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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	
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4	
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Total	

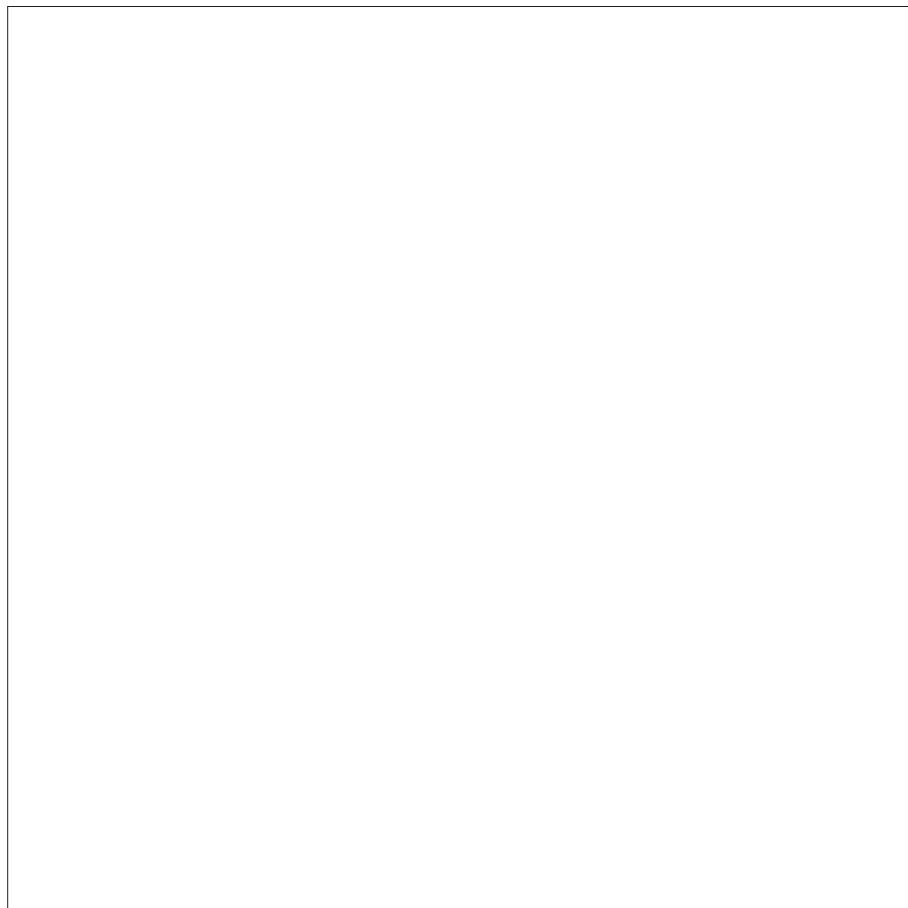
This document has **16** pages. Any blank pages are indicated.

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]

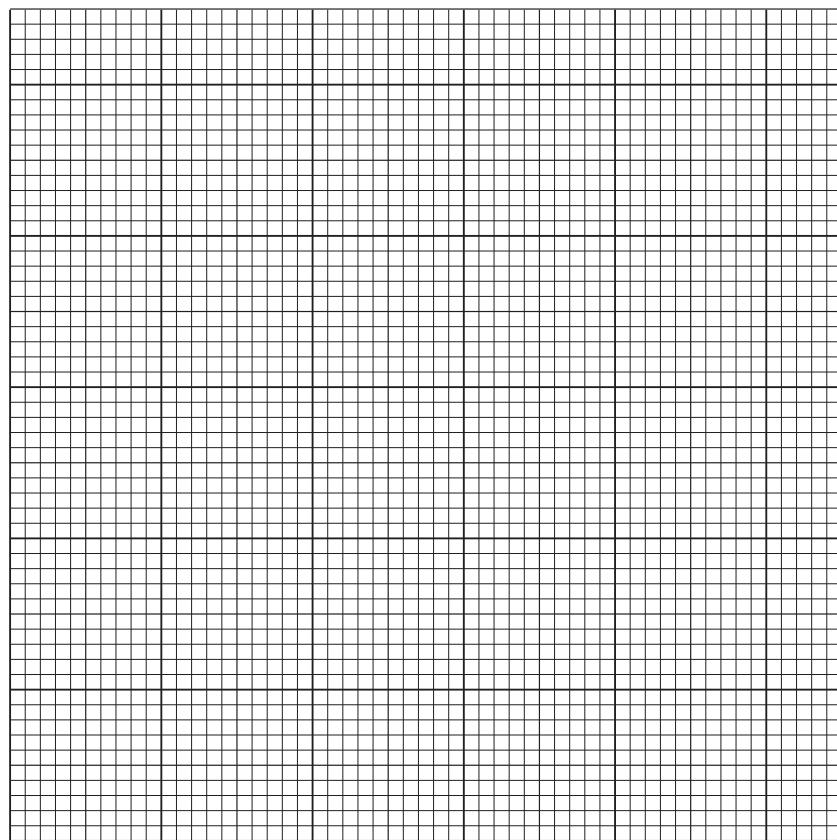
(iv) The substance made when solution **H** and solution **K** react together turns the starch solution blue-black.

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.

$$m = \dots \text{ g} \quad [1]$$

(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.

$$V_1 = \dots \text{ cm}^3 \quad [1]$$

(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 .

$$V_2 = \dots \text{ cm}^3$$

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

$$V = \dots \text{ cm}^3 \quad [1]$$

(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.**

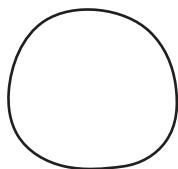
Use the equation shown.

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

$$\rho_1 = \dots \text{ g/cm}^3 \quad [1]$$

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.

$$M = \dots \text{ g} \quad [1]$$

(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.

$$d_1 = \dots \text{ cm} \quad [2]$$

(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.

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

$\rho_2 =$ g/cm³ [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]

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

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