Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **May/June 2023**

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	
Total	

This document has **20** pages. Any blank pages are indicated.

DC (CE/FC) 314683/2

1 You are going to investigate the effect of plants and animals on their aqueous environment.

(a) Organisms that photosynthesise or respire affect the concentration of carbon dioxide dissolved in their aqueous environment.

A sample of water **W** is provided.

(i) **Procedure**

- Add a few drops of hydrogencarbonate indicator to the sample of water in test-tube **W**.
- Record the colour observed.

colour observed .... [1]

(ii) Fig. 1.1 shows the aqueous environments set up in three beakers **A**, **B** and **C**.

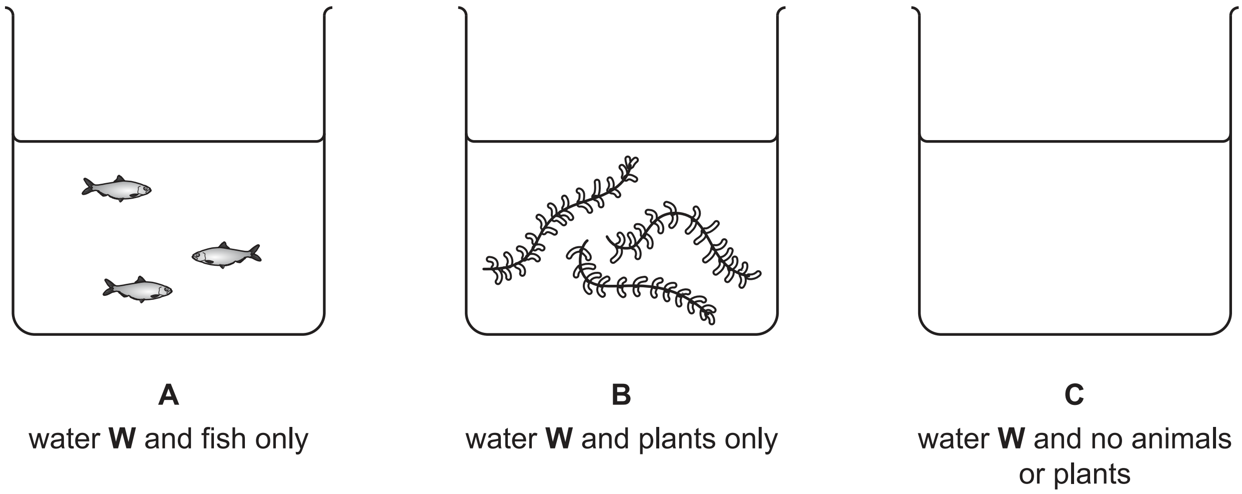

Fig. 1.1

The three beakers **A**, **B** and **C** are at the same temperature and are placed in the light for 1 hour.

Hydrogencarbonate indicator changes colour depending on the concentration of carbon dioxide dissolved in the water.

Fig. 1.2 shows the colour changes for the hydrogencarbonate indicator.

concentration of carbon dioxide	colour of hydrogencarbonate indicator
high	yellow
medium	red
low ↓	purple ↓

Fig. 1.2

Use Fig. 1.2 and your answer in **(a)(i)** to deduce the concentration of carbon dioxide dissolved in water **W** at the start of the investigation.

.... [1]

(iii) You are provided with three test-tubes **A**, **B** and **C**.

These contain water samples taken at the end of the investigation from the three beakers **A**, **B** and **C**.

- Add a few drops of hydrogencarbonate indicator to each test-tube and swirl to mix.

Complete Table 1.1 by:

- recording the final colour observed in each test-tube
- transferring your answer from **(a)(i)** for the colour of hydrogencarbonate indicator with water **W**
- using Fig. 1.2 to state the change in carbon dioxide concentration in each aqueous environment **A**, **B** and **C**.

Table 1.1

water sample	colour with water **W** **from (a)(i)**	final colour observed	change in carbon dioxide concentration (increase / decrease / no change)
A			
B			
C			

[4]

(b) Respiration releases carbon dioxide and photosynthesis uses carbon dioxide.

(i) Explain your observation for aqueous environment **B**.

....

.... [1]

(ii) Aqueous environment **C** is a control.

Explain why a control is used in this investigation.

....

.... [1]

(c) A student repeats the experiment using a beaker of water containing equal amounts of fish and plants.

Suggest the colour of the hydrogencarbonate indicator.

Explain your answer.

colour of hydrogencarbonate indicator ....

explanation ....

....
[1]

[Total: 9]

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2 You are going to investigate three nutrient solutions **D**, **E** and **F**.

Procedure

- Add approximately 1 cm depth of Benedict's solution to each test-tube **D**, **E** and **F**.
- Place the test-tubes in a hot water-bath for at least 3 minutes.

You may continue with Question 3 while you are waiting.

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

State a conclusion for each nutrient solution.

Table 2.1

nutrient solution	final colour observed	conclusion
D		
E		
F		

[4]

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3 The seeds of a sycamore tree are shown in Fig. 3.1.

They have "wings" to help carry them in the wind.

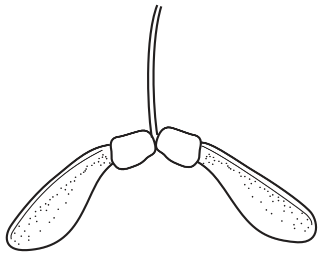

Fig. 3.1

Fig. 3.2 shows sycamore seeds fallen from the parent tree.

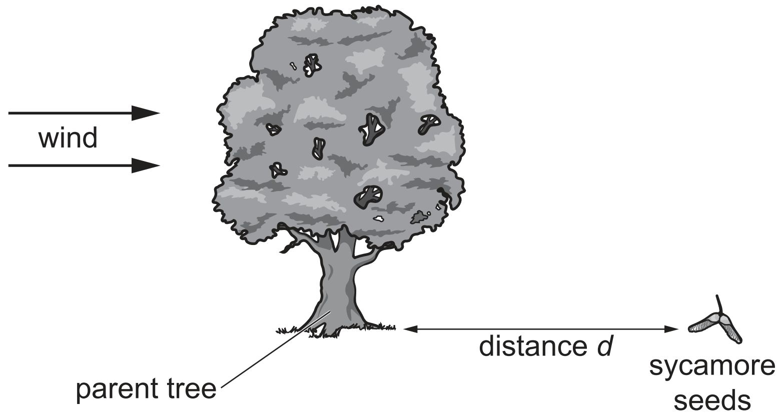

Fig. 3.2

Plan an investigation to determine the relationship between the vertical height the seeds fall from and the horizontal distance *d* the seeds travel from the height they were dropped.

You are provided with several sycamore seeds.

You may use any common laboratory apparatus.

You are not required to do this investigation.

Include in your plan:

- the apparatus needed
- a brief description of the method
- what you will measure
- the variables you will control
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a results table if you wish. You are **not** required to include any results.

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.... [7]

Remember to go back and complete Question 2.

4 You are going to investigate the rate of reaction between solutions **H** and **K**.

When solutions of **H**, **K** and starch are mixed together, a blue-black colour is seen after a period of time.

When the volume of solution **H** is changed, the time taken for the blue-black colour to appear changes.

(a) (i) Procedure

- Using the syringe labelled **H**, add 4 cm^3 of solution **H** into a conical flask.
- Add 5 drops of starch solution into the conical flask.
- Using the syringe labelled **K**, add 10 cm^3 of solution **K** into the conical flask, swirl the flask and immediately start the stop-watch.
- Stop the stop-watch when the solution turns blue-black.
- Record in Table 4.1 the time taken *t* in seconds to the nearest 0.1 second.

Table 4.1

volume of solution **H** / cm^3	volume of distilled water / cm^3	drops of starch solution	volume of solution **K** / cm^3	time taken *t* / s	rate of reaction per 100 s
4.0	0	5	10.0		
7.0	0	5	10.0		
10.0	0	5	10.0		

[1]

(ii) Repeat the procedure in **(a)(i)** using the other volumes shown in Table 4.1. [3]

(iii) Explain why a different syringe is used to measure solution **H** and solution **K**.

....

.... [1]

(iv) The substance made when solution **H** and solution **K** react together turns the starch solution blue-black.

Identify the substance made.

.... [1]

(v) Explain why the results are more reliable if the experiment is repeated and averages calculated.

....

.... [1]

(b) (i) Calculate the rate of reaction per 100 s for each of the three experiments.

Use the equation shown.

$$\text{rate of reaction per 100 s} = \frac{100}{t}$$

Record in Table 4.1 the values of rate to **three** significant figures. [3]

(ii) State the relationship between volume of solution **H** added and rate of reaction.

....

.... [1]

(iii) Look at Table 4.1 at the volumes of solutions added to each conical flask.

To be able to compare the rates of reaction fairly, distilled water needs to be added to some of the experiments.

Complete Table 4.2 to show the volumes of distilled water that need to be added so that a fair comparison can be made.

Table 4.2

volume of solution **H** / cm^3	volume of distilled water that needs to be added / cm^3
4.0	
7.0	
10.0	

[1]

[Total: 12]

5 You are going to identify solution **L** and solution **M**.

(a) Procedure

- Add approximately 2 cm depth of solution **L** into four test-tubes.
- Place a wooden splint to one of the test-tubes of solution **L**.
- Do the tests described in Table 5.1 with solution **L**. Use a different test-tube of solution **L** for each test.
- Add approximately 2 cm depth of solution **M** into the **other** four test-tubes.
- Place a wooden splint to one of the test-tubes of solution **M**.
- Do the tests described in Table 5.1 with solution **M**. Use a different test-tube of solution **M** for each test.

Table 5.1

test	observation	
	solution **L**	solution **M**
add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide		
add approximately 1 cm depth each of dilute nitric acid and aqueous silver nitrate		
add approximately 1 cm depth each of dilute nitric acid and aqueous barium nitrate		
place the wooden splint into the top of a blue Bunsen burner flame and record the first colour seen (if no colour seen, dip the splint in the solution and repeat)		

[6]

(b) State the identities of solution **L** and solution **M**.

solution **L** is ....

solution **M** is ....
[2]

[Total: 8]

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6 You are going to measure the mass M of an object using a balancing method.

The object has been secured to the metre rule. Its position is fixed with its centre over the 15.0 cm mark.

Do **not** attempt to move the object during the experiment.

(a) Procedure

- Place the pivot directly under the 50.0 cm mark.
- Place a mass m = 80 g on the rule.
- Adjust the position of the mass until the rule is as close as possible to balance, as shown in Fig. 6.1.

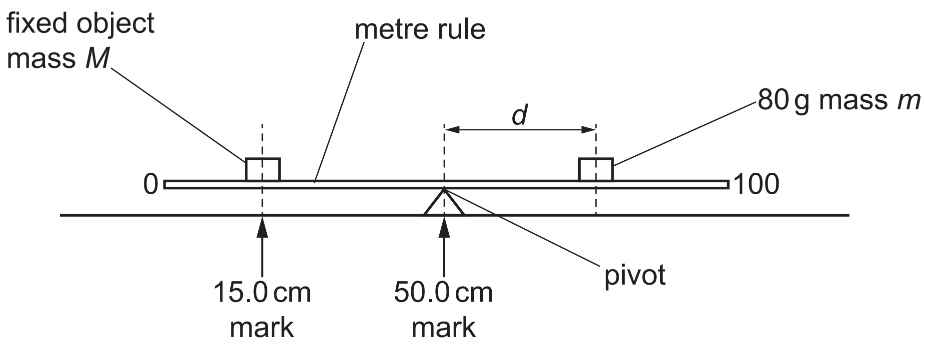


Fig. 6.1

Calculate, to the nearest 0.1 cm, the distance d from the **centre** of the 80 g mass to the 50.0 cm mark on the rule.

Record this distance in Table 6.1.

Table 6.1

mass m / g	distance d / cm	($m \times d$) / g cm
80		
60		
40		

[1]

(b) Repeat the procedure in **(a)** using masses of 60 g and 40 g.

Record your values in Table 6.1. [2]

(c) Describe how you locate the position of the centres of the 40 g, 60 g and 80 g masses.

....

....

.... [1]

(d) **(i)** Calculate the product ($m \times d$) for each mass m.

Record your answers in Table 6.1. [1]

(ii) The teacher says that the product ($m \times d$) for each mass is constant.

Quantities can be considered to be equal, within the limits of experimental error, if their values are within 10% of each other.

Compare your values of ($m \times d$) for each mass in Table 6.1.

State, giving a reason, if you agree with the teacher.

statement ....

reason ....

....
[1]

(e) The mass M of the fixed object is calculated using the equation shown.

$$M = \frac{(m \times d)}{35}$$

Calculate M using your results for the 80 g mass.

M = ... g [2]

(f) State **one** practical problem that makes it difficult to get accurate measurements when doing this experiment.

....

.... [1]

[Total: 9]

7 You are going to investigate the image formed by a convex lens.

The apparatus is assembled as shown in Fig. 7.1.

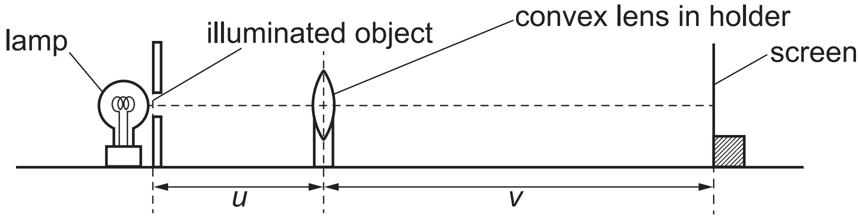


Fig. 7.1

(a) Procedure

- Switch on the lamp.
- Place the lens a distance u = 20.0 cm from the illuminated object (the triangular hole in the card).
- Adjust the position of the screen by moving it backwards and forwards along the bench, until a sharp image of the illuminated object is formed on the screen.

Measure, to the nearest 0.1 cm, the image distance v from the screen to the lens.

Record the image distance v in Table 7.1.

Table 7.1

object distance u / cm	image distance v / cm
20.0	
25.0	
35.0	
40.0	
50.0	
60.0	

[1]

(b) (i) The diagram in Fig. 7.2 shows the illuminated object.

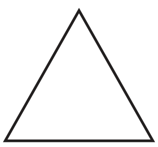


Fig. 7.2

In the space next to the object, draw a diagram to show the image that you observe on the screen. [1]

(ii) The magnification m of the image is calculated using the equation shown.

$$m = \frac{v}{u}$$

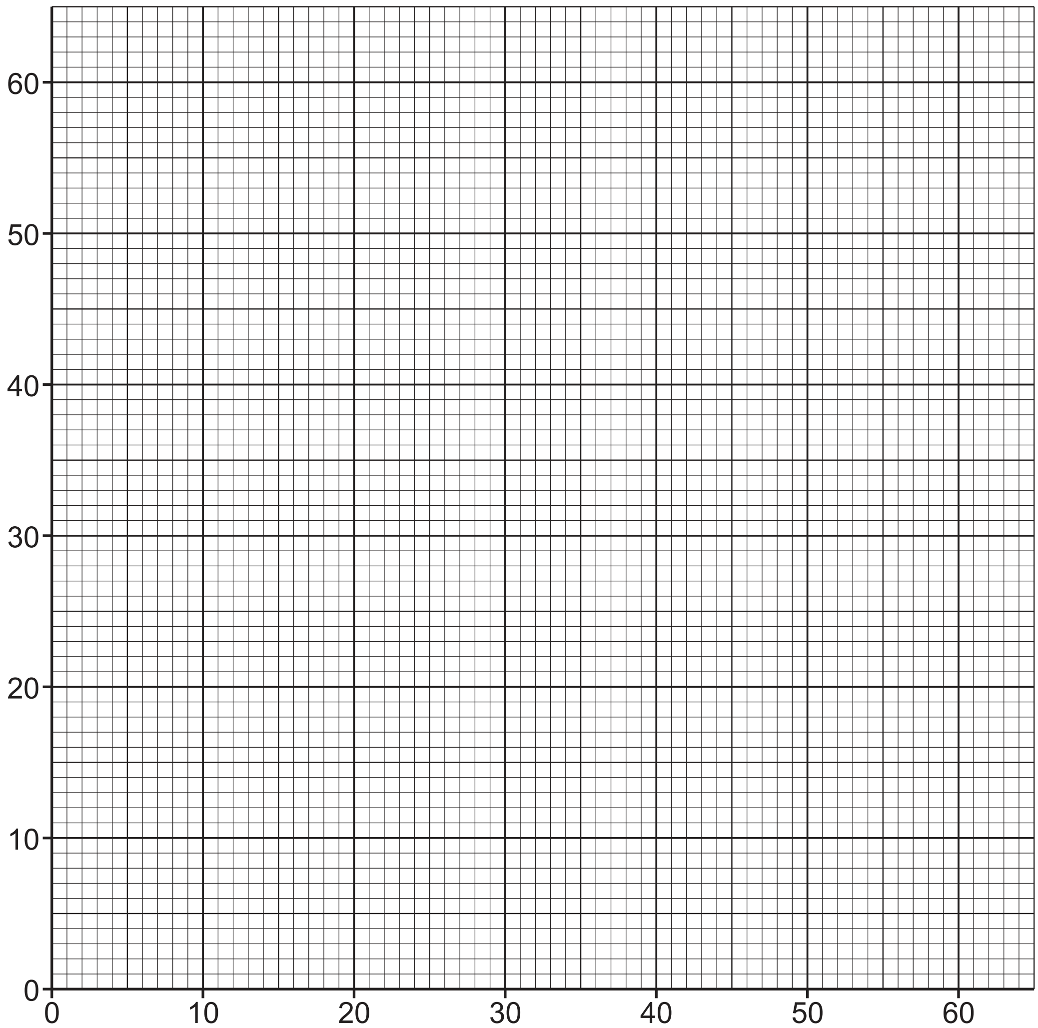
Calculate the magnification of the image.

m = ... [1]

(c) Repeat the procedure in **(a)** for values of u = 25.0 cm, 35.0 cm, 40.0 cm, 50.0 cm, and 60.0 cm.

Record your values of v in Table 7.1. [2]

(d) **(i)** On the grid, plot a graph of v (vertical axis) against u.



[2]

(ii) Draw the best-fit curve. [1]

(e) Use your graph to find the value of v when u = 30.0 cm.

v = ... cm [2]

(f) State **one** precaution you take when doing the experiment to ensure that the readings you obtain are as accurate as possible.

....

.... [1]

[Total: 11]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests 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.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
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

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

Flame tests for metal ions

metal ion	*flame colour*
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green