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CO-ORDINATED SCIENCES **0654/51**

Paper 5 Practical Test **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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 **20** pages. Any blank pages are indicated.

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[Turn over

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.

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

Include the internal parts of the flower.

[3]

(ii) On your drawing in **1(a)(i)**, draw a line labelled **A** to show an anther. An anther is the part of the flower that produces pollen. [1]

(b) (i) Measure the length of **one** petal on the actual flower.

Record this length in millimetres to the nearest millimetre.

length of petal on actual flower = ... mm [1]

(ii) Draw a line on your drawing in **1(a)(i)** to show the length of this petal.

Record this length in millimetres to the nearest millimetre.

length of petal on drawing = ... mm [1]

(iii) Use your measurements in **1(b)(i)** and **1(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{length of petal on drawing}}{\text{length of petal on actual flower}}$$

Give your answer to **two** significant figures.

m = ... [2]

[Total: 8]

2 You are going to investigate the use of an enzyme for the extraction of juice from apples.

You are provided with a beaker of apple puree and a solution of an enzyme. Both have been kept at 40 °C.

(a) Procedure

step 1 Place a filter funnel in the top of a measuring cylinder.

step 2 Place a folded piece of filter paper in the funnel.

step 3 Add the enzyme solution to the beaker of apple puree.

step 4 Use a glass rod to stir the contents of the beaker.

step 5 Start the stop-watch.

step 6 Leave the beaker for at least 5 minutes at room temperature.

(i) While you are waiting, read through the rest of the procedure in **2(a)(ii)** and draw a results table to record your results.

[3]

(ii) Procedure continued

step 7 Almost fill the filter paper in the measuring cylinder with apple puree from the beaker.

step 8 Zero and re-start the stop-watch.

Record, in your table in **2(a)(i)**, the volume of apple juice in the measuring cylinder every minute for 5 minutes.
Measure your volumes to the nearest 0.5 cm^3. [4]

(iii) Describe how the volume of juice collected each minute changes during the 5 minutes.

.....

..... [1]

(b) (i) Describe how to modify the investigation to determine if an enzyme is needed to extract juice from apple puree.

.....

..... [1]

(ii) Suggest why it is important to stir and mix the contents of the beaker in **step 4**.

.....

..... [1]

(iii) Suggest why the apple is pureed (liquidised) for this investigation.

.....

..... [1]

(iv) Suggest why the beaker is left for 5 minutes in **step 6** before the apple puree is put into the filter paper.

.....

..... [1]

[Total: 12]

3 You are going to investigate the thermal energy released when zinc reacts with aqueous copper(II) sulfate.

When zinc reacts with aqueous copper(II) sulfate, thermal energy is released and the temperature of the reaction mixture increases.

When the reaction is complete, no more thermal energy is released.

(a) Procedure

- Place a polystyrene cup into a beaker.
- Using a measuring cylinder, add 30 cm^3 of aqueous copper(II) sulfate into the polystyrene cup.
  The assembled apparatus is shown in Figure 3.1.

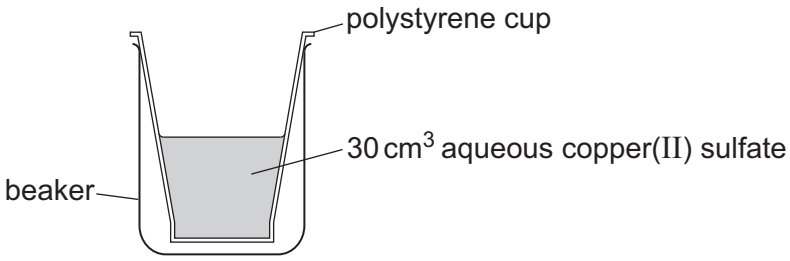


Figure 3.1

- Record in Table 3.1 the temperature of the aqueous copper(II) sulfate to the nearest 0.5 °C.
- Add all of the zinc powder to the aqueous copper(II) sulfate in the polystyrene cup.
- Start the stop-watch.
- Stir the solution continually.
- Measure the temperature of the mixture every 30 seconds for 5 minutes.
- Record in Table 3.1 these temperatures to the nearest 0.5 °C.
- Keep the contents of the polystyrene cup for use in **3(c)**.

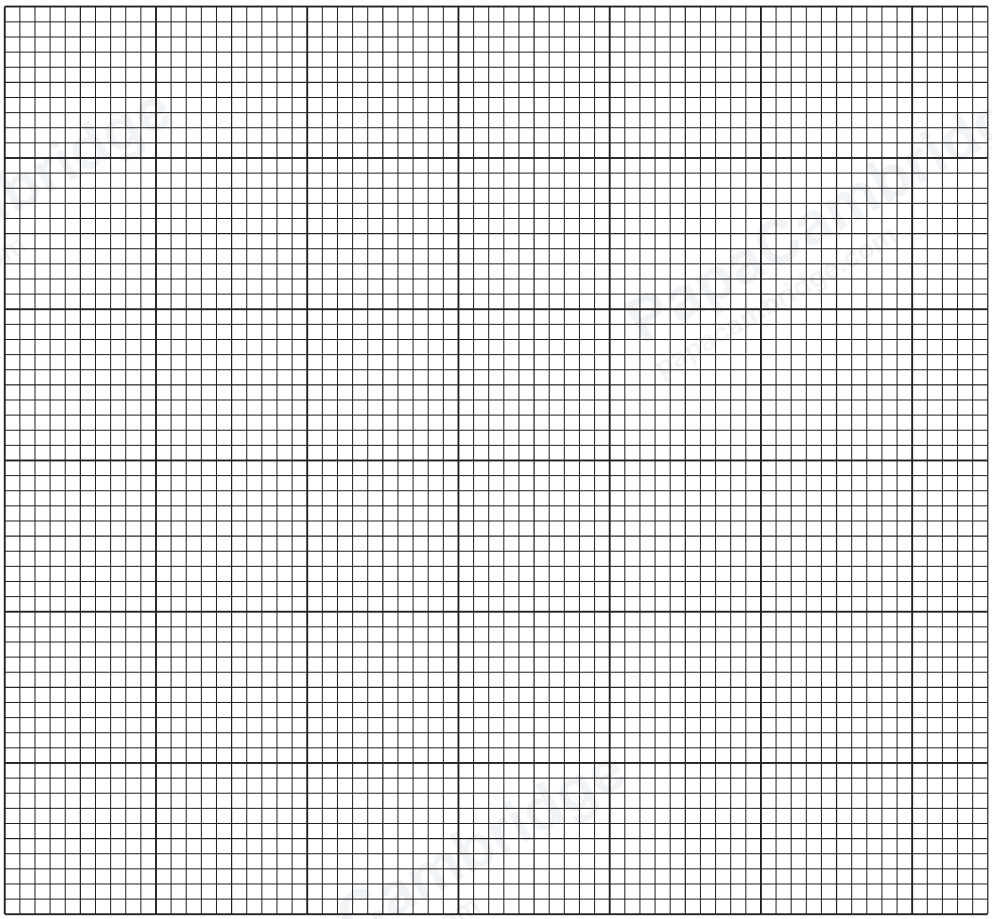
Table 3.1

time / s	temperature / °C
0	
30	
60	
90	
120	
150	
180	
210	
240	
270	
300	

[4]

(b) (i) On the grid, plot temperature (vertical axis) against time.

Do **not** start the vertical axis from 0.



[3]

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

(iii) Use the graph to determine the maximum temperature reached by the mixture.

Show on the graph how you reached your answer.

maximum temperature = ... °C [2]

(iv) Calculate the maximum temperature increase.

Use the equation shown.

maximum temperature increase = maximum temperature – temperature at 0 s

maximum temperature increase = ... °C

Calculate the thermal energy, ΔE, released in this reaction.

Use the equation shown.

$\Delta E = 126 \times$ maximum temperature increase

ΔE = ... J

[1]

(c) Look at the contents of the polystyrene cup from the end of the procedure in **3(a)**.

State which reagent is in excess in this reaction, zinc or aqueous copper(II) sulfate.

Explain your answer.

reagent .....

explanation .....

.....

[1]

(d) A systematic error in an experiment causes all readings to differ from the true reading by a similar amount or similar proportion.

Repeating does **not** correct for a systematic error.

(i) Identify **one** systematic error in this experiment.

.....

..... [1]

(ii) Suggest **one** method of reducing this systematic error.

.....

..... [1]

(iii) A random error in an experiment is due to changes in the environment or the misreading of a measurement.

Repeating, excluding anomalies and calculating a mean may reduce the effect of the random error.

Identify **one** random error in this experiment.

Suggest how to reduce this random error.

Do **not** include repeating the procedure, repeating the readings or changes in the environment.

random error .....

suggestion .....

.....

[1]

[Total: 15]

4 You are going to identify the ions present in aqueous **K**.

(a) Procedure

- Add approximately 1 cm depth of aqueous **K** into each of three test-tubes.
- Complete the tests described in Table 4.1.
- Record your observations in Table 4.1.

Table 4.1

test number	test	observations
1	add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	
2	add 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate	
3	add 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate	

[3]

(b) State the identity of the ions present in aqueous **K**.

..... [1]

(c) State why nitric acid is added in tests **2** and **3**.

.....

..... [1]

[Total: 5]

Turn over

5 You are going to investigate the strength of spaghetti strips.

(a) (i) Procedure

- Assemble the apparatus as shown in Figure 5.1.

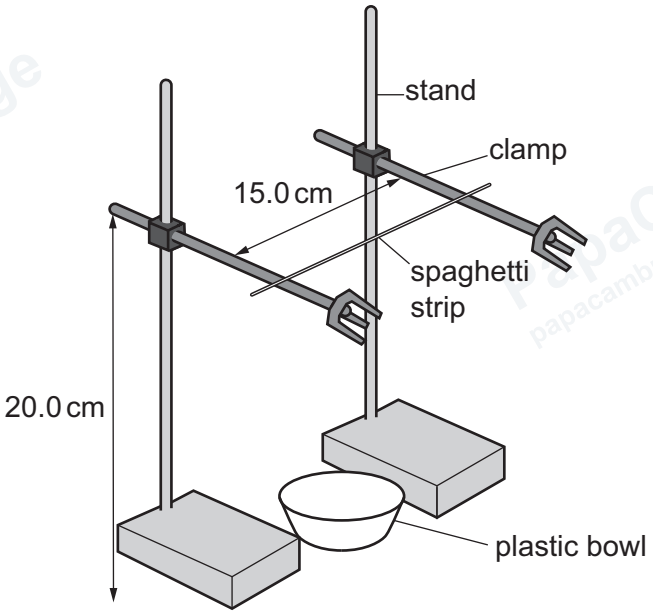


Figure 5.1

- Suspend the small bag from the spaghetti strip using a small hook. Make sure the hook is at the centre of the spaghetti strip.
- Add glass marbles to the bag **one** at a time until the spaghetti breaks.
- Measure the total mass of these marbles that causes the spaghetti to break plus the mass of the bag and hook.
- Record in Table 5.1 this mass to the nearest 0.1 g.

Repeat the procedure with 2 and 3 strips of spaghetti instead of 1 strip.

Table 5.1

number of spaghetti strips	total mass / g
1	
2	
3	

[4]

(ii) State the relationship between the number of spaghetti strips and the mass.

.....

..... [1]

(iii) Describe **one** difficulty with the procedure and suggest how to overcome this difficulty.

difficulty .....

.....

how to overcome this difficulty .....

.....

[1]

(iv) A student repeats the procedure in **5(a)(i)** using glass marbles made from the same type of glass, but with a smaller diameter.

Explain the advantage of using these marbles instead of the ones used in the procedure.

.....

.....

..... [2]

(v) Place 10 glass marbles in the bag.

Use the force meter to find the weight of the bag and the 10 marbles.

Record this value in N to the nearest 0.1 N.

weight = ... N [1]

(b) Another student investigates how the distance *d* between the supports affects the force *F* needed to break a spaghetti strip.

Figure 5.2 shows the assembled apparatus.

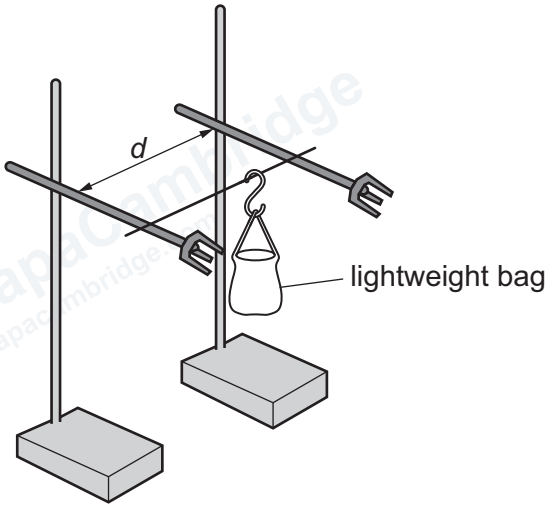


Figure 5.2

The student:

- uses the procedure in **5(a)(i)** to determine the mass needed to break one spaghetti strip for different values of *d*
- repeats the procedure for a total of three trials for each value of *d*
- calculates the force *F* for each trial
- calculates the average value of *F* for each value of *d*
- calculates $\frac{1}{F}$ for each average value of *F*.

The student's results are shown in Table 5.2.

Table 5.2

***d*/cm**	**force *F* needed to break one spaghetti strip/N**				$\frac{\mathbf{1}}{\boldsymbol{F}}$ **/** $\frac{\mathbf{1}}{\mathbf{N}}$
	trial 1	**trial 2**	**trial 3**	**average**	
5	1.25	1.27	1.30	1.27	0.79
10	0.65	0.66	0.60	1.91	1.57
15	0.36	0.42	0.38	0.39	
20	0.25	0.26	0.22	0.24	4.17
25	0.18	0.15	0.16	0.16	6.25

(i) The student makes a mistake when recording one of the average values of F but uses the correct value when calculating $\frac{1}{F}$.

Identify the incorrect average value shown in Table 5.2 and suggest a reason for the error.

incorrect value .....

suggestion .....

.....

[2]

(ii) Calculate $\frac{1}{F}$ for $d = 15\,\text{cm}$.

Record your answer in Table 5.2. [1]

(iii) Suggest a value for the force F needed to break one spaghetti strip for $d = 22$ cm.

force F = ... N [1]

[Total: 13]

6 A student investigates the voltage output from a solar cell.

Plan an investigation to determine the relationship between the distance of a lamp from a solar cell and the voltage produced by the solar cell.

You are provided with:

- a small solar cell
- a desk lamp.

You may use any common laboratory apparatus in your plan.

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

In your plan, include:

- any other apparatus you will use
- a brief description of the method
- the measurements you will take and how you will ensure they are valid
- the variables you will control
- how you will process your results to reach a conclusion.

You may include a results table in your answer. You are **not** required to enter any readings in the table.

You may include a labelled diagram in your answer.

[7]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	test	test result
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	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.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate, NO_3^- [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, 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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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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