Name: _____ ( ) Class: Sec 4 / ( )

南华中学

NAN HUA HIGH SCHOOL

PRELIMINARY EXAMINATIONS 2025

Subject : Physics

Paper : 6091/3

Level : Secondary Four

Date : 12 August 2025

Duration : 1 hour 50 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces at the top of this page and on any separate answer paper used.

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 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 these observations are made.
An account of the method of carrying out the experiment is **not** required.
The use of 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	

This paper consists of **15** printed pages.

Section A

1 *In this experiment you will investigate the deviation of a ray of light that is reflected internally from the surface of a rectangular transparent block.*

You are provided with:

- a transparent block
- Light source with slit,
- 30-cm ruler,
- protractor,
- an A4 paper

(a) **(i)** Measure the length (L), width (W) and height (H) of the transparent block using the 30 cm ruler.

L = _____

W = _____

H = _____ [1]

(ii) Given that the mass of the glass block is 416 g.

Calculate the density of the glass block.

density = _____ [2]

(b)

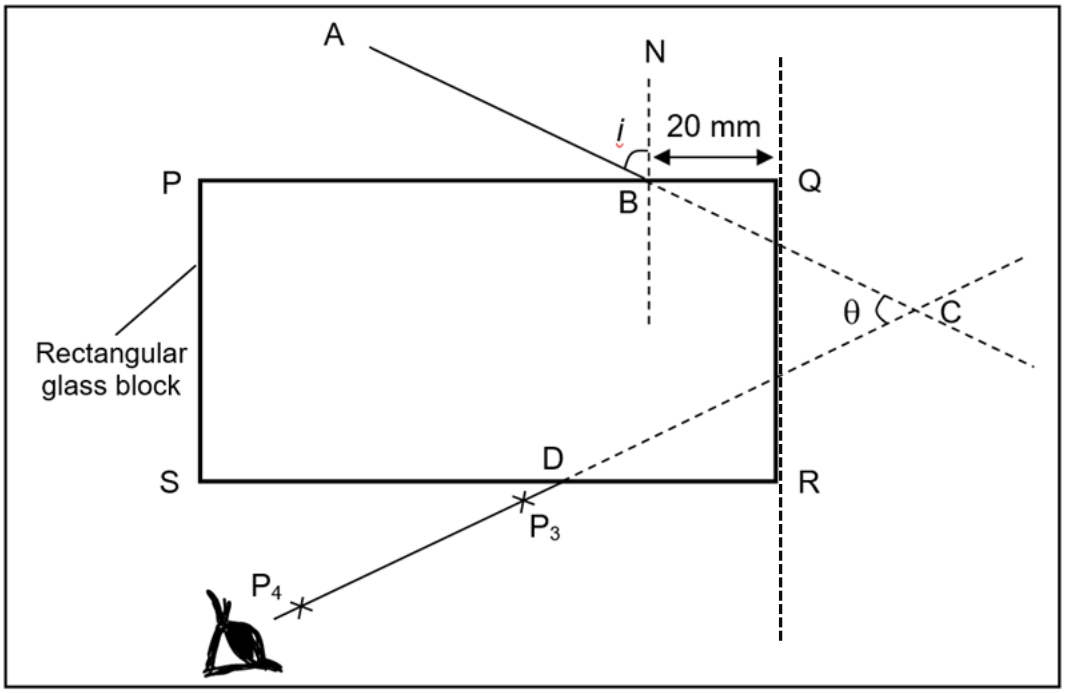

Fig. 1.1

On Fig. 1.2 on page 5 of your question paper,

Trace the outline of your glass block and label it **PQRS** as above. Align the short side QR along the dotted line.

Mark a point **B** on edge **PQ** at 20 mm from **Q**. Draw a dotted line at **B** perpendicular to **PQ** and label it **N** to represent the normal.

Draw a line which makes an angle of incidence (***i***) of 40 ° with the normal.

(i) Measure and record ***i***.

i = _____ [1]

Place the glass block onto the outline marked **PQRS**.

Turn on the light source to illuminate the slit.

Position the illuminated slit so that a single ray of light is along the line.

The light ray will emerge from the edge **SR** of the glass block as shown in the diagram.

You may use the A4 paper provided shade the diagram (to block the ambient light in the room) if the emergent ray is not clear enough.

Mark two points $\mathbf{P_3}$ and $\mathbf{P_4}$ on the emergent ray.

Remove the glass block and draw a straight line passing through $\mathbf{P_3}$ and $\mathbf{P_4}$ till it intersects with side SR at point D. Extend this line with dotted line. (See diagram)

Extend the line AB with a dotted line until it intersects with the dotted line you have drawn earlier.

(ii) Measure and record the angle θ between BC and DC and the perpendicular distance (x) between C and face QR

θ = _____ [1]

x = _____ [1]

(c) State two precautions which you took to ensure the experiment was performed as accurately as possible.

---

[2]

(d) Identify two sources of error which make the measurements taken to be inaccurate.

---

[2]

[Total: 10]

Fig. 1.2

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2 *In this experiment, you will investigate an electric circuit containing a light-dependent resistor (LDR).*

You are provided with:

- a lamp,
- a light-dependent resistor with blue tack,
- a power supply,
- a fixed resistor of resistance 470 Ω,
- a ruler,
- a stand and boss,
- a switch,
- a voltmeter and two connecting leads
- 6 connecting leads.

(a) Set up the circuit as shown in Fig. 1.1.

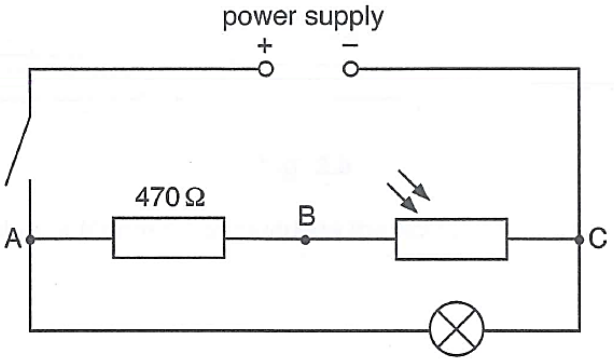

Fig. 2.1

(b) Set up the light-dependent resistor (LDR) and lamp as shown in Fig. 2.2. Secure the light bulb to the boss above the LDR. The boss can be moved up and down to change the distance between the LDR and the lamp. Set distance *d* to approximately 2.0 cm.

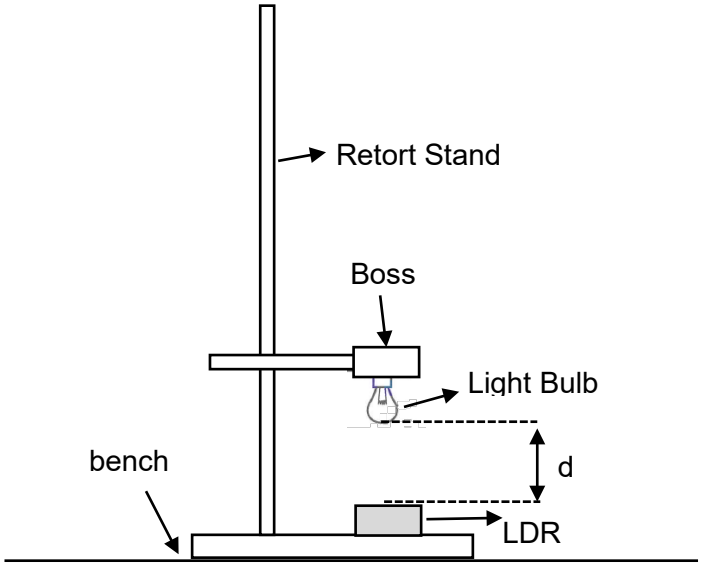

Fig. 2.2

(i) Measure the distance *d*.

d = _____ [1]

(ii) State one difficulty when making this measurement.

_____

_____ [1]

(c) **(i)** Connect the voltmeter across the terminals of the power supply. Close the switch.

Record the voltmeter reading V_S.

V_S = _____

(ii) Connect the voltmeter across points A and B. Close the switch.

Record the voltmeter reading V_{AB}.

V_{AB} = _____ [1]

(iii) Open the switch.

The current I in the fixed resistor is given by the equation

$$I = \frac{V_{AB}}{R}$$

Where R = 470 Ω.

Calculate I.

I = _____ [1]

(iv) Calculate the resistance R_L of the LDR using the equation

$$R_L = \frac{V_L}{I}$$

Where the potential difference (p.d.) V_L across the LDR is given by $V_L = (V_S - V_{AB})$.

R_L = _____ [1]

(d) A student who is investigating the relationship between the resistance of the LDR and the distance from the LDR to the light source, claims that the relationship should be

$$R_{LDR} = 2\gamma d + k$$

where R_{LDR} *is the resistance of the LDR, d is* the distance from the light source, *k* and γ are constants.

Plan an experiment using the above relationship to determine the constant γ using a graphical method.

Your plan should include

- the quantities that you should keep constant,
- a detailed description of how you would perform the experiment,
- 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 for the constant γ from your graph.

[5]

[Total: 10]

Section B

3 *In this experiment, you will investigate the oscillation of a mass on a spring.*

You are provided with:

- two stands, bosses and weights
- a piece of adhesive putty moulded to a spring
- a rod
- a small piece of adhesive putty
- a stop-watch
- a rule

The supervisor has set up the apparatus, as shown in Fig. 3.1.

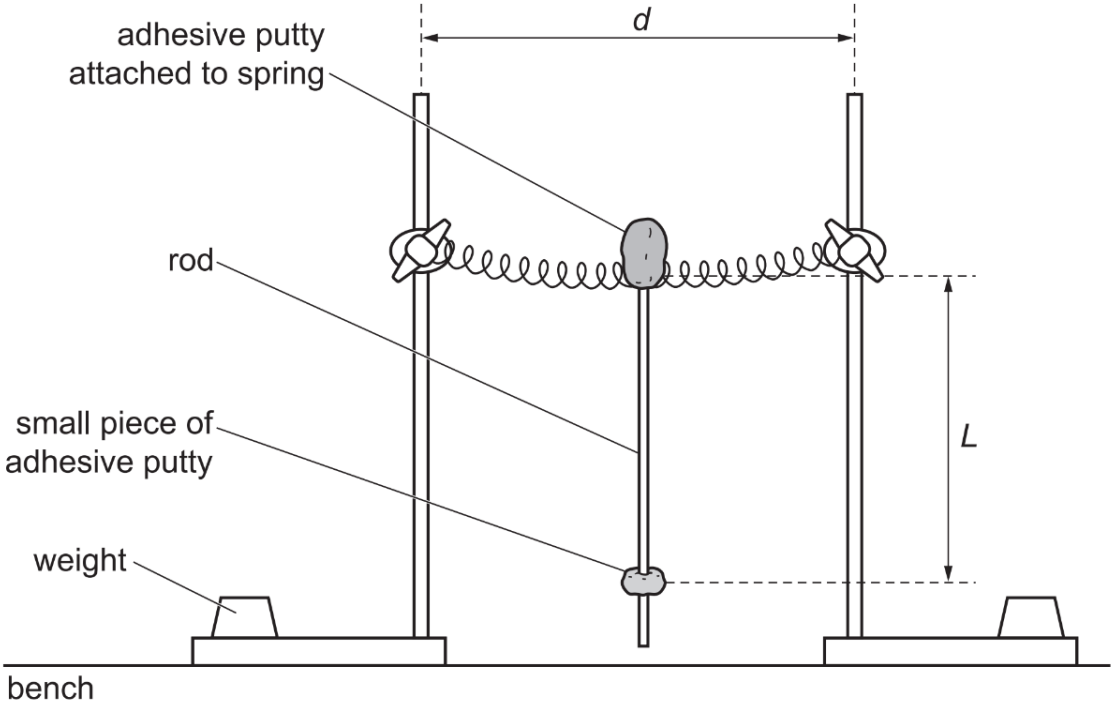

Fig. 3.1

(a) Describe two ways that the apparatus is arranged to reduce the risk of the stands toppling over.

1. .....

.....

2. .....

..... [2]

(b) **(i)** Adjust the position of the stands so that d = 26 cm. While moving the stands, take care that the spring does not become loose.

Adjust the position of the small piece of adhesive putty so that it is approximately 3.0 cm from the lower end of the rod. Press it firmly to the rod to ensure that it does not slip off.

Measure and record the distance, L in cm, from the centre of the spring to the centre of the small piece of adhesive putty.

L = _____ [1]

(ii) Calculate $\frac{L^2}{100}$.

$\frac{L^2}{100}$ = _____ [1]

(c) **(i)** Pull the bottom tip of the rod towards you by approximately 20.0 cm. Release the rod so that it swings freely.

Describe a technique for determining an accurate time T for one oscillation.

_____

_____ [1]

(ii) Determine an accurate value for the period T of the rod.

T = _____ [2]

(iii) Calculate T^2.

T^2 = _____ [1]

(d) Repeat steps **(b)** and **(c)** for further values of *L*.
Record your results for *L*, $\frac{L^2}{100}$, *T* and T^2. Include all of your results. [4]

(e) Using the grid provided, plot a graph of T^2 against $\frac{L^2}{100}$. [4]

Draw a straight line of best fit.

(f) Determine the gradient G of your line.

G = _____ [2]

(g) A student suggests that the best fit of line should be a curve.

State and explain whether the points on your graph support this suggestion.

_____

_____

_____ [1]

(h) Another student suggests that the measurement of T when L is large is more accurate than when L is small.

Explain whether your observations support this suggestion.

_____

_____ [1]