Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME		
CENTRE NUMBER		CANDIDATE NUMBER

5223713571

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **May/June 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Notes for Use in Qualitative Analysis for this paper are printed on page 16.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **15** printed pages and **1** blank page.

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Cambridge Assessment International Education

[Turn over

1 You are going to investigate the loss of body temperature from an adult animal and from a baby animal using a large test-tube and a small test-tube to represent the animals.

(a) **(i)** Read through the procedure in part **(a)(ii)**.

Complete the heading of the first column of Table 1.1, including units. [1]

(ii) **Procedure**

- Use the hot water to fill the large test-tube carefully to the line marked.
- Place a thermometer in the hot water in the large test-tube.
- When the reading stops rising, record in Table 1.1 the temperature to the nearest 0.5°C of the hot water in the large test-tube for time = 0.
- Start the stopclock.
- Read and record in Table 1.1 the temperature to the nearest 0.5°C of the water in the large test-tube every minute, for 5 minutes.
- Repeat the above procedure using the small test-tube instead of the large test-tube. Use a fresh supply of hot water.

Table 1.1

……………………….. / ……………	temperature of water in large test-tube / °C	temperature of water in small test-tube / °C
0		
1		
2		
3		
4		
5		

[4]

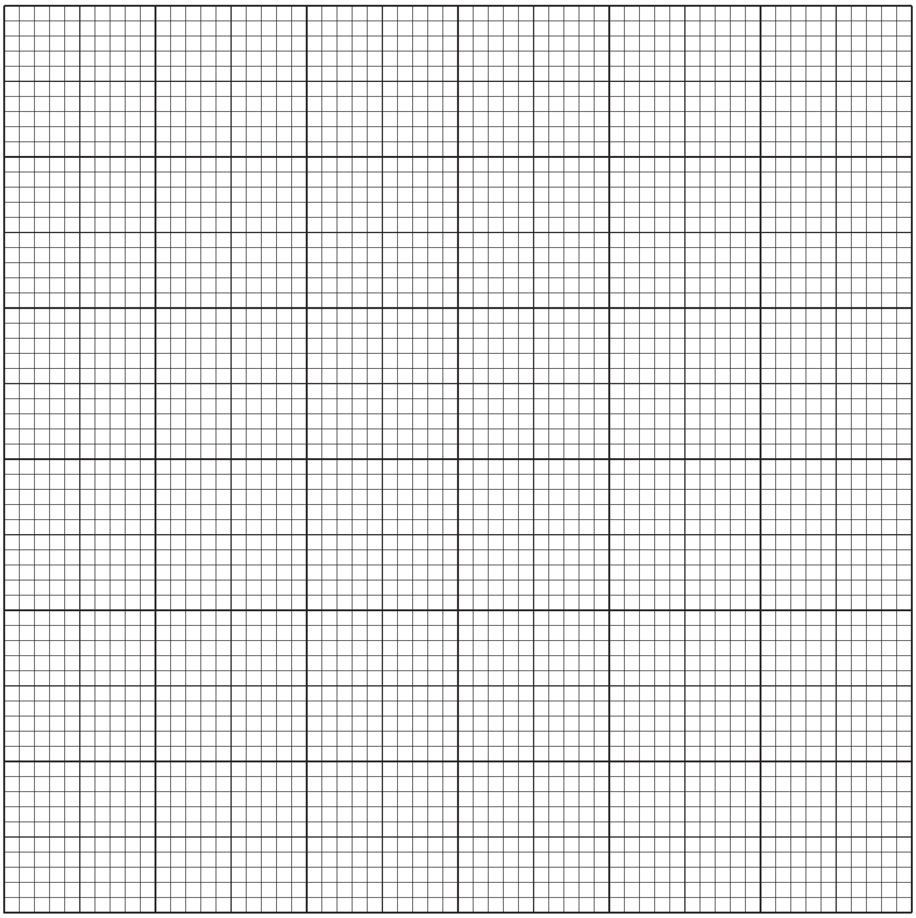
(b) **(i)** On the grid provided, draw and label the axes for a graph of temperature (vertical axis) against time.

Choose a scale for the temperature axis suitable to plot all the data in Table 1.1.

You do **not** need to start your temperature axis at 0°C. [2]

(ii) On the axes drawn in **(b)(i)**:

- plot the points for the large test-tube
- draw the smooth curve of best fit and label the line L
- using the same axes, plot the points for the small test-tube
- draw the smooth curve of best fit for the small test-tube and label the line S.



[2]

(c) **(i)** Use your results in Table 1.1 to calculate the drop in temperature of the water over 5 minutes for each test-tube.

large test-tube = ... °C

small test-tube = ... °C
[1]

(ii) State and explain what the graphs show about the rate of heat loss from the test-tubes.

.... [1]

(iii) The teacher says that baby animals need more energy from food for each gram of their body mass than adults. Use your answers to **(c)(i)** and **(c)(ii)** to explain whether your results support this statement.

....

.... [1]

[Total: 12]

2 When acids react with alkalis, heat is given out. These reactions are exothermic.

Plan an investigation using a thermometer to compare the amount of heat given out when each of the acids listed reacts with an alkali.

hydrochloric acid
nitric acid
sulfuric acid

You are not required to carry out this experiment.

Your plan should include:

- a suitable named alkali
- a description of the apparatus needed and how it is used, including how to reduce heat losses
- the readings to be taken
- which variables you will keep the same
- how you will use the readings to make the comparison.

....

....

....

....

....

....

....

....

....

.... [7]

[Total: 7]

3 You are going to use a pendulum to measure the acceleration of free fall *g*.

A pendulum has been set up in a clamp for you as shown in Fig. 3.1.

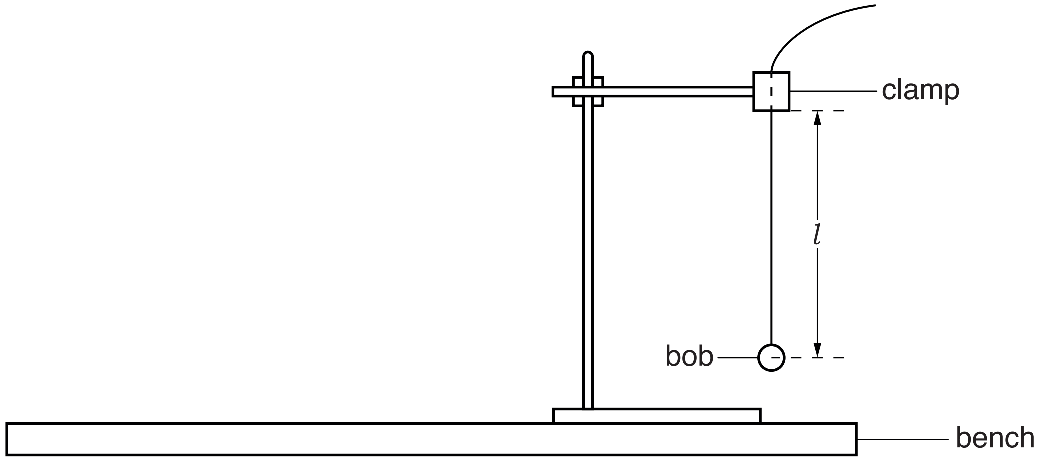


Fig. 3.1

The length l of the pendulum is the distance from the bottom of the clamp to the centre of the pendulum bob.

(a) Adjust the string until the length l of the pendulum is 40.0 cm.

One complete oscillation of the pendulum is shown in Fig. 3.2.

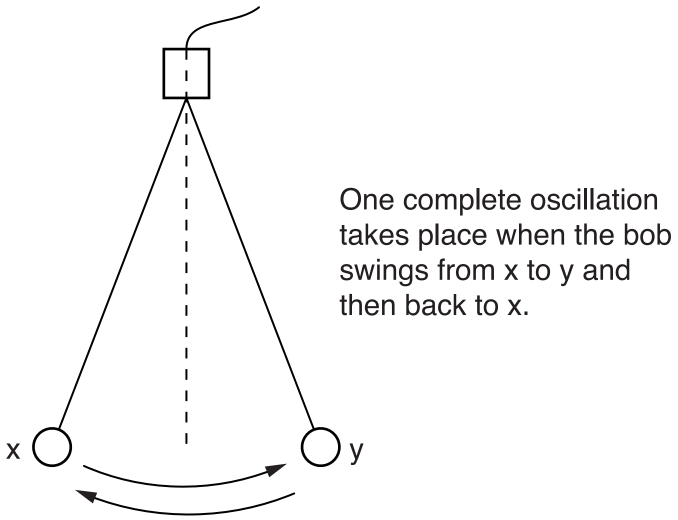


Fig. 3.2

Give the bob a small sideways displacement, and release it so that it oscillates freely.

(i) Measure the time *t* for 20 complete oscillations.

t = ... s [1]

(ii) Calculate the time *T* for **one** complete oscillation of the pendulum for l = 40.0 cm.

T = ... s [1]

(iii) Calculate T^2.

T^2 = ... s^2 [1]

(b) The acceleration of free fall g is given by the equation shown.

$$g = \frac{(0.395 \times l)}{T^2}$$

Use this equation with l = 40.0 cm to calculate a value for g.

Give your answer to three significant figures.

g = ... m/s^2 [2]

(c) Adjust the string until the length l of the pendulum is 80.0 cm.

Repeat the procedure in **(a)(i)**, **(ii)** and **(iii)** for l = 80.0 cm.

t = ... s

T = ... s

T^2 = ... s^2
[1]

(d) Use the equation in **(b)** with l = 80.0 cm to calculate a second value for g.

g = ... m/s^2 [1]

(e) Compare your measured values of g from parts **(b)** and **(d)** with the actual value of 9.8 m/s^2. State whether or not your values agree with the actual value of g within the limits of experimental error. Justify your answer with reference to your values.

....

....

.... [1]

(f) **(i)** Using your value for T in **(c)**, calculate the frequency of oscillation for pendulum length l = 80.0 cm using the equation shown.

$$\text{frequency} = \frac{1}{T}$$

.... Hz [1]

(ii) Suggest why it is better experimental practice to use longer lengths of pendulum when performing this experiment.

....

.... [1]

[Total: 10]

4 You are provided with a piece of fruit. The fruit has been cut in half and the stone removed.

(a) In the box, make an enlarged detailed pencil drawing of the cut surface of the fruit.

[3]

(b) **(i)** Measure the diameter of the piece of fruit.

Record this length in millimetres to the nearest millimetre.

diameter of fruit = ... mm [1]

(ii) Draw a line to show the same diameter on your drawing.

Measure and record this diameter in millimetres to the nearest millimetre.

diameter of drawing = ... mm [1]

(iii) Use your measurements to calculate the magnification of your drawing.

magnification = ... [1]

(c) **(i)** A student tests the fruit for the presence of reducing sugar.

State the name of the solution he uses to test for reducing sugar.

.... [1]

(ii) The fruit gives a positive result for the presence of reducing sugar.

State a colour that indicates a positive result for the presence of reducing sugar.

.... [1]

[Total: 8]

5 Notes for use in Qualitative Analysis for this question are printed on page 16.

You are going to investigate the use of barium nitrate solution as a reagent in qualitative analysis.

You will then identify the cation and anion in the unknown substance **H**.

(a) **(i)** React aqueous sodium carbonate with dilute nitric acid in a test-tube.

In a separate test-tube react aqueous sodium carbonate with barium nitrate solution.

Record your results in Table 5.1. [1]

Table 5.1

	observations	
	reaction with dilute nitric acid	reaction with barium nitrate solution
aqueous sodium carbonate		
aqueous sodium sulfate		

(ii) Repeat **(a)(i)** using aqueous sodium sulfate instead of aqueous sodium carbonate.

Record your results in the next row in Table 5.1. [1]

(b) Use of barium nitrate solution on its own does not distinguish between the carbonate ion and the sulfate ion.

(i) Use the results in Table 5.1 to explain why this statement is correct.

....

.... [1]

(ii) State and explain how this problem is overcome in Qualitative Analysis.

....

....

.... [2]

(c) Use Qualitative Analysis to identify the **cation and anion** in the unknown substance **H**.

Solid **H** has been dissolved in distilled water to make a solution of **H**.

You may use the following reagents for carrying out the tests on the solution of **H**.

ammonia solution
barium nitrate solution
litmus papers
nitric acid
silver nitrate solution
sodium hydroxide solution

Record all tests, observations and conclusions in Table 5.2.

Table 5.2

tests for ions	observations	conclusions

[8]

[Total: 13]

6 You are going to find the spring constant k of a spring. You will then use the spring to measure the mass and density of a stone.

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

A spring has been set up on a stand for you as shown in Fig. 6.1.

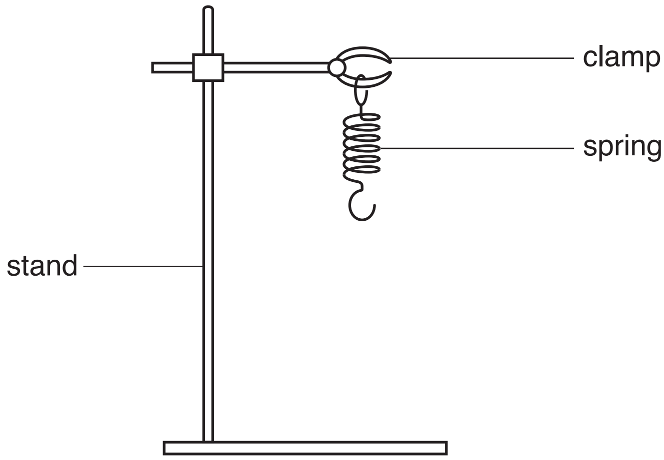


Fig. 6.1

(a) Measure the unstretched length l_1 of the spring to the nearest millimetre. Do not include the loops at the end of the spring in your measurement.

l_1 = ... mm [1]

(b) (i) Suspend the 300 g mass on the spring. Measure the stretched length l_2 of the spring. Do not include the loops at the end of the spring in your measurement.

l_2 = ... mm

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

$$e = l_2 - l_1$$

e = ... mm [1]

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

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

where F = 3 N (the weight of the 300 g mass).

k = ... N/mm [1]

(c) It is important to avoid errors when measuring the length of the spring.

Describe **two** ways in which you can avoid these errors.

1 ....

....

2 ....

....
[2]

(d) Procedure

- Remove the 300 g mass from the spring.
- Attach the stone provided to the spring.

Measure the stretched length l_A of the spring and calculate the extension e_A of the spring caused by the stone.

l_A = ... mm

e_A = ... mm
[1]

(e) Use your answers to **(b)(ii)** and **(d)** to calculate the mass m of the stone. Use the equation shown.

$$m = 100ke_A$$

m = ... g [1]

(f) Procedure

- Place the beaker of water under the spring.
- Slowly lower the clamp until the stone is completely submerged in water, as shown in Fig. 6.2.

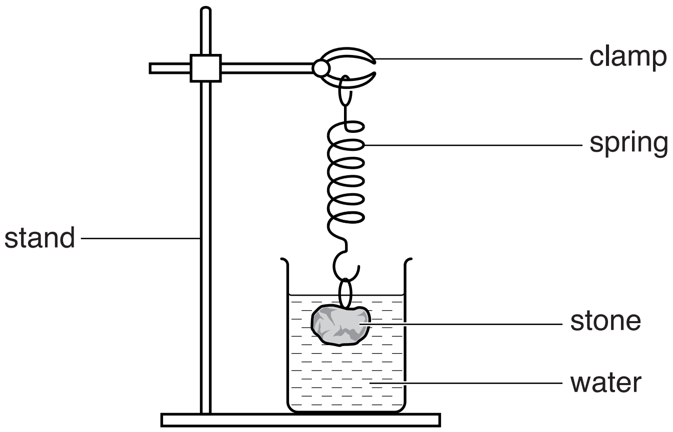


Fig. 6.2

Measure the length l_W of the spring and calculate the extension e_W of the spring caused by the stone.

l_W = ... mm

e_W = ... mm
[1]

(g) Use your answers to **(d)** and **(f)** to calculate the density ρ of the stone, using the equation shown.

$$\rho = \frac{e_A}{(e_A - e_W)}$$

ρ = ... g/cm^3 [2]

[Total: 10]

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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 (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