



## Cambridge IGCSE™

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## CO-ORDINATED SCIENCES

0654/52

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            |  |
| 7            |  |
| <b>Total</b> |  |

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

## 2

- 1 You are going to investigate an enzyme used in the extraction of apple juice.

You are provided with a beaker containing 50g apple puree and a test-tube containing an enzyme solution. The beaker and test-tube are in a water-bath at a temperature of 35 °C.

**(a) Procedure**

Carefully remove the beaker of apple puree and test-tube containing the enzyme solution from the water-bath.

- Add the enzyme solution to the beaker containing the apple puree.
  - Using the stirring rod provided, mix the contents of the beaker of apple puree and enzyme.
  - Return this beaker to the water-bath at approximately 35 °C and leave for about five minutes.
  - During this time continue with the rest of the question and complete the next steps in the procedure.
  - Place a filter funnel in the top of the measuring cylinder.
  - Fold the filter paper provided and place in the filter funnel.
  - After about five minutes, fill the filter funnel using the contents of the beaker containing apple puree and enzyme.
  - Start the stop-clock.
- (i) Record in Table 1.1 the total volume of the juice collected in the measuring cylinder every 2 minutes for 10 minutes.

**Table 1.1**

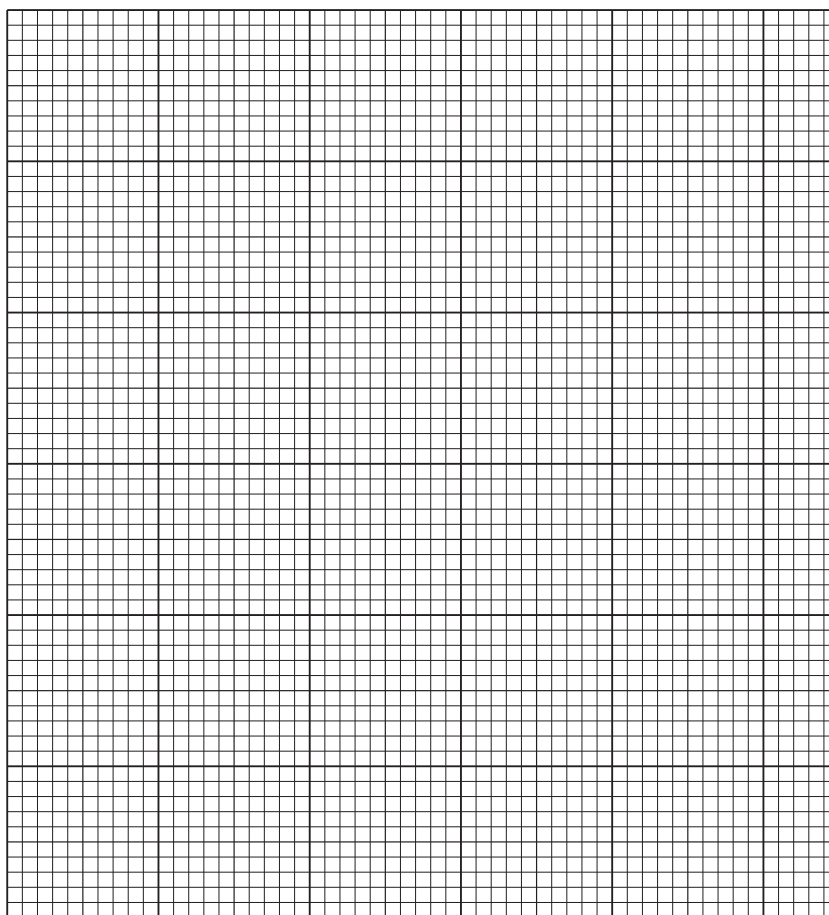
| time<br>/ ..... | total volume of juice collected<br>/ ..... |
|-----------------|--|
| 2               |  |
| 4               |  |
| 6               |  |
| 8               |  |
| 10              |  |

[3]

- (ii) Complete Table 1.1 by inserting the units in the column headings.

[1]

- (b) (i)** On the grid, plot a graph of volume of juice collected (vertical axis) against time.



[3]

- (ii)** Draw the best-fit curve.

[1]

- (c)** Use your graph to estimate the total volume of juice collected at 3 minutes.

Show on your graph how you arrived at your answer.

total volume of juice collected at 3 minutes ..... [2]

- (d)** A student does an experiment to determine the optimum temperature for juice extraction using an enzyme.

Suggest temperatures that the student should use.

.....

..... [2]

[Total: 12]

2 You are going to investigate the nutrient content of apple puree and bread.

**(a) Procedure**

- Add about 1 cm depth of Benedict's solution to one of the test-tubes containing apple puree.
- Place in the water-bath at approximately 80 °C for at least three minutes.
- Continue with the procedure while you are waiting.
- Add about 1 cm depth of biuret solution to the second test-tube containing apple puree.
- Add a few drops of biuret solution to one of the pieces of bread and leave for about two minutes to soak in.
- Add a few drops of iodine solution to the other piece of bread.

Record in Table 2.1 the final colours observed.

**Table 2.1**

| food sample | final colour observed<br>with Benedict's<br>solution | final colour observed<br>with biuret solution | final colour observed<br>with iodine solution |
|-------------|--|---|---|
| apple puree |  |   |   |
| bread       |  |   |   |

[4]

**(b)** Use your results to state the nutrient content of the apple puree and bread.

apple puree contains .....

bread contains .....

[2]

**(c) (i)** A student tests the apple puree and bread for the presence of fat.

State two reagents he needs to use.

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

**(ii)** State the observation for a positive result.

..... [1]

[Total: 8]

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

The names of the solutions are shown.

**aqueous ammonia**

**acidified aqueous barium nitrate**

**aqueous copper(II) sulfate**

**aqueous sodium hydroxide**

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

**(a) Experiment 1**

- Place 1 cm depth of **J** in a test-tube.
- Add a small volume of **K**.
- Record your observations.

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

**(b) Experiment 2**

- 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]

**(c) Experiment 3**

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

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

(d) **J** is a blue solution.

All the other solutions are colourless.

(i) Name solution **J**.

..... [1]

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

..... [1]

(iii) Use the observations from experiments **2** and **3** to name solutions **L** and **M**.

Explain how you arrived at your answer.

**L** .....

**M** .....

explanation .....

.....

.....

.....

[2]

[Total: 7]

- 4 You are going to investigate the amount of thermal energy (heat) absorbed when a sample of solid ammonium chloride dissolves in water.

(a) Measure  $25\text{ cm}^3$  of distilled water using a measuring cylinder.

Pour the water into a  $100\text{ cm}^3$  glass beaker.

(i) Record the temperature of the water to the nearest  $0.5^\circ\text{C}$ .

temperature of water = .....  $^\circ\text{C}$  [1]

(ii) Add all the sample of ammonium chloride to the water in the beaker.

Stir the mixture thoroughly.

Record the lowest temperature reached to the nearest  $0.5^\circ\text{C}$ .

lowest temperature = .....  $^\circ\text{C}$  [1]

(iii) Calculate the maximum temperature change,  $\Delta T$ .

$\Delta T =$  .....  $^\circ\text{C}$  [1]

(b) Calculate the thermal energy  $E$  absorbed when ammonium chloride dissolves in water.

Use the equation shown.

$$E = 105 \times \Delta T$$

$E =$  ..... J [1]

(c) The temperature does not decrease as much as it should.

This is because the water gains thermal energy from the surroundings.

Suggest two changes to the apparatus that will reduce the amount of thermal energy gained from the surroundings.

1 .....

.....

2 .....

.....

[2]

(d) Explain why this experiment should be repeated several times and an average for the temperature change calculated.

.....

..... [1]

[Total: 7]



- 5 A student investigates the thermal decomposition of copper carbonate.

Copper carbonate decomposes in a similar way to calcium carbonate.



The student wants to find out how changing the mass of copper carbonate heated affects the mass of copper oxide formed.

Plan an investigation to find out how changing the mass of copper carbonate heated affects the mass of copper oxide formed.

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

In your plan, include:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method and any safety precautions that should be taken
- what you would measure
- how you would process your results to reach a conclusion.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 6]

- 6 You are going to find the focal length  $f$  of a lens by measuring the magnification of the image that it forms.

(a) Set up the apparatus as shown in Fig. 6.1.

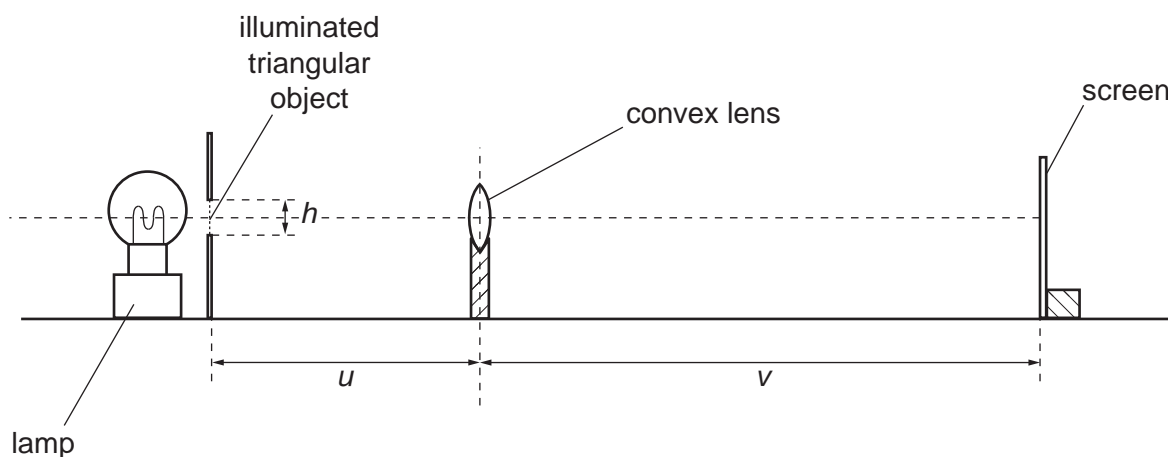


Fig. 6.1

Measure and record the height  $h$  of the illuminated triangular object to the nearest 0.1 cm.

Fig. 6.2 shows the measurement you should make.

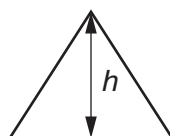


Fig. 6.2

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

**(b) Procedure**

- Switch on the lamp.
  - Place the lens at a distance  $u = 20.0$  cm from the illuminated triangular object.
  - Adjust the position of the screen by moving it slowly backwards and forwards until a sharp triangular image is formed on the screen.
- (i) Measure the image distance  $v$  from the lens to the screen to the nearest 0.1 cm. Record the distance  $v$  in Table 6.1. [1]
- (ii) Measure and record in Table 6.1 the height  $H$  of this image on the screen to the nearest 0.1 cm. [1]

Table 6.1

| $u/\text{cm}$ | $v/\text{cm}$ | $H/\text{cm}$ | $m$ | $f/\text{cm}$ |
|---------------|---------------|---------------|-----|---------------|
| 20.0          |               |               |     |               |
| 40.0          |               |               |     |               |

(iii) Repeat the procedure in (b) for  $u = 40.0\text{cm}$ , and record your values of  $v$  and  $H$  in Table 6.1. [2]

(c) Use your answer to (a) and the values of  $H$  in Table 6.1 to calculate the magnifications  $m$  of the images.

Use the equation shown.

$$m = \frac{\text{height } H \text{ of image}}{\text{height } h \text{ of object}}$$

Record your answers in Table 6.1.

[1]

(d) The focal length  $f$  can be calculated using the equation shown.

$$f = \frac{v}{(1 + m)}$$

Use the equation to calculate both values of  $f$ . Record your answers in Table 6.1.

Give your answers to **three** significant figures.

[2]

(e) State whether the values of  $f$  in Table 6.1 are the same, within the limits of experimental error.

Justify your answer with reference to the values of  $f$ .

..... [1]

(f) State one precaution taken in this experiment to obtain accurate results.

..... [1]

- 7** You are going to determine the thermal energy lost from a beaker of water when hot and cold water are mixed.

- (a) (i)** Pour  $100\text{ cm}^3$  of cold water into beaker **P**.

Measure and record the temperature  $\theta_{\text{C}}$  of the cold water to the nearest  $0.5^\circ\text{C}$ .

$$\theta_{\text{C}} = \dots\dots\dots^\circ\text{C} \quad [1]$$

- (ii)** Pour hot water into beaker **Q** up to the line marked on the side of the beaker.

Measure and record the temperature  $\theta_{\text{H}}$  of the hot water to the nearest  $0.5^\circ\text{C}$ .

$$\theta_{\text{H}} = \dots\dots\dots^\circ\text{C} \quad [1]$$

- (b)** As soon as you have recorded the temperature of the hot water, pour the cold water from beaker **P** into beaker **Q**.

Stir the mixture.

Measure and record the temperature  $\theta_{\text{M}}$  of the mixture to the nearest  $0.5^\circ\text{C}$ .

$$\theta_{\text{M}} = \dots\dots\dots^\circ\text{C} \quad [2]$$

- (c)** Explain why the water is stirred before measuring the temperature of the mixture.

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

- (d)** Calculate the rise in temperature  $\Delta\theta_{\text{C}}$  of the cold water. Use the equation shown.

$$\Delta\theta_{\text{C}} = \theta_{\text{M}} - \theta_{\text{C}}$$

$$\Delta\theta_{\text{C}} = \dots\dots\dots^\circ\text{C}$$

Calculate the fall in temperature  $\Delta\theta_{\text{H}}$  of the hot water. Use the equation shown.

$$\Delta\theta_{\text{H}} = \theta_{\text{H}} - \theta_{\text{M}}$$

$$\Delta\theta_{\text{H}} = \dots\dots\dots^\circ\text{C} \quad [1]$$

- (e) Calculate the increase in thermal energy  $E_C$  of the cold water. Use the equation shown.

$$E_C = 420 \times \Delta\theta_C$$

$$E_C = \dots\dots\dots \text{ J}$$

Calculate the decrease in thermal energy  $E_H$  of the hot water. Use the equation shown.

$$E_H = 420 \times \Delta\theta_H$$

$$E_H = \dots\dots\dots \text{ J}$$

[1]

- (f) The increase in thermal energy  $E_C$  should be equal to the decrease in thermal energy  $E_H$ .

Any difference between  $E_C$  and  $E_H$  is the thermal energy lost by the water when the hot and cold water are mixed.

Calculate the thermal energy lost  $E_L$  by the water when the hot and cold water are mixed.

$$E_L = \dots\dots\dots \text{ J} \quad [1]$$

- (g) (i) Suggest what has happened to the thermal energy lost by the water.

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

- (ii) State one way in which the thermal energy lost  $E_L$  by the water can be reduced.

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

[Total: 10]

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## 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 ( $\text{Cl}^-$ )<br>[in solution]     | acidify with dilute nitric acid, then add aqueous silver nitrate | white ppt.                             |
| bromide ( $\text{Br}^-$ )<br>[in solution]      | acidify with dilute nitric acid, then add aqueous silver nitrate | cream ppt.                             |
| nitrate ( $\text{NO}_3^-$ )<br>[in solution]    | add aqueous sodium hydroxide then aluminium foil; warm carefully | ammonia produced                       |
| sulfate ( $\text{SO}_4^{2-}$ )<br>[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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