Name	Class				Index Number		

BROADRICK SECONDARY SCHOOL
SECONDARY 4 EXPRESS
PRELIMINARY EXAMINATION 2024

PHYSICS **6091/03**

Paper 3 Practical Test **August 2024**

1 hour 50 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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.

Answer **all** questions.
All of 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 experiments is **not** required.

The use of an approved 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.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **12** printed pages.
Setter: Ms Amanda de Souza

Section A

1 *In this experiment, you will investigate the density of the wire used to make a spring.*

You are provided with:

- a spring
- a 30 cm ruler
- a card displaying the mass of the spring.

A spring is made from a piece of wire that is wrapped around a cylinder to form many turns.

Fig. 1.1 shows an example of a spring. The spring has a length l and a diameter d.
It has 21 turns along its length and another 2 turns at each end.
This makes 25 turns in total.

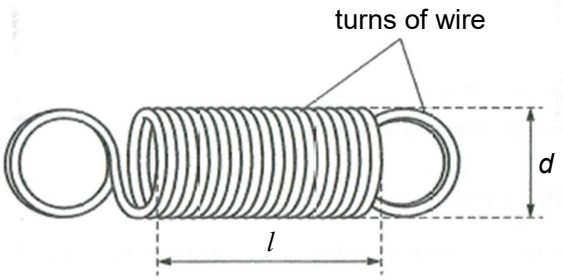

Fig. 1.1

The spring you have been provided with is different from the one shown in Fig. 1.1.

(a) Hold the spring so that there are no gaps between the turns along length l.

Measure the length l and the diameter d of the spring you have been provided with. Record your answers in centimetres.

l = ... cm [1]

d = ... cm [1]

(b) The mass m of the spring is written on the card.

Record m.

m = ...

Count and record:

- the number of turns n in your spring along length l

n = ... [1]

- the total number of turns N in your spring.

N = ... [1]

(c) The spring is made from wire of diameter *D*.

Calculate the diameter *D* of the wire using the equation

$$D = \frac{l}{n}.$$

D = …… cm [1]

(d) Calculate:

(i) the total length *L* of the wire in the spring using the equation

$$L = N\pi d$$

L = …… [1]

(ii) the volume *V* of the wire in the spring using the equation

$$V = \frac{L}{4}\pi D^2$$

V = …… [1]

(iii) the density ρ of the wire in the spring using the equation

$$\rho = \frac{m}{V}.$$

ρ = …… [1]

(e) Describe **one** source of error in the experimental procedure.

Explain how this error affects the calculated value of ρ.

source of error ……

……

effect on calculated value of ρ ……

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……

…… [2]

[Total: 10]

2 *In this experiment, you will investigate the movement of a solid object through oil.*

You are provided with:

- a measuring cylinder containing cooking oil
- a piece of Blu-Tack attached to a length of string
- a stop-watch
- a thermometer
- a 30 cm ruler
- paper towels.

(a) Measure and record the temperature θ of the oil.

When you have completed your measurement, place the thermometer on a paper towel.

θ = ... [1]

(b) Determine the radius r of the piece of Blu-Tack.

r = ... [1]

(c) Place the piece of Blu-Tack at the top of the oil, as shown in Fig. 2.1. Use the string to hold the piece of Blu-Tack so that it just touches the surface of the oil in the measuring cylinder.

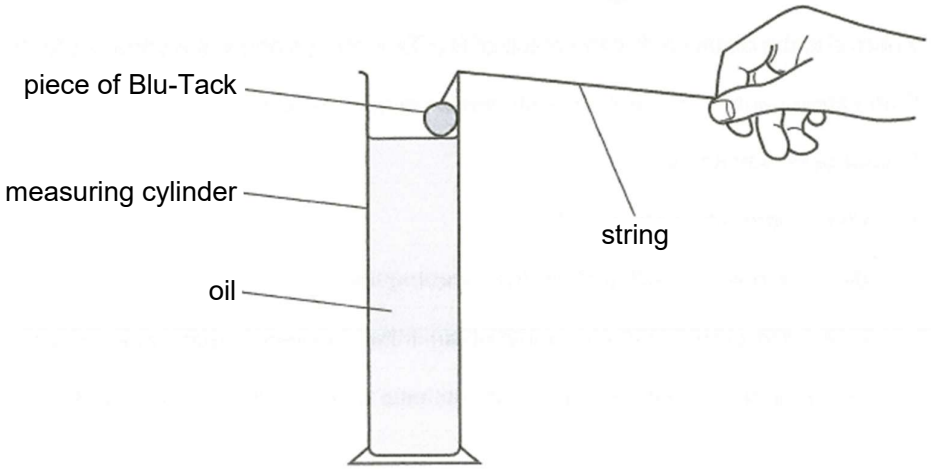

Fig. 2.1

Release the string and start the stop-watch. Stop the stop-watch when the piece of Blu-Tack reaches the bottom of the measuring cylinder.

Record the time *T* taken for the piece of Blu-Tack to reach the bottom of the cylinder.

When you have completed your measurement, use the string to gently pull the piece of Blu-Tack out of the oil and place it on the paper towel.

T = ... [1]

(d) Plan

A student claims that $T = \frac{kd}{r^2}$

where *d* is the distance that the piece of Blu-Tack moves and *k* is a constant for this oil.

Plan experiments to find out if the student's claim is correct.

In your plan, you should:

- identify **one** other key variable
- describe how you will perform the experiments
- sketch the graphs that you would obtain if the suggested relationship is correct
- explain **one** precaution you should take to ensure the accuracy of the experiments.

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[Total: 10]

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Section B

3 *In this experiment, you will investigate the power dissipated by a lamp at different voltages.*

You are provided with:

- a power supply
- an ammeter
- a voltmeter
- a lamp
- a resistance wire attached to a metre rule
- a switch, leads and crocodile clips.

Assemble the circuit, as shown in Fig. 3.1.

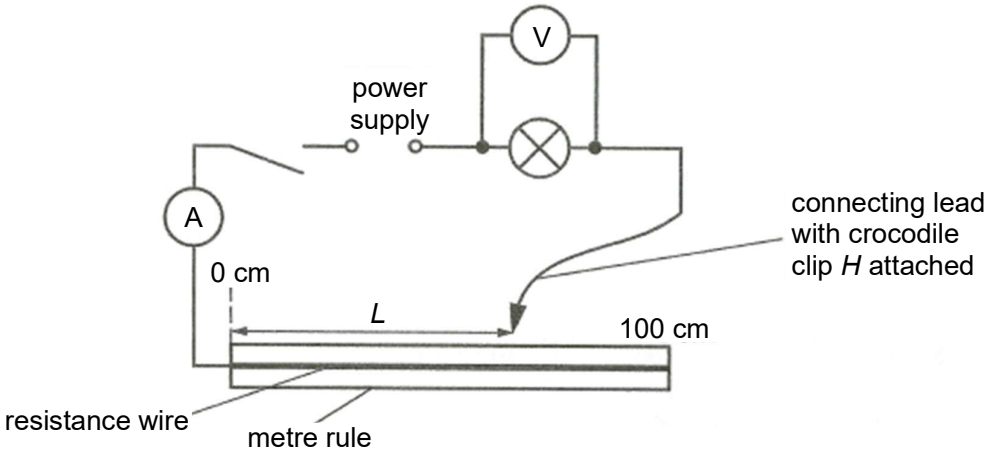

Fig. 3.1

(a) (i) Connect crocodile clip *H* to the resistance wire such that *L* = 100.0 cm.

Close the switch.

Measure and record the potential difference (p.d.) V_1 across the lamp and the current I_1 in the circuit.

V_1 = ... [1]

I_1 = ... [1]

Disconnect the crocodile clip *H* from the resistance wire.

(ii) Calculate:

the resistance *R* of the lamp using the equation $R = \frac{V_1}{I_1}$

R = ... [1]

the power *P* dissipated by the lamp using the equation $P = V_1 \times I_1$.

P = ... [1]

(b) For different values of L, measure V, the p.d. across the lamp and I, the current in the circuit.
Disconnect the crocodile clip H from the resistance wire.

Calculate R and P for each set of measurements. Record all measurements and calculations in a table, including those from **(a)(i)** and **(a)(ii)**.

[6]

(c) On the grid provided, plot a graph of P against L.

Draw the curved line of best fit. [4]

(d) Draw a tangent to the curve at L = 60.0 cm.

Determine the gradient G of this tangent.

G = …… [2]

(e) Explain the trend in your graph.

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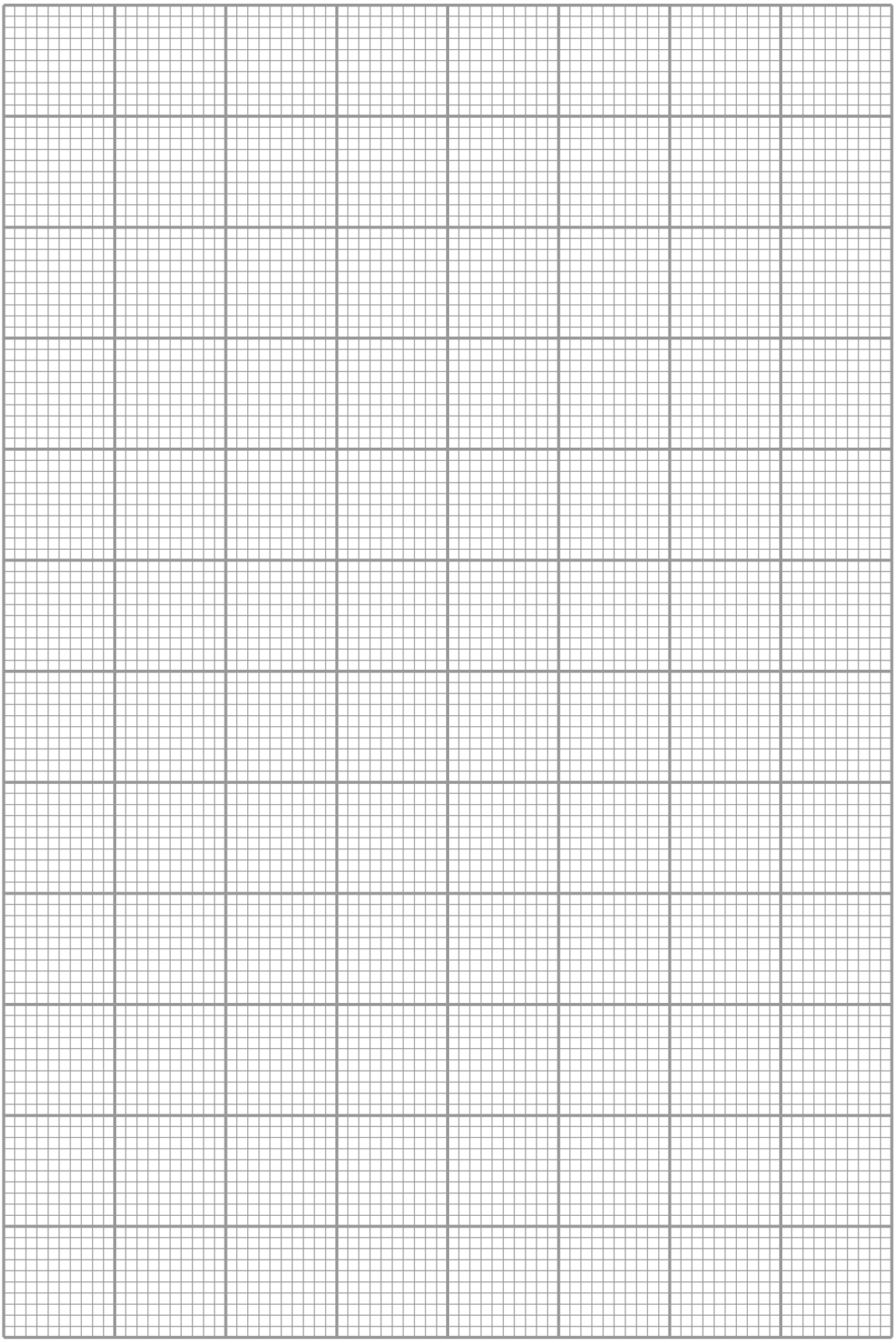
……...……..

……...……..

……...……..

……...…….. [2]



(f) Describe **two** sources of error in the method used to determine *G*.

1. ……...……...

……...……..

2. ……...……

……...……..

[2]

[Total: 20]