Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

4493082612

PHYSICAL SCIENCE **0652/61**

Paper 6 Alternative to Practical **October/November 2016**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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.

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 **18** printed pages and **2** blank pages.

DC (RW/SG) 128600/3

CAMBRIDGE International Examinations

1 The science teacher asks a student to make crystals of hydrated copper sulfate, $CuSO_4.5H_2O$, from a sample of the mineral malachite which has the formula $CuCO_3.Cu(OH)_2$.

The teacher gives the student the following instructions for the experiment.

1. Grind the mineral sample into a powder.
2. Slowly add sulfuric acid until the reaction stops.
3. Remove any undissolved solid impurities from the mixture.
4. Obtain blue crystals from the clear blue solution.

(a) **(i)** Name the **two** pieces of apparatus that the student needs to grind the mineral sample in step **1**.

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

(ii) State how the student knows that the sulfuric acid has stopped reacting with the malachite in step **2**.

....

....[1]

(iii) Draw a labelled diagram to show how the student removes the undissolved solid impurities from the reacted mixture in step **3**. Label the filtrate and the residue.

[3]

(iv) Describe how the student obtains blue crystals of hydrated copper sulfate from the clear blue solution in step **4**.

....

....

....

....

....

....[3]

(b) Anhydrous copper sulfate, $CuSO_4$, is a white powder that can be used to test for the presence of water.

(i) Suggest how a sample of anhydrous copper sulfate can be made from the hydrated copper sulfate, $CuSO_4.5H_2O$, obtained in **(a)(iv)**.

....

....[1]

(ii) Describe what you would expect to see when water is added to anhydrous copper sulfate.

....

....[1]

2 A student is given a pale green solution **J** containing a dissolved salt and a grey solid **L**, which is an element. He carries out some experiments to identify the ions of the salt in **J** and to identify the element **L**.

(a) He chooses from the following solutions to carry out tests to identify the cation and the anion in solution **J**.

barium nitrate solution
dilute nitric acid
silver nitrate solution
sodium hydroxide solution

(i) State the details of the test and observations which allow him to identify the cation as Fe^{2+}.

cation

test ....

....

observations ....

.... [2]

(ii) State the details of the test and the observations which allow him to identify the anion as SO_4^{2-}.

anion

test ....

....

observations ....

.... [3]

(b) **(i)**
- The student places solid **L** in a test-tube. He adds dilute hydrochloric acid.
- He warms the test-tube gently for a short time to increase the rate of reaction.
- He stirs carefully and tests the gas produced.
- He records in Table 2.1 his observations and the test which identifies this gas.

Table 2.1

test	observation
add dilute hydrochloric acid	fizzing and colourless solution is formed
lighted splint at mouth of test-tube	popping sound

Identify the gas produced.

gas produced ....[1]

(ii) • He filters the mixture from **(b)(i)** into a test-tube.
• To the filtrate in the test-tube he slowly adds sodium hydroxide solution until there are no further changes.
• He identifies the element **L** as zinc.

Suggest the observations which lead him to this conclusion.

observations ....

....

....[2]

(c) He then places magnesium powder in a test-tube. He adds solution **J** to the magnesium powder and records his observations.

observations test-tube becomes warmer

After three minutes, he filters the mixture into another test-tube and records the appearance of the filtrate.

appearance of filtrate colourless

He then adds sodium hydroxide solution slowly to a portion of the filtrate until there is no further change. He records his observations.

observations faint white ppt

(i) Using your answers to **(a)** and this information, suggest what has happened to the **cation** in solution **J**.

....

....[1]

(ii) State the name given to a reaction that gives out heat.

....[1]

3 A student investigates how the period of a simple pendulum depends on its length.

The period of a pendulum is the time for one complete swing (oscillation) of the pendulum. This is shown in Fig. 3.1, where the period is the time taken for the bob to swing from **P** to **Q** and back to **P** again.

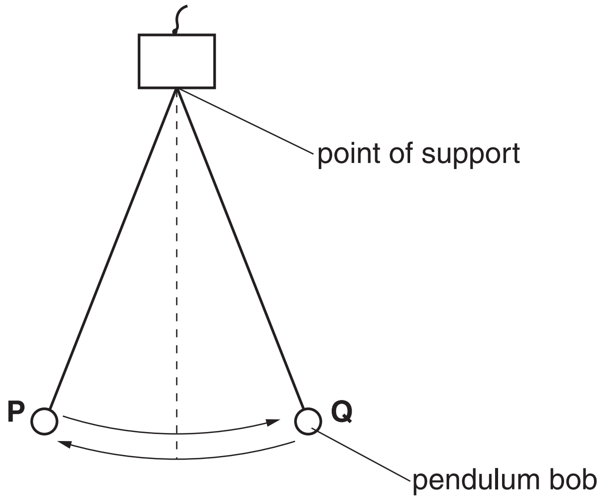


Fig. 3.1

She sets up the pendulum as shown in Fig. 3.2.

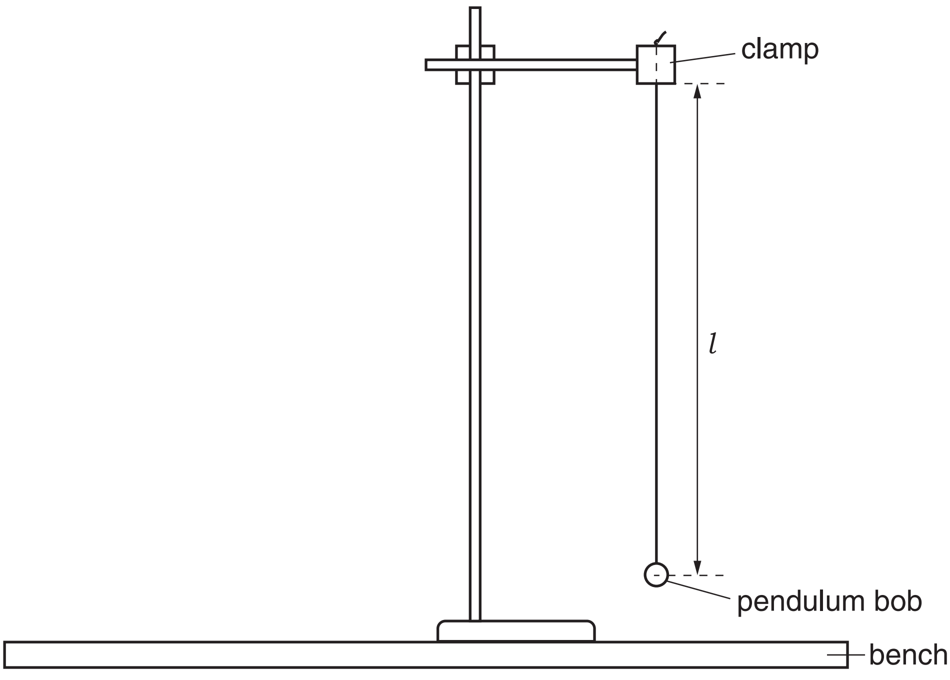


Fig. 3.2

Fig. 3.2 is drawn to a scale of **one-tenth full size**.

(a) **(i)** Measure the length l of the pendulum in Fig. 3.2 to the nearest 0.1 cm.

length l = ... cm [1]

(ii) Calculate the actual length l_A of the pendulum she uses. Record your answer below and in Table 3.1 on page 8.

actual length l_A = ... cm [1]

(iii) The actual length l_A of the pendulum is the distance from the point of support to the centre of the pendulum bob.

Describe a precaution that the student should take to measure l_A as accurately as possible. You may draw a diagram if you wish.

....

....[1]

(b) The student then moves the pendulum bob to position **P** and releases it so that it oscillates. She records the time taken for 20 oscillations. Fig. 3.3 shows the reading on the stopwatch.

00 : 30 . 98

Fig. 3.3

Record in Table 3.1 the reading on the stopwatch to three significant figures. [1]

Table 3.1

l_A / cm	time for 20 oscillations / s	period T / s	T^2 / s^2
50.0	28.4	1.42	2.0
40.0	25.4	1.27	1.6
30.0	22.0	1.10	1.2
20.0	18.0	0.90	0.8

She repeats the procedure described in **(b)** for lengths l_A of 50.0 cm, 40.0 cm, 30.0 cm and 20.0 cm.

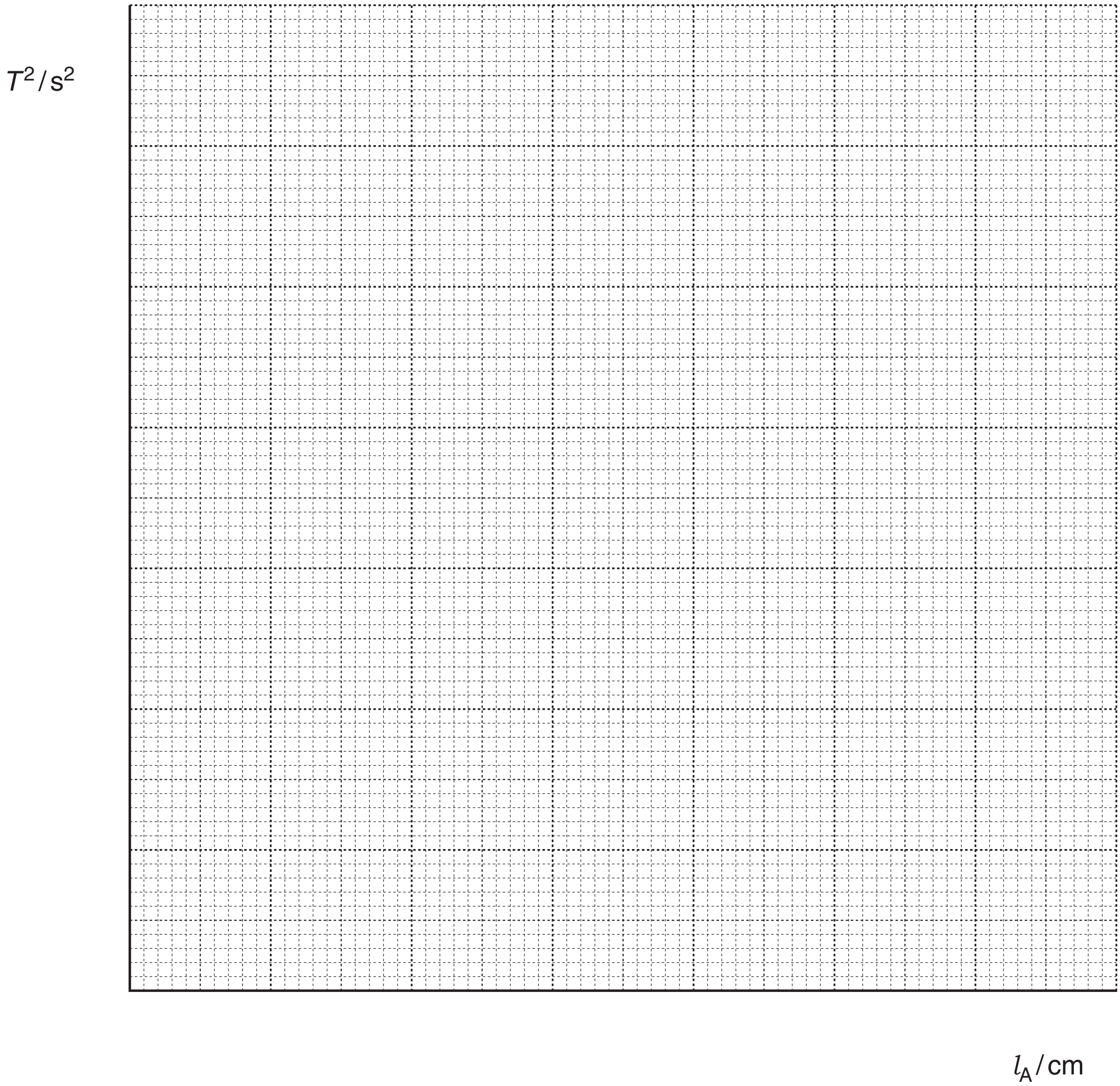
Her values are shown in Table 3.1.

(c) Complete Table 3.1 by calculating the period T of the pendulum and T^2 for the first set of results. Remember that the period is the time for **one** oscillation.

[2]

(d) On the grid provided, use the information in Table 3.1 to plot a graph of T^2 against l_A.

Start both axes of your graph from the origin (0, 0). Draw the best-fit straight line.



[3]

(e) Another student suggests that T^2 is directly proportional to l_A.

State whether your graph supports this suggestion. Give a reason for your answer.

....

....

....[1]

4 The Science teacher shows the class an experiment. The apparatus is shown in Fig. 4.1.

Procedure

- Steam at 100 °C is passed into a beaker containing 100 g of crushed ice. The ice is at 0 °C.
- The ice is stirred as it melts and the temperature is measured every 20 s.
- The steam is made using an electrical circuit containing an electric heater. The power supply is a 24 V battery and the current is kept at 5 A.
- When the temperature begins to rise above 0 °C the flow of steam is stopped.
- The mass of water in the beaker is measured.

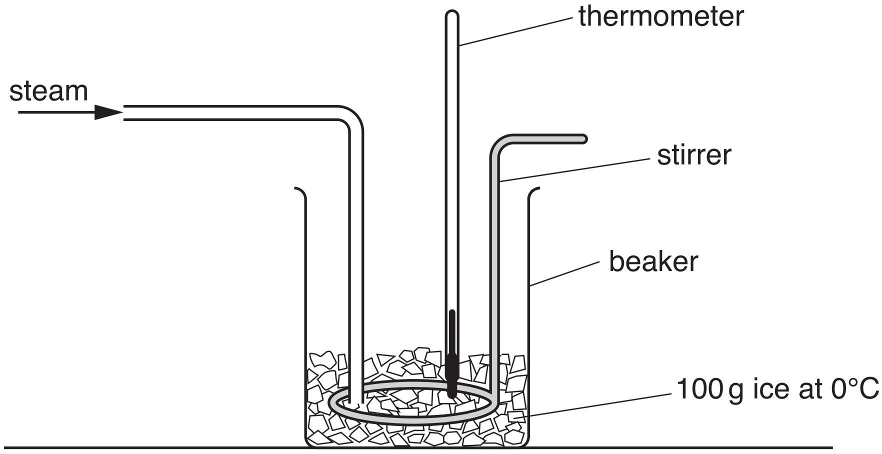


Fig. 4.1

(a) (i) State the name of the component in the electrical circuit used to keep the current at 5 A.

....

....[1]

(ii) Explain why it is important to stir the ice throughout the experiment.

....

....[1]

(iii) State what the students observe in the beaker when the thermometer shows the temperature rising above 0 °C.

....

....[1]

(b) After 4 minutes 20 seconds the temperature begins to rise above 0 °C and the teacher stops the flow of steam.

She gives the class a formula to find the electrical energy, *E*, supplied to the melting ice.

$$E \text{ (J)} = \text{potential difference (V)} \times \text{current (A)} \times \text{time (s)}$$

Use the information shown in the procedure and the formula to calculate the electrical energy, *E*, supplied in 4 minutes 20 seconds.

E = ... J [2]

(c) Fig. 4.2 shows the balance reading for the mass of water, including the melted ice, in the beaker at the end of the experiment.

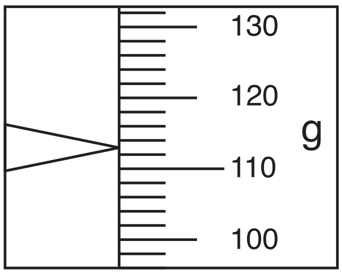


Fig. 4.2

(i) Read the scale and record this mass of water.

mass of water = ... g [1]

(ii) State why the mass in **(c)(i)** is different to the original mass of ice.

....

....[1]

(d) The amount of energy, E_{ice}, needed to melt 100 g of ice is less than the electrical energy, E, calculated in **(b)**.

(i) Explain why E_{ice} is less than E.

....

....

....

....[2]

(ii) Suggest a modification to the apparatus in Fig. 4.1 which would reduce the difference between E_{ice} and E.

....

....[1]

Please turn over for Question 5.

5 A science class is investigating the properties of five different colourless gases. The teacher has given them test-tubes containing the gases **V**, **W**, **X**, **Y** and **Z**. Each test-tube contains only one gas.

The students carry out different tests on the gases.

(a) **(i)** **Test 1**. A glowing splint is inserted into a test-tube of each gas. In gas **Z** the splint relights. Suggest the name of gas **Z**.

.... [1]

(ii) **Test 2**. The gases are tested by lowering a lit wooden splint into each test-tube. Gas **X** burns with a squeaky pop. Suggest the name of gas **X**.

.... [1]

(b) **Test 3**. Gases **V**, **W** and **Y** are tested to find out if they are acidic, alkaline or neutral.

(i) Describe how a student can show that a gas is acidic or alkaline.

....

....

.... [1]

(ii) Describe how a student can show that a gas is neutral.

....

....

.... [1]

(c) **Test 4**. The teacher gives the students a bowl of water. They have no other apparatus except the test-tubes containing the gases.

Draw a diagram to show how the students could use only this to find out if the gases are soluble in water.

Show clearly what is seen if the gas is soluble in water.

[2]

(d) The students find out that gases **V** and **W** are soluble in water. They also find out that gas **V** is alkaline and gas **W** is acidic.

Use these results to suggest a name for the gases **V** and **W**.

gas **V** ....

gas **W** ....
[2]

(e) These tests may not be able to identify carbon dioxide gas.

Suggest a test to identify carbon dioxide gas and state the observations for a positive result.

test ....

....

observations ....

....
[2]

6 A student carries out an experiment to compare the electrical resistance of wires **L** and **M**. The wires are made of different metal alloys and are each 100 cm long.

The student connects wire **L** into the circuit shown in Fig. 6.1 so that the current and voltage can be measured when the switch is closed.

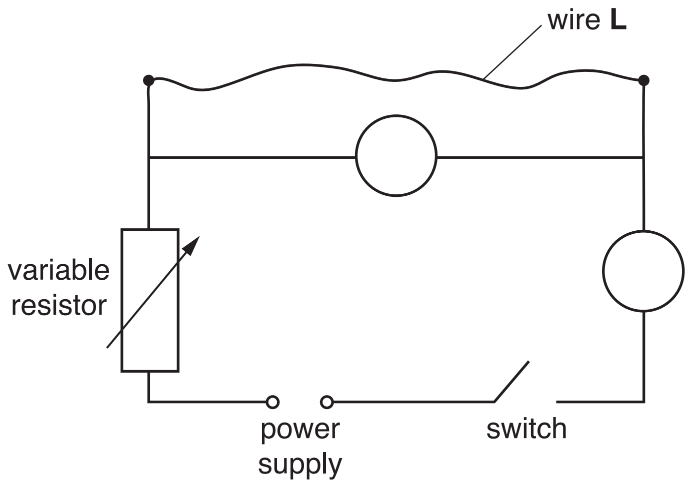


Fig. 6.1

(a) Complete the symbols for the ammeter and voltmeter in Fig. 6.1. [1]

(b) The student closes the switch. She adjusts the variable resistor until there is a small current in wire **L**. She reads the ammeter and voltmeter and records the readings in Table 6.1.

She opens the switch.

She repeats the experiment using wire **M**.

Table 6.1

wire	current / A	voltage / V
L	0.80	1.2
M		

Fig. 6.2 shows the ammeter and voltmeter readings for wire **M**.

Read the current to the nearest 0.05 A and the voltage to the nearest 0.1 V.

Record the values in Table 6.1. [2]

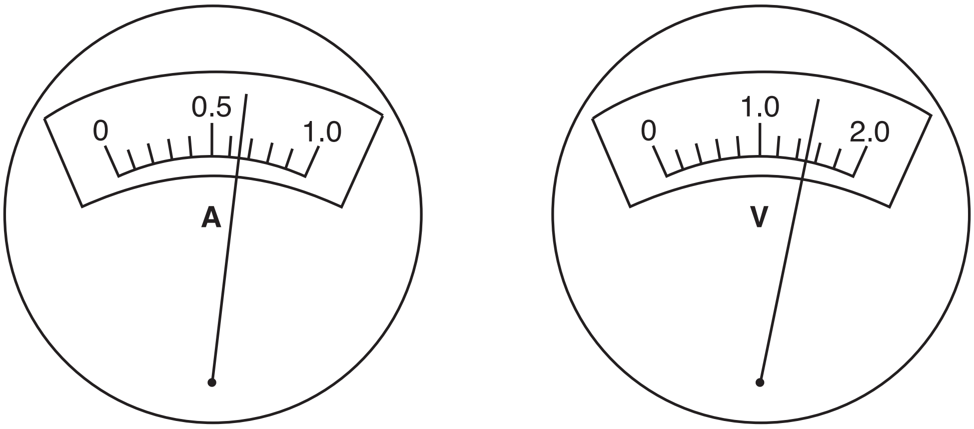


Fig. 6.2

(c) Calculate the resistances of wires **L** and **M** using the formula:

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

State the unit of resistance.

resistance of wire **L** = ...

resistance of wire **M** = ...

unit = ...

[3]

(d) Using the circuit in Fig. 6.1, design an experiment to find out how the resistance of a wire changes with its length.

In your answer you should include the lengths of the wire to be used and the variables to be controlled.

State the results you would record and how you would present your results to show the relationship.

....

....

....

....

....

....[4]

BLANK PAGE

BLANK PAGE