Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME										
CENTRE NUMBER							CANDIDATE NUMBER			

5418861367

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **October/November 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	
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Total	

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1 You are going to estimate the concentration of reducing sugar in a sample of food **U**.

You will do this by comparing sample **U** with glucose solutions of known concentrations.

(a) Procedure

- Label five test-tubes **A**, **B**, **C**, **D** and **U**.
- Use a syringe to add 2 cm^3 of testing solution **G** to each of the five test-tubes.
- Use a clean syringe to add 1 cm^3 of the 0.0% glucose solution into test-tube **A**.
- With the same syringe add 1 cm^3 of the 0.5% glucose solution into test-tube **B**.
- With the same syringe add 1 cm^3 of the 1.0% glucose solution into test-tube **C**.
- With the same syringe add 1 cm^3 of the 2.0% glucose solution into test-tube **D**.
- Use a clean syringe to add 1 cm^3 of the food sample **U** into test-tube **U**.
- Place the test-tubes in a hot water-bath and start the stop-clock.
- The test-tubes need to be in the hot water-bath for three minutes, so you may continue with parts **(b)**, **(c)** and **(d)** while you are waiting.
- After three minutes remove the test-tubes from the water-bath and immediately observe the final colours.

(i) Record in Table 1.1 the final colour in each test-tube.

Table 1.1

test-tube	percentage concentration of glucose solution	final colour observed
A	0.0	
B	0.5	
C	1.0	
D	2.0	
U	unknown	

[5]

(ii) Suggest the concentration of the glucose solution in test-tube **U**.

Explain your answer using Table 1.1.

concentration .... %

explanation ....

.... [1]

(b) Name the test solution **G**.

.... [1]

(c) State and explain a safety precaution taken when carrying out this investigation.

precaution ....

explanation ....
[1]

(d) **(i)** Suggest why it would be better to use clean syringes for adding the different glucose solutions.

....

.... [1]

(ii) Suggest how you could get a more accurate estimate for the concentration of reducing sugar in the food sample **U**.

....

.... [1]

(e) A food sample is tested for fat.

(i) Name the **two** substances used to test a food sample for the presence of fat.

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

(ii) State the observation for a positive result.

.... [1]

(iii) Explain why there should be no flames in the laboratory when doing this test.

.... [1]

[Total: 13]

2 A teacher says that the shoots of germinated seeds grow more quickly in a warmer environment.

Plan an investigation to test if the teacher's statement is correct.

You are provided with germinated seeds. You may also use any other common laboratory apparatus.

In your answer, you should include:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method including the measurements you will make
- the variables you will control
- how you will process your results to draw a conclusion.

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

....

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[Total: 7]

3 You are provided with solid **J** which is a mixture of **two** compounds.

Solid **J** contains one anion and two cations.

One compound is soluble and the other is insoluble in water.

You are going to do a series of experiments to identify the ions in **J**.

(a) Place a spatula load of **J** into a test-tube.

Add 3 cm depth of dilute hydrochloric acid to the test-tube.

(i) Record your observations.

.... [1]

(ii) Identify the gas that is produced.

State the test used to identify the gas and give the positive result for this test.

test used ....

positive result ....

identity of gas ....
[1]

(iii) Identify the anion shown to be present in **J**.

.... [1]

(b) Place a spatula load of **J** into a boiling tube.

Add about 2 cm depth of aqueous sodium hydroxide into the boiling tube.

Carefully warm the mixture.

(i) Identify the gas that is produced.

State the test used to identify the gas and give the positive result for this test.

test used ....

positive result ....

identity of gas ....
[1]

(ii) Identify a cation shown to be present in **J**.

.... [1]

(iii) State and explain **one** safety precaution you took during this experiment.

safety precaution ....

explanation ....

....
[1]

(c) Procedure

- Place two spatula loads of **J** into a 100 cm^3 glass beaker.
- Add about 20 cm^3 of distilled water to **J** and stir for about one minute.
- Filter the mixture and keep the residue in the filter paper.
- Wash the residue with a dropping pipette full of distilled water.
- Place a small sample of the residue into a test-tube.
- Add about 3 cm depth of dilute hydrochloric acid into this test-tube.
- Stir the mixture to make a solution. Ignore any formation of a gas.
- Split this solution between two test-tubes.

(i) Do the tests shown and record your observations in Table 3.1.

Table 3.1

test	observations
to the first test-tube, add aqueous sodium hydroxide drop by drop … … until it is in excess.	
to the second test-tube, add aqueous ammonia drop by drop … … until it is in excess.	

[3]

(ii) Suggest why it is important to wash the residue with distilled water.

....

.... [1]

(iii) Use your results from **(c)(i)** to identify the other cation shown to be present in **J**.

.... [1]

[Total: 11]

4 You are going to investigate the effect of increasing the length of magnesium ribbon on the temperature rise in the reaction between magnesium and dilute hydrochloric acid.

(a) Procedure

- Cut a 10 mm length of magnesium ribbon.
- Measure 25 cm^3 of dilute hydrochloric acid using a measuring cylinder.
- Pour the acid into a 100 cm^3 glass beaker.
- Measure and record in Table 4.1 the temperature of the dilute hydrochloric acid to the nearest 0.5 °C.
- Add the magnesium ribbon into the beaker and keep the magnesium ribbon under the surface of the acid using the thermometer.
- Record in Table 4.1 the highest temperature of the reaction mixture to the nearest 0.5 °C.
- Rinse the beaker with water.

Repeat the procedure using fresh dilute hydrochloric acid and the different lengths of magnesium ribbon shown in Table 4.1.

Table 4.1

length of magnesium ribbon / mm	temperature of acid at start / °C	highest temperature of the reaction mixture / °C	temperature rise of the reaction / °C
10			
20			
30			
40			
50			

[4]

(b) Calculate the temperature rise for each experiment.

Record your answers in Table 4.1. [1]

(c) State the relationship between the length of magnesium ribbon and the temperature rise of the reaction.

....

.... [1]

(d) State **one** variable that must be controlled in this investigation.

.... [1]

(e) A teacher says that the highest temperature measured in each experiment is lower than expected.

(i) Suggest **one** reason why the highest temperature measured is lower than expected.

....

.... [1]

(ii) Suggest **one** improvement to the investigation which will make the highest temperature measured closer to the expected value.

....

.... [1]

[Total: 9]

5 You are going to use two different methods to measure the spring constant k of a spring.

The spring constant k of a spring is a measure of the stiffness of the spring.

(a) Method 1

Measure the unstretched length l_0 of the spring to the nearest 0.1 cm.

Do **not** include the loops at the end of the spring in your measurement.

l_0 = ... cm [1]

(b) • Attach the spring to the clamp as shown in Fig. 5.1.

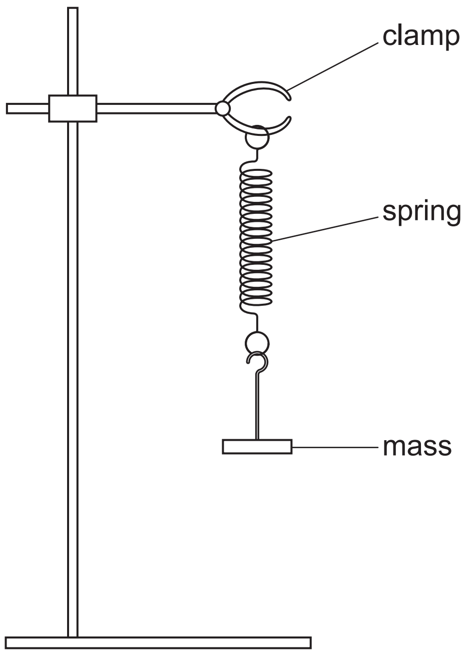


Fig. 5.1

• Suspend a 200 g mass on the spring.

Measure the new length l_1 of the spring.

l_1 = ... cm

Calculate the extension e of the spring produced by the mass. Use the equation shown.

$$e = l_1 - l_0$$

e = ... cm [1]

(c) Calculate the spring constant k of the spring. Use the equation shown.

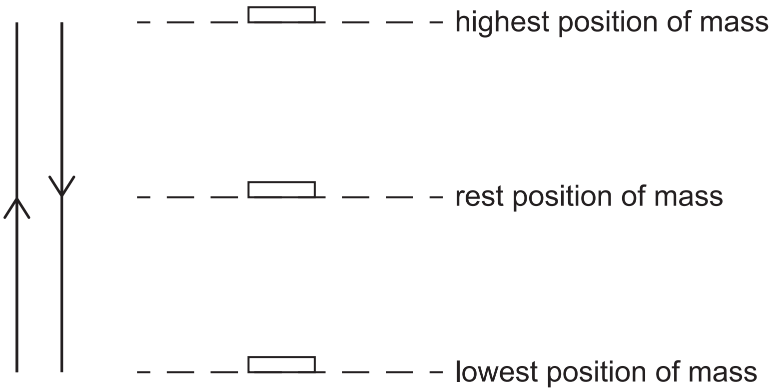
$$k = \frac{2}{e}$$

k = ... N/cm [1]

(d) Method 2

When the 200 g mass is pulled down a small distance and released, it oscillates up and down.

The period *T* of the oscillations is the time taken for **one** oscillation. One complete oscillation of the mass is shown in Fig. 5.2.



One complete oscillation is from the lowest position to the highest position and back to the lowest position.

Fig. 5.2

- Pull the 200 g mass down a **small** distance and release it.

(i) Measure the time *t* taken for 20 oscillations. Record this time in Table 5.1. [1]

(ii) Repeat **(d)(i)** for a mass of 300 g. Record the time *t* in Table 5.1. [1]

Table 5.1

mass *m* / g	time *t* for 20 oscillations / s	period *T* / s	T^2 / s^2
200			
300			

(e) (i) Calculate the period *T*, the time for **one** oscillation, for each of the masses.

Record these values in Table 5.1. [1]

(ii) Calculate the values of T^2.

Record your answers in Table 5.1. [1]

(f) Use your results for the 200 g mass in Table 5.1 to calculate the spring constant k of the spring.

Use the equation shown.

$$k = \frac{0.08}{T^2}$$

k = ... N / cm [1]

(g) Compare your values of k from **(c)** and **(f)**. State whether they agree within the limits of experimental error.

Explain your answer.

....

.... [1]

(h) It is important to avoid line-of-sight (parallax) errors when measuring the length of the spring in **Method 1**.

Describe how you avoided this error.

....

.... [1]

[Total: 10]

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6 You are going to investigate the cooling of hot water in a beaker.

A thermometer has been set up in a clamp for you as shown in Fig. 6.1.

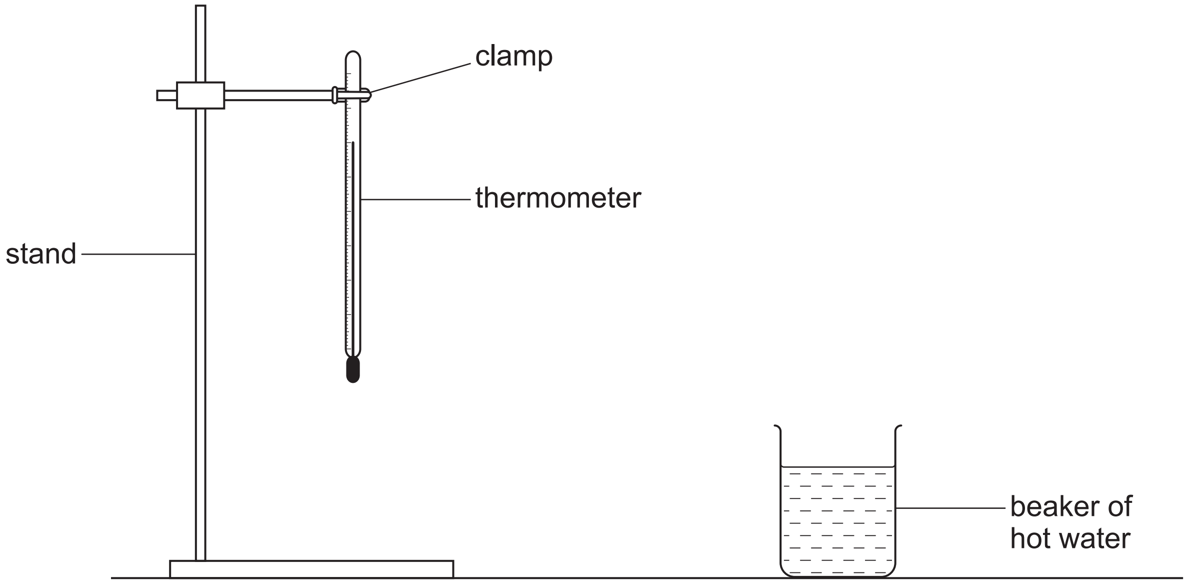


Fig. 6.1

- Pour approximately 200 cm^3 of hot water into the beaker.
- Lower the thermometer into the hot water.
- When the reading on the thermometer stops rising, measure the temperature θ of the hot water. This is time $t = 0$.

(a) Record in Table 6.1 the value of the temperature θ to the nearest 0.5 °C at time $t = 0$ and start the stop-watch. [1]

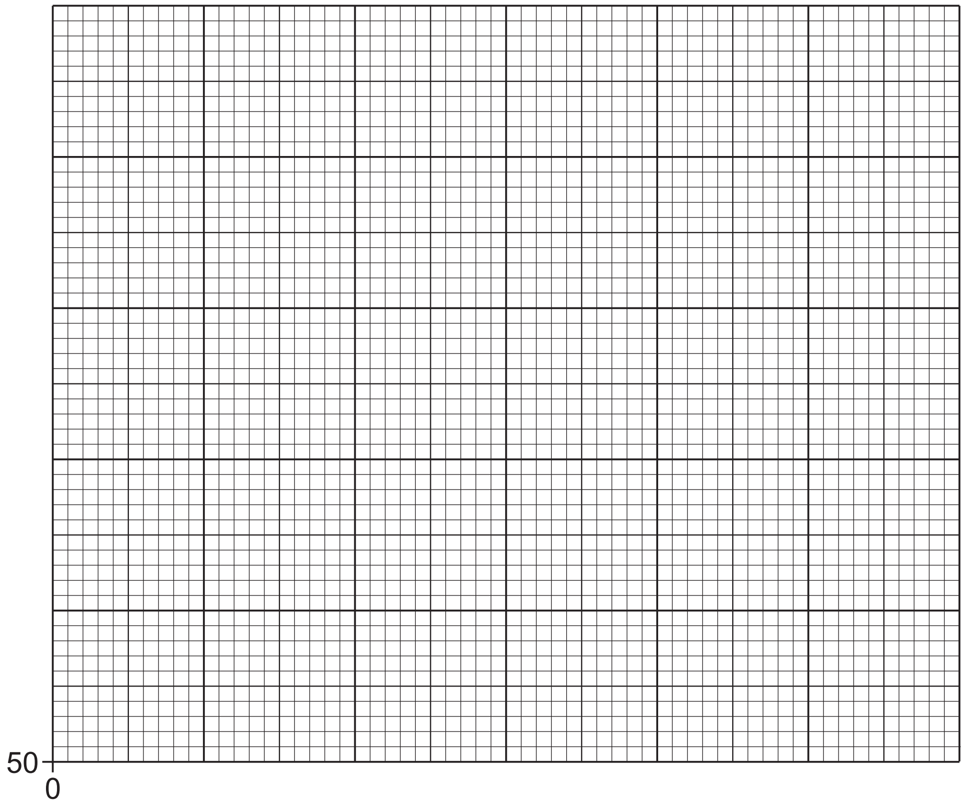
Table 6.1

time t / s	temperature θ / °C
0	
300	

(b) Record in Table 6.1 the temperature θ of the water and the time t every 60 s for 300 s. [2]

(c) **(i)** On the grid provided, plot a graph of temperature θ (vertical axis) against time t.

The vertical axis starts at θ = 50 °C. [3]



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

(d) Calculate the average rate of cooling of the hot water during the whole investigation. Use the equation shown.

$$\text{average rate of cooling} = \frac{\text{total temperature decrease}}{\text{time taken}}$$

average rate of cooling = ... °C / s [1]

(e) **(i)** State **one** safety precaution taken during the investigation.

Explain your answer.

safety precaution ....

explanation ....

.... [1]

(ii) Suggest **one** change that you can make to your investigation to reduce the rate of cooling of the hot water.

....

.... [1]

[Total: 10]

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 (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

