



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**COMBINED SCIENCE**

**0653/52**

Paper 5 Practical Test

**May/June 2014**

**1 hour 30 minutes**

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 8.

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.

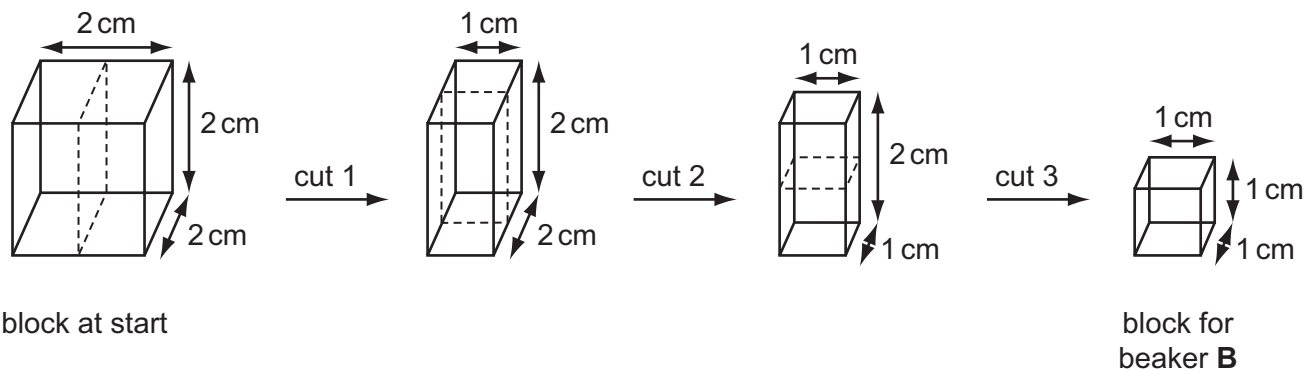
For Examiner's Use	
1	
2	
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<b>Total</b>	

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

- 1 You will be investigating the rate at which acid moves from an aqueous solution into a block of agar. The agar contains the indicator phenolphthalein. This indicator is purple in a pH of greater than 8 and colourless in a pH of less than 8.

You are provided with a dish containing two agar blocks of dimensions  $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ .

- Use the forceps to place one, uncut, agar block into a beaker. Label this beaker **A**.
- Cut the other block as shown in Fig. 1.1 to make a cube of  $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ .



**Fig. 1.1**

- Return the excess agar to the dish.
- Use the forceps to place the  $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$  block of agar into a beaker. Label this beaker **B**.

**(a)** State the colour of the agar and what this tells you about its pH.

..... [1]

**(b) (i)** Read part **(b)(ii)** on page 3.

Draw a table of results to record the observations that you make in the space below.

[2]

- (ii) • To beaker **A** add sufficient hydrochloric acid to cover the block of agar and immediately start the stopclock.
- Record the time taken (in seconds), in your table, for the block to go colourless.
- Repeat the procedure for beaker **B** containing the smaller block of agar.

[2]

(c) Explain why the agar changes colour.

.....  
..... [1]

(d) Identify **one** inaccuracy of this experimental method and suggest an improvement to reduce this inaccuracy.

inaccuracy .....

.....

improvement .....

.....

[2]

(e) (i) Explain the difference between the times taken for the two blocks to go colourless in beakers **A** and **B**.

.....  
.....  
..... [1]

(ii) Suggest how you could extend this experiment to be more confident about your explanation in (i).

.....  
..... [1]

- 2 Solid **X** is a mixture of two salts which have the same anion. You are going to carry out a series of tests to identify the anion and the two cations.

**(a) Identification of the anion**

- (i) Dissolve one spatula load of solid **X** in a test-tube which is three-quarters full of distilled water. Divide the resulting solution into two test-tubes in equal portions.

Record the colour of the solution.

colour of solution ..... [1]

- (ii) To one portion of the solution add a few drops of silver nitrate solution.

Record your observations and state what you can conclude about the anion in **X**.

observations .....

conclusion about the anion ..... [2]

- (iii) To the other portion of the solution add barium chloride solution.

Record your observations and state what you can conclude about the anion in **X**.

observations .....

conclusion about the anion ..... [2]

**(b) Identification of the two cations**

Fill a test-tube with distilled water and then empty it into a small beaker. Add one spatula load of solid **X** to the water in the beaker and stir well to dissolve the solid. Do not shake.

- (i) Slowly add approximately 50 cm<sup>3</sup> of ammonia solution to the solution in the beaker.

Record your observations. Keep the mixture for **(b)(ii)**.

observations .....

..... [1]

- (ii) Filter the mixture from (b)(i) into a large test-tube. When you have collected about 5 cm<sup>3</sup> of the filtrate remove the test-tube. You do not need to filter any more of the mixture.

Wash the residue with a small amount of distilled water and discard the liquid into the beaker labelled **washings**.

Describe the colours of the filtrate and of the residue.

colour of filtrate .....

colour of residue ..... [2]

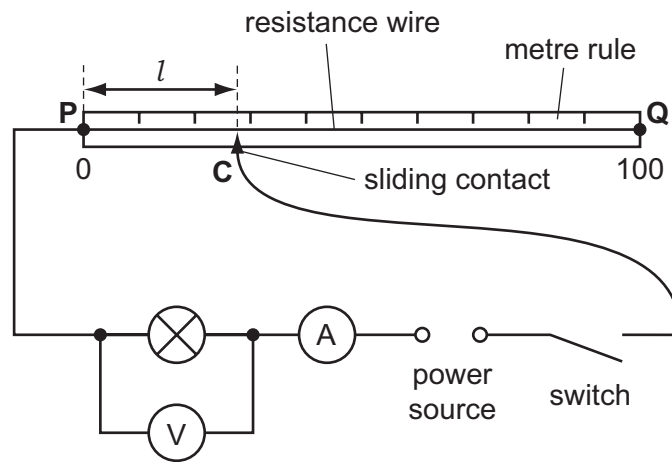
- (iii) Use your results from (b)(i) and (b)(ii) to identify the cations in the filtrate and in the residue.

cation in filtrate .....

cation in residue ..... [2]

- 3 You are going to find out how the potential difference (p.d.) across a lamp and the power of the lamp vary with the length of resistance wire in series with the lamp.

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



**Fig. 3.1**

- (a) (i) Close the switch and place the sliding contact **C** on the resistance wire at a distance of 10.0 cm from end **P**.

Record this length  $l$  of resistance wire used, in Table 3.1.

Record, in Table 3.1, the current  $I$  flowing through the lamp and the potential difference  $V$  across it.

Switch off the circuit.

[2]

- (ii) Insert the unit for the current  $I$  in Table 3.1.

[1]

**Table 3.1**

length $l$ /cm	current $I$ / .....	p.d. $V$ /V	power $P$ /W

- (iii) Repeat step (i) for values of  $l$  of 20.0 cm, 40.0 cm, 60.0 cm and 80.0 cm.

Record your values of  $l$ ,  $I$  and  $V$  in Table 3.1. Remember to switch off the circuit between readings.

[4]

(b) (i) Calculate the power,  $P$  of the lamp for each length of wire, using the equation

$$P = V \times I$$

Record your values of  $P$  in Table 3.1 to an appropriate number of significant figures. [2]

(ii) What have you observed, when carrying out this experiment, which shows that the power of the lamp decreases as the length of resistance wire increases?

.....  
..... [1]

## NOTES FOR QUALITATIVE ANALYSIS

## Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify then add aqueous barium chloride <i>or</i> aqueous barium nitrate	white ppt.

## Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium ( $\text{NH}_4^+$ )	ammonia produced on warming	-
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	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 ( $\text{NH}_3$ )	turns damp red litmus paper blue
carbon dioxide ( $\text{CO}_2$ )	turns limewater milky
chlorine ( $\text{Cl}_2$ )	bleaches damp litmus paper
hydrogen ( $\text{H}_2$ )	"pops" with a lighted splint
oxygen ( $\text{O}_2$ )	relights a glowing splint

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