



# Cambridge IGCSE™

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NAME

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**CO-ORDINATED SCIENCES**

**0654/51**

Paper 5 Practical Test

**May/June 2020**

**2 hours**

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

## INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

## INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
<b>Total</b>	

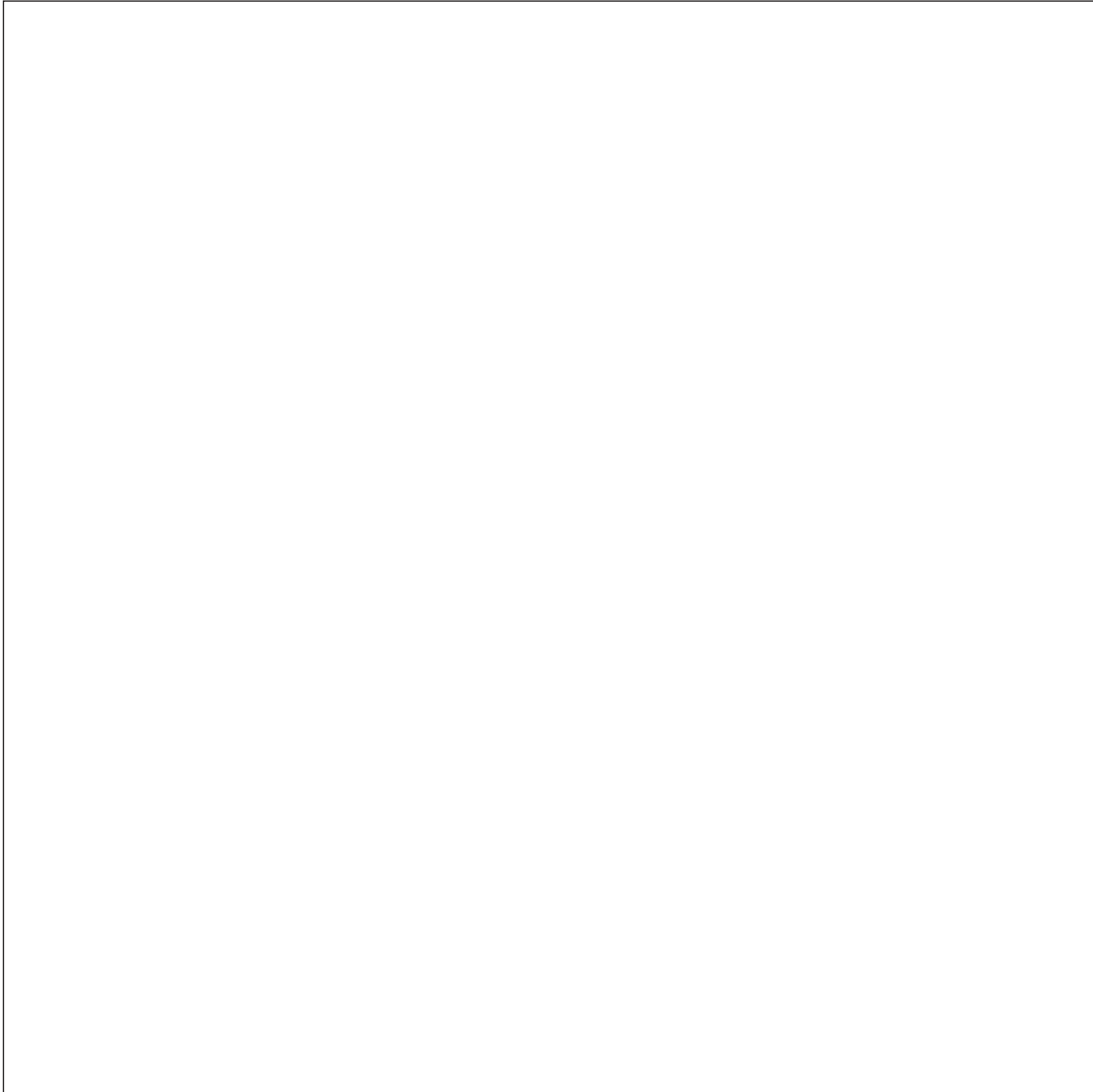
This document has **16** pages. Blank pages are indicated.

1 You are provided with a flower.

Remove two of the petals and discard them.

(a) (i) In the box, make an enlarged, detailed pencil drawing of the flower.

Include the internal parts of the flower.



[3]

(ii) On your drawing, label an anther, a petal and a stigma.

[3]

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

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

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

length of line = ..... mm [1]

- (ii) Measure this length on the real flower in millimetres to the nearest millimetre.

length on real flower = ..... mm [1]

- (iii) Calculate the magnification  $m$  of your drawing.

Use the equation shown.

$$m = \frac{\text{length of line}}{\text{length on real flower}}$$

Give your answer to two significant figures.

$m =$  ..... [2]

[Total: 10]

2 You are provided with a sample of nectar and a sample of pollen from a flower.

The pollen is a suspension in water.

**(a) Procedure**

- Pour about 1 cm depth of the sample of nectar into a test-tube.
- Add an equal volume of Benedict's solution.
- Place in a hot water-bath for a few minutes.
- You may continue with the rest of the procedure while you are waiting.
- Pour about 1 cm depth of the sample of nectar into a clean test-tube.
- Add an equal volume of biuret solution.
- Pour about 1 cm depth of the sample of nectar into a clean test-tube.
- Add a few drops of iodine solution.

Record in Table 2.1 the final colour observed in each test-tube.

**Table 2.1**

sample	final colour with Benedict's solution	final colour with biuret solution	final colour with iodine solution
nectar			
pollen			

[2]

**(b)** Repeat the procedure in **(a)** using the pollen instead of the nectar.

[2]

**(c)** Use your results in **Table 2.1** to state the nutrients present in the nectar and pollen samples.

nectar contains .....

pollen contains .....

[2]

**(d)** Describe how you would test the nectar for the presence of fat.

method .....

.....

observation for a positive result .....

[2]

- (e) A student investigates the nutrient concentration in some nectar and pollen samples using Benedict's solution.

Benedict's solution will give a range of colours depending on the concentration of the nutrient.

State two variables which the student needs to control.

variable 1 .....

variable 2 .....

[2]

[Total: 10]

3 In this investigation you are going to identify five solutions, **J**, **K**, **L**, **M** and **N**.

The names of the aqueous solutions are shown.

**aqueous ammonia**

**acidified aqueous barium nitrate**

**aqueous copper(II) chloride**

**aqueous sodium hydroxide**

**aqueous zinc sulfate**

You are going to do four experiments to identify which of these solutions are solutions **J**, **K**, **L**, **M** and **N**.

(a) Experiment 1

- Place 1 cm depth of **K** in a test-tube.
- Add **M** slowly drop by drop until there is no further change.
- Record your observations.

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

(b) Experiment 2

- Place 1 cm depth of **K** in a test-tube.
- Add **L** slowly drop by drop until there is no further change.
- Record your observations.

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

(c) Experiment 3

- Place 1 cm depth of **J** in a test-tube.
- Add **L** slowly drop by drop until there is no further change.
- Record your observations.

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

(d) Experiment 4

- Place 1 cm depth of **N** in a test-tube.
- Add **J** slowly drop by drop until there is no further change.
- Record your observations.

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

(e) **K** is a blue solution.

All the other solutions are colourless.

(i) Name solution **K**.

..... [1]

(ii) Use the observations from experiment **1** to name solution **M**.

..... [1]

(iii) Use the observations from experiment **2** to name solution **L**.

..... [1]

(iv) Use the observations from experiments **3** and **4** to name solutions **J** and **N**.

Explain how you arrived at your answers.

**J** .....

**N** .....

explanation .....

.....

.....

.....

.....

[2]

[Total: 9]

- 4 You are going to investigate the temperature change that occurs when dilute hydrochloric acid is neutralised by aqueous sodium hydroxide.

**(a) Procedure**

- Measure 5 cm<sup>3</sup> of dilute hydrochloric acid using a 25 cm<sup>3</sup> measuring cylinder.
  - Measure 10 cm<sup>3</sup> of aqueous sodium hydroxide using a 10 cm<sup>3</sup> measuring cylinder and pour into a glass beaker.
  - Measure and record in Table 4.1 the temperature of this aqueous sodium hydroxide to the nearest 0.5 °C.
  - Pour the 5 cm<sup>3</sup> dilute hydrochloric acid into the 10 cm<sup>3</sup> aqueous sodium hydroxide and stir the mixture with the thermometer.
  - Record in Table 4.1 the highest temperature reached, to the nearest 0.5 °C.
  - Rinse the beaker.
- Repeat the procedure using the volumes of dilute hydrochloric acid and aqueous sodium hydroxide shown in Table 4.1.

**Table 4.1**

volume of dilute hydrochloric acid /cm <sup>3</sup>	volume of aqueous sodium hydroxide /cm <sup>3</sup>	temperature of aqueous sodium hydroxide in beaker /°C	highest temperature of mixture in beaker /°C	temperature change, $\Delta T$ /°C
5	10			
10	10			
15	10			
20	10			
25	10			

[3]

- (b)** Calculate the temperature changes,  $\Delta T$ .

Record your values in Table 4.1.

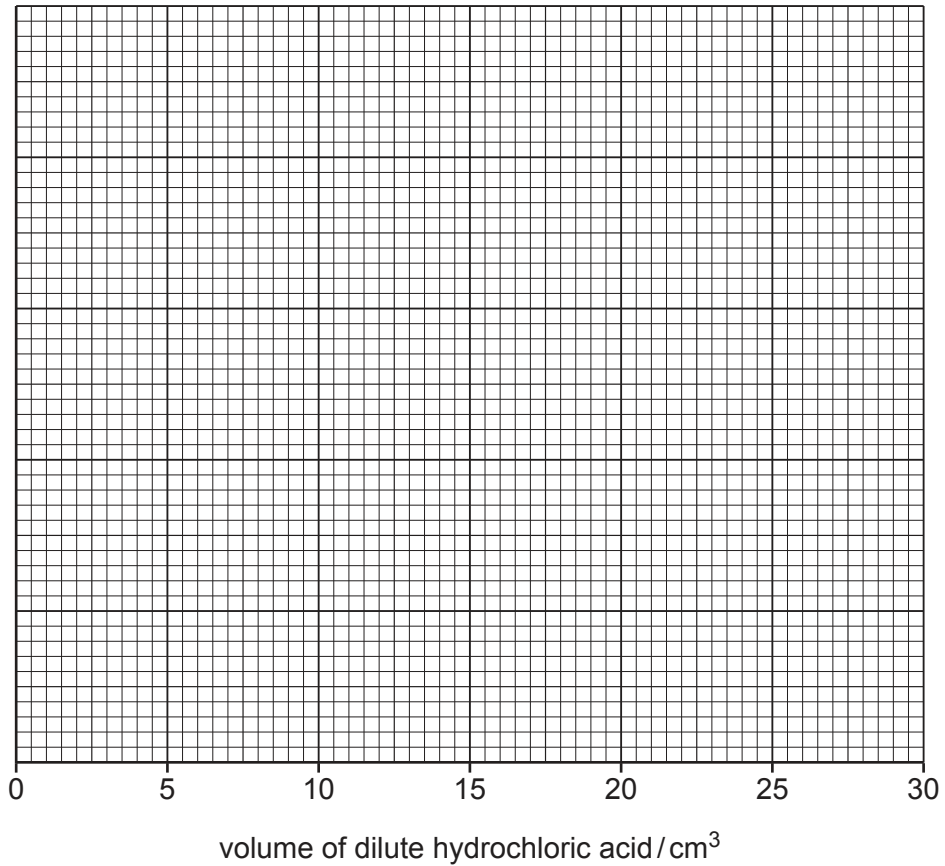
[1]

- (c)** Identify the dependent variable in this investigation.

..... [1]



- (d) (i) Plot a graph of the temperature change,  $\Delta T$ , against the volume of dilute hydrochloric acid, on the grid provided.



- [2]
- (ii) Draw the best-fit curve. [1]
- (e) During the experiment the liquid in the beaker loses thermal energy to the surroundings.
- (i) State the effect this will have on the results of the experiment.
- .....
- ..... [1]
- (ii) Suggest **one** way of reducing the loss of thermal energy in this experiment.
- .....
- ..... [1]
- (f) Give **one** advantage of using a 10 cm<sup>3</sup> measuring cylinder to measure the volume of aqueous sodium hydroxide, rather than a 25 cm<sup>3</sup> measuring cylinder.
- ..... [1]

[Total: 11]

5 You are going to determine the density of the material from which a metre rule is made.

You are provided with a metre rule.

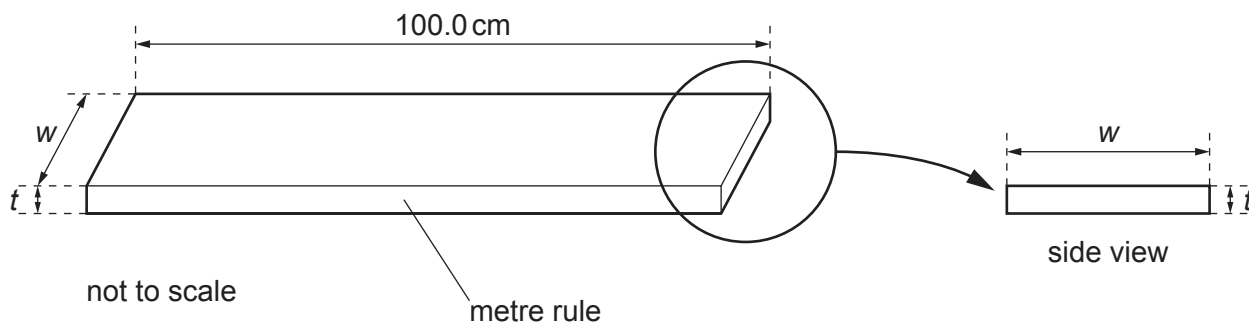


Fig. 5.1

(a) (i) Fig. 5.1 shows the width  $w$  and thickness  $t$  of a metre rule.

Measure the width  $w$  and thickness  $t$  of your metre rule, each to the nearest 0.1 cm.

$w =$  ..... cm

$t =$  ..... cm  
[2]

(ii) State which of your measurements,  $w$  or  $t$ , is the more accurate. Give a reason for your answer.

measurement .....

reason .....

.....

[1]

(b) Calculate the volume  $V$  of the metre rule. Use the equation shown.

$$V = 100 \times w \times t$$

$V =$  ..... cm<sup>3</sup> [1]

(c) (i) Procedure

- Place the pivot directly under the 65.0 cm mark on the metre rule, so that the distance  $d = 65.0$  cm, as shown in Fig. 5.2.
- Place load  $m$  on the metre rule.
- Adjust the position of load  $m$  until the rule is as close to being balanced as possible.

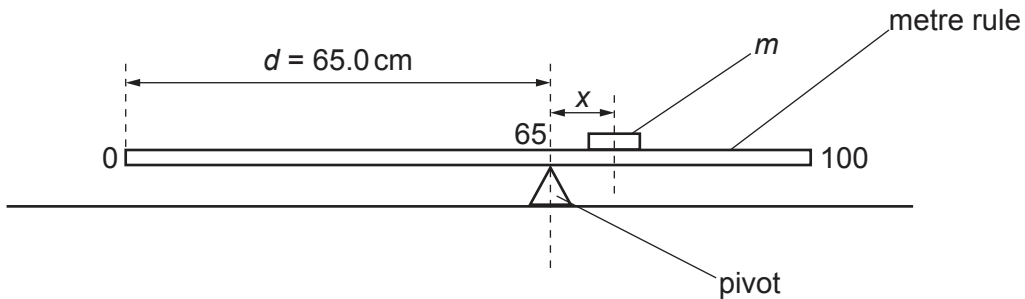


Fig. 5.2

Measure the distance  $x_1$  from the **centre** of load  $m$  to the pivot to the nearest 0.1 cm.

$x_1 = \dots\dots\dots$  cm [1]

(ii) Describe how you identified the position of the centre of load  $m$ .

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

(iii) Repeat the procedure in (c)(i) for  $d = 70.0$  cm.

Measure the distance  $x_2$  from the **centre** of load  $m$  to the pivot.

$x_2 = \dots\dots\dots$  cm [2]

(d) Use your results for (c)(i) and (c)(iii) to calculate the mass  $M$  of the metre rule.

Use the equation shown.

$$M = 5.7 (x_1 + x_2)$$

$M = \dots\dots\dots$  g [2]

(e) The value of  $M$  obtained in (d) is approximate.

State **one** practical difficulty involved in doing this experiment that makes the measured values of  $x_1$  and  $x_2$  subject to experimental error.

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

- (f) Use your answers to (b) and (d) to calculate the density  $\rho$  of the material from which the rule is made.

Use the equation shown.

$$\rho = \frac{M}{V}$$

Give the unit for your answer.

$\rho =$  .....

unit = ..... [2]

[Total: 13]



6 The rate of cooling of water in a beaker depends upon the volume of water in the beaker.

Plan an experiment to investigate how the rate of cooling of hot water depends upon the volume of the water.

The apparatus available is listed.

- thermometer**
- stop-watch**
- beaker**
- measuring cylinder**
- supply of hot water**

You are **not** required to do this experiment.

In your answer you should:

- explain briefly how you would do the experiment
- state the key variables you would control
- draw a table with column headings to show how you would present your results (you are not required to enter any readings in the table)
- explain how you would use your results to reach a conclusion.

.....

.....

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.....

.....

..... [7]

[Total: 7]

## NOTES FOR USE IN QUALITATIVE ANALYSIS

## Tests 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.
bromide ( $\text{Br}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream 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 nitrate	white ppt.

## Tests 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	–
calcium ( $\text{Ca}^{2+}$ )	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper ( $\text{Cu}^{2+}$ )	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

## Tests for gases

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

## Flame tests for metal ions

<i>metal ion</i>	<i>flame colour</i>
lithium ( $\text{Li}^+$ )	red
sodium ( $\text{Na}^+$ )	yellow
potassium ( $\text{K}^+$ )	lilac
copper(II) ( $\text{Cu}^{2+}$ )	blue-green

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