**Cambridge International Examinations**
Cambridge Ordinary Level

| | |
|---|---|
| CANDIDATE NAME | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | | |

*1068241930*

**PHYSICS** **5054/32**

Paper 3 Practical Test **October/November 2017**

**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.

| For Examiner's Use | |
|---|---|
| **1** | |
| **2** | |
| **3** | |
| **4** | |
| **Total** | |

This document consists of **11** printed pages and **1** blank page.



CAMBRIDGE International Examinations

## Section A

**1** *In this experiment, you will investigate the oscillations of a mass connected to springs.*

You are provided with

- an arrangement of two springs that are connected in parallel,
- a mass labelled M,
- a stand, boss and clamp from which to suspend the springs,
- a stopwatch,
- a second clamp and boss.

The Supervisor has set up the apparatus as shown in Fig. 1.1.

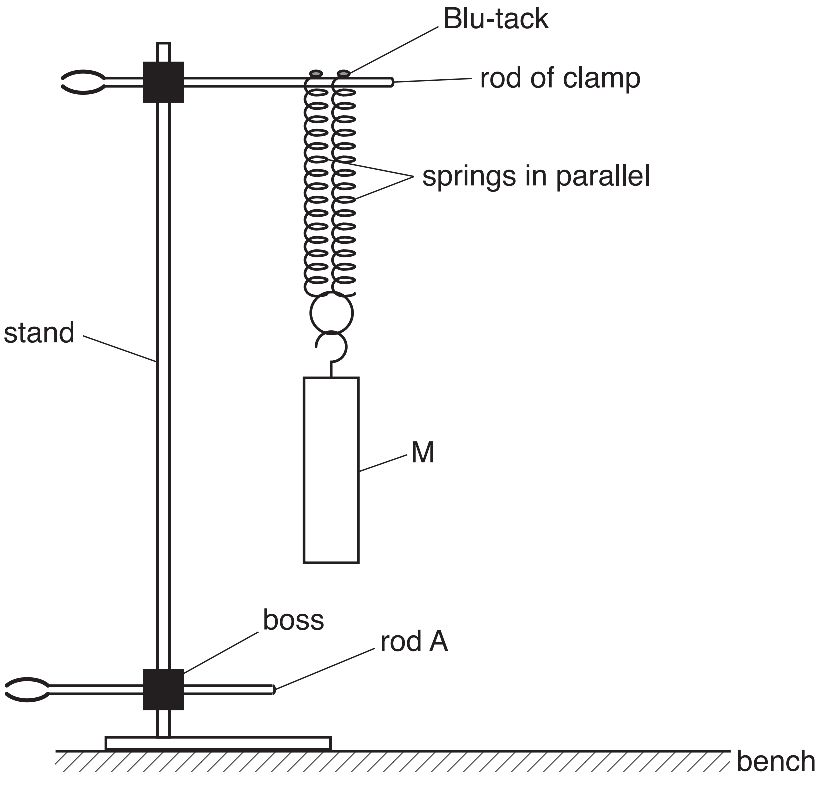


**Fig. 1.1**

The two springs in parallel are suspended close to each other from the rod of the clamp.

**(a)** Adjust the height of rod A so that it is level with the bottom of the mass M. Pull the mass M down a short distance vertically and release it. One oscillation of the mass occurs when the mass moves from its lowest position to its highest position and then back down to its lowest position. Rod A is to help you when counting.

**(i)** The time for 10 oscillations is $t_1$.

Take measurements to determine an accurate value of $t_1$.

$t_1$ = ..............................................................

**(ii)** Calculate the time $T_1$ for one oscillation. Give your answer to an appropriate number of significant figures.

$T_1$ = ........................................................[2]

**(b)** Unhook one of the springs from the mass so that mass M is only suspended from one spring.

Repeat **(a)(i)** and **(a)(ii)** so that new values are obtained for the time $t_2$ for 10 oscillations and the time $T_2$ for one complete oscillation.

$t_2$ = ...........................................................

$T_2$ = ........................................................[1]

**(c)** Calculate $R$, where $R = \frac{T_2}{T_1}$.

$R$ = ........................................................[1]

**(d)** Theory suggests that the value of $R$ is 1.41.

**(i)** Calculate the percentage difference between your value of $R$ and the theoretical value using

$$\left(\frac{R - 1.41}{1.41}\right) \times 100\%.$$

percentage difference = ........................................................ %

**(ii)** Explain whether your experimental results agree with the theory.

..........................................................................................................................

..........................................................................................................................

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

**2** *In this experiment, you will investigate a circuit containing an unknown component.*

You are provided with

- a power supply,
- a switch,
- the unknown component labelled X,
- a resistor labelled R,
- a voltmeter,
- connecting leads,
- a beaker filled with water at room temperature,
- a beaker filled with an ice and water mixture,
- a stirrer,
- paper towels or cloths to mop up spillages.

The Supervisor has set up the apparatus as shown in Fig. 2.1. The component X is placed on the bench.

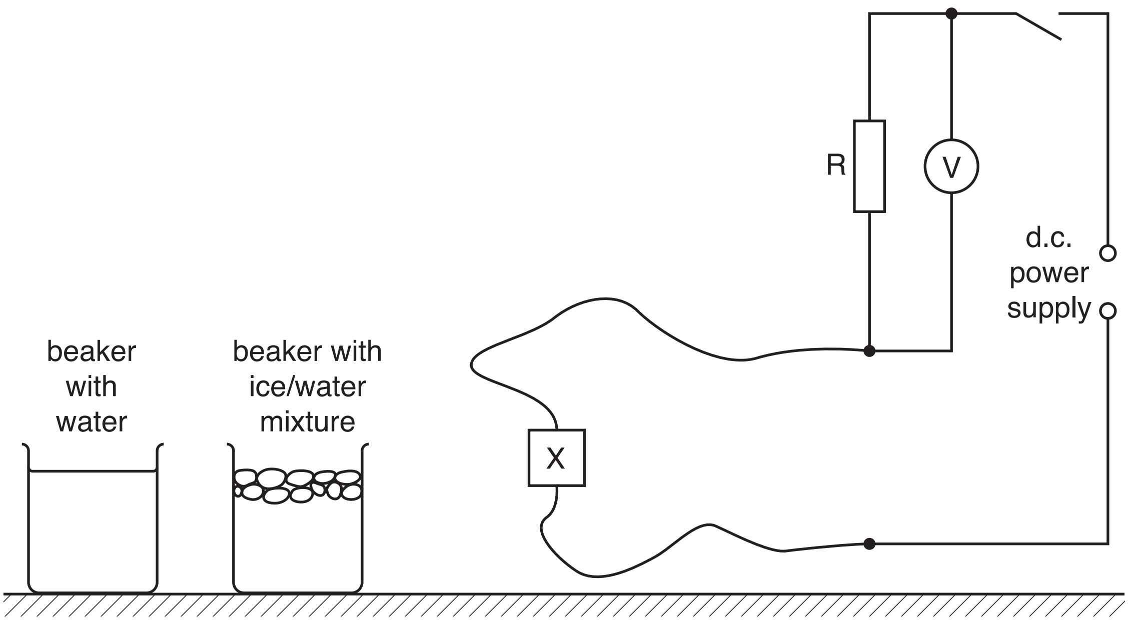


**Fig. 2.1**

**(a) (i)** Immerse X in the water at room temperature. Wait for about 1 minute for X to reach the temperature of the water.

Close the switch in the electrical circuit and record the voltmeter reading $V_1$. Open the switch.

$V_1$ = ..........................................................[1]

**(ii)** Take X out of the water and immerse it in the ice and water mixture. Wait for about 1 minute for X to reach the temperature of the mixture.

Close the switch and record the new voltmeter reading $V_2$. Open the switch.

$V_2$ = ..........................................................[1]

**(b)** Calculate the resistance of X in kΩ for each of your values of $V_1$ and $V_2$, measured in volts, using

$$\text{resistance} = 2.2\left(\frac{5}{V} - 1\right)\text{k}\Omega.$$

resistance of X in the water at room temperature = .......................................................... kΩ

resistance of X in the ice and water mixture = .......................................................... kΩ [2]

**(c)** Use your results to suggest the relationship between the resistance of X and its temperature.

..........................................................................................................................................

..........................................................................................................................................

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

3 *In this experiment, you will investigate the distance travelled by a glass sphere that has rolled down a ramp.*

You are provided with

- a tray containing sand,
- a ramp,
- two metre rules,
- a glass sphere,
- a piece of card.

**(a)** The Supervisor has set up the apparatus as shown in Fig. 3.1. The edge of the sand in the tray is directly below the end of the ramp.

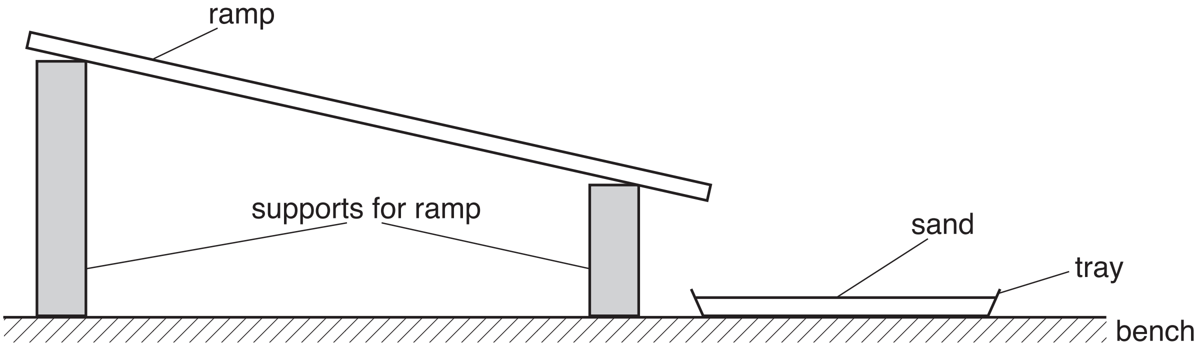


**Fig. 3.1**

**(b)** Use the two metre rules to form a channel down the centre of the ramp so that the glass sphere can roll down the ramp in a straight line. Release the glass sphere from a point that is a distance $y$ = 10.0 cm up the ramp, from its lower end. Observe that the sphere lands in the sand. Carefully remove the sphere from the tray without disturbing the sand. The sphere makes an indentation in the sand and may move a short distance in the sand from its landing position.

**(i)** Measure the horizontal distance $x$ from the end of the tray to the centre of the indentation made as the sphere landed.

$x$ = ...............................................................

**(ii)** Explain how you removed the sphere from the tray without disturbing the sand.

...................................................................................................................................

...................................................................................................................................

...................................................................................................................................

 

**(iii)** Smooth the surface of the sand with the card.

Take measurements to determine an average value for $x$.

$x =$ ..............................................................
[3]

**(c)** A student suggests that $x$ is directly proportional to $y$.

**(i)** The experiment is to be repeated with $y$ increased by a factor of 5 to 50.0 cm.

Using your value of $x$ from **(b)(iii)**, predict the new value of $x$, assuming that $x$ is directly proportional to $y$.

predicted new $x =$ ..............................................................

**(ii)** Repeat **(b)(iii)** to obtain the new value of $x$ for $y = 50.0$ cm.

new $x =$ ..............................................................

**(iii)** Using your values from **(c)(i)** and **(c)(ii)** comment on the student's suggestion.

..............................................................................................................................

..............................................................................................................................

..............................................................................................................................
[2]

## Section B

**4** *In this experiment, you will investigate the equilibrium of a metre rule that is set up as a simple model of the human arm.*

You are provided with

- two springs connected in parallel,
- a stand, boss and clamp to support the springs,
- an S-hook,
- a metre rule with holes at the 30.0 cm mark and the 90.0 cm mark, through which there are loops of thread,
- a second boss and clamp to loosely pivot the metre rule at the 10.0 cm mark,
- a 10 g slotted mass hanger with nine 10 g slotted masses,
- a 30 cm ruler,
- a set square.

**(a)** The Supervisor has set up the apparatus as shown in Fig. 4.1.

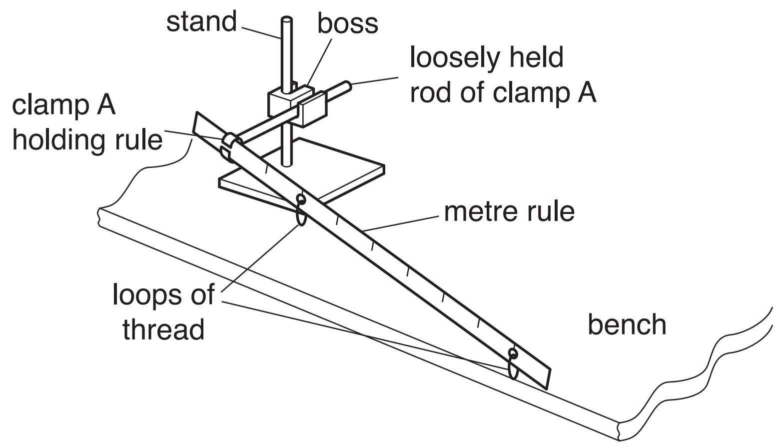


**Fig. 4.1**

The metre rule is already clamped firmly at the 10.0 cm mark by clamp A. This clamp is able to rotate in the boss because the rod of the clamp is loosely held in the boss.
Use the S-hook and loop at the 30.0 cm mark to attach the spring arrangement to the rule. Adjust the height of the clamp B to make the rule horizontal, as shown in Fig. 4.2. Make sure that the spring arrangement is vertical and that the rule is still able to rotate freely about the boss.

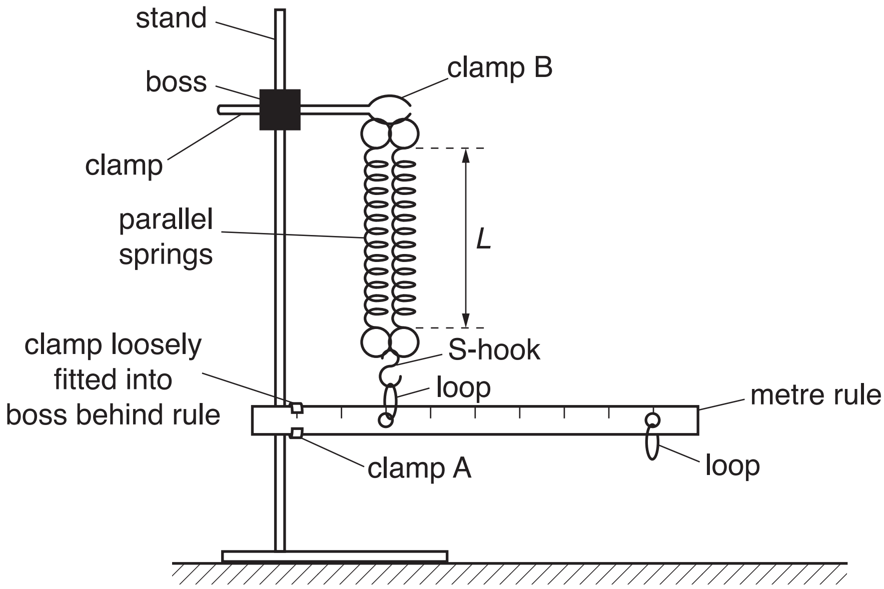


**Fig. 4.2** (front view)

**(i)** Explain how you made sure that the metre rule was horizontal. You may add to Fig. 4.2 if you wish.

..........................................................................................................................................

..........................................................................................................................................

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

**(ii)** Explain how you checked that the rule was able to rotate freely.

..........................................................................................................................................

..........................................................................................................................................

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

**(iii)** Measure the length $L$ of the spring shown in Fig. 4.2.

$L$ = ..........................................................[1]

**(b)** Suspend the 10 g slotted mass hanger and a 10 g slotted mass from the loop of thread in the hole at the 90.0 cm mark on the rule. Adjust the height of clamp B, to make the rule horizontal again. Measure a new value for the length $L$ of the spring arrangement and record the total mass $M$ of the mass hanger and slotted mass.

$L$ = ..............................................................

$M$ = ..............................................................

[1]

**(c)** Repeat **(b)** by adding slotted masses to the mass hanger to obtain a series of values of *L* and *M*.

Record your results in the table of Fig. 4.3. Include the headings of the table and your results from **(a)(iii)** and **(b)**.

| | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

**Fig. 4.3**

[5]

**(d)** Using the grid opposite, plot a graph of *L* / cm (*y*-axis) against *M* / g (*x*-axis).

Draw the straight line of best fit. [4]

**(e)** Determine the gradient *G* of your graph.

Give your answer to an appropriate number of significant figures.

*G* = ...........................................................[2]

**BLANK PAGE**