



DUNMAN SECONDARY SCHOOL

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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PRELIMINARY EXAMINATION 2024 SECONDARY 4 EXPRESS

PHYSICS

Paper 3 Practical Test

6091/03

14 August 2024
1 hour 50 minutes

Candidates answer on the Question Paper.
Additional Materials are required. As listed in the confidential instructions.

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, highlighters, 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 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.

Shift
Laboratory

For Examiner's Use	
1	
2	
3	
Total	

Section A

1 In this experiment, you will investigate the resistivity of a resistance wire.

You are provided with

- digital micrometer screw gauge
- three 1.5 V cells
- an ammeter (range of 0 A to 1 A)
- a switch
- a voltmeter (range of 0 V to 5 V)
- connecting leads
- a resistance wire secured onto a half-metre rule by using transparent tapes (as shown in Fig. 1.1).

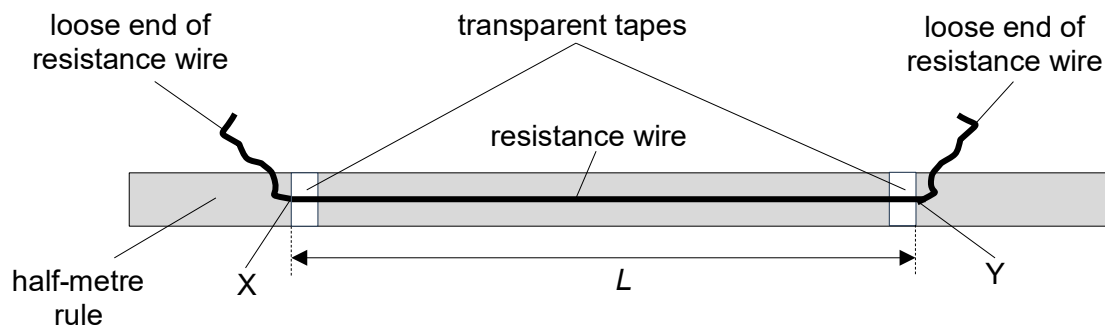


Fig. 1.1

- (a) 1. Using the markings on the half-metre rule, record the length L of the resistance wire between point X and point Y, as shown in Fig. 1.1. Record the length in m.

$L = \dots\dots\dots$ m [1]

2. Use a digital micrometer screw gauge to measure the diameter d of the resistance wire. Record the diameter in m.

$d = \dots\dots\dots$ m [1]

3. Calculate the cross-sectional area of the resistance wire A using the equation shown.

$$A = \frac{\pi}{4} d^2$$

$A = \dots\dots\dots$ [1]

- (b) Set up the circuit as shown in Fig. 1.2. Ensure that the crocodile clips are clipped as close as possible to point X and point Y without peeling off the tape.

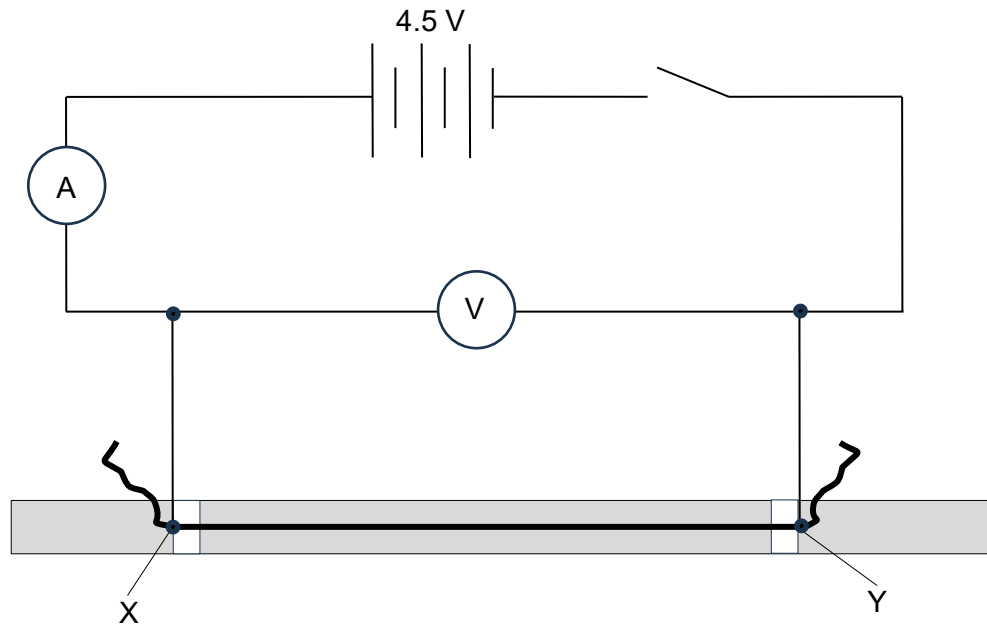


Fig. 1.2

1. Close the switch and record the current I shown on the ammeter and the potential difference V shown on the voltmeter.

$$I = \dots\dots\dots [1]$$

$$V = \dots\dots\dots [1]$$

2. Calculate the resistance R of the resistance wire between point X and point Y using the equation shown.

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

$$R = \dots\dots\dots [1]$$

- (c) Calculate the resistivity ρ of the resistance wire using the equation shown.

$$\rho = \frac{RA}{L}$$

$$\rho = \dots\dots\dots [2]$$

(d) State **one** precaution taken when carrying out the experiment.

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

(e) Describe **one** source of error in the experiment which may affect the value of ρ .

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

[Total : 10]

- 2 In this experiment, you will investigate the heat gained by a fixed volume of water from the surroundings.

You are provided with

- a measuring cylinder of capacity 50 cm³
- a laboratory thermometer
- an empty beaker to contain cold water
- a digital stopwatch
- a retort stand, boss and thermometer clamp.

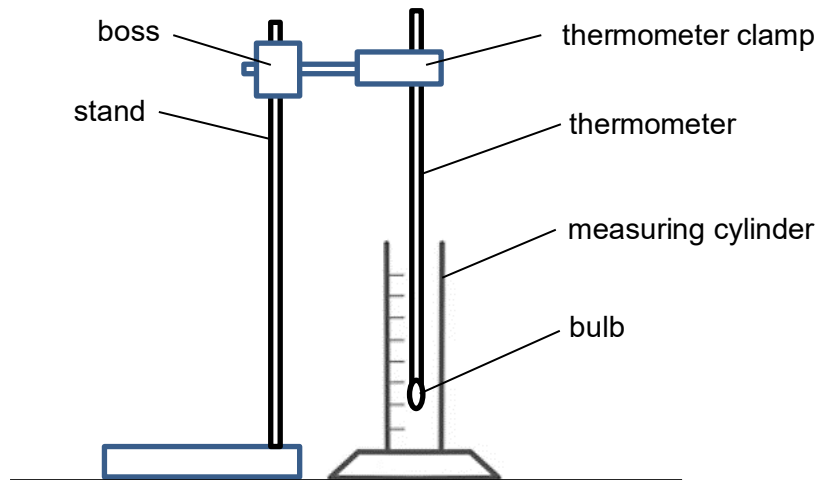


Fig. 2.1

- (a) Set up the apparatus as shown in Fig. 2.1. Ensure that the thermometer is securely clamped so that its bulb is approximately at the 15 cm³ mark of the measuring cylinder.

Raise your hand when you are ready for the cold water to be poured into your empty beaker by the Invigilator. For accuracy of readings, you must immediately proceed with steps (b), (c) and (d) once the cold water has been poured into your empty beaker.

- (b) Carefully pour the cold water from the beaker into the measuring cylinder up till about the 30 cm³ mark of the measuring cylinder.

Record the volume of water V shown on the measuring cylinder.

$V = \dots\dots\dots$ [1]

- (c) Leave the thermometer in the measuring cylinder for about one minute. Then, start the stopwatch and at the same time, record the temperature T_0 shown on the thermometer.

$T_0 = \dots\dots\dots$

- (d) At 5 minutes, record the temperature T_5 shown on the thermometer.

$T_5 = \dots\dots\dots$ [1]

- (e) The rate of heat gained by the water, in watts, from its surroundings is given by the equation shown.

$$P_{\text{gain}} = 0.014V(T_5 - T_0)$$

where V is in cm^3 .

Calculate P_{gain} .

$$P_{\text{gain}} = \dots\dots\dots \text{ W [1]}$$

- (f) In (c), the thermometer was left in the water for about 1 minute before the temperature was recorded.

Explain the reason for doing so.

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..... [1]

- (g) **Plan**

A student claims that the change in temperature ΔT of the water is related to the elapsed time t by the equation

$$\Delta T = at + b$$

where a and b are constants.

Using the same apparatus provided in Fig. 2.1, plan an experiment to find out if the claim is true. You are **not** required to carry out this experiment.

Your plan should include

- **all** quantities that you will keep constant,
- a detailed description of how you would perform the experiment,
- a suitable table in which to display your measurements (you do **not** need to enter any data into your table),
- a sketch of the graph that you would obtain if the suggested claim is true,
- an explanation of how you would obtain a value of the constants a and b from your graph.

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Section B**3** *In this experiment, you will investigate the centre of mass of a metre rule.*

You are provided with

- a metre rule with a hole at its 30 cm mark
- a loop of string
- a mass hanger of mass 50 g
- six pieces of 50 g mass
- a pivot consisting of a pin and cork
- a retort stand, boss and clamp.

Set up the apparatus as shown in Fig. 3.1.

The pivot P is at the 30 cm mark of the metre rule.

Point X is at the 0 cm mark of the metre rule and point Y is at the 100 cm mark of the metre rule.

Using the loop of string, suspend the mass hanger and add a 50 g mass for a total mass, m , of 100 g.

Adjust the position of the loop of string along the metre rule until the metre rule remains horizontal.

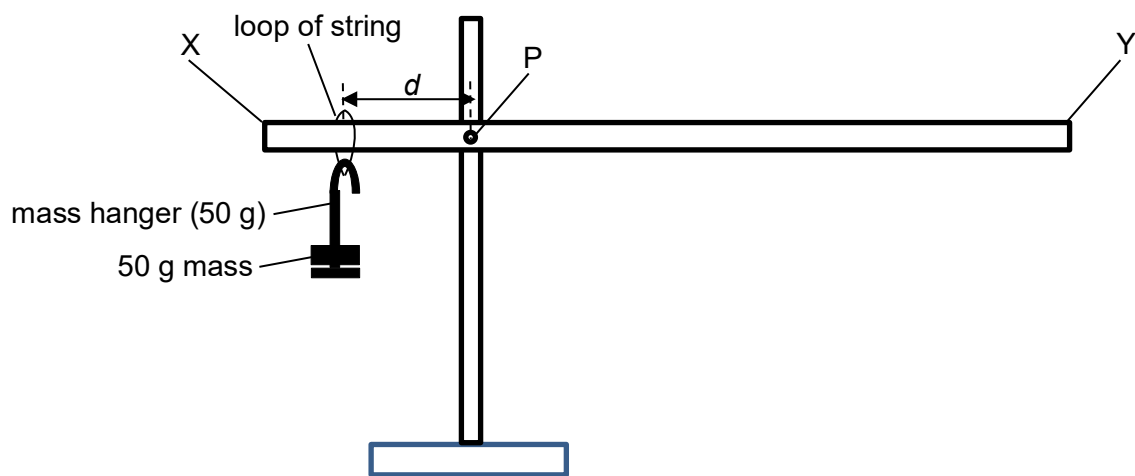


Fig. 3.1

- (a) Describe the process and techniques used to ensure that the metre rule becomes horizontal.

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..... [4]

- (b) Determine an accurate value for the distance d , in cm, when the mass $m = 100$ g.

$d =$ [1]

- (c) Record your values of m and d in a table. Include a column for $\frac{1}{m}$.

For values of m from 100 g to 350 g, determine the corresponding values of d and $\frac{1}{m}$.

Record all your measurements and calculations in your table.

[5]

- (d) Using the grid provided, plot a graph of d against $\frac{1}{m}$. [4]

- (e) Calculate g , the gradient of the graph.

$$g = \dots\dots\dots [2]$$

- (f) The mass M of the metre rule is pasted on the metre rule.
Record the value of M .

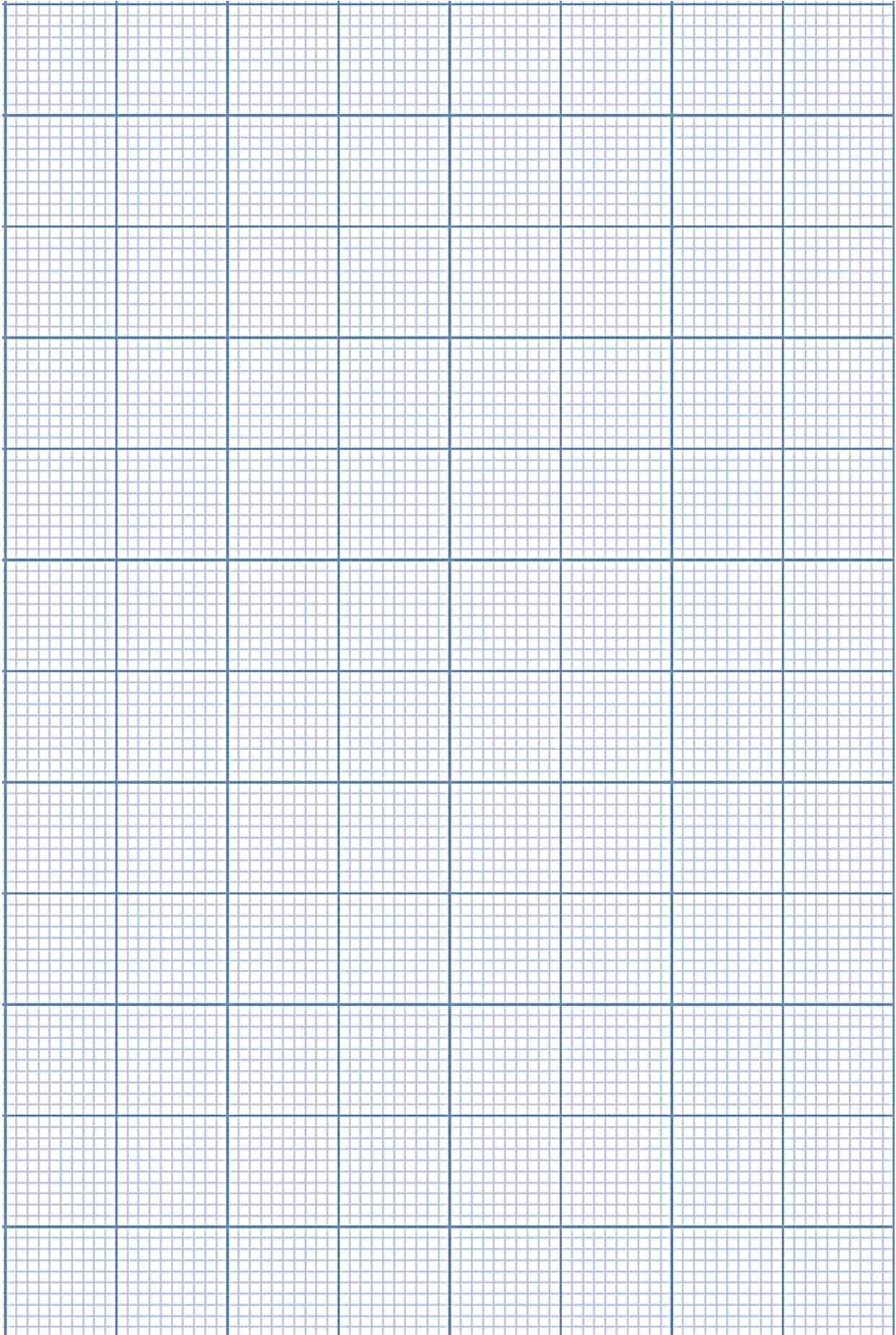
$$M = \dots\dots\dots$$

- (g) The distance D of the centre of mass of the metre rule from the pivot is given by the equation shown.

$$D = \frac{g}{M}$$

Calculate D .

$$D = \dots\dots\dots [2]$$



(h) Describe **two** improvements to the experiment that reduce experimental error.

1

..... [1]

2

..... [1]

[Total : 20]

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