Candidate Name	Form Class	Index Number

ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

PHYSICS **6091/03**

Paper 3 **23 August 2024**

1 hour 50 minutes

Setter: Mrs Yeo Chai Hoon
Candidates answer on the Question Paper
No Additional Materials are required.

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 in the spaces provided on the Question Paper.
You may use pencil for any diagrams, graphs or rough working.
Do **not** use paper clips, highlighters, glue or correction fluid/tape.

Answer **ALL** questions.
All of your answers should be written in this Question Paper: scrap paper must **not** be used.
Graph grids 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.
You may lose marks if you do not show your working or if you do not use appropriate units.
The use of an approved scientific calculator is expected, where appropriate.

At the end of the examination, faster 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	
Q1	
Q2	
Q3	
Total	

This document consists of **12** pages.

[Turn Over

Section A

1 *In this experiment, you will investigate the cooling rate of water.*

You have been provided with

- two boiling tubes in a rack, each with a water-level marking 10 cm from the bottom
- two plasticine (about 2cm tall) placed under the boiling tubes on the rack.
- two thermometers
- a retort stand, boss and clamp
- hot water
- a stopwatch
- a dropper
- a beaker
- cloth

Set up the apparatus as shown in Fig 1.1

Thermometer A is the thermometer in boiling tube A and thermometer B is the thermometer in boiling tube B.

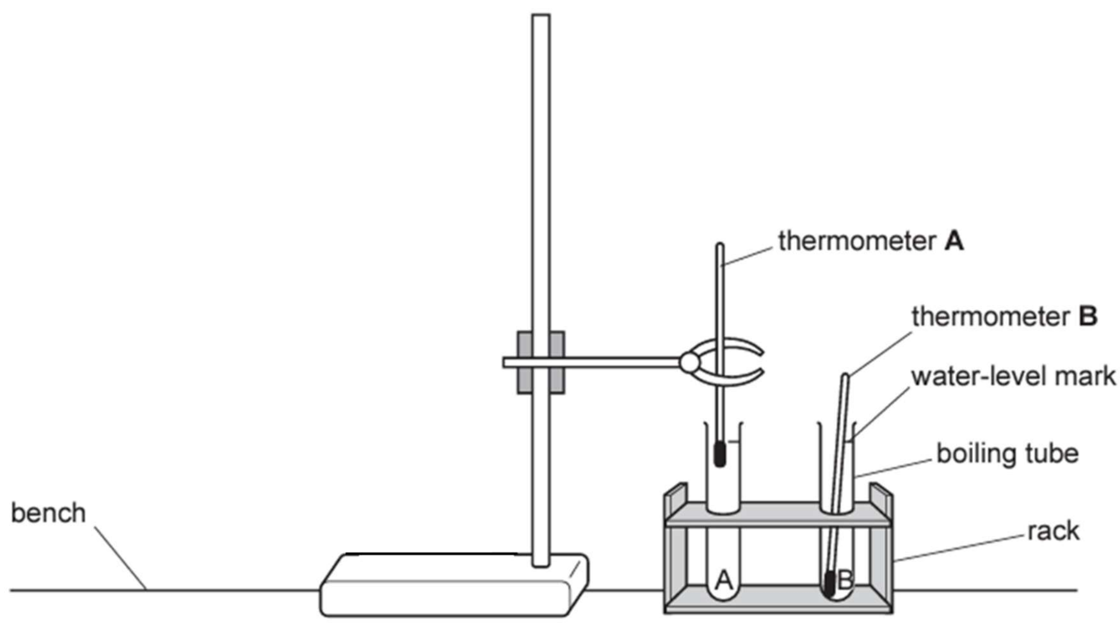

Fig. 1.1

Thermometer A must be held by the clamp and positioned so that the bottom of the bulb is about 1 cm below the water-level marking on the side of the boiling tube.

Thermometer B must rest gently on the bottom of the boiling tube.

Assemble the setup shown in Fig 1.1.

(a) Measure and record the temperature:

T_A on thermometer A T_A = ...

T_B on thermometer B T_B = ...[2]

(b) Do not change the position of the thermometers.

Carefully pour hot water from the beaker into both boiling tubes until the water is level with the marked line on each tube.

Measure and record the maximum temperature:

$T_{A\ (MAX)}$ on thermometer A

$T_{A\ (MAX)}$ = ...

$T_{B\ (MAX)}$ on thermometer B

$T_{B\ (MAX)}$ = ...[2]

(c) Start the stopwatch and wait for 4 minutes.

Record the time t, in seconds, on the stopwatch after 4 minutes.

t = ... [1]

(d) Read and record the temperature on the thermometers after 4 minutes.

State which thermometer shows a smaller temperature decrease from the maximum temperature.

$T_{A\ (4\ MIN)}$ on thermometer A

$T_{A\ (4\ MIN)}$ = ...

$T_{B\ (4\ MIN)}$ on thermometer B

$T_{B\ (4\ MIN)}$ = ...[2]

Thermometer which has a smaller temperature decrease = ...[1]

(e) Suggest two reasons why one thermometer shows a smaller temperature decrease after 4 minutes.

1. ……………………………………………………………………………………………

……………………………………………………………………………………………

2. ……………………………………………………………………………………………

……………………………………………………………………………………………[2]

2 In this experiment, you will determine the resistivity of the wire PQ.

You have been provided with

- a power supply,
- a fixed resistor,
- a switch,
- an ammeter,
- a voltmeter,
- a length of resistance wire PQ on a metre rule,
- a jockey (crocodile clip),
- a digital micrometer screw gauge,
- seven connecting leads.

Assemble the circuit as shown in Fig. 2.1.

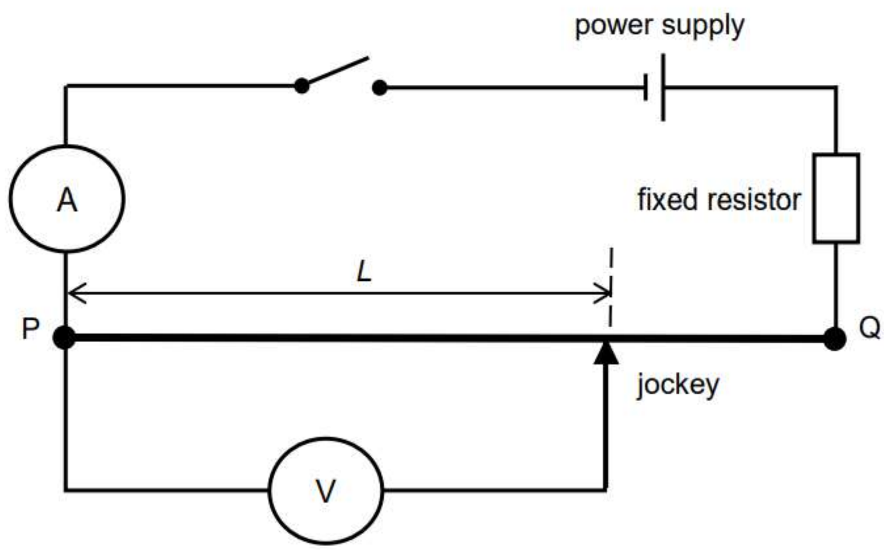

Fig. 2.1

Adjust the position of the jockey along the wire PQ so that L = 80.0 cm.

With the switch closed,

(a) **(i)** record the ammeter reading I.

I = ………………………. [1]

(ii) record the voltmeter reading V.

V = ……………………….. [1]

(iii) Given that the resistance R = V / I, calculate the resistance R of the wire when L = 80.0 cm.

R = ………..……………. [1]

(b) **(i)** Using the digital micrometer screw gauge, record the average diameter D of the wire PQ.

D = ……………………… [1]

(ii) The resistivity of the wire, ρ, is given by the formula:

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

Using the values from **(a)** and **(b)(i)**, determine the resistivity of the wire PQ.

ρ = …………….……….. [1]

(c) Plan

The circuit is now assembled as shown in Fig. 2.2.

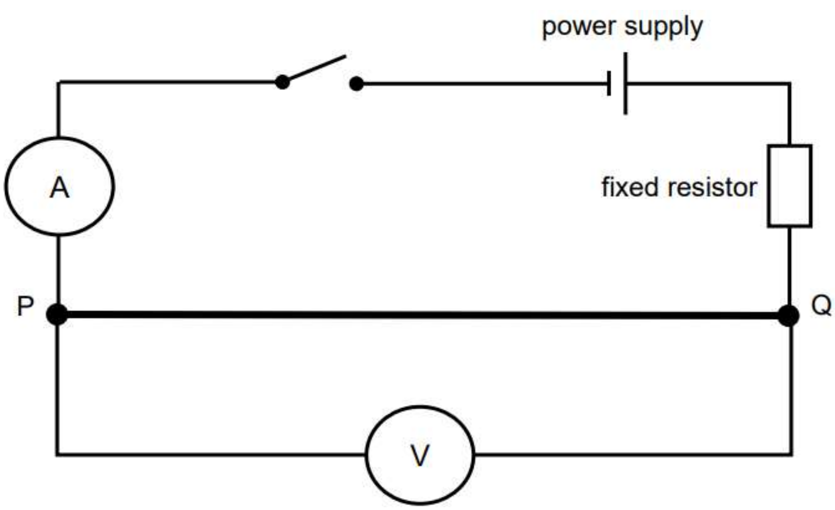

Fig. 2.2

It is suggested that the relationship between V and D is

$$\frac{1}{V} = \frac{a}{D^2} + b$$

where a and b are constants.

Using resistance wires with different diameters and the apparatus in Fig. 2.2, plan an experiment to investigate the 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 suggested relationship is correct,
- an explanation of how you would obtain a value of the constant b from your graph.

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End of Section A

Section B

3 *In this experiment, you will investigate a cylinder rolling down a ramp.*

You have been provided with

- a cylinder consisting of two slotted masses taped together
- a stopwatch
- a ramp, supported by a wooden block
- two metre rules that are attached to the ramp
- a stop at the end of the ramp
- a half-metre rule
- a set square

Do not remove the ramp or support.

The apparatus has been set up as shown in Fig. 3.1.

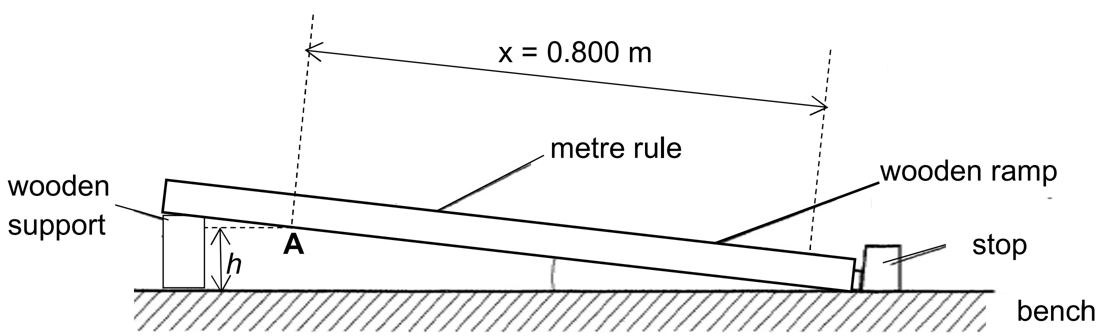

Fig. 3.1

(a) A point labelled **A** is a distance x = 0.800 m from the bottom of the ramp.
Measure the height *h*, from the lower surface of the ramp above the bench at **A**.

h = ……………………...………………….. [1]

(b) (i) (1) Determine the time t_1 for the cylinder to travel from rest near the top of the ramp, a distance x = 0.800 m down the ramp. Record the time as t_1.

t_1 = ……………………...……………….. [1]

(2) Hence, determine the **average** time t_{ave} for the cylinder to travel, from rest near the top of the ramp, a distance x = 0.800 m down the ramp.

t_{ave} = ……………………..……………….. [2]

(ii) Fig. 3.2 shows the position of the cylinder when the stopwatch was started and when the stopwatch was stopped. On Fig. 3.2, mark the distance *x*. [1]

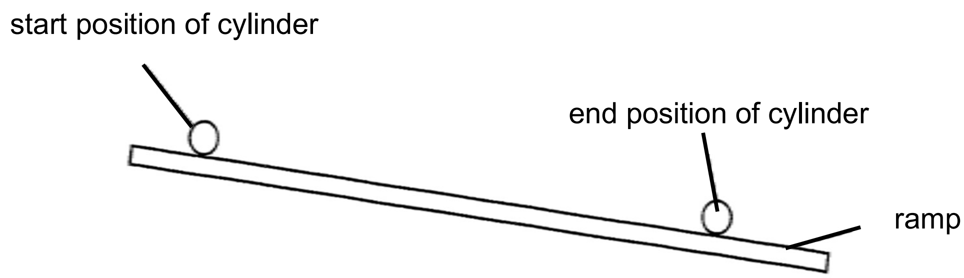

Fig. 3.2

(c) (i) Calculate the average speed *v* of the cylinder using the relationship

$$v = \frac{x}{t_{ave}}$$

v = ……………………..……………….. m/s [1]

(ii) Calculate v^2.

v^2 = ……………………..……………….. $(m/s)^2$ [1]

(d) By releasing the cylinder from near the top of the ramp, allow the cylinder to travel different distances $x \geq 0.200$ m down the ramp.
For each distance, determine x, t_{ave}, v and v^2.

Record your results and calculations in a suitable table in the space below.

Include your values from **(b)(i)** and **(c).**

[5]

(e) On the grid provided, plot a graph of v^2 against x. Draw the straight line of best fit. [4]

(a) Determine the gradient *G* of the line of best fit.

G = ……………………..………………….. [2]

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

1……………………………………………………………………………………………..

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……………………………………………………………………………………………..

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[2]

[Total: 20]

END OF PAPER