Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

* 1 9 8 2 3 5 1 1 4 6 *

CO-ORDINATED SCIENCES **0654/53**

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	
Total	

This document has **16** pages. Any blank pages are indicated.

1 You are provided with a flower.

(a) Remove three petals from one side of the flower so that the internal structures of the flower are clearly visible.

In the box, make a large and detailed pencil drawing of the flower.

Include the internal parts of the flower.

[3]

(b) **(i)** Measure the width of one of the petals still attached to the real flower in millimetres to the nearest millimetre.

width of petal on real flower = ... mm [1]

(ii) Draw a line on your drawing in **(a)** to show the width of the petal.

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

width of petal on your drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{width of petal on your drawing}}{\text{width of petal on real flower}}$$

Record your value to **two** significant figures.

magnification *m* = ... [2]

(c) Fig. 1.1 shows two flowers, **1** and **2**, at the same magnification.

flower **1**

flower **2**

Fig. 1.1

(i) Describe three **visible** differences between flower **1** and flower **2**.

difference 1 ....

difference 2 ....

difference 3 ....
[3]

(ii) Add a line labelled anther to identify an anther on flower **1** in Fig. 1.1. [1]

[Total: 11]

2 You are going to investigate the action of three different concentrations of an enzyme on milk protein.

Milk contains a protein that makes it look white (opaque).

When the protein is broken down, the milk becomes clear.

(a) Procedure

Step **1** Label three test-tubes **A**, **B** and **C**.
Step **2** Use a syringe to add $5\,cm^3$ of 4% enzyme solution to test-tube **A**.
Step **3** Use a clean syringe to add $5\,cm^3$ of 2% enzyme solution to test-tube **B**.
Step **4** Use a clean syringe to add $5\,cm^3$ of 1% enzyme solution to test-tube **C**.
Step **5** Use a clean syringe to add $2\,cm^3$ of milk to test-tube **A**.
Step **6** Use a clean glass stirring rod to mix the contents of test-tube **A**.
Step **7** Start the stop-watch.
Step **8** Measure the time it takes for the milk in test-tube **A** to become clear.

(i) Record in Table 2.1 the time to the nearest second.

Table 2.1

test-tube	percentage concentration of enzyme	time / s
A	4	
B	2	
C	1	

[1]

(ii) Repeat Steps **5**, **6**, **7** and **8** of the procedure in **(a)** with test-tubes **B** and **C**.

Record in Table 2.1 your times to the nearest second.

If the milk is not clear at 4 minutes, record the time as >240.

[4]

(b) Use your results to state the relationship between the concentration of the enzyme and the time it takes for the milk to clear.

....

.... [1]

(c) **(i)** Explain why it is important to mix the contents of the test-tubes.

....

.... [1]

(ii) Describe a difficulty you encountered when doing Step **8**.

....

.... [1]

(iii) Suggest how a student alters the procedure to investigate the action of this enzyme on a protein solution which is already clear.

....

.... [1]

[Total: 9]

3 You are going to investigate the rate of reaction between solution **H** and solution **K**.

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

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

(a) (i) Procedure

- Use the syringe labelled **H** to add 2 cm^3 of solution **H** into a conical flask.
- Use the syringe labelled **W** to add 8 cm^3 of distilled water into the conical flask.
- Add 5 drops of starch solution into the conical flask.
- Use the syringe labelled **K** to 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 3.1 the time taken *t* in seconds to the nearest second.

Table 3.1

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
2	8	5	10	
4	6	5	10	
6	4	5	10	
8	2	5	10	
10	0	5	10	

[1]

(ii) Repeat the procedure in **(a)(i)** using the other volumes shown in Table 3.1.

If a time is greater than 200 seconds, then record it as >200 s. [3]

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

....

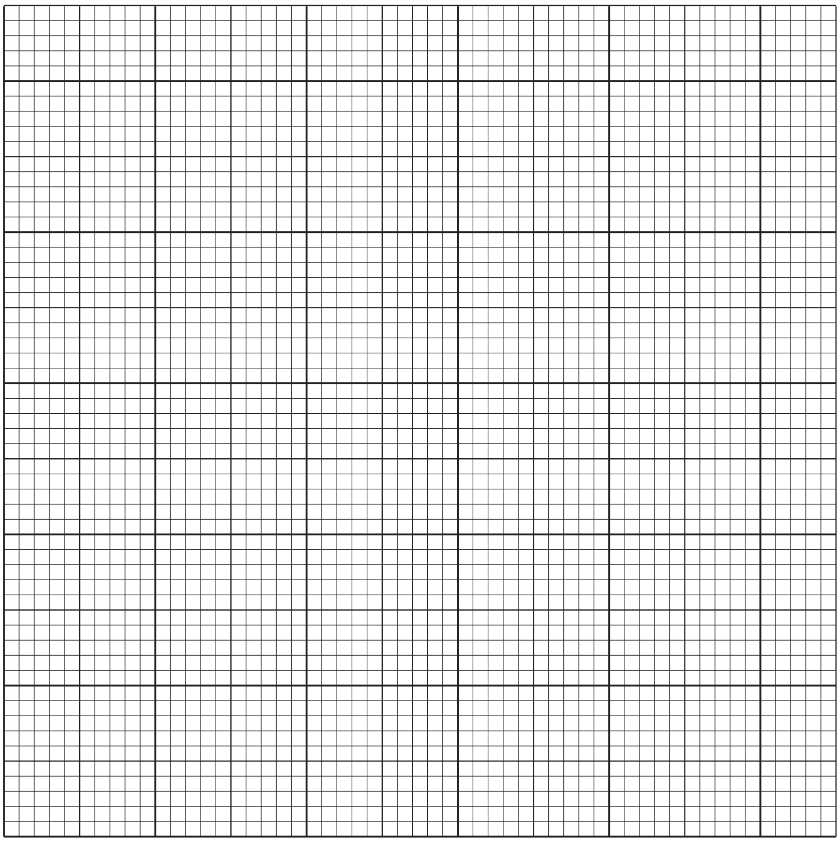
.... [1]

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

Identify the substance made.

.... [1]

(b) **(i)** On the grid, plot a graph of time taken *t* (vertical axis) against the volume of solution **H**.



[3]

(ii) Draw the line of best fit. [1]

(c) When distilled water is added to solution **H**, the solution becomes less concentrated.

(i) State the relationship between the concentration of solution **H** and the time taken for the reaction.

....

.... [1]

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

....

.... [1]

(d) Suggest what you do to have more confidence in your results.

....

.... [1]

[Total: 13]

4 (a) You are going to identify solution **L**.

(i) **Procedure**

- Add approximately 3 cm depth of solution **L** into each of four test-tubes.
- Do the tests described in Table 4.1. Use a different test-tube of solution **L** for each test.
- Record your observations in Table 4.1.

Table 4.1

test-tube	test	observations
1	add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	
2	add a few drops of aqueous ammonia add excess aqueous ammonia	
3	add approximately 1 cm depth of nitric acid followed by a few drops of aqueous silver nitrate	
4	add approximately 1 cm depth of nitric acid followed by a few drops of aqueous barium nitrate	

[4]

(ii) **L** contains two ions.

Identify the two ions.

.... and .... [2]

(b) The teacher has a bottle labelled **M** which they think contains the same anion as solution **L**.

Procedure

- Add approximately 1 cm depth of solution **M** into a clean test-tube.
- Add approximately 1 cm depth of nitric acid followed by a few drops of aqueous silver nitrate into the test-tube.
- Record your observation and explain if the anion in solution **M** is the same as the anion in solution **L**.

observation ....

explanation ....

....

[1]

[Total: 7]

5 You are going to measure the density of plasticine (modelling clay) by two different methods.

Method 1

(a) Procedure

- Break the piece of plasticine into two pieces of approximately the same size.
- Choose **one** of the pieces and put the other piece to one side for use in **(d)**.

Use the balance to find the mass *m* of the piece of plasticine to the nearest gram.

m = ... g [1]

(b) (i) Procedure

- Pour approximately 40 cm^3 of water from the beaker into the measuring cylinder.

Record the volume V_1 of water in the measuring cylinder.

V_1 = ... cm^3 [1]

(ii) Procedure

- Reshape the plasticine so that it fits into the top of the measuring cylinder.
- Tie the thread around the plasticine.
- Use the thread to lower the plasticine into the measuring cylinder until it is completely immersed.

Record the new volume V_2.

V_2 = ... cm^3

Use the values of V_1 and V_2 to calculate the volume V of the piece of plasticine.

V = ... cm^3 [1]

(iii) State **one** precaution that you take when reading the volume of water in a measuring cylinder to obtain an accurate reading.

....

.... [1]

(c) Use your answers to **(a)** and **(b)(ii)** to calculate the density ρ_1 of the plasticine.

Use the equation shown.

$$\rho_1 = \frac{m}{V}$$

ρ_1 = ... g/cm^3 [1]

Method 2

(d) Procedure

- Remove the plasticine from the measuring cylinder.
- Dry the plasticine with paper towels.
- Pour the water from the measuring cylinder back into the beaker.
- Take **both** pieces of plasticine and mould them into a shape that approximates to a sphere, as shown in Fig. 5.1.

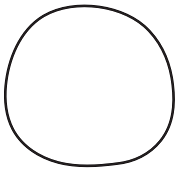


Fig. 5.1

Use the balance to find the mass *M* of the plasticine sphere to the nearest gram.

M = ... g [1]

(e) (i) Place the plasticine between the two wooden blocks so that the diameter of the plasticine can be measured.

Use the ruler to measure the diameter d_1 of the sphere of plasticine in centimetres to the nearest 0.1 cm.

Draw a diagram to show how you arrange the wooden blocks and the sphere.

d_1 = ... cm
[2]

(ii) Rotate the sphere and measure the diameter d_2 of the sphere across a different part of the sphere.

d_2 = ... cm

Use the values of d_1 and d_2 to calculate the average diameter D of the sphere.

D = ... cm
[1]

(iii) Calculate the volume V_S of the plasticine sphere.

Use the equation shown.

$$V_S = 0.52D^3$$

V_S = ... cm^3 [1]

(f) Use your answers to **(d)** and **(e)(iii)** to calculate the density ρ_2 of the plasticine.

Use the equation shown.

$$\rho_2 = \frac{M}{V_S}$$

ρ_2 = ... g/cm^3 [1]

(g) Compare your answers for the density of plasticine from **(c)** and **(f)**.

Suggest two **practical** reasons why the values you obtain are different.

1 ....

....

2 ....

....
[2]

[Total: 13]

6 Plan an investigation to find out if the material from which a spring is made affects the extension of the spring when it is stretched by a load.

You are provided with:

- springs made from aluminium, steel, iron and nickel
- a set of 100 g masses, together with a hanger
- boss, stand and clamp.

You may use any other common laboratory apparatus.

You are not required to do this investigation.

In your plan include:

- any other apparatus needed
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the variables you will control
- a results table to record your measurements (you are **not** required to enter any readings in the table)
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

[7]

BLANK PAGE

BLANK PAGE

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