Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4336199027

PHYSICS **5054/32**

Paper 3 Practical Test **May/June 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	
4	
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 heating of water.*

You are provided with:

- a power supply
- a switch
- an ammeter
- a voltmeter
- an arrangement of resistors to act as a heater.

The supervisor has set up the circuit shown in Fig. 1.1.

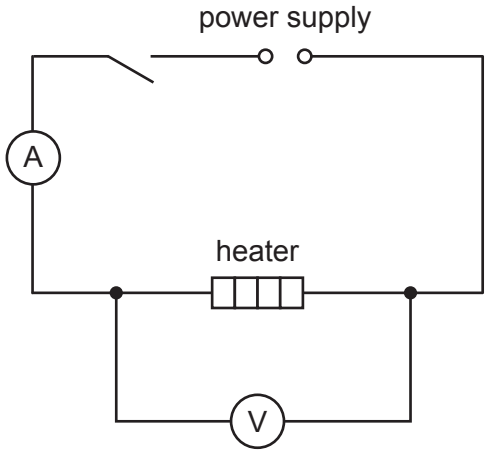


Fig. 1.1

(a) Close the switch.

Record the current I and the voltage V.

I = ... A

V = ... V
[1]

Open the switch.

(b) You are also provided with:

- a beaker of water held in a clamp, boss and stand
- a thermometer
- a stop-watch
- another boss and clamp.

Draw a diagram in the space provided on page 3 to show how this apparatus is arranged to measure the temperature of the water. [1]

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(c) Measure and record the temperature θ_1 of the water.

θ_1 = ... °C

Remove the thermometer from the water.

Place the heater in the water.

Close the switch and start the stop-watch.

Open the switch at time t = 200 seconds.

Remove the heater from the water.

Replace the thermometer in the water. Gently swirl the water until the reading on the thermometer stops increasing.

Measure and record the temperature θ_2 of the water.

θ_2 = ... °C

Calculate the temperature change $\theta_2 - \theta_1$.

$\theta_2 - \theta_1$ = ... °C [1]

(d) (i) Calculate the electrical energy E_e supplied to the heater, given that $E_e = V I t$.

E_e = ... J [1]

(ii) Calculate the thermal energy E_T gained by the water. Use the equation:

$$E_T = m c (\theta_2 - \theta_1)$$

where m = 50 g and c = 4.2 J / (g °C).

E_T = ... J [1]

[Total: 5]

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2 *In this experiment you will investigate the size of images produced by lenses.*

You are provided with:

- a single lens mounted on a slotted mass
- a double lens arrangement
- an object A, marked with horizontal lines
- a half-metre rule
- small pieces of Blu Tack
- a 30 cm ruler.

(a) Measure the distance d_o between two adjacent lines on object A.

d_o = ... mm [1]

Attach object A to the half-metre rule at the 10.0 cm mark, using a small piece of Blu Tack.

Place the single lens on the slotted mass on the rule somewhere between the 10 cm mark and the 50 cm mark, as shown in Fig. 2.1.

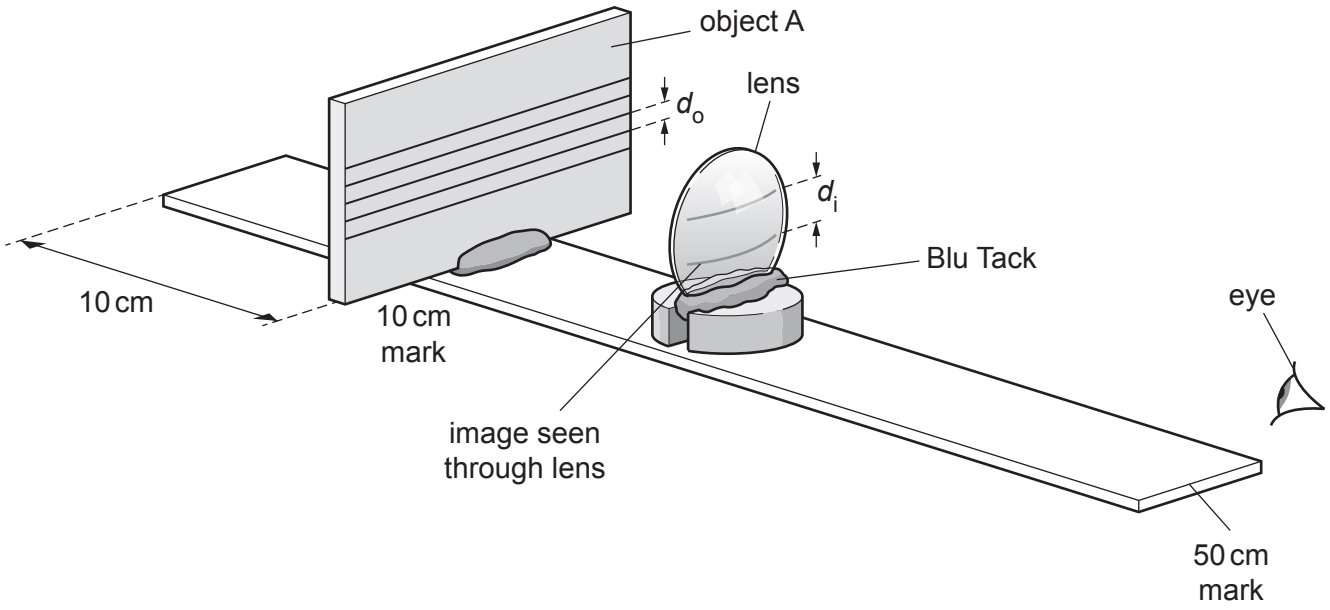


Fig. 2.1

(b) Position your eye over the 50 cm mark on the rule, and observe the image of two adjacent lines **through** the lens.

Observe how the distance d_i between the images of the adjacent lines changes when you move the lens along the rule between the 10 cm mark and the 50 cm mark.

Move the lens to a position between the 10 cm mark and the 50 cm mark so that

$$d_i = 2 \times d_o.$$

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(i) Describe the method you used to ensure that $d_i = 2 \times d_o$.

You may draw a diagram if you wish.

.....

.....

..... [1]

(ii) With the lens in this position, measure and record the distance *P* between object A and the centre of the lens.

distance *P* for single lens = ... cm [1]

(iii) Remove the single lens from the rule and replace it with the double lens arrangement.

Repeat the procedure at the beginning of **(b)**.

Measure and record the distance *Q* between object A and the centre of the double lens.

distance *Q* for double lens = ... cm [1]

(c) A student suggests that because the number of lenses is double, $\frac{P}{Q} = 2$.

Using your results from **b(ii)** and **(iii)**, state whether you agree with the student.

Explain your reasoning.

.....

.....

..... [1]

[Total: 5]

3 *In this experiment you will investigate the average diameter of a ball.*

You are provided with:

- a ball
- a metre rule
- two set squares.

(a) (i) Examine the ball.

Explain why it is difficult to determine the diameter of this ball.

.....

..... [1]

(ii) Describe a method to determine an accurate diameter of the ball using the apparatus provided.

You may draw a diagram if you wish.

.....

.....

.....

..... [3]

(b) Determine the average diameter of the ball.

Record all your measurements and show your working and the unit of your answer.

average diameter = ... [1]

[Total: 5]

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Section B

4 *In this experiment you will investigate the equilibrium of a load attached to a spring.*

You have been provided with

- a 100 g mass hanger and three 100 g masses
- a metre rule attached to a hook with thread looped through the rule
- a half-metre rule and a 30 cm ruler
- a stand and boss
- 2 identical springs
- a clamp or a rod used as a pivot.

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

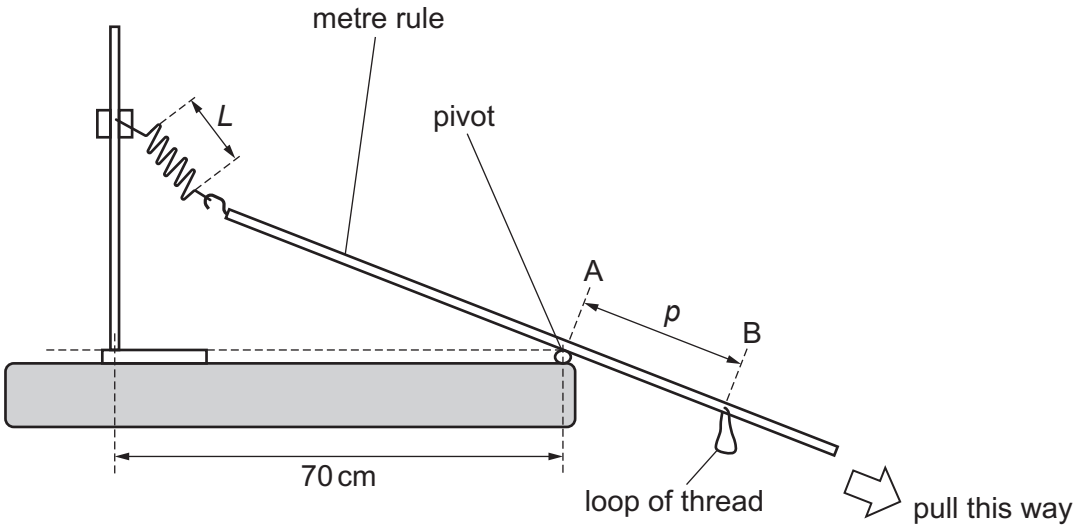


Fig. 4.1

The top end of the metre rule is attached to a spring. The other spring is on the bench. The metre rule rests on a pivot at point A. A loop of thread is attached at point B.

Ensure that the rod of the stand and the pivot are 70 cm apart.

Gently pull the metre rule one or two centimetres down to the right in the direction indicated by the arrow shown on Fig. 4.1. The spring exerts an opposing force.

Release the metre rule and observe it slide back along the pivot and come to rest.

(a) Two distances *L* and *p* are shown on Fig. 4.1.

(i) Measure and record, with units:

- the length *L* of the stretched spring

L = ...

- the distance *p* between point A, where the metre rule comes to rest in contact with the pivot, and point B where the loop of thread is attached.

p = ...
[2]

(ii) A second spring, identical to the one attached to the stand and metre rule, is on the bench.

Measure the length l of the coil of the unstretched spring, as shown in Fig. 4.2.

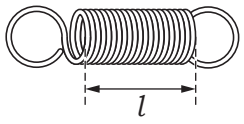


Fig. 4.2

l = ... cm [1]

(iii) Calculate the extension x of the spring using the equation:

$$x = (L - l)$$

x = ... cm

Calculate the force F in the stretched spring using the equation:

$$F = kx$$

where k = 0.25 N / cm and x is measured in cm.

F = ... N [1]

(iv) Write appropriate headings with units in the spaces provided in Table 4.1.

Record your results from **(a)** in the first row of the table, for mass = 0 g. [1]

(b) Hang the 100 g mass hanger from the loop of thread suspended from point B.

Gently pull the metre rule down to the right in the direction indicated on Fig. 4.1. The spring exerts an opposing force. Release the metre rule and observe it slide back along the pivot and come to rest.

Repeat **(a)(i)** and **(a)(iii)** to obtain new values for L, p, x and F.

Complete the table by finding results for masses of 200 g, 300 g and 400 g.

Table 4.1

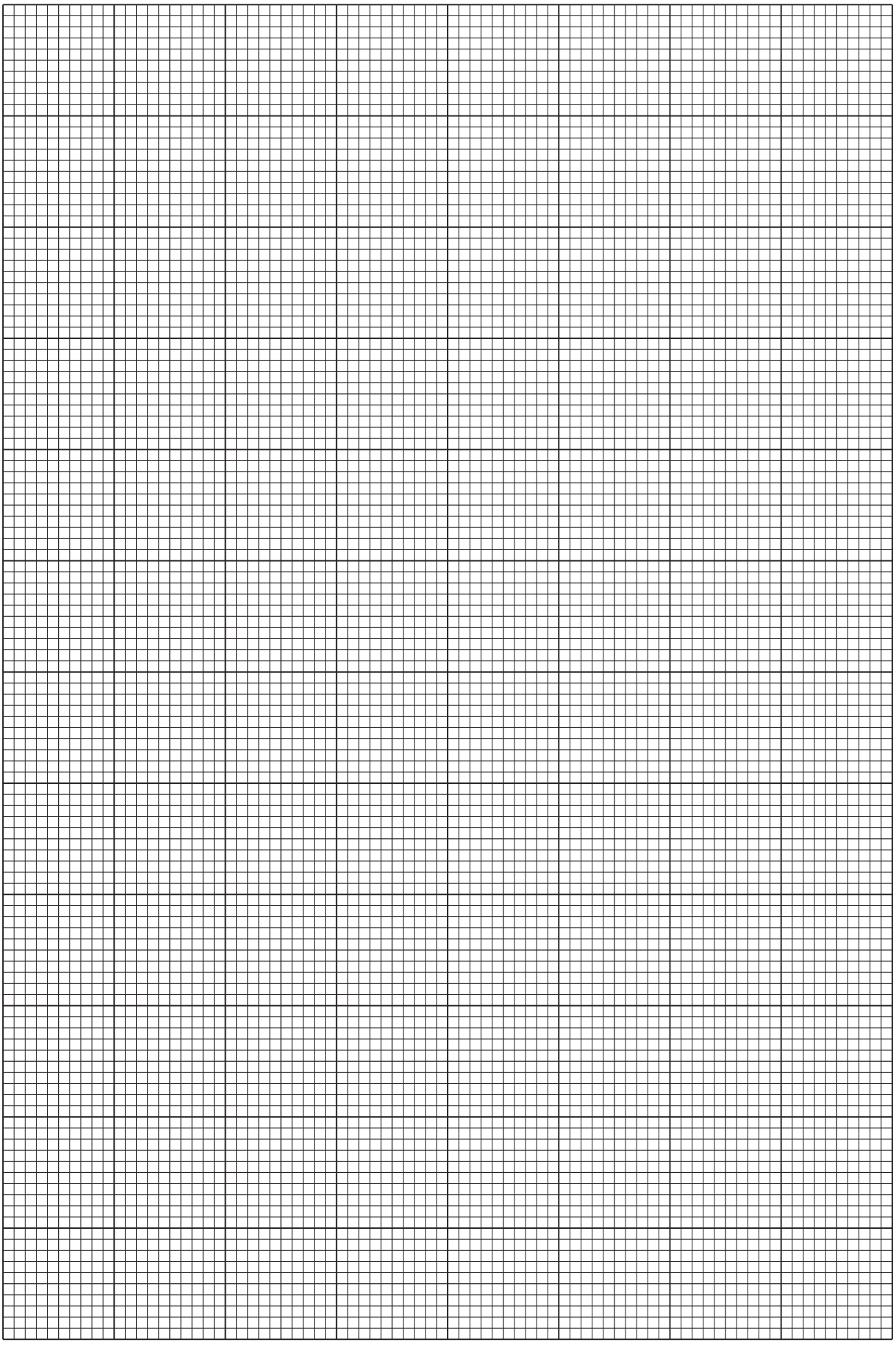
mass / g	..... /	..... /	..... /	..... / .....
0				
100				
200				
300				
400				

[3]

(c) **(i)** On the grid on page 11, plot a graph of F on the y-axis against p on the x-axis.

Draw the straight line of best fit.

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[4]

(ii) Determine the gradient of this straight line. Include a unit in your answer.

gradient = ... [2]

(d) Suggest why this investigation does not use masses greater than 400 g.

.....

.....

..... [1]

[Total: 15]

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