Anglican High School
Secondary Four
Preliminary Examination 2021

S4

CANDIDATE NAME

CLASS 4

CLASS INDEX

PHYSICS **6091/03**

Paper 3 Practical Test

6 Sep 2021

1 hour 50 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name 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 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.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **11** printed pages.

1 *In this experiment, you will investigate the resistivity and the power dissipated in a length of resistance wire.*

You are provided with:

- a length of resistance wire (W) attached to a meter rule,
- a sample of resistance wire
- a micrometer screw gauge
- an ammeter (0 – 1 A),
- a voltmeter (0 – 5 V),
- a switch,
- a power supply,
- a fixed resistor (R_2),
- connecting wires,
- a jockey.

Set up the apparatus as shown in Fig. 1.1

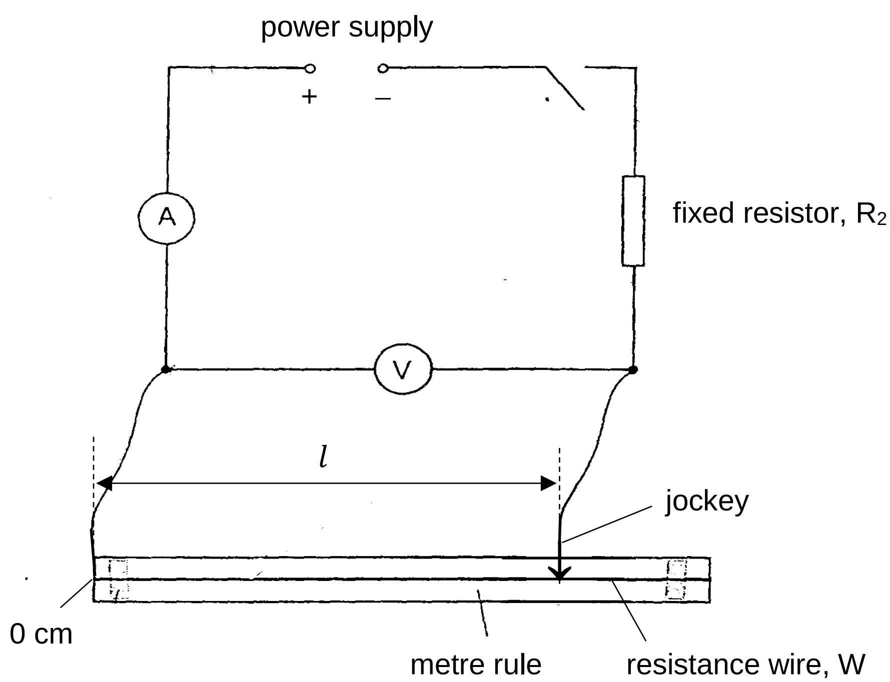

Fig. 1.1

(a) Measure and record d, the diameter of the sample of resistance wire.

d = ……………………..…… [1]

(b) Calculate the cross-sectional area of the resistance wire, in **m²,** using the equation shown.

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

A = …………………… m^2 [1]

(c) Close the switch.
Place the jockey on the resistance wire so that a length l of 0.8 m of resistance wire is connected in the circuit.
Record the current I in the circuit and the potential difference V across the length of wire.

I = ……………………………..

V = ……………………………..
[2]

(d) Open the switch.

(i) Calculate the resistance R of 0.8 m of the wire using the equation shown.

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

R = ………………………… [1]

(ii) The resistance R and the resistivity ρ are related by the equation

$$R = \frac{\rho l}{A}$$

where A is the cross-sectional area and l is the length of the wire.

Calculate the resistivity of the wire, ρ.

ρ = ………………………… [2]

(iii) Calculate the power dissipated P in 0.8 m of the wire using the equation shown.

$$P = I V$$

P = ………………………… [1]

(e) Repeat **(c)** for l = 0.4 m. Hence determine P for l = 0.4 m.

P = ………………………… [1]

(f) Using your answers to **(d)(iii)** and **(e)**, explain whether the power dissipated P is directly proportional to the length l of the wire.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [1]

[Total: 10]

2 *In this experiment, you will investigate a spinning mass.*

You are provided with:

- a 1 N mass-hanger and four 1 N weights,
- a half-metre rule,
- a length of string attached to a wooden rod,
- a stopwatch,
- a stand, boss and clamp.

Set up the apparatus as shown in Fig. 2.1

Ensure that the weight is directly above the base of the stand so that it does not topple over.

Adjust the position of the boss so that the bottom of the 5 N weight is approximately 2 cm above the base of the stand.

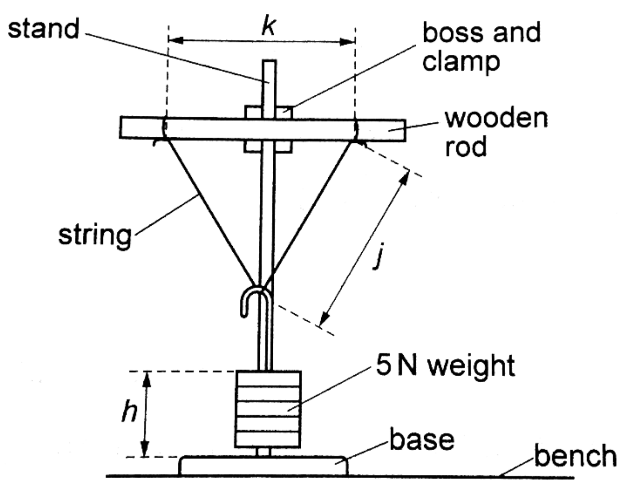

Fig. 2.1

Fig. 2.1 shows the weight and the strong in the equilibrium position.

(a) Measure

the height *h* of the top of the weight above the base of the stand in the equilibrium position,

h = ……………………………..

The length of *j* of one side of the string,

j = ……………………………..

the distance k between the two points where the string is attached to the rod.

k = ……………………………

[1]

(b) Rotate the weight clockwise when viewed from above until h increases by 10 mm.

Release the weight and immediately start the stopwatch.

The time for the string to first unwind is t.

Determine an accurate value for t.

t = …………………………… [2]

(c) The rate at which gravitational potential energy is transferred by the spinning weight can be calculate using the equation

$$P = \frac{W\Delta h}{t}$$

Where W is the weight on the string and Δh is the change in h.

Calculate P_1 using your value of t from **(b)**.

P_1 = …………………………….. [2]

(d) Remove three weights from the mass-hanger.
Repeat **(b)** and **(c)** to obtain a new value, P_2.

P_2 = …………………………….. [1]

(e) Plan an experiment to investigate the relationship between P and W.

Your plan should include

- a list of the quantities that remain constant,
- a description of how you would perform the experiment
- a sketch of the graph that you would plot using preliminary observations.

………. [4]

[Total: 10]

3 *In this experiment, you will apply several forces to a metre rule.*

You are provided with:

- seven slotted masses,
- a spring with a string loop attached,
- two metre rules (one of them with a rubber band wrapped around its centre)
- a pair of vernier calipers,
- a set square
- a stand, boss and clamp.

(a) Measure and record the length l_o of the unstretched spring, as shown in Fig. 3.1.

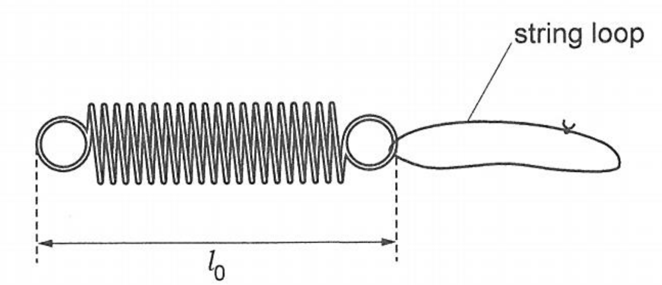

Fig. 3.1

l_o = ……………………….. [1]

(b) Record the distance L from one end of the metre rule to the rubber band, as shown in Fig. 3.2.

Do not adjust the position of the rubber band throughout the experiment.

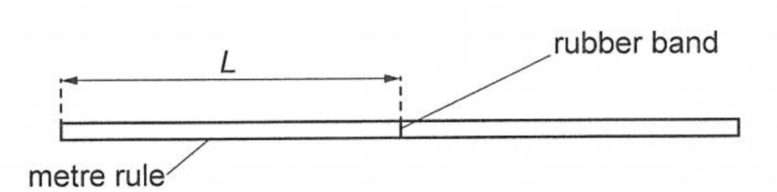

Fig. 3.2

L = ……………………….. [1]

(c) Measure and record the diameter d of one of the slotted masses, as shown Fig. 3.3.

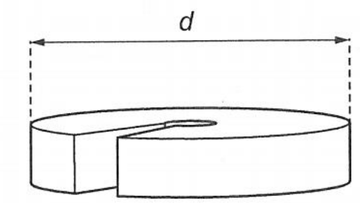

Fig. 3.3

d = ……………………….. [1]

(d) (i) Set up the apparatus as shown in Fig. 3.4.

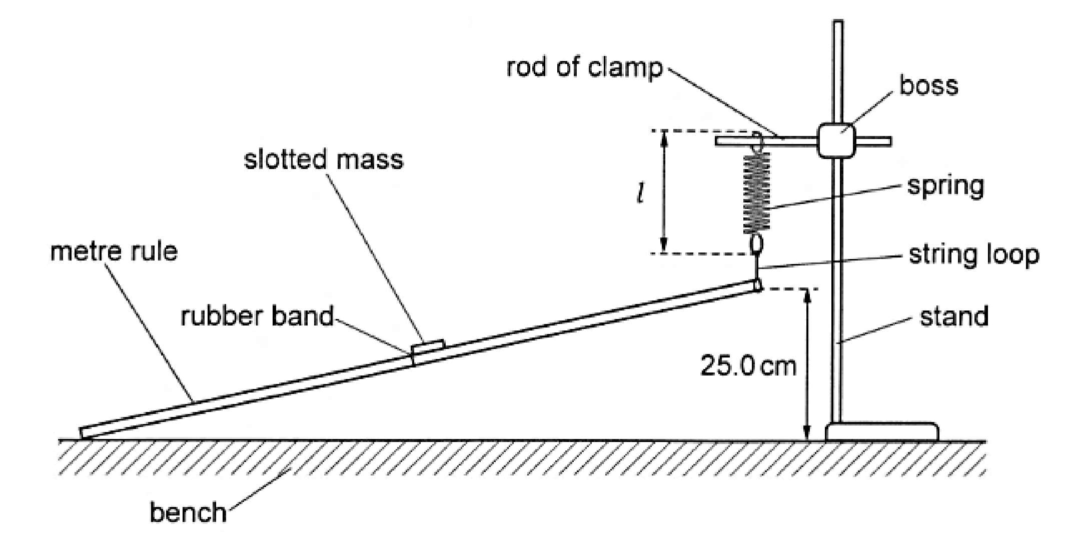

Fig. 3.4

One of the slotted masses should be placed on the metre rule and be resting against the rubber band.

(ii) Adjust the clamp so that the bottom edge of the raised end of the metre rule is 25.0 cm above the bench and the spring is **vertical**.
Measure and record the length l of the stretched spring.

l = ………………………. [1]

(iii) Calculate e where $e = l - l_0$.

e = ………………………. [1]

(e) Place a second mass next to the first, as shown in Fig 3.5.
Repeat **(d)(ii)** and **(d)(iii)**.

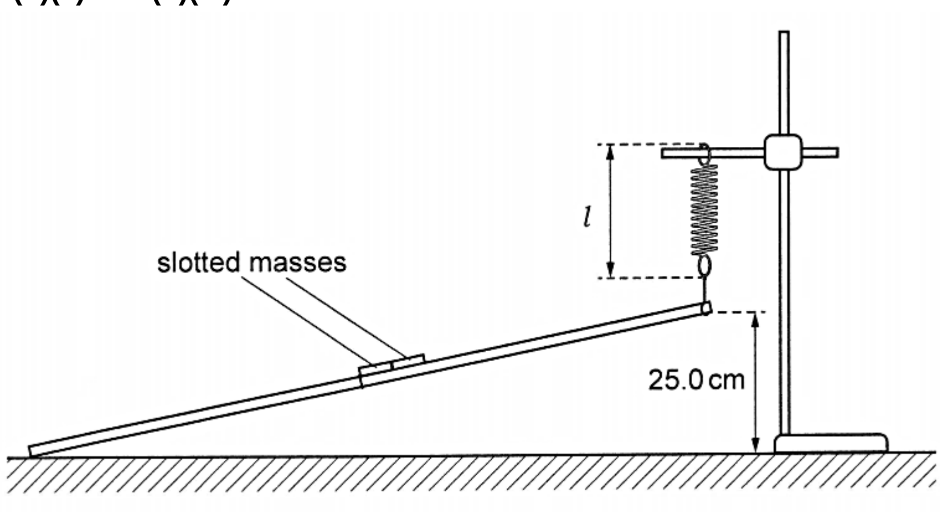

Fig. 3.5

l = ………………………. [1]

e = ………………………. [1]

(f) **(i)** Add further slotted masses next to the masses already on the metre rule. Repeat **(d)(ii)** and **(d)(iii)** for each additional mass.

For each set of measurements, record the values of *n*, *l* and *e* where *n* is the number of slotted masses on the rule. Include your previous results.

[4]

(ii) Plot a graph of *e* against *n*. [4]

(iii) Determine the gradient of the graph, *G*.

G = ……………………….. [2]

(g) G and n are related by the expression

$$G = \frac{mg}{2kL}\,(dn + L)$$

Where k is the spring constant of the spring, m = 0.100 kg, g = 10 N / kg and n = 3.

Calculate constant k.

k = ……………………….. [3]

[Total: 20]