Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0573816351

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2018**

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.
For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.

You are expected to record all your observations as soon as these observations are made.
An account of the method of carrying out the experiments is **not** required.

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.

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This document consists of **12** printed pages and **4** blank pages.

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CAMBRIDGE International Examinations

Section A

Answer all the questions in this section.

1 *In this experiment, you will investigate the extension of a spring.*

You are provided with

- a spring,
- a length of string,
- a stand, boss and rod,
- a 30 cm ruler with a mm scale,
- a mass holder.

(a) On the spring provided measure the unstretched length l_A of the coiled part of the spring, as shown in Fig. 1.1.

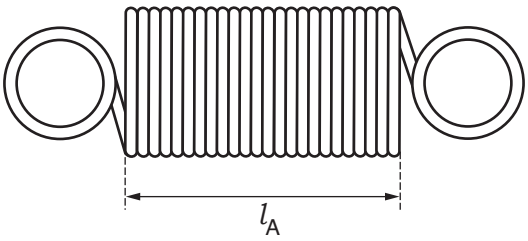


Fig. 1.1

l_A = ... [1]

(b) Hold the free end of the spring in one hand and place the string over the rod, as shown in Fig. 1.2.

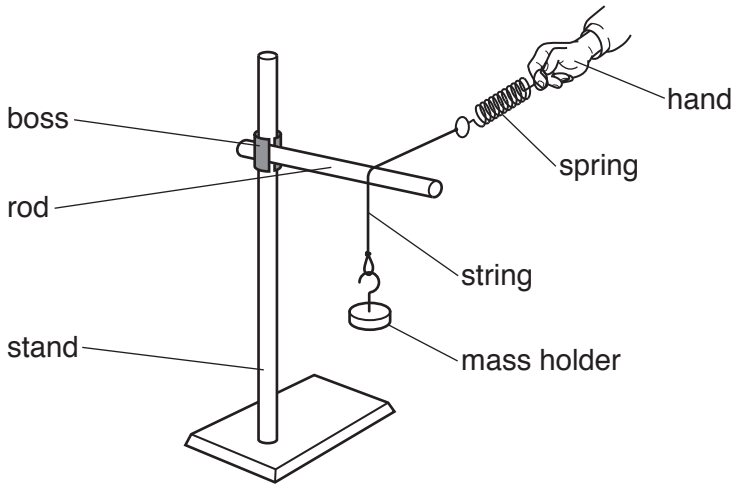


Fig. 1.2

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(i) Hold the free end of the spring so that the string is horizontal, as shown in Fig. 1.3.

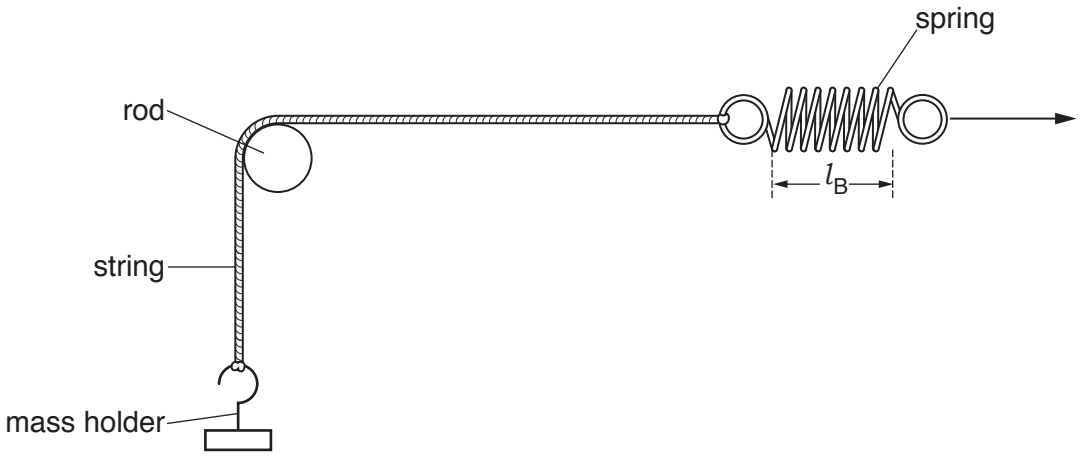


Fig. 1.3

The string is in contact with one quarter of the circumference of the rod.

Slowly pull the spring **horizontally to the right** until the mass holder starts to move upwards.

Measure the stretched length l_B of the spring at the instant that the mass holder starts to move.

l_B = ... [1]

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[Turn over

(ii) Continue the experiment.

1. Measure the stretched length, l_C, of the spring at the instant that the mass holder starts to move when the spring is pulled **vertically downwards**, as shown in Fig. 1.4a. The string is in contact with half of the circumference of the rod.

2. Measure the stretched length, l_D, of the spring at the instant that the mass holder starts to move when the spring is pulled **horizontally to the left**, as shown in Fig. 1.4b. The string is in contact with three quarters of the circumference of the rod.

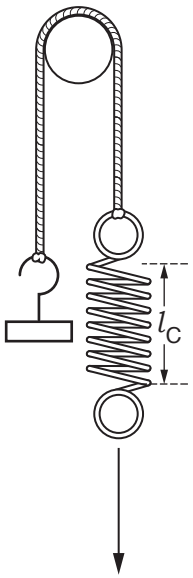


Fig. 1.4a

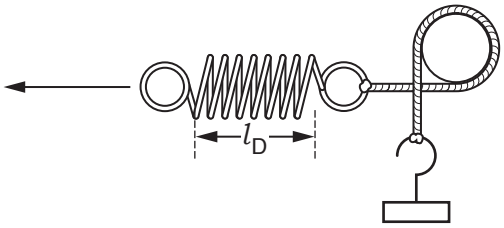


Fig. 1.4b

l_C = ...

l_D = ...
[1]

(c) Write a conclusion for this investigation and suggest why the lengths l_B, l_C, and l_D are different.

conclusion .....

.....

suggestion .....

.....

.....
[2]

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2 *In this experiment, you will investigate the cooling of a thermometer.*

You are provided with

- a thermometer placed in a container of very hot water,
- a stopwatch,
- a small tube of aluminium foil,
- access to a supply of hot water.

(a) Explain why care must be taken when removing the thermometer from the water.

.....

.....[1]

(b) Remove the thermometer from the hot water and hold it in the air.

Describe how the temperature decreases during the first minute.

.....

.....[1]

(c) Put the thermometer back in the container of hot water.

If the reading on the thermometer does not reach at least 70 °C ask the supervisor to replace the hot water in the container.

When the reading on the thermometer is 70 °C or more, remove the thermometer from the hot water and hold it in the air.

Start the stopwatch when the reading on the thermometer is 60 °C.

Stop the stopwatch when the reading is 40 °C.

Repeat and average to determine an accurate value T_A for the time taken for the reading on the thermometer to change from 60 °C to 40 °C. Show your working.

T_A = ... s [1]

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(d) Put the thermometer back in the container of hot water.

If the reading on the thermometer does not reach at least 70 °C ask the supervisor to replace the hot water in the container.

When the reading on the thermometer is 70 °C or more, remove the thermometer from the hot water.

Immediately place the bulb end of the thermometer in the small tube of aluminium foil, as shown in Fig. 2.1.

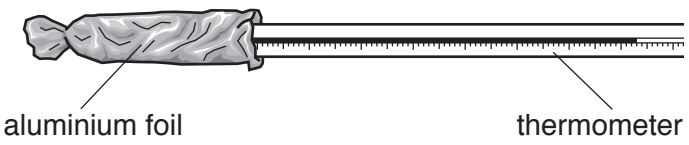


Fig. 2.1

Determine an accurate value T_F for the time taken for the reading on the thermometer to change from 60 °C to 40 °C.

T_F = ... s [1]

(e) It is suggested that trapped air reduces convection.

Explain whether your observations support this statement.

.....

.....[1]

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3 *In this experiment, you will investigate the electrical properties of a salt solution.*

You are provided with

- a power supply,
- a switch,
- a 47 Ω resistor,
- a voltmeter,
- a measuring cylinder,
- a beaker with two pieces of bare copper wire fixed on opposite sides,
- a container containing salt solution,
- connecting leads and crocodile clips.

The Supervisor has set up a circuit, as shown in Fig. 3.1. It shows a dry beaker with two pieces of thick copper wire on opposite sides. The copper wire is in series with a resistor of resistance R, where $R = 47\,\Omega$, and a power supply.

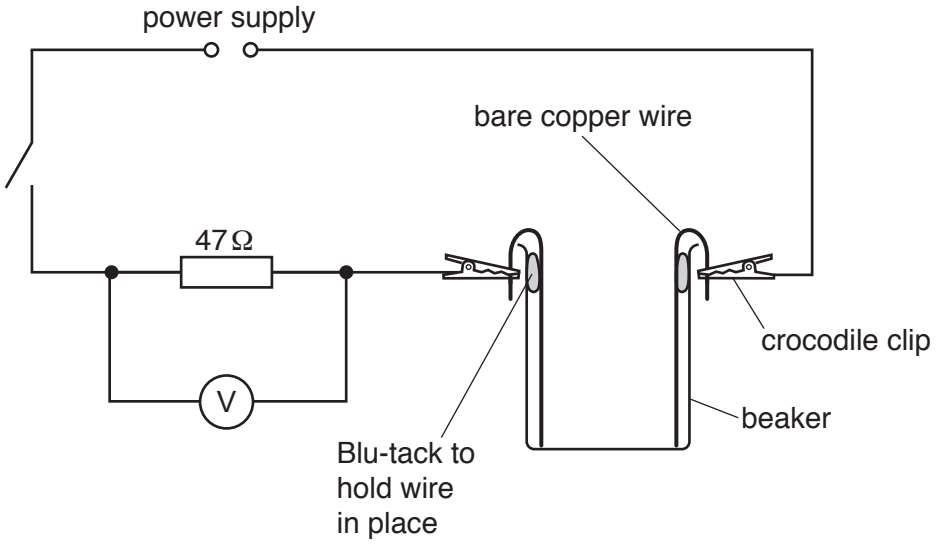


Fig. 3.1

(a) (i) Use the measuring cylinder to pour 50 cm^3 of salt solution into the dry beaker.

Switch on the circuit.

Wait a few moments until the reading on the voltmeter is steady.

Record the voltmeter reading V in the table of Fig. 3.2.

Switch off the circuit.

volume of salt solution / cm^3	potential difference V / V
50	
100	
150	
200	
250	

Fig. 3.2

(ii) Add a further 50 cm^3 of salt solution and measure the potential difference across the resistor.

Record your result in the table of Fig. 3.2.

Repeat until the total volume of salt solution is 250 cm^3.

Complete the table in Fig. 3.2.

[3]

(b) A student suggests that the greater the volume of salt solution in the beaker, the larger the current I in the circuit.

Use the equation $I = \frac{V}{R}$ in **two** calculations to explain whether your results support this suggestion.

.....

.....

.....

.....

.....[2]

Section B

4 *In this experiment, you will investigate the time taken for water to flow through a small hole in the bottom of a can.*

You are provided with

- a can with a small hole at the bottom,
- a supply of water,
- a 250 cm^3 beaker with a mark at the 150 cm^3 level,
- a funnel,
- a stand, boss and clamp,
- a measuring cylinder,
- a stopwatch.

The Supervisor has set up the apparatus, as shown in Fig. 4.1.

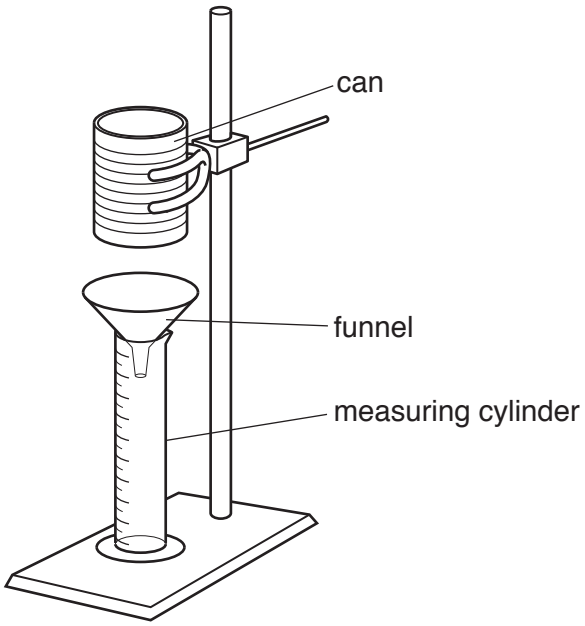


Fig. 4.1

(a) (i) Pour water into the beaker up to the 150 cm^3 mark on the side of the beaker.
Pour **all of this water** quickly into the can.
Observe the water flow into the measuring cylinder.
Empty the water from the measuring cylinder back into the beaker.

(ii) Repeat **(a)(i)** and as you pour the water into the can, start the stopwatch.

Measure the time t when the volume V of water in the measuring cylinder is 30 cm^3.

t = ... s [1]

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(iii) Calculate the flow rate F using the equation

$$F = \frac{V}{t},$$

where $V = 30\,\text{cm}^3$. Give the unit of your answer.

$F =$ ..... unit ..... [1]

(iv) Empty the water from the measuring cylinder back into the beaker.

Repeat **(a)(i)** and as you pour the water into the can, start the stopwatch.

Measure the time t when there is $60\,\text{cm}^3$ of water in the measuring cylinder.

$t =$ ..... s

(v) Calculate the flow rate F for $V = 60\,\text{cm}^3$. Give the unit of your answer.

$F =$ ..... unit .....[1]

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[Turn over

(b) Empty the water from the measuring cylinder back into the beaker.

Continue the investigation.

Pour 150 cm^3 of water from the beaker into the can and record the readings on the stopwatch when the volume of the water in the measuring cylinder reaches values in the range 30 cm^3 to 100 cm^3.

- Record all of your results in the table of Fig. 4.2.
- Repeat the experiment once and calculate the average times.
- Write headings in the top row of the results table of Fig. 4.2.

(Do **not** calculate the flow rates)

volume /	...../.....	...../.....	...../.....

Fig. 4.2

[5]

(c) On the grid opposite, plot a graph of time on the *y*-axis against volume on the *x*-axis.

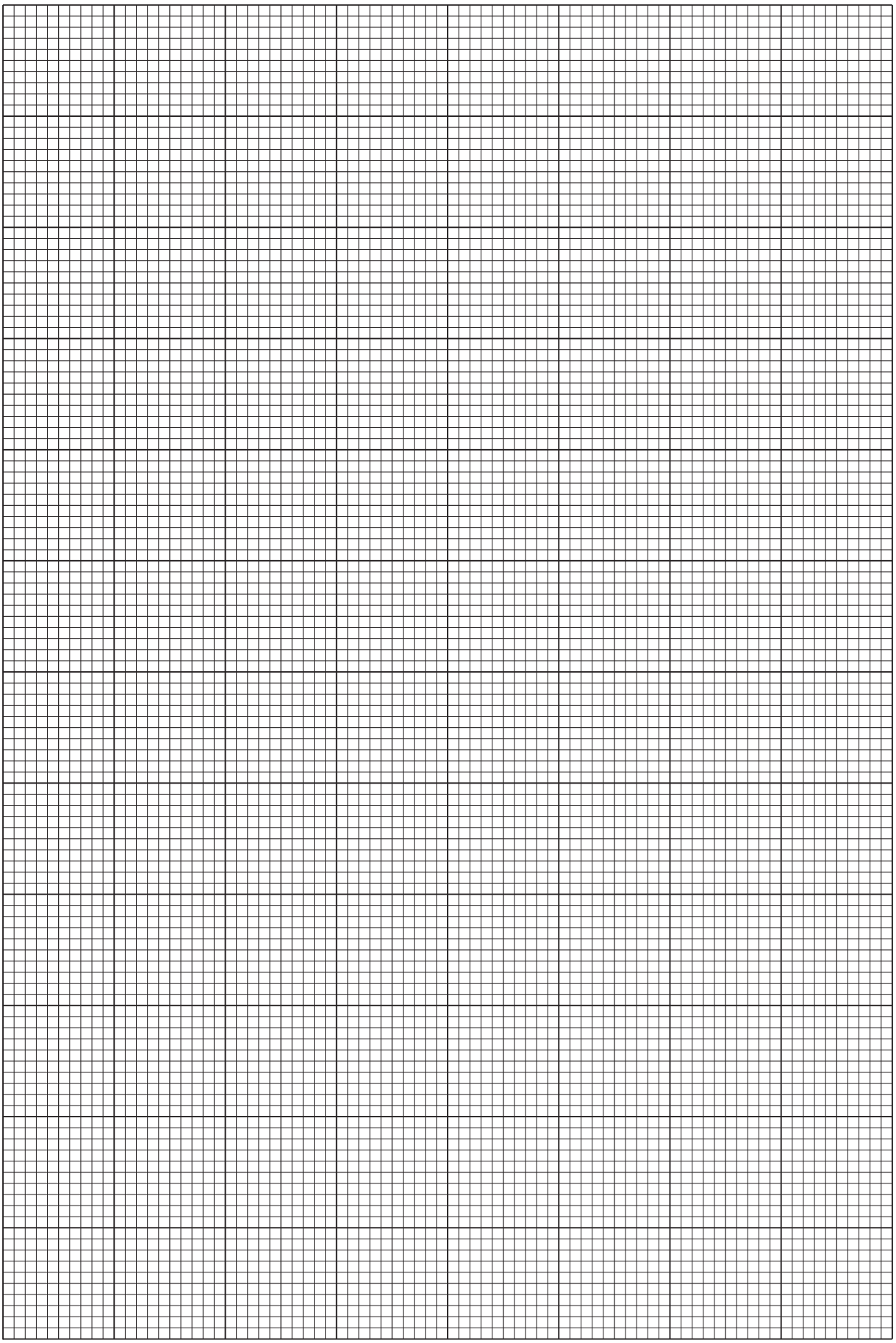
Draw the curve of best fit through your points. [4]

(d) Draw a tangent to the curve when the volume of water is 70 cm^3.

Determine the gradient *G* of the tangent at this point.

G = ...[3]

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