	Class	Register Number
Name		

6091/03 **22/4P/6091/03**

PHYSICS
PAPER 3

Friday **12 August 2022** **1 hour 50 minutes**

VICTORIA SCHOOL

PRELIMINARY EXAMINATION

SECONDARY FOUR

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.
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.

Answer **all** questions.
All your answers should be written in this Question Paper: scrap paper must **not** be used.
Graph paper is provided in this Question Paper. Additional sheets of graph paper should be used only if it is necessary to do so.

You will be allowed to work with the apparatus for a maximum of 55 minutes for each section.
You are expected to record all your observations as soon as they are made.
An account of the method of carrying out the experiment is **not** required.

The use of an approved scientific calculator is expected, where appropriate.
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.

Unless otherwise stated, take gravitational field strength on earth as 10 N kg^{-1}.

For Marker's Use	
1	/12
2	/8
3	/20
Total	/40

This Question Paper consists of 12 printed pages (including this cover page).
[Turn over]

1 In this experiment, you will investigate the power developed by a falling mass.

You are provided with:

- a pulley attached to a retort stand
- two 50 g mass hangers
- two 10 g slotted mass
- a length of string
- a metre rule
- a stop-watch
- a set-square
- a G-clamp to keep the stand in position

Set up the apparatus as shown in Fig. 1.1.

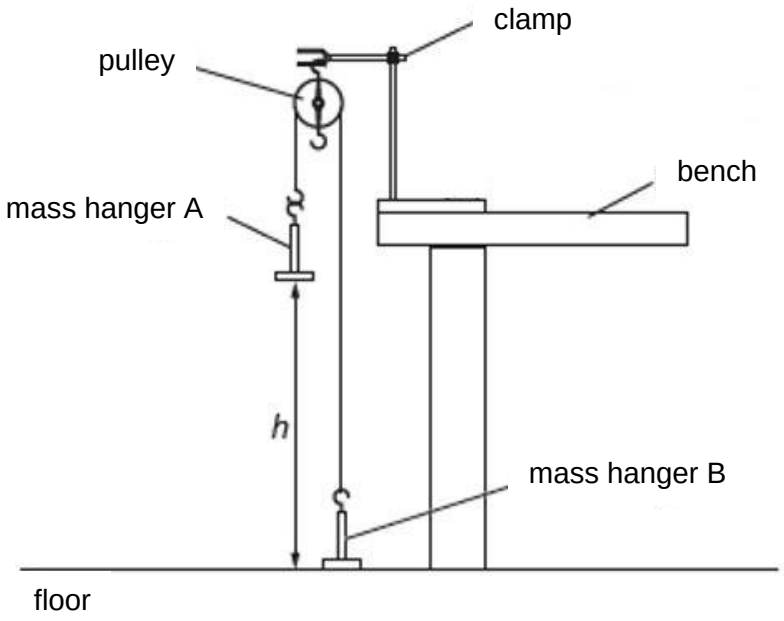

Fig. 1.1

Adjust the position of the clamp so that the height h = 1.000 m and mass hanger B is at rest on the floor.

(a) Describe how you ensured an accurate measurement of height h.

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…… [2]

(b) You are also provided with two 10 g slotted mass.

Carefully place a slotted mass on mass hanger A and hold this mass hanger in position.

Release the mass hanger and start the stopwatch. (You may have to give the mass hanger a gentle push downwards to start the movement.)

Measure and record the average value for the time t for the mass hanger to fall to the floor.

t = ... [1]

(c) Record the total mass M_A of the mass hanger A.

M_A = ... [1]

(d) Calculate the power P_0 produced as mass hanger A falls, using the equation:

$$P_0 = \frac{M_A g h}{t}$$ where g is the gravitational field strength

P_0 = ... J / s [1]

(e) Add the second 10 g slotted mass to mass hanger A and repeat **(b)** to **(c)**. Calculate the power P_1 produced as mass hanger A falls through the same distance h.

P_1 = ... J / s [1]

(f) It is suggested that the relationship between the difference in mass of mass hanger A M_A and mass hanger B M_B, and the average time t for the mass hanger to fall to the floor is

$$(M_A - M_B) = \frac{k}{t^2}$$

where k is a constant.

Using the same apparatus as in Fig. 1.1, plan an experiment to investigate this relationship.

Your plan should include

- the quantities that you should keep constant,
- a detailed description of how you will perform the experiment,
- a suitable table in which to display your measurements and calculated values (you do not need to enter any data into the table),
- a statement of the graph that you would plot to test the relationship,
- a sketch of the graph that you would obtain if the relationship is correct,
- an explanation of how you would obtain the value of constant k from your graph.

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2 In this experiment, you will determine the focal length of a converging lens.

You have been provided with

- a convex lens in holder
- a white screen
- an illuminated object and torchlight
- a retort stand with boss and clamp
- a metre rule

(a) Determine an accurate estimate of the focal length *f* of the converging lens by focusing on a distant object.

f = ... cm [1]

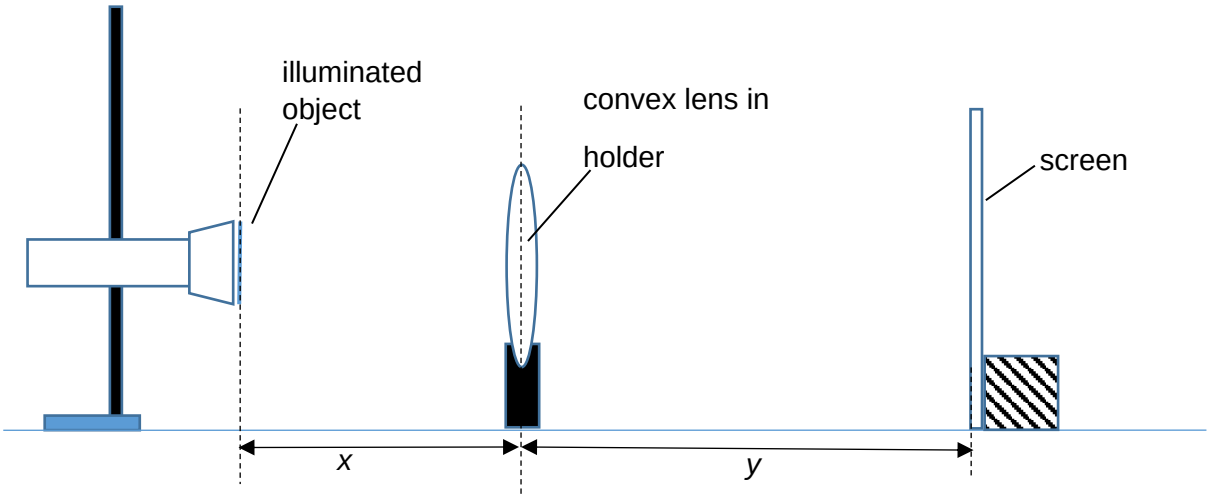

Fig. 2.1

(b) Set up the apparatus as shown in Fig. 2.1. Place the lens at a distance *x* from the illuminated object where *x* = 1.5*f*. Moves the screen until a sharp image of the object is formed on it.

Measure the length *x* and *y*.

x = ... cm

y = ... cm [2]

(c) Calculate the focal length *f* of the lens, using the equation

$$f = \frac{xy}{x+y}$$

f = ...cm [2]

(d) State one precaution that can be taken to obtain an accurate value for the focal length *f* of the lens.

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..... [1]

(e) If $x = 2f$, describe the changes in the image size and image distance.

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..... [2]

3 In this experiment, you will investigate a circuit containing a length of resistance wire and a fixed resistor of unknown resistance *R*.

You are provided with

- a battery holder with one cell,
- a length of resistance wire attached to a metre rule,
- a fixed resistor of unknown resistance *R*,
- an ammeter,
- a voltmeter,
- a switch,
- a jockey,
- connecting leads.

(a) Connect the voltmeter across the battery and determine the reading. Record the value as V_0.

V_0 =.....[1]

(b) State a precaution when using the voltmeter.

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..... [1]

(c) Set up the circuit as shown in Fig. 3.1.

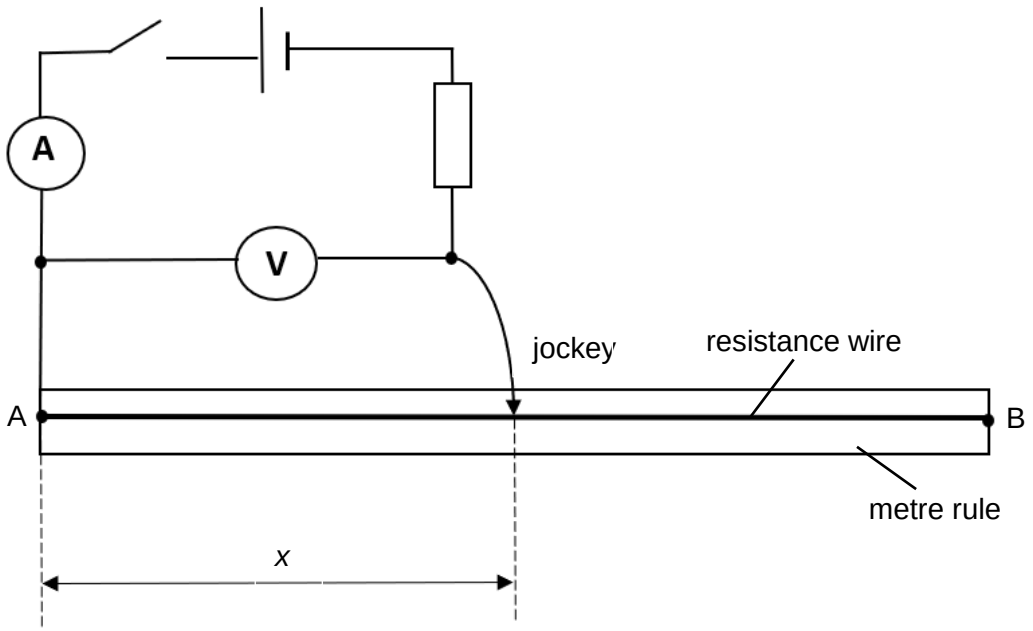

Fig. 3.1

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(d) The distance between end A of the metre rule and the jockey position on the resistance wire is *x*.

Place the jockey on the resistance wire for x = 0.500 m. Close the switch. Record the voltmeter reading V and the ammeter reading I shown on the ammeter. Open the switch after you have taken your readings.

V = ... [1]

I = ... [1]

(e) By placing the jockey at different positions on the wire, repeat **(d)** for additional values of *x*.

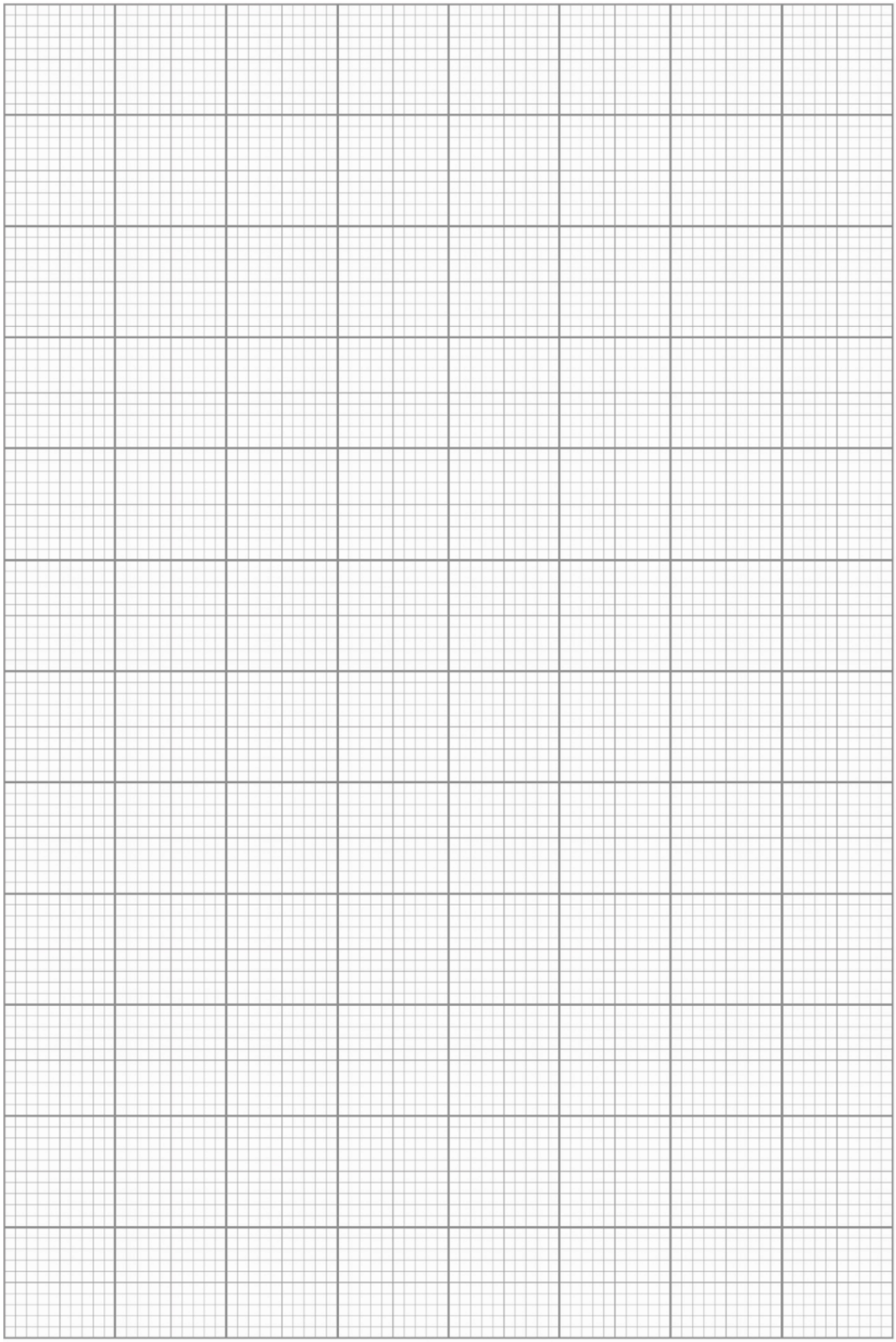
Tabulate your values for x, V, and I. Also include your result from **(d)** in the table.

[4]

(f) Using the grid provided, plot a graph of V against x. [4]

(g) Determine the gradient of the graph.

gradient = ... [2]



(h) From the graph, show clearly how you determine x_1, the value of x for which $V = \frac{V_0}{4}$. Record x_1.

x_1 = ... [2]

(i) **1.** The resistance R of the fixed resistor is given by the equation

$$R = 2\sigma x_1$$

where σ is given as 25.0 Ω / m.

Calculate R.

R = ... [1]

2. Suggest why your value of R may not be accurate.

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..... [1]

(j) A motor is to be connected in the circuit such that it can operate at varying speed of rotation.

Using your result in **(g)**, explain whether the motor should be connected in series or in parallel with the resistance wire.

Draw the position of the motor, with the symbol (M), and its connection in Fig. 3.1.

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..... [2]

End of Paper