Cambridge Assessment International Education

# Cambridge O Level

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| CANDIDATE NAME | | | | | | | | | |
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*1390658292*

**PHYSICS** **5054/31**

Paper 3 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.
- 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 should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- You may use a calculator.
- You should show all your working and use appropriate units.

**INFORMATION**

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [ ].

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
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| Total | |

This document has **12** pages. Blank pages are indicated.


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## Section A

Answer **all** the questions in this section.

**1** *In this experiment you will investigate the images in mirrors.*

You are provided with:

- a pair of mirrors joined together
- a small piece of modelling clay
- a sheet of paper
- a protractor.

Place the piece of modelling clay between the mirrors.

Adjust the angle between the mirrors until you see the object plus four reflected images of the object.

The images must be equally spaced as shown in Fig. 1.1.

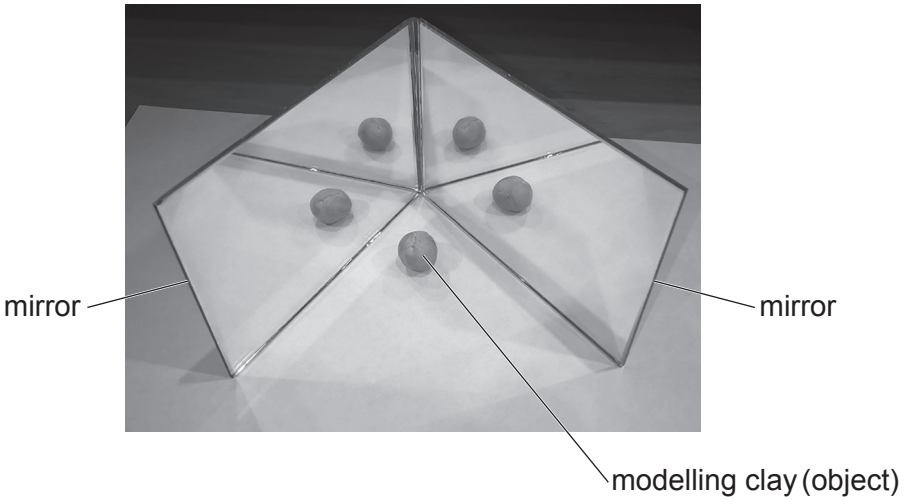



**Fig. 1.1**

**(a)** Measure the angle $\theta$ between the mirrors.

angle $\theta$ = ..... ° [1]

**(b)** Describe how to investigate the relationship between the number of reflected images and the angle $\theta$.

.....

.....

.....

.....

.....

..... [4]

[Total: 5]

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**2** *In this experiment you will investigate the height gained by a mass held in the jaws of a clamp.*

You are provided with:

- a mass and thread
- a stand, boss and clamp
- a 30 cm ruler or a half-metre rule.

The supervisor has set up the apparatus as shown in Fig. 2.1.

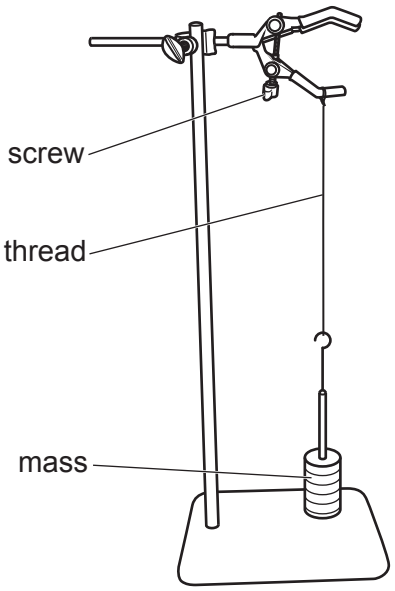



**Fig. 2.1**

The mass is resting on the base of the stand.

Rotate the screw so that the jaws of the clamp begin to close together. Stop rotating the screw when the mass is approximately 1.0 mm above the base of the stand.

**(a)** Describe a method for determining when the screw has rotated through exactly one complete revolution.

.....

.....

..... [1]

**(b) (i)** Determine the vertical height *h* gained by the mass when the screw rotates through two complete revolutions.

*h* = ..... mm [1]

**(ii)** Describe how you determined the vertical height gained by the mass.

.....

.....

..... [1]

**(c)** The horizontal distance *k* between the stand and the thread is shown in Fig. 2.2.

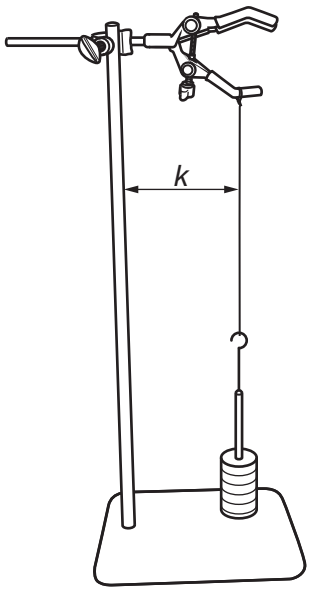



**Fig. 2.2**

Measure *k*.

*k* = ..... [1]

**(d)** Continue to rotate the screw and observe what happens to *h* and *k*.

Explain why the vertical height gained *h* is not constant every time the screw is rotated through two revolutions.

.....

..... [1]

[Total: 5]

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**3** *In this experiment you will investigate the balancing of a beam using three masses.*

You are provided with:

- a metre rule
- a rod to act as a pivot
- a stand and boss
- a 30 cm ruler.

The supervisor has set up the apparatus shown in Fig. 3.1. (The metre rule may not be horizontal.)

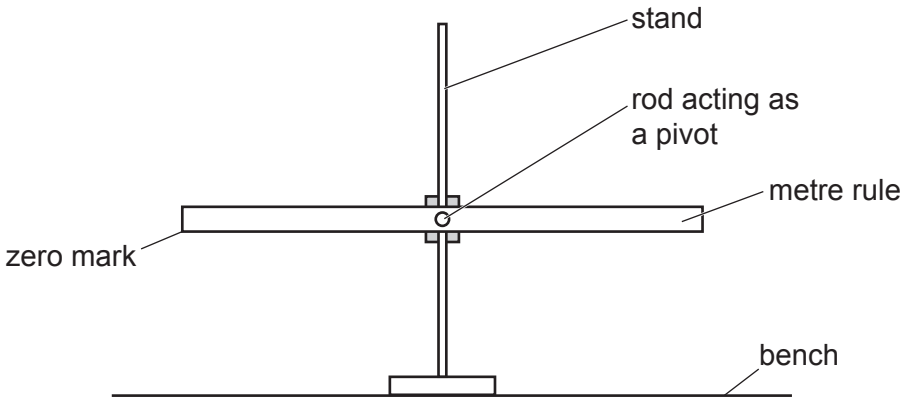



**Fig. 3.1**

You are also provided with one small, one medium and one large mass. The masses are attached to loops of thread so that they may be suspended from the metre rule, as shown in Fig. 3.2.

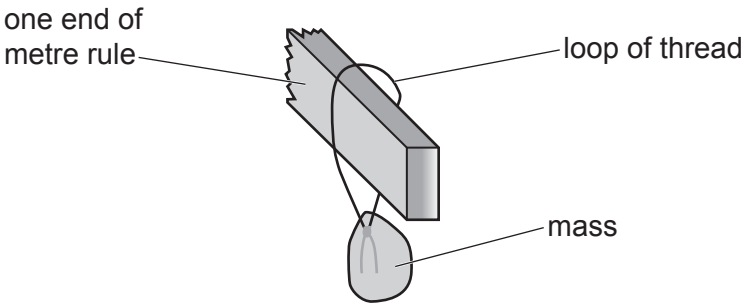



**Fig. 3.2**

**(a)** Suspend the large mass at the 25.0 cm mark on the metre rule to the left of the pivot.

Suspend the medium mass at the 75.0 cm mark on the metre rule to the right of the pivot.

Suspend the small mass on the end of the metre rule to the right of the pivot.

Adjust the position of the small mass so that the metre rule is balanced horizontally.

Record the reading on the metre rule at the position of the thread holding the small mass.

position of the thread holding the small mass = ..... cm [1]

**(b)** **(i)** Keep the small mass in the same position as recorded in **(a)**.

Move the large mass to the 20.0 cm mark on the metre rule to the left of the pivot.

Adjust the position of the medium mass so that the metre rule is balanced in the horizontal position.

Determine:

the distance $L$ moved by the large mass

$L$ = ..... cm

the distance $M$ moved by the medium mass.

$M$ = ..... cm
[1]

**(ii)** Calculate the weight $W_m$ of the medium mass using the equation

$$W_m = \frac{0.50L}{M}$$

$W_m$ = ..... N [1]

**(c)** Describe how you ensure that the metre rule is horizontal.

.....

..... [1]

**(d)** Remove all the masses from the metre rule.

Suspend the medium mass on the metre rule to the left of the pivot.

Suspend the small mass on the metre rule to the right of the pivot.

Adjust the position of both masses so that the metre rule is balanced horizontally.

Determine:

the distance $d_m$ from the pivot to the thread holding the medium mass

$d_m$ = .....

the distance $d_s$ from the pivot to the thread holding the small mass.

$d_s$ = .....

Calculate $\frac{d_m}{d_s}$

$\frac{d_m}{d_s}$ = .....
[1]

[Total: 5]

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**TURN OVER FOR QUESTION 4**

## Section B

**4** *In this experiment you will investigate the resistance of a solution. You must wear safety goggles for parts (a) and (b).*

You are provided with:

- a power supply
- a beaker of water with two wooden rods wrapped in wire
- a voltmeter
- an ammeter
- a switch
- connecting leads.

The supervisor has set up the apparatus shown in Fig. 4.1.

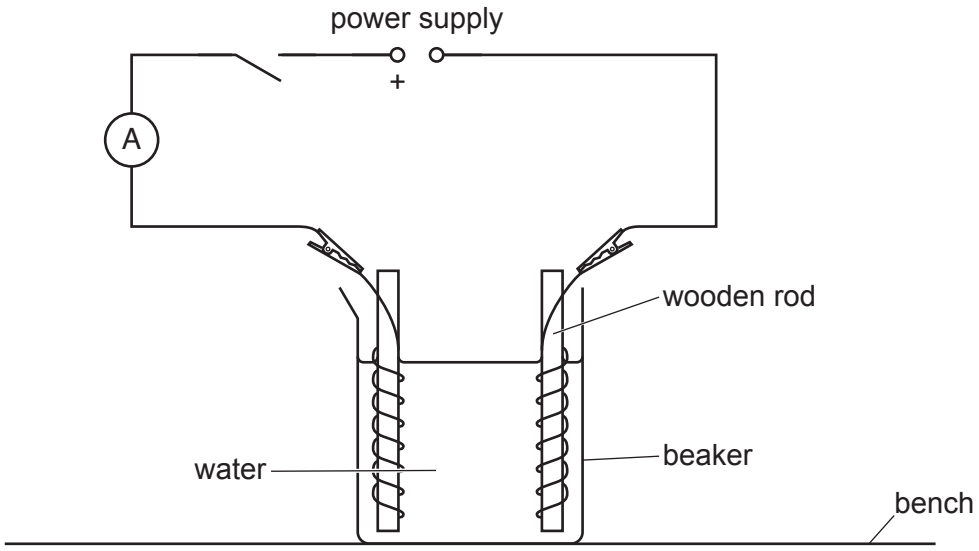



**Fig. 4.1**

You are also provided with:

- a small beaker containing salt solution
- a syringe
- a stop-watch
- a stirring rod.

**(a) (i)** Connect the voltmeter across the terminals of the power supply.

Record the voltage reading $V$ on the voltmeter.

$V$ = ..... V [1]

Remove the voltmeter from the circuit.

**(ii)** Use the syringe to add 1.0 $cm^3$ (1.0 m$l$) of the salt solution to the water in the beaker and stir gently.

**Close the switch.**

After one minute, record the current reading $I$ on the ammeter. Give the unit.

**Open the switch immediately.**

$I$ = ..... [1]

**(iii)** The resistance $R$ of the solution is given by the equation:

$$R = \frac{V}{I}$$

Calculate $R$.

Give your answer in kΩ.

$R$ = ..... kΩ [1]

**(iv)** In Table 4.1 on page 10, record the volume $X$ of salt solution added and your readings and calculation from **(a)(i)**, **(ii)** and **(iii)**.

Add appropriate headings with units to the table. [1]

**(v)** Describe how to use the syringe to add exactly 1.0 $cm^3$ of the salt solution to the water in the beaker.

.....

.....

..... [2]

**(vi)** Suggest why the reading on the ammeter is recorded one minute after the salt solution is added to the water in the beaker.

.....

..... [1]

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**(b)** Continue the investigation. Repeat **a(ii)** and **a(iii)** until you have added a total of 8.0 $cm^3$ (8.0 m$l$) of the salt solution to the beaker.

Assume that the voltage $V$ across the terminals of the power supply recorded in **(a)(i)** remains unchanged throughout the investigation.

Record your readings and calculations in Table 4.1.

**Table 4.1**

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|---|---|---|---|
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[2]

**(c)** On the grid on page 11, plot a graph of the current $I$ on the $y$-axis against the volume $X$ of salt solution added on the $x$-axis.

Draw the straight line of best fit. [4]

**(d)** Determine the gradient of the line of best fit.

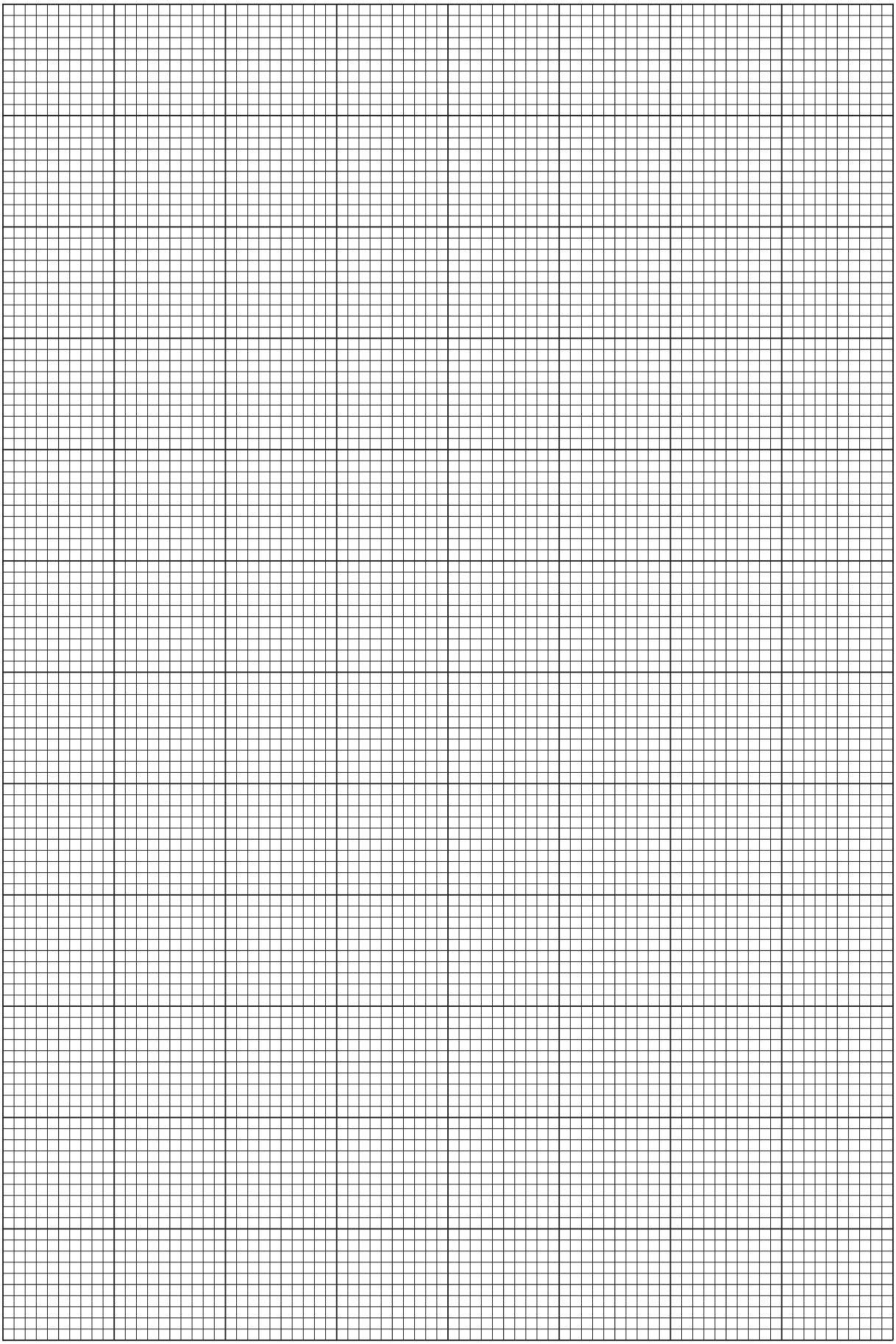
Show your working.

Give your answer to an appropriate number of significant figures.

gradient = ..... [2]

[Total: 15]

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