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0653/51

May/June 2017

1 hour 30 minutes

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

Notes for Use in Qualitative Analysis for this paper are printed on page 8.

The number of marks is given in brackets [] at the end of each question or part question.

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1	
2	
3	
Total	

This document consists of **8** printed pages.

1 You are going to investigate the nutrient content of banana, chickpea and egg white.

- (a) • Label three test-tubes **A**, **B** and **C**.
- Chop up the banana and place in the small beaker. Mash with a little distilled water until it can be poured.
 - Divide the mixture between the three test-tubes.
 - Carry out Benedict's test with test-tube **A**.
 - Carry out the biuret test with test-tube **B**.
 - Carry out the iodine test with test-tube **C**.

State in which of these tests a source of heat is required.

.....[1]

- (b) (i) Complete the third row of Table 1.1 to show your observations.
- (ii) Rinse out the test-tubes **A**, **B** and **C** with distilled water or label three clean test-tubes **A**, **B** and **C**.
Add chickpea to a depth of approximately 2 cm to test-tubes **A**, **B** and **C**.
Repeat the tests and complete the fourth row of Table 1.1 to show your observations.
- (iii) Rinse out the test-tubes **A**, **B** and **C** with distilled water or label three clean test-tubes **A**, **B** and **C**.
Add egg white to a depth of approximately 2 cm to test-tubes **A**, **B** and **C**.
Repeat the tests and complete the fifth row of Table 1.1 to show your observations.

Table 1.1

	Benedict's test	biuret test	iodine test
nutrient tested for	reducing sugar	protein	starch
banana			
chickpea			
egg white			

[3]

- (c) Use your observations in (b) to state the nutrient content of the foods you tested.

- (i) Banana contains [1]
- (ii) Chickpea contains [1]
- (iii) Egg white contains [1]

(d) Describe how you can test for the presence of fat in egg white.

method

.....

.....

observation for positive result

.....

[3]

- 2 Notes for use in Qualitative Analysis for this question are printed on page 8.

Solution **H** and solution **J** are each one of the following solutions:

list of possible solutions

ammonia solution
sodium hydroxide solution
hydrochloric acid
sulfuric acid
barium nitrate solution
silver nitrate solution

- (a) (i) Test solution **H** with both red and blue litmus papers.

Record your observations in Table 2.1.

Test solution **J** with both red and blue litmus papers.

Record your observations in Table 2.1.

Table 2.1

	solution H	solution J
red litmus paper		
blue litmus paper		

[2]

- (ii) Using the observations in Table 2.1, choose from the list of possible solutions the two possible identities for each of solutions **H** and **J**.

solution **H** could be or

.....

solution **J** could be or

.....

[2]

- (b) (i)
- Place solution **H** in a test-tube to a depth of 2 cm.
 - Slowly add the copper sulfate solution until the test-tube is almost full.
 - Record your observations in Table 2.2.
 - Filter the mixture and record in Table 2.2 the colour of any residue.

Repeat this procedure with solution **J**.

Table 2.2

	solution H	solution J
observations on slowly adding copper sulfate solution		
colour of any residue		

[3]

- (ii) Use (a)(ii) and your observations in Table 2.2 to identify solution **H** and **J**.

solution **H** is

solution **J** is

[2]

- (c) Suggest one reason why iron(III) sulfate solution cannot be used in (b)(i) instead of copper sulfate solution to identify solution **J**.

.....

.....[1]

- 3 You are going to investigate how the resistance of a metal wire depends upon its length.

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

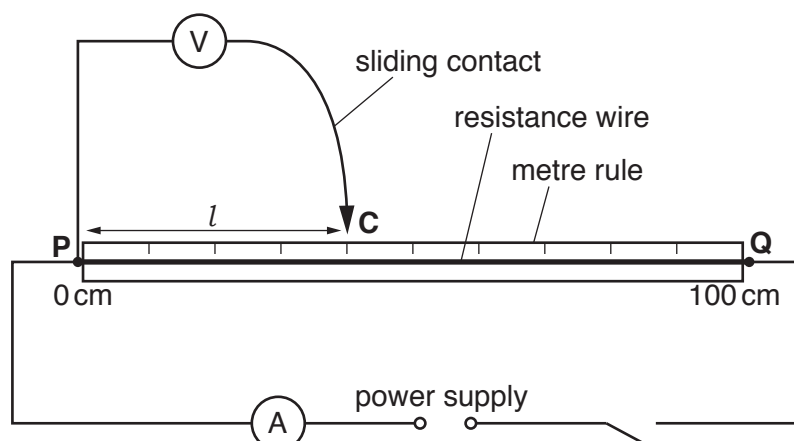


Fig. 3.1

- (a) (i) • Connect the crocodile clip **C** to the resistance wire **PQ** at a length $l = 20.0$ cm from end **P**.
- Close the switch.
 - Record in Table 3.1 the current I flowing through the wire and the potential difference V .
 - Switch off the circuit.

[1]

Table 3.1

length l /cm	current I /A	potential difference V /V	resistance R/Ω
20.0			
35.0			
50.0			
65.0			
80.0			
95.0			

- (ii) Repeat the steps in (a)(i) for values of $l = 35.0$ cm, 50.0 cm, 65.0 cm, 80.0 cm and 95.0 cm.
- (iii) Calculate the resistance R for each length of wire, using the equation

$$R = \frac{V}{I}.$$

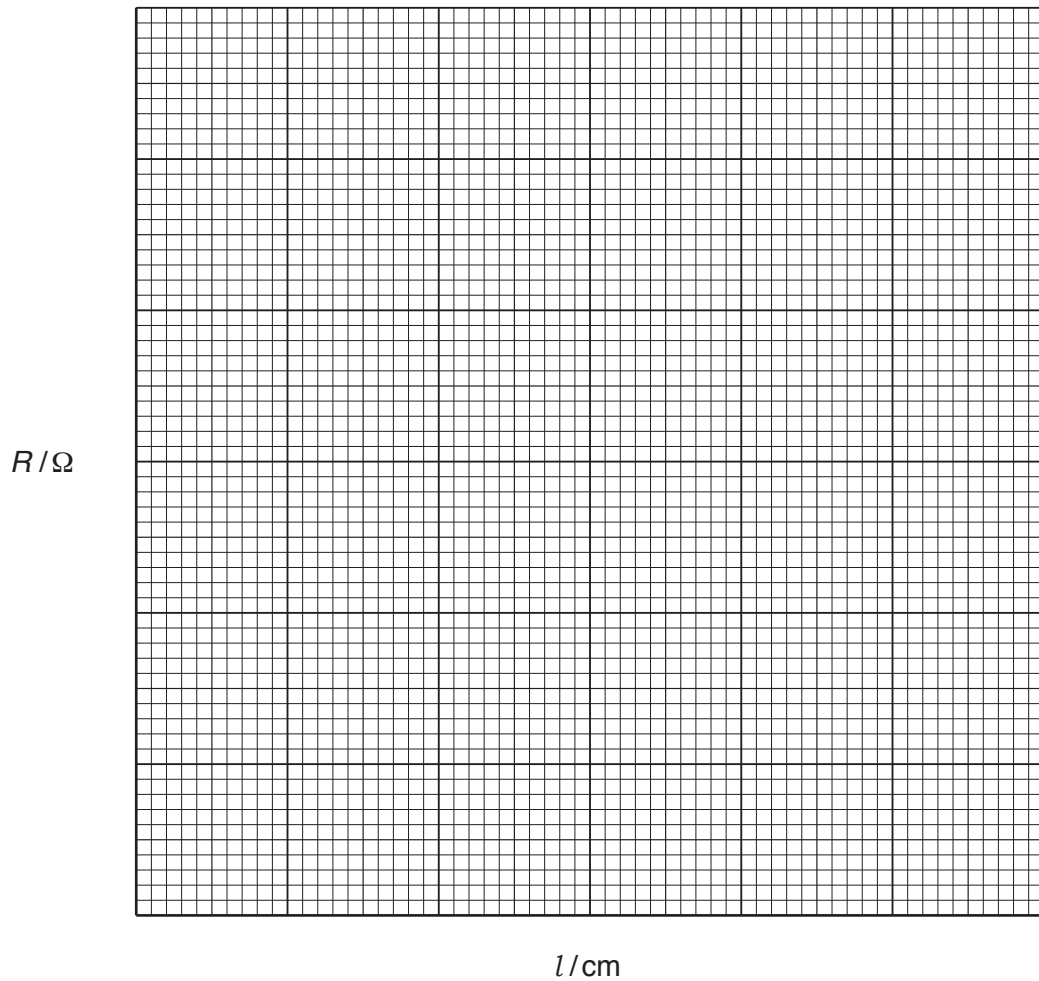
Record, in Table 3.1, your values of R .

[1]

(b) Use the results in Table 3.1 to plot a graph of R (vertical axis) against l .

Start both axes of your graph at the origin (0, 0). Draw the best-fit straight line.

[3]



(c) (i) Extend your line to predict the value of R at length $l = 110.0 \text{ cm}$.

$R = \dots\dots\dots \Omega$ [1]

(ii) Suggest the relationship between the length of the wire and its resistance.

relationship $\dots\dots\dots$

$\dots\dots\dots$ [1]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
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.

Tests for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
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

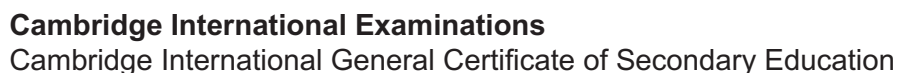
Tests for gases

<i>gas</i>	<i>test and test result</i>
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

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This document consists of **10** printed pages and **2** blank pages.

- 1 You are provided with a flower.

Carefully remove 2 petals.

- (a) In the box below, make a **large** pencil drawing of the flower.

This should show all the flower parts including some petals.



[4]

- (b) You are going to calculate the magnification of your drawing.

- (i) Draw a straight line across your drawing from one edge to the other.

Measure the length of this line in millimetres to the nearest millimetre.

length = ... mm

Measure the same length of the same part on the real flower in millimetres to the nearest millimetre.

length = ... mm

[2]

- (ii) Use your two measurements to calculate the magnification of your drawing.

Show your working in the space below.

magnification = ...[1]

- (c) Flowers contain nectar.

Plan an investigation using two different flowers to find out which nectar contains more reducing sugar.

You should include details of how you will carry out the test and what observations will allow you to conclude which nectar contains more reducing sugar.

.....

.....

.....

.....

.....

.....[3]

- 2 You are going to investigate how the temperature of a reactant affects the rate of reaction between calcium carbonate and hydrochloric acid.

You are provided with marble chips (calcium carbonate) and hydrochloric acid.

- (a) Set up the apparatus provided as shown in Fig. 2.1.

To obtain an inverted 100 cm³ measuring cylinder full of water:

- fill the measuring cylinder with water
- place your finger or hand firmly over the open end of the cylinder so no water can run out
- invert and place this end under the water in the water container
- remove your hand and clamp the cylinder in place (note that a small amount of air in the measuring cylinder will not be a problem in this experiment)
- push the tubing of the delivery tube up into the cylinder a little way.

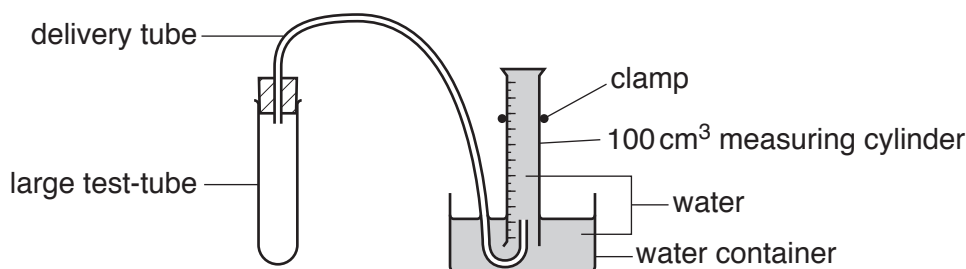


Fig. 2.1

(i) **experiment 1**

- Disconnect the large test-tube and use a measuring cylinder to place 20 cm³ of hydrochloric acid into it.
- Measure the temperature of the acid in the large test-tube and record in Table 2.1 the temperature to the **nearest half degree** for **experiment 1**.
- Add ten marble chips to the acid.
- Connect the delivery tube to the large test-tube making sure that the tube goes up into the measuring cylinder as in Fig. 2.1.
- Start the stopclock.
- When **one minute** is shown on the stopclock read the volume V_1 of gas collected in the measuring cylinder.
- Record in Table 2.1 this volume V_1 for **experiment 1**.
- When **two minutes** is shown on the stopclock read the volume V_2 of gas collected in the measuring cylinder.
- Record in Table 2.1 this volume V_2 for **experiment 1**.

[2]

Table 2.1

experiment	temperature of acid / °C	volume of gas after one minute V_1/cm^3	volume of gas after two minutes V_2/cm^3	volume of gas produced in second minute V/cm^3
1				
2				
3				

(ii) experiment 2

- Pour the contents of the large test-tube into the beaker labelled waste.
- Rinse out the large test-tube with water.
- Refill the inverted measuring cylinder with water and replace the tube as in Fig. 2.1.
- Remove some water from the water container if it is close to overflowing.
- Using a measuring cylinder, place 20cm^3 of hydrochloric acid into the large test-tube.
- Place the large test-tube containing the acid in a beaker of hot water.
- When the temperature of the acid in the large test-tube is about 10°C above the temperature for **experiment 1**, record in Table 2.1 this temperature to the **nearest half degree** for **experiment 2**.
- Immediately remove the large test-tube from the beaker of hot water and add ten unused marble chips to the acid.
- Connect the delivery tube to the large test-tube making sure that the tube goes up into the measuring cylinder as in Fig. 2.1.
- Start the stopclock.
- When one minute is shown on the stopclock read the volume V_1 of gas collected in the measuring cylinder.
- Record in Table 2.1 this volume V_1 for **experiment 2**.
- When two minutes is shown on the stopclock read the volume V_2 of gas collected in the measuring cylinder.
- Record in Table 2.1 this volume V_2 for **experiment 2**.

[2]

(iii) experiment 3

Repeat **(a)(ii)**, increasing the temperature of the acid by a further 10°C .

You may need to replace the hot water in the beaker.

[2]

- (b) (i) For each experiment calculate the volume V of gas produced during the second minute.
Record your values in Table 2.1.

[1]

- (ii) Use your data to describe the relationship between the temperature of the acid and the rate of the reaction.

.....

.....[1]

- (c) Suggest an alternative method for measuring the rate of reaction between marble chips and acid.

You may draw a labelled diagram but you must state what is being measured.

.....

.....

.....

.....[2]

Please turn over for Question 3.

3 You are going to find the density of water.

You are provided with a test-tube, a balance, a measuring cylinder and a beaker containing water.

- (a) (i)** Use the balance to measure the mass m of the test-tube to the nearest 0.1 g.

$$m = \dots\dots\dots \text{ g [1]}$$

- (ii)** Pour approximately 65 cm³ of water from the beaker into the measuring cylinder.

Record the volume V_1 of water on the scale of the measuring cylinder.

$$V_1 = \dots\dots\dots \text{ cm}^3 \text{ [1]}$$

- (iii)** Slowly and carefully lower the test-tube into the measuring cylinder until it floats, approximately vertically, as shown in Fig. 3.1. The test-tube should not touch the bottom of the measuring cylinder.

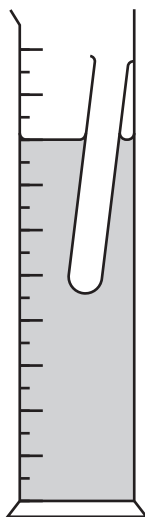


Fig. 3.1

Record the new volume V_2 of water on the scale of the measuring cylinder.

$$V_2 = \dots\dots\dots \text{ cm}^3 \text{ [2]}$$

- (iv)** Use your volume values from **(a)(ii)** and **(a)(iii)** to calculate the volume V_3 of water displaced by the test-tube.

$$V_3 = \dots\dots\dots \text{ cm}^3 \text{ [1]}$$

- (v)** Calculate the density d of the water using your values from **(a)(i)** and **(a)(iv)**, using the equation below. Include the unit in your answer.

$$d = \frac{m}{V_3}$$

$$d = \dots\dots\dots \text{ unit } \dots\dots\dots \text{ [2]}$$

(b) (i) Suggest **two** possible sources of inaccuracy in this experiment.

1.

2.

[2]

(ii) State and explain the effect that **one** of the sources of inaccuracy you gave in (b)(i) would have on the calculated value of d .

.....

.....

.....[1]

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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
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Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
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
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zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

<i>gas</i>	<i>test and test results</i>
ammonia (NH_3)	turns damp red litmus paper blue
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hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint

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