Class:	Register No:	Name:

CRESCENT GIRLS' SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

6091/03
PHYSICS

PAPER 3 Practical

18 AUGUST 2023

1 hour 50 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class in the spaces provided at the top of this page.
Give details of the practical shift and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen.
You may use a 2B pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions in the spaces provided on the Question paper.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show working or if you do not use appropriate units.
Qualitative Analysis Notes are printed on page 9.

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

P	R	For Examiner's Use	
		Q1	**/10**
		Q2	**/10**
		Q3	**/20**
		Total	**/40**

This document consists of **10** printed papers.

Section A

1. In this experiment, you will determine the density of a sphere.

You are provided with

- five glass spheres,
- two half-metre rules,
- two set squares,
- access to electronic balance.

(a) Place the two half-metre rules parallel to one another, with a gap between the two, as shown in Fig. 1.1.

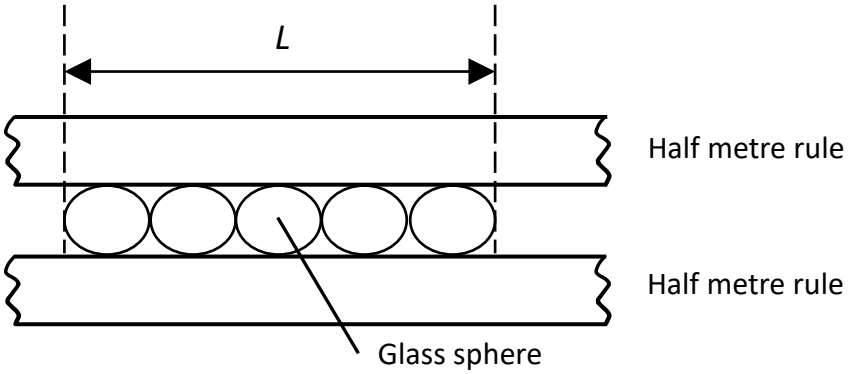

Fig. 1.1 (top view)

Ensure that the 5 spheres are touching each other and are in a line.
Measure the total length *L* occupied by the 5 spheres.

L = …… [1]

(b) State, with the aid of a diagram, how you ensured that *L* was determined as accurately as possible.

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…… [2]

(c) Use your value of *L* to determine the average diameter *d* of a sphere.

d = ... [1]

(d) Explain why this method of finding average diameter *d* determined in **(c)** will give a lower value than the actual diameter *d*.

.....

.....

.....

..... [2]

(e) Calculate the volume *V* of a sphere using the equation shown.

$$V = \frac{4\pi}{3}\left(\frac{d}{2}\right)^3$$

V = ... [1]

(f) Use the top-pan balance to determine the mass *m* of a sphere.

m = ... [1]

(g) Determine the density of the sphere using the equation shown.

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

ρ = ... [1]

(h) Suggest a change to the apparatus so that *V* can be measured **directly**.

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..... [1]

2. In this experiment, you will investigate the power dissipated in a resistance wire.

You are provided with

- a power supply,
- an ammeter,
- a voltmeter,
- a switch,
- a jockey,
- a variable resistor,
- a length of resistance wire attached to a metre rule,
- leads and crocodile clips.

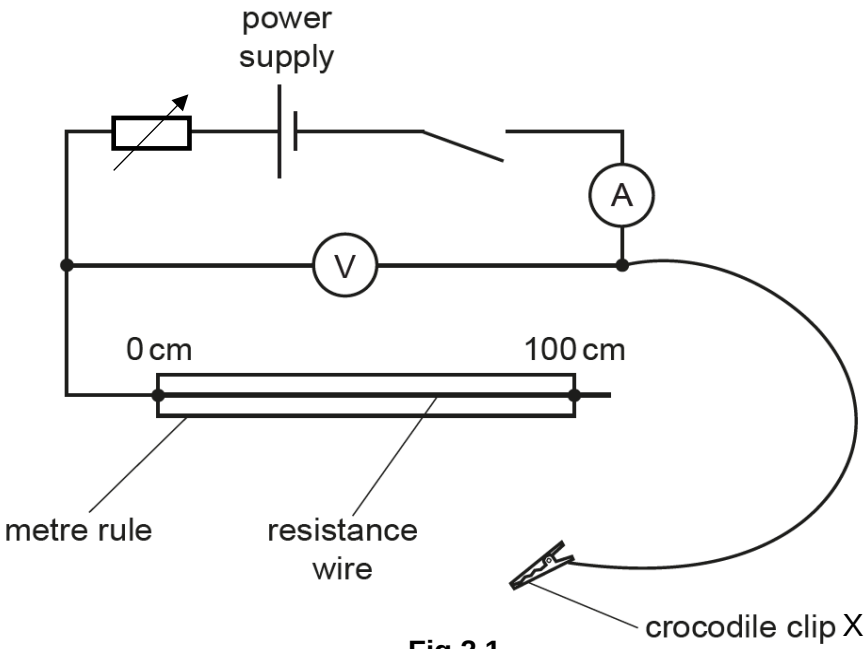

Fig.2.1

(a) The circuit shown in Fig. 2.1 has been set up for you.

(i) Connect the crocodile clip X at the 50.0 cm mark so that the length of resistance wire in the circuit is 50.0 cm.

Close the switch.

Adjust the variable resistor until the voltmeter reading is 1.00 V. Measure and record potential difference (p.d.) V_1 across the resistance wire and the current I_1 through the resistance wire.

Open the switch.

V_1 = ...

I_1 = ... [1]

(ii) Calculate the power P dissipated across the 50.0 cm length of wire using the equation shown.

$$P_1 = V_1 \times I_1.$$

P_1 = ... [1]

(b) Do not adjust the variable resistor. Remove the crocodile clip X and connect it so that the length of resistance wire in the circuit is 80.0 cm.

(i) Close the switch.

Measure and record the potential difference (p.d.) V_2 across the wire and the current I_2 through the wire.

V_2 = ...

I_2 = ... [1]

(ii) Calculate the power P_2 dissipated across the 80.0 cm length of wire.

P_2 = ... [1]

(c) A student claims that $P = GL$.
where G is a constant.

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

In your plan, you should:

- identify **one** other key variable,
- describe of how you would perform the experiment,
- sketch the graph that you would obtain using preliminary observations,
- how A can be obtained from your graph.
- Explain **one** precaution that you should take to ensure the accuracy of the experiment.

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Section B

3. In this experiment, you will determine the focal length of a thin converging lens.

You have been provided with

- a converging lens,
- a lens holder,
- cross wire object,
- a light source mounted on a stand,
- a screen,
- a metre rule.
- an A4 piece of card

(a) Describe how you could estimate the focal length of a converging lens using just a lens and a screen.

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……[1]

(b) Set up the apparatus as shown in Fig. 3.

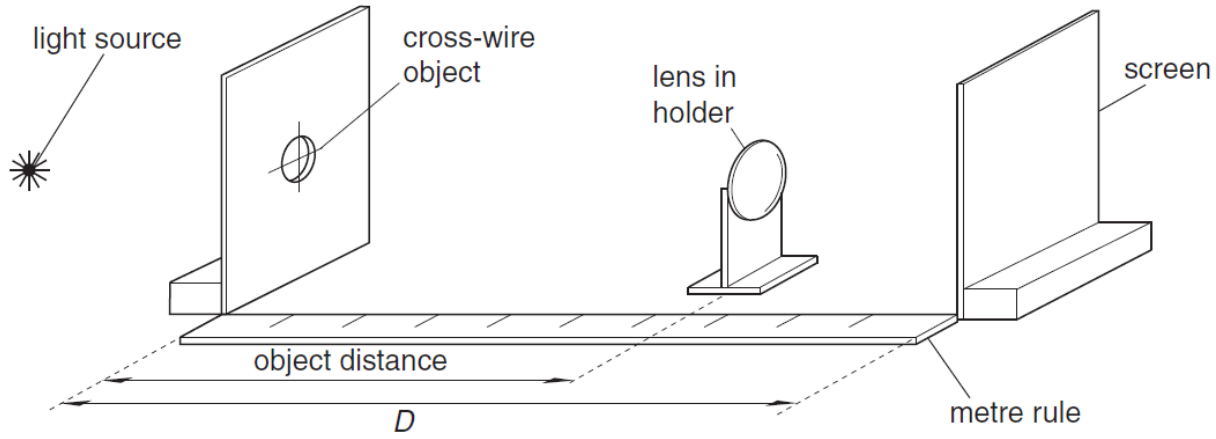

Fig. 3

The cross-wire object is at the 0.0 cm end of the rule and the screen is at the 90.0 cm mark.

By only changing the position of the lens, obtain an image on the screen that is **smaller** than the object. You may hold the A4 piece of card above the set-up to block some light from the surroundings in order to see the image more clearly.

Measure and record the distance u_s, between the object and the centre of the lens when the image is **smaller** than the object and is in sharp focus on the screen.

u_s = ……[1]

(c) By changing the position of the lens, obtain an image on the screen that is **larger** than the object.

Measure and record the distance u_L, between the object and the centre of the lens when the image is **larger** than the object and is in sharp focus on the screen.

u_L = ……[1]

(d) Describe two ways in which you ensured your values for u_s, and u_L, was accurate.

1……

……

2……

…… [2]

(e) In order to change from an image that is smaller than the object to an image that is larger than the object, the lens has been moved by a distance d.

(i) Calculate d using $d = u_s - u_L$.

d = ……[1]

(i) Calculate y using $y = D^2 - d^2$,
where D is the distance between the object and the screen.

y = ……[1]

(b) Repeat **(b)** and **(c)** using different values of D in the range of 60 cm to 100 cm. The object should remain at the 0.0 cm mark on the rule and the position of the screen should be changed to give different values of D. Record your results for D, u_s, u_L, d, D^2, d^2 *and* y in a table, including those from **(b)** and **(c)**.

[5]

(c) Using the grid opposite, plot a graph of y *against* D. [4]

(d) Determine

(i) the gradient G of your graph,

G = ……[2]

(ii) the focal length of the lens using using the equation $f = G / 4$.

f = ……[1]

(e) Suggest why the experiment cannot be conducted for values of D that is less than 50 cm.

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……..... [2]