-tube **J**.
- Zero the stopwatch.
- Add ten marble chips to test-tube **K** and quickly attach the bung of the delivery tube so that the gas produced passes into the limewater in test-tube **J**. Start the stopwatch.
- Stop the stopwatch at the first appearance of a white precipitate or milkiness in the limewater.
- Record **to the nearest second** in Table 2.1 this time t_1 for concentration 1.00 Q. [1]

Table 2.1

concentration of hydrochloric acid	time t_1 for white ppt. to appear / s	time t_2 for white ppt. to appear / s	average time t_a for white ppt. to appear / s	speed of reaction $\frac{1}{t_a}$
1.00 Q				
0.75 Q				
0.50 Q				

(ii) Rinse out the test-tubes and the delivery tube with water, placing the used marble chips in the container labelled **used chips**.

Repeat **(a)(i)** and record **to the nearest second** in Table 2.1 the time t_2 for concentration 1.00 Q. [1]

(iii) You are going to make up solutions of hydrochloric acid which are less concentrated than solution **H**.

Table 2.2 shows how to make different concentrations of hydrochloric acid.

Table 2.2

volume of **H** / cm^3	volume of water / cm^3	resulting concentration of hydrochloric acid
20	0	1.00 Q
15	5	0.75 Q
10	10	0.50 Q

- You will begin by making a solution of concentration 0.75 Q.
- Using a 25 cm^3 measuring cylinder, place 15 cm^3 of solution **H** in a small beaker.
- Add 5 cm^3 of water to the small beaker and stir the mixture well.

Repeat **(a)(i)** and **(a)(ii)** using this more dilute hydrochloric acid and record **to the nearest second** in Table 2.1 the times t_1 and t_2 for concentration 0.75 Q. [1]

(iv) Repeat the procedure in **(a)(iii)**, using the information in Table 2.2, to make hydrochloric acid of concentration 0.50 Q. Then repeat **(a)(i)** and **(a)(ii)** using hydrochloric acid of concentration 0.50 Q.

Record your results in Table 2.1. [1]

(b) **(i)** Calculate the average time t_a for each concentration of hydrochloric acid.

Record the values in Table 2.1.

[1]

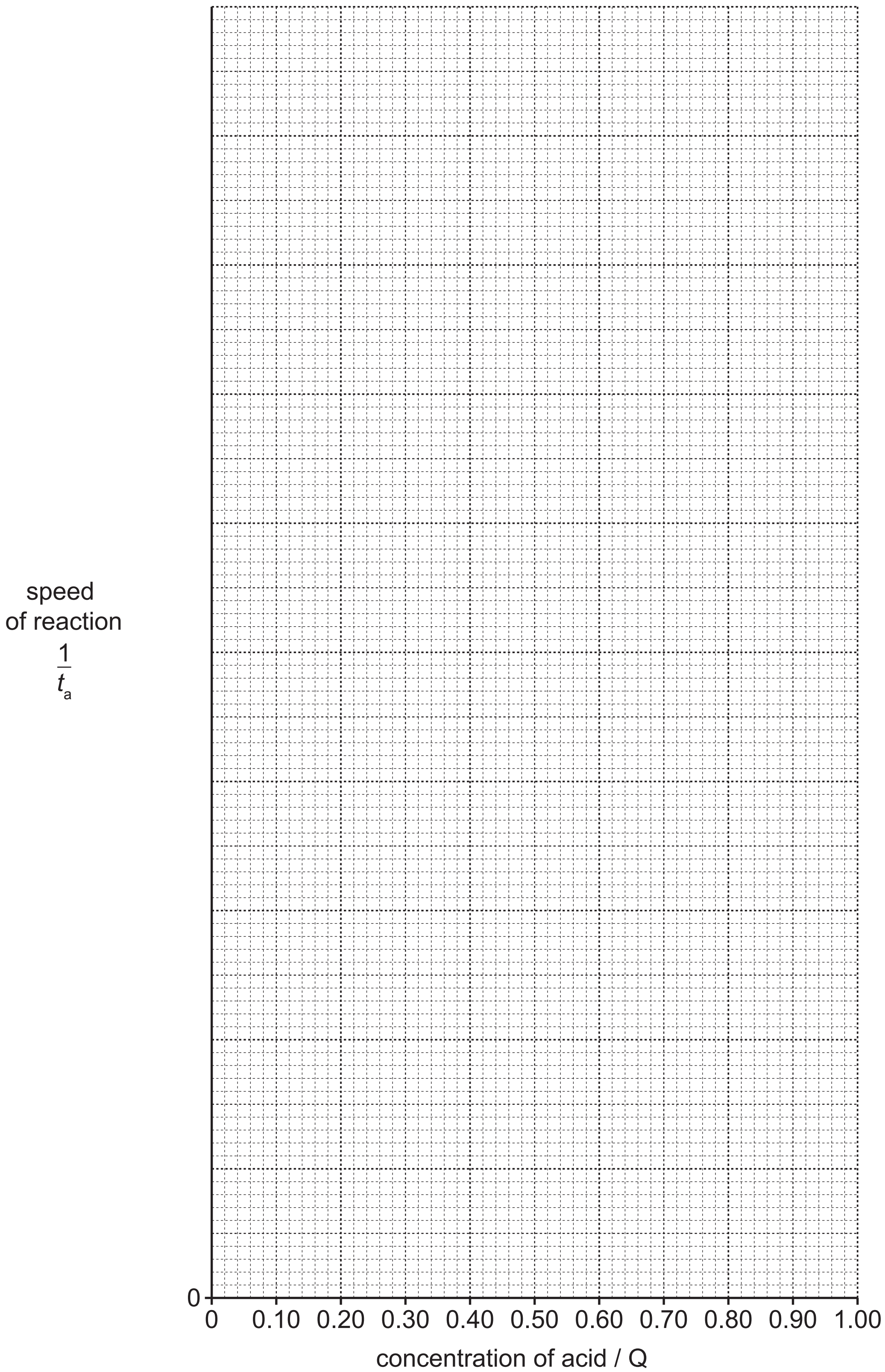
(ii) For each concentration of hydrochloric acid, calculate $\frac{1}{t_a}$.

$\frac{1}{t_a}$ is a measure of the speed of reaction.

Record in Table 2.1 these values **to three decimal places**. [1]

(c) **(i)** On the grid provided, plot a graph of the speed of reaction, $\frac{1}{t_a}$, against the concentration of hydrochloric acid used.

Draw the most appropriate line **through the origin**.



[3]

(ii) Using your graph, state the relationship between the speed of the reaction and the concentration of hydrochloric acid.

....

....[1]

(d) Explain why it is important to replace the marble chips for each experiment.

....

....

....[1]

(e) A student suggests that another experiment should be carried out using hydrochloric acid of concentration 0.25Q.

(i) Explain how this would improve the investigation.

....

....

....[1]

(ii) State the volumes of **H** and water required to make a solution of hydrochloric acid of concentration 0.25 Q.

volume of **H** .... cm^3

volume of water .... cm^3
[1]

(f) Temperature affects the speed of reaction. The reaction between calcium carbonate and hydrochloric acid is exothermic.

Consider this information and suggest how temperature affects the speed of reaction. Explain your answer.

....

....

....[2]

3 You are going to investigate the effective resistance of different combinations of identical resistors.

The circuit shown in Fig. 3.1 has been set up for you.

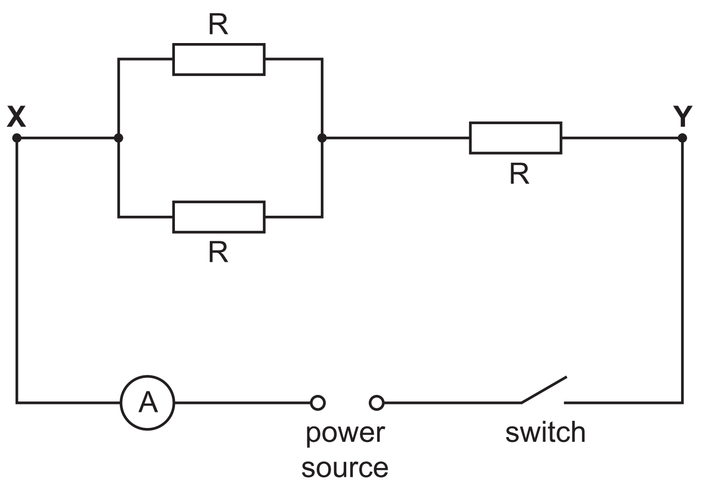


Fig. 3.1

(a) **(i)** Switch on the circuit by closing the switch. Use the voltmeter provided to measure the potential difference V between points **X** and **Y**. Record V and switch off the circuit by opening the switch.

V = ... V [1]

(ii) Complete Fig. 3.1, to show how the voltmeter is connected to measure V in **(a)(i)**. [2]

(iii) Close the switch. Record the current I shown on the ammeter and then open the switch.

I = ... A [1]

(iv) Calculate the total resistance R_T between points **X** and **Y** using the equation shown.

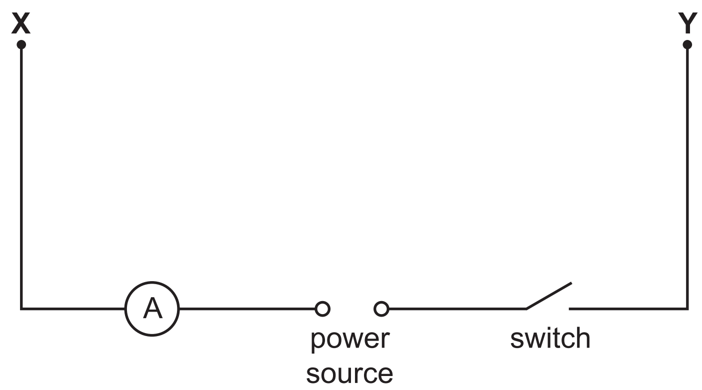
$$R_T = \frac{V}{I}$$

Include the unit of resistance in your answer.

R_T = ... unit = ... [2]

(b) Disconnect the resistors from the circuit. Reconnect the resistors in the circuit so that all three resistors are in series between points **X** and **Y**.

(i) Complete the circuit diagram in Fig. 3.2 to show the resistors connected in series between points **X** and **Y**.



[1]

Fig. 3.2

(ii) Close the switch. Use the voltmeter to measure the potential difference V_S between points **X** and **Y**. Record V_S and then open the switch.

V_S = ... V [1]

(iii) Close the switch. Record the current I_S shown on the ammeter and then open the switch.

I_S = ... A [2]

(iv) Calculate the resistance R_S of the series combination of the three resistors using the equation shown.

$$R_S = \frac{V_S}{I_S}$$

R_S = ...[2]

(c) Theory suggests that, because the resistors are identical the following relationship exists.

$$R_T = 0.5\ R_S$$

State whether your results support the theory. Justify your statement by reference to your results.

statement ....

justification ....

.... [1]

(d) Explain why it is important to open the switch between taking readings.

....

....[1]

(e) Predict **how** the reading on the ammeter **changes** if the three resistors are replaced by just one of the resistors connected between points **X** and **Y**. Assume that the potential difference between points **X** and **Y** stays the same.

....[1]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Test for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Test for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint