PHYSICS PAPER 2 (PRACTICAL)

Answer **all** *questions.*

You should not spend more than one and a half hours on Question 1.

Question 1 **[10]**

This experiment determines the focal length of the given convex lens by **no parallax** method.

You are provided with:

(i) A lens holder

(ii) A convex lens

(iii) Two optical pins

(iv) An optical bench

Note: *The experiment may be performed on a table top, using a metre scale, in case an optical bench is not available.*

Mount the given convex lens (L) on the lens holder. Adjust the heights of object pin (O) and image pin (I) till their tips lie on the principal axis of the lens.

Now, arrange them as shown in ***Figure 1***:

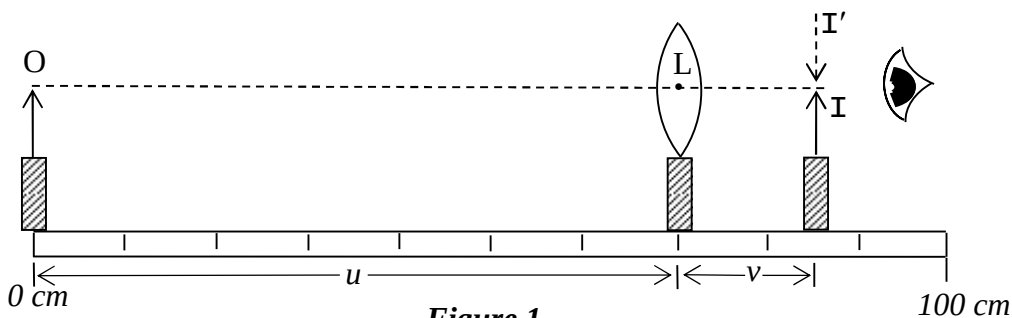

Figure 1

Object pin (O) is at zero cm mark and the lens (L) is at 70 cm mark so that the object distance (OL) = u = 70 cm. Look at the tip of the object pin, through the lens, from a distance. You will see a diminished and inverted image (I′) of the object pin.

Now, adjust the position of the image pin (I) till it coincides with I′. Thus, there is no parallax between I′ and I. Ensure that 'tip to tip' parallax is removed. Note this position (I) of the image pin and determine the image distance v = LI, correct up to **one decimal place**.

Show this reading to the Visiting Examiner.

Calculate q = $\frac{uv}{100}$ and p = $\left(\frac{u+v}{10}\right)$, both up to **one decimal place**.

Now, repeat the experiment for **five more** values of u in the range 20 cm to 70 cm. Each time, find v and calculate p and q.

Tabulate **all six sets** of values of *u*, *v*, p and q with their units given at the column head.

Plot a graph of q vs p, taking q on y axis. Take origin at (0, 0).

Draw the **line of best fit**. Find its slope 'm' using:

$$m = \frac{change\ in\ q}{change\ in\ p}$$

and record its value, correct up to **three significant figures**.

Find '*f* ' using $f = 10 \times m$ and record its value with proper unit, correct up to **one decimal** place.

Comments of Examiners

Record:

- In a few cases, the proper trend of u and v was not followed.
- Several candidates could not express u and v upto one decimal place with unit.
- A few candidates took 'u' out of range.
- Some candidates did wrong calculations of p and q and did not record them upto 1 decimal place after rounding off.
- In some cases, the unit was not written or written incorrectly.
- A few candidates wrote wrong formula, e.g. $P = \frac{U+V}{100}$ instead of $P = \frac{U+V}{10}$.

Graph:

- A number of candidates labelled the axes incorrectly.
- In some cases, kink was taken.
- Some candidates did not take a uniform and convenient scale;
- In a number of cases, the points were not plotted correctly – they were shown as blobs.
- Understanding of the concept of best-fit-line was found to be lacking in many candidates.

Deduction:

While finding slope, many candidates did not take two unplotted points. In some cases, slope was not expressed upto three significant figures.

Suggestions for teachers

- Tell students about the least count of different instruments and how to write the observations consistent with least count.
- Stress upon writing the unit.
- The concept of significant figures and the rules for rounding off values upto proper decimal place need to be clarified.
- Give practice in practicals on Optics so that students are confident of how to remove the parallax error to get correct reading.
- Instruct students to read the question paper carefully and underline the important points in pencil.
- Give sufficient practice in graphical skills which include :
  - Choice of uniform and convenient scale;
  - Correct labelling the axes with units;
  - Not to use kink along any axis.
  - Correct plotting of points;
  - Concept of best fit line.
  - Procedure to find slope (taking uplotted points).

MARKING SCHEME

Question 1.

RECORD [R]

(i) 5 correct sets of *u* and *v*

[Correct set means *v* decreases as *u* increases]

Unit of *u*, not necessary.

(ii) Correct calculation of p and q at least in six values with 1 d.p. with proper rounding off

Unit of q : cm^2 and p : cm

GRAPH [G]

(i) Axes labelled correctly with appropriate scales to cover 50% or more than half the graph paper with / without unit.

Kink not allowed

(ii) 5 correct plots: thin encircled points (blob is a mis plot)

Correct plot means if the plotting points lie within ±50% of one smallest division on both the scale of the actual point can be treated as correct plot.

(iii) Best fit line (At least the line passes very close to four points or within 5 divisions or 1 cm. perpendicular distance on both sides of the line drawn)

Line should be thin and uniform.

DEDUCTION [D]

Correct calculation of slope of the best fit line using two distant points (at least 50%), at least one unplotted point & correct up to 3 significant figures (proper rounding is necessary)

QUALITY [Q]

Candidate's *f* = Supervisor's *f* ± 2.5 cm. [condition f should lie between 7.0 cm to 13.0 cm]

f should be expressed with unit

Question 2 **[7]**

This experiment is based on **Wheatstone bridge** principle.

You are provided with:

(i) A 100 cm long and uniform metallic wire **AB** attached to a metre scale on a wooden board. It is provided with binding terminals at its ends.

(ii) A 50 cm long and uniform wire R wound on a wooden frame.

(iii) A resistance box **R.B.** of range 0 Ω to 10 Ω.

(iv) A plug key **K**

(v) A jockey **J**

(vi) A central zero galvanometer **G**.

(vii) 0 – 2V d.c. source **E**

(viii) A few connecting wires

Set up a circuit as shown in ***Figure 2*** below:

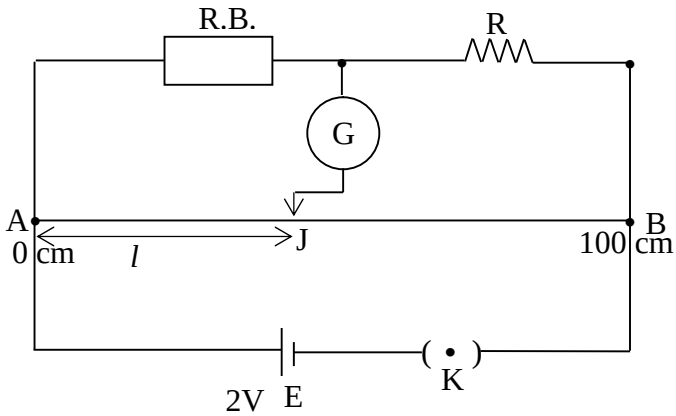

Figure 2

Ensure that all connections are tight.

Close the key K and take out 1 Ω plug from the resistance box, so that X = 1 Ω. Remaining plugs must be kept tightly closed. Gently touch the jockey on the wire AB and locate its position J for which the galvanometer G shows no deflection.

Note and record the length AJ = *l* in cm, correct upto **one decimal place**.

Show this reading to the Visiting Examiner.

Repeat the experiment and obtain **four more** values of *l* with X = 2, 3, 4 and 5 Ω. For each value of X, compute Y $= \frac{100X}{l}$ correct up to **one decimal place** only.

Tabulate all five sets of values of X, *l* and Y with their units.

Plot a graph of Y against X, taking origin at (0, 0).

From the graph, read and record Y_0 the value of Y, when X = 0.

Comments of Examiners

Record:

- In some cases, the trend (X proportional to L) was not observed.
- The value of Y = $\frac{100x}{l}$ was not calculated correctly in a number of cases.
- Several candidates who calculated 'Y' correctly, did not express it upto one decimal place.

Suggestions for teachers

- Develop the habit among students of writing the least count of any instument and to express readings in consistence with least count of the instrument used, along with appropriate unit.

Graph:

Common mistakes observed in the answers were:

- The axes were not labelled correctly.
- In some cases, kink was taken.
- Understanding of the concept of best-fit-line was found to be lacking in many candidates.
- Candidates plotted blobs intead of points.

Deduction:

Several candidates could not read 'Y_0' from the graph correctly.

- Check the practical record books regularly and give feedback to students on the mistakes made by them so that their concepts are clear.
- A lot of emphasis needs to be laid on development of graphical skills among students.

MARKING SCHEME

Question 2.

RECORD [R]

(i) Four correct sets of X and l (Correct set means l increases as X increases) with l recorded up to 1 d.p. with unit atleast in three sets.

(ii) Correct calculation of Y up to 1 d.p. in at least three sets with proper rounding off

GRAPH [G]

(i) Labelling of axes with appropriate scales to occupy more than half the graph with / without unit.

Origin (0,y) or (0,0) must be taken. Remaining same as in question one.

(ii) Three or more correct plots

(iii) Line of best fit

DEDUCTION [D]

Value of Y_0 read correctly [means ± 50% of one smallest division] from graph

Question 3 **[3]**

Determine the value of unknown resistance R for X = 2, 3 and 4 Ω, using:

$$R = \frac{(100 - l)X}{l}$$

Tabulate **all the three sets** of values of X, l and R.

Find and record the mean value of R, correct up to **one decimal place**, with proper unit.

Comments of Examiners

Record:
- A few candidates calculated only one value of R.
- Some candidates made mistakes in calculations.

Deduction:
- Some candidates did not calculate the mean value of R.

Quality:
- A few candidates did not express the mean value of R upto one decimal place.
- In some cases, the unit of R was not written or written wrongly.
- In a few cases, the mean value of R out of range.

Suggestions for teachers

Instruct students to utilise the fifteen minutes reading time for going through the question paper carefully. Ask them to underline the important parts.

- Writing of physical quantity with unit and knowledge of rounding off are essential. For this, practice needs to be given in class.

MARKING SCHEME

Question 3.

RECORD [R]

Correct calculation of R in all the two or three sets.

DEDUCTION [D]

Mean value of R calculated correctly for two or three sets.

QUALITY [Q]

Candidate's value of R R recorded up to1or 2 d.p. with unit.	=	Supervisor's value of R ± 20% of R. Condition: R should lie within 1.20Ω to 2.80Ω

Question 4

Show the following to the Visiting Examiner for assessment:

Project **[7]**

Physics Practical File. **[3]**

GENERAL COMMENTS:

a) Topics found difficult by candidates in the Question paper:

- Removal of parallax.
- Concept of significant figures.
- Rounding off any value upto 1d.p or 2d.p.
- Record of readings in consistence with the least-count of instruments.

In the Graph:

- Marking of origin.
- Selection of proper uniform and convenient scales.
- Meaning of correct plotting.
- Concept of best fit line.
- Finding of slope.

b) Concepts between which candidates got confused:

- Confusion about the concept of parallax error.
- Record of u and writing u as negative as per sign convention.
- Writing of v upto 1d.p.
- Calculation of p and q as per instructions.
- Trend of u and v in Q1 and X and 'l' in Q2.
- Concept of significant figure and rounding off .
- Marking origin.
- Taking a uniform and convenient scale
- Making the best fit line.
- Finding the slope.
- Proper choice of axes.

c) Suggestions for students:

- Read the theory related to the experiment before starting an experiment and try to understand the trend followed between any two physical quantities by understanding theoretical aspects.
- Find out the least count of various instruments and learn how to write readings that are consistent with L.C of the instrument, with proper unit.
- Learn to write values upto correct significant figures (take 20 sets of observations and write them in 1s.f, 2s.f and 3s.f).
- Practice making graphs [marking the origin, selecting a uniform and convient scale, correct plotting, making a thin uniform best fit line and finding the slope].
- Read the Question paper carefuly within alloted time (15 minutes) and underline by pencil the important points asked.
- Record the observations neatly, in a tabular form, with proper heading and with units as per the instructions.
- Do not waste time by writing unnecessary information which is not asked.