Name ____________________________ (   )   Class _______

PRELIMINARY EXAMINATION
GENERAL CERTIFICATE OF EDUCATION ORDINARY LEVEL

PHYSICS **6091/03**
Paper 3 Practical Test **15 August 2025**
1 hour 50 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS

Write your name 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, correction fluid, correction tape or highlighters.

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 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	/10
2	/10
3	/20
Total	/40

This document consists of **14** printed pages and 2 blank pages.

圣尼各拉女校
CHIJ ST NICHOLAS GIRLS' SCHOOL
Girls of Grace · Women of Strength · Leaders with Heart

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Section A

1 *In this experiment you will determine the length of a wire used in the experiment.*

You are provided with:

- a power supply
- a switch
- a variable resistor
- a 3V voltmeter
- a 1A ammeter
- a half-metre rule
- a nichrome resistance wire
- connecting leads.

The nichrome resistance wire is partially hidden inside an envelope and the remainder is held onto a piece of cardboard by pieces of clear tape.

You must **not** remove the wire from the cardboard, or interfere with the envelope in any way.

You must **not** write on, or mark, the cardboard in any way.

Set up the circuit as shown in Fig. 1.1.

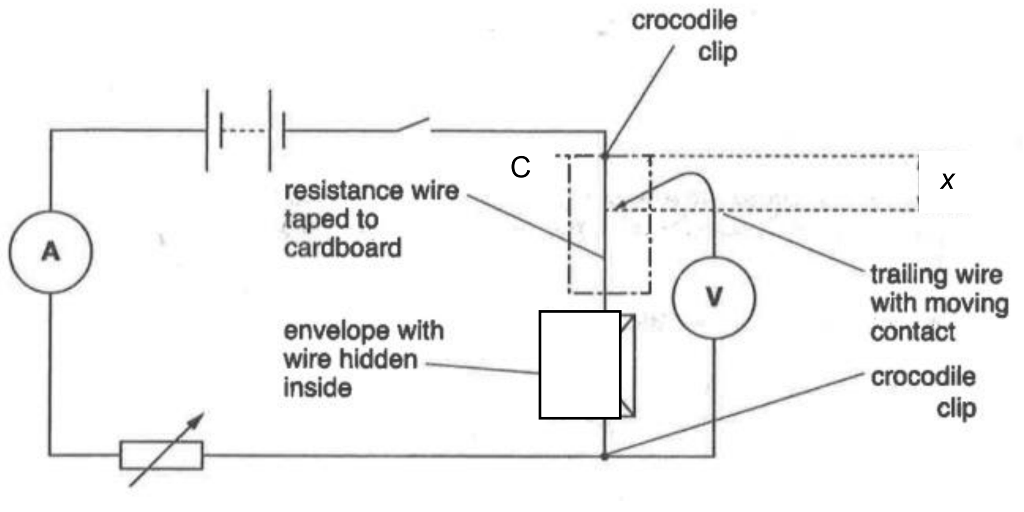

Fig. 1.1

Place your ruler along the resistance wire on the cardboard so that the zero mark on the ruler is at point C, where the wire leaves the crocodile clip. You are going to place the moving contact on the resistance wire at different distances, *x*, from point C and measure the current through the circuit.

[Turn Over

(a) Place the moving contact on the resistance wire at a point approximately 40 cm from C.

Measure and record the value of *x*.

x = ... [1]

(b) **(i)** Close the switch and adjust the variable resistor until the voltmeter shows the maximum possible value.

Measure and record the voltage V and the current in the circuit, I.

V = ...

I = ...

[2]

(ii) Hence calculate the resistance of the nichrome resistance wire, R.

R = ... [2]

(c) Given that the resistivity of nichrome is 1.00×10^{-6} Ω m, and the cross-sectional area of the resistance wire is 6.2×10^{-8} m^2, calculate the length of the resistance wire across the voltmeter and hence estimate the length of resistance wire hidden in the envelope.

length of resistance wire across voltmeter = ...

length of resistance wire in envelope = ...

[3]

(d) Suggest how the cross-sectional area of the resistance wire may be determined accurately and reliably.

....

....

....

....

.... [2]

[Total: 10]

[Turn Over

2 *In this experiment you will determine the mass of a half-metre rule.*

You are provided with:

- a half-metre rule with holes near both ends
- a length of string attached to the half-metre rule at the 49.0 cm mark
- a pivot in the form of a pin mounted on cork on a retort stand
- a 50 g mass hanger and five 20 g masses
- a pulley
- a retort stand with boss and clamp
- a metre rule
- a protractor
- two bricks.

The supervisor has set up the apparatus as shown in Fig. 2.1.

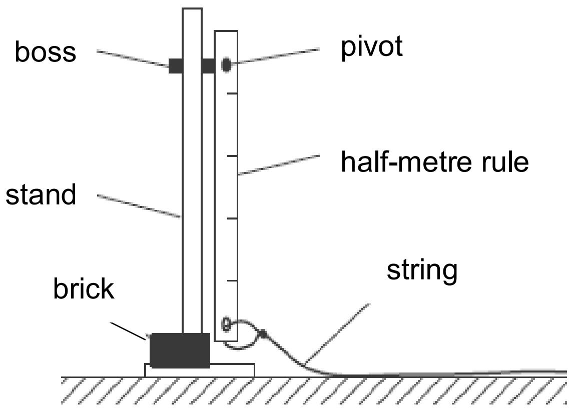

Fig. 2.1

Pass the string through the pulley and hang the mass hanger from the loop at the free end of the string. Set up the apparatus as shown in Fig. 2.2, with the pulley held up by the second retort stand (not shown in diagram).

Adjust the pulley so that the mass hanger is above the benchtop when the string is horizontal.

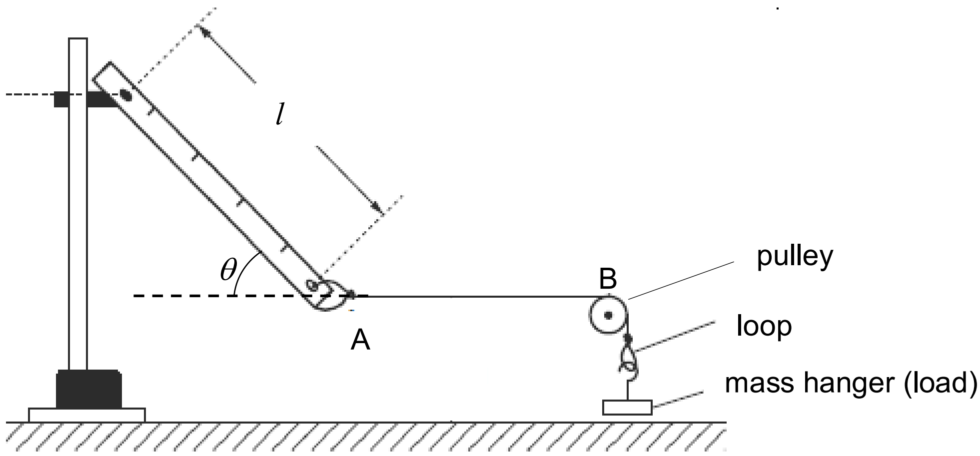

Fig. 2.2

(a) Explain how you ensured that AB was horizontal.

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(b) **(i)** Record the mass m of the load that is suspended from the loop.

m = …………………………

(ii) Measure and record the distance l between the centre of the holes on the half-metre rule.

l = ………………………… [1]

(iii) Measure and record the angle θ, that the half-meter rule makes with the horizontal, and calculate the value of tan θ.

θ = …………………………

tan θ = …………………………

[2]

(c) Add a 20 g mass to the mass hanger.

Calculate the new value of m.

m = ………………………… [1]

(d) Adjust your setup such that AB is horizontal again.

Measure and record the new value of θ, and calculate the new value of tan θ.

θ = …………………………

tan θ = …………………………

[1]

[Turn Over

(e) A student claims that

$$\tan\theta = \frac{M}{2}\left(\frac{1}{m}\right),$$

where M is the mass of the half-metre rule and a constant.

Plan an experiment to investigate the student's claim.
In your plan, you should:

- state **one** key variable to control
- describe how you would perform the experiment
- sketch the graph that you would obtain, assuming that the student's claim is correct
- explain how you would determine M from your graph.

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…………………………………………………………………………………… [4]

[Total: 10]

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Section B

3 *In this experiment, you will investigate the true minimum temperature of an endothermic process.*

You are provided with:

- a measuring cylinder
- two Styrofoam cups
- a retort stand
- two bosses and clamps
- a thermometer
- a glass rod
- a stopwatch
- a container containing sample P
- a labelled card
- paper towels
- a mass balance (shared).

You are provided with a sample of solid P in a container. When sample P is added to water, it dissolves. As this is an endothermic process, energy is transferred from the water to the dissolving sample and the temperature of the solution falls.

(a) The mass of the container for sample P is given on the labelled card.

Determine the mass, *m*, of your sample P.

m = ... [1]

(b) Use the measuring cylinder to measure approximately 50 cm^3 of water.

Record the volume of water *V*.

V = ... [1]

(c) Pour the water into the Styrofoam cup as shown in Fig. 3.1.

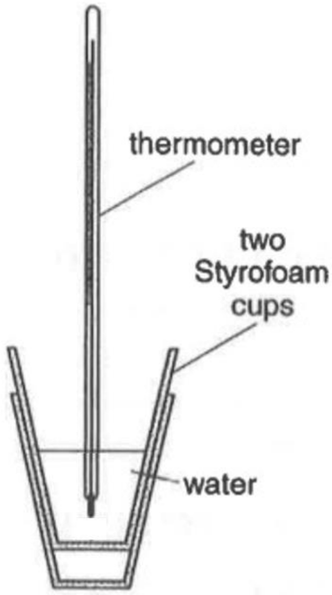

Fig. 3.1

Measure and record the temperature of the water in the Styrofoam cup, *T*.

T = ……………………… [1]

[Turn Over

(d) Add the entire sample of P into the water and start the stopwatch at the same time. Stir the mixture but do not measure the temperature, until the first 30-second interval is reached. Record the corresponding time *t* and temperature *T* at the first 30-second interval.

Continue to measure and record the temperature of the mixture at 30-second intervals over a duration of at least 6 minutes in a table in the space provided below. Continue to stir the mixture during the process.

[3]

(e) On the grid provided, plot a graph of temperature *T* against time *t*. [4]

[Turn Over

(f) Determine the gradient of your graph.

gradient = ………………………… [2]

(g) The minimum temperature, T_{min}, of the mixture can be determined from the y-intercept of your graph.

Determine T_{min}.

T_{min} = ... [2]

(h) The amount of energy transferred from the water to sample P to dissolve it can be calculated using the equation

$$Q = \text{m} \ x \ c \ x \ \Delta T.$$

where c is the specific heat capacity of water, ΔT and is the maximum change of temperature of the water.

Given that c = 4200 J / (kg °C), calculate the value of Q for your experiment.

Q = ... [3]

(i) Describe **one** significant source of error in this experiment.

....

....

....

.... [1]

(j) Suggest an improvement to the experiment that would reduce the error you identified in **(i)**.

....

.... [1]

(k) Describe and explain one precaution taken to ensure reliability of the measured values of *T*.

....

....

.... [1]

[Total: 20]

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