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ISC 2008
PHYSICS - 2
(PRACTICAL)

- **SOLUTION OF 2008**
- **COMMENTS OF COUNCIL EXAMINERS**
- **SUGGESTIONS FOR TEACHERS**

Dedicated to all my lovely students. May God help you always.

This small booklet contains solution of ISC 2008 Physics Paper 2 (Practical).

The comments from the council examiners under solution of every question makes this a very handy guide for students to understand what the council expects as answer from the students.

I hope that the students will find this to be useful.

- *Md. Zeeshan Akhtar*

5th February, 2016.

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PHYSICS PAPER 2 (PRACTICAL)

Question 1 **[10]**

This experiment determines the focal length of a convex lens by the displacement method.

Determine the approximate focal length f of the given convex lens (marked L) by projecting the image of a distant object on a wall or a screen. Record the value of f in cm.

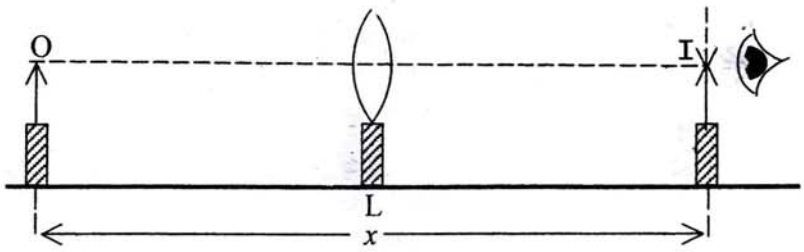

Figure 1(a)

Now arrange the object pin O, the image pin I and the lens on the optical bench or table top as shown in figure 1(a) so that the tips of O and I lie on the principal axis of the lens. Adjust the distance x between O and I to be nearly equal to $(4f + 10)$ cm. Ensure that this separation is maintained constant throughout this particular setting.

Move the lens towards the pin I and adjust its position until the diminished and inverted image of O coincides with the image pin I. Record the position L_1 of the lens.

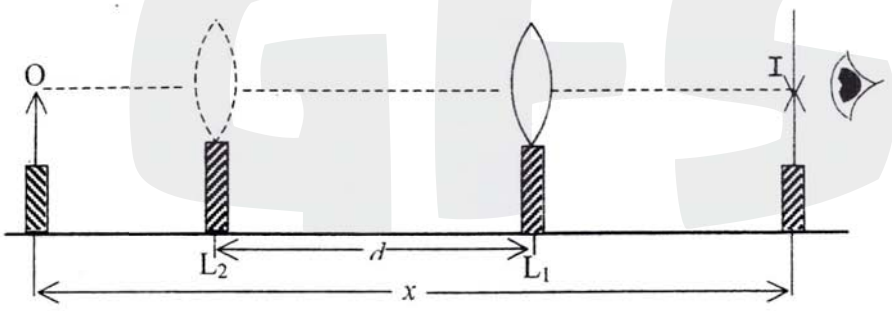

Figure 1(b)

Now move the lens towards the object pin O and adjust its position as shown in figure 1(b) until the magnified and inverted image of O coincides with I. Record the new position L_2 of the lens. The difference between the two positions L_1 and L_2 of the lens is the displacement d of the lens. Determine d and record its value.

Repeat the experiment to obtain four more sets of x and d, taking values of x in the range $(4f + 10)$ cm and 100 cm.

Note that for each set, the positions of O and I are maintained constant and the parallax between the image of object pin and image pin is removed by moving the lens only.

MARKING SCHEME

Question 1.

Record

Approximate focal Length of the given convex lens by distant object method rounded correctly up to 1 d.p. in cm only.

Six readings positions of L_1 & L_2 with proper units, significant figures in tabular column (in one d.p. with or without unit)

4 correct sets of x & d (d increases when x increases) with or without unit. (Tabular form)

4 correct 'd' values such that $d = L_1 \sim L_2$ with unit.

y values recorded correctly upto 3 s.f . (at least for 3 sets)

(Correct calculations).

Graphs

Axis labeled (unit), Proper scale chosen plots must have 60% of the Graph Paper on either sides (axis).

4 points plotted correctly with thin, uniform line of best fit (blob is a misplot).

A thin, uniform line of best fit extended till beyond the last plot on either sides.

Deduction

Δ x & Δ y are correctly read from the graph (from 2 points widely separated, 1 point should be non plotted).

Correct calculation of the slope ($S = \Delta y / \Delta x$) & correct calculation of $Q = 10 S$ (1 d.p.)

Question 2 **[7]**

This experiment determines resistivity of the material of a wire. You are provided with a 1 m long uniform wire AB stretched along a metre scale and provided with binding terminals at the two ends. You are also provided with a resistance box RB, a piece of wire 'P' wound on a wooden bobbin and provided with binding terminals, a jockey 'J', a 2 V d.c. power supply (E), a plug key 'K', a centre-zero galvanometer 'G' and a few connecting wires.

Now set up the circuit as shown in Figure 2 below. Ensure that all connections are tight.

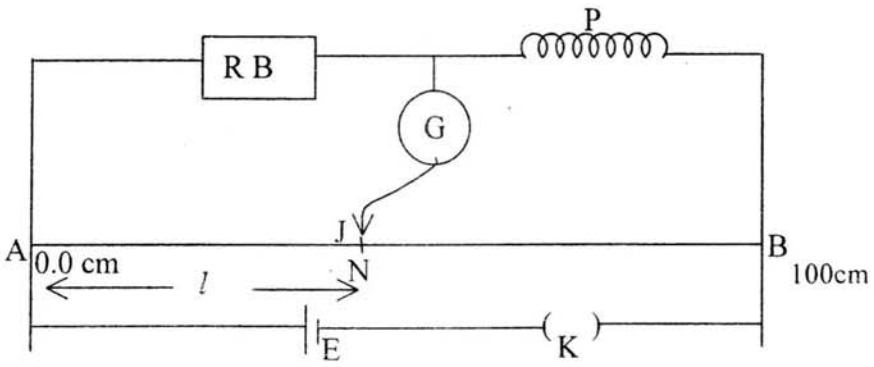

Figure 2

Take out R = 1Ω plug from the resistance box RB. By touching the jockey at various points on the wire AB, find the null point N for which the galvanometer shows no deflection. Record l = AN in cm. Repeat the experiment for five more values of R in the range 1Ω – 10Ω, each time finding and recording the value of l.

Tabulate the values of R, l and $y = \frac{100\,R}{l}$. Compute y upto 1 decimal place.

Plot a graph of y *vs* R and draw the line of best fit. Determine the slope S of the line using $S = \frac{\text{Change in y}}{\text{Change in R}}$.

Record the value of S upto three significant figures. From the graph, read and record the value Y_o of Y when $R = 0$.

Comments of Examiners

Some of the mistakes committed by candidates in this question are as listed below:

Record:

- The value of resistance (R) and null point (l) were not recorded with units and the readings were not consistent with the least count of the instruments.
- Value of y was not calculated correctly with proper rounding off.

Graph:

- Inconvenient scales were used for plotting graphs – the axes were reversed in several cases;
- Origin was not marked (0,0);
- The axes were not labeled;
- A thin uniform best-fit line was not drawn. In many cases, it did not extend beyond the extreme plotted points.

Slope:

- Observed values were used for calculation of slope from the graph.
- Slope was not calculated up to three significant figures.
- Value of Y_0 was not recorded correctly from the graph.

Suggestions for teachers

- Teach students that observations/ records should be multiples of the L.C. of the instrument.
- Teach students how to calculate and record up to proper decimal places and significant figures.
- Tell students not to calculate the slope by using data points (observed values) but by using any two distant and convenient points from the graph (using more than half of the line).
- Emphasize on starting the origin at (0,0) for intercept and shift origin instead of kink for spreading of points on the graph sheet.
- Emphasize on regular 'graph work' during practical classes.

MARKING SCHEME

Question 2.

Record

4 correct sets of R & *l* with units (*l* increases as R increases) unit in both l & R.

Graph

Axis labeled (unit), Proper scale chosen, plots must have 60% of the graph paper on either sides (axis).

4 points plotted correctly with thin, uniform line of best fit (blob is a misplot).

A thin, uniform line of best fit extended till beyond the last plot on either side.

Deduction

Correct calculation of slope S = Δ y /Δ R (3 s.f.), covering more than ½ the line (at least 1 unplotted point) with or without unit.

Quality

Y_0 : the value of Y from the Graph when R=0

$$Y_0 = \left[\frac{\text{Resistance per m. provided by school}}{2}\right] \pm 0.3 \quad \textbf{OR} \quad 1.3 \leq Y_0 \leq 2.5$$

Question 3 **[3]**

Find the least count of the given micro meter screw gauge. Using it, determine the diameter 'd' of the sample wire 'W'. Find and record the radius *r* of the wire in cm in your answer paper. Using this value of *r* and the value of Y_o of Question 2, find the value of K where:

$$K = \pi r^2 Y_o \times 10^4.$$

Comments of Examiners

A number of candidates were unable to calculate the least count of the screw gauge correctly. Units were omitted in many cases. In some cases, the value obtained after dividing the diameter by 2, was not rounded off to be consistent with the least count of the screw gauge.

Suggestion for teachers

- Experiments on measurement of physical parameters involving various instruments should be done regularly.

MARKING SCHEME

Question 3.

L.C. of screw gauge with the unit (mm, cm, m).

(Working may or may not be given)

Calculation of diameter of the wire and recording radius 'r' in cm. consistent with the L.C. of micrometer screw gauge.

Correct calculation of K (with or without unit)

$[13 \leq K \leq 25]$

Topics/ concepts found Difficult

- Understanding the relevant theory of the experiments.
- The concepts of significant figures and Least Count of an instrument.
- Making proper graphs - choosing a proper scale, calculation of slope, drawing the line of best-fit, etc.
- Obtaining the two positions L_1 and L_2 of the lens for no parallax. (Q 1).
- Calculating slope from the graph and finding out Y_o from the graph (Q 2).

Suggestions for Candidates:

- Read the question carefully and follow the instructions given.
- The value of a quantity or any observation must always be supported with correct units.
- Record all observations up to appropriate number of decimal places depending on the least count of the measuring instrument.
- Round off calculated values to appropriate number of significant figures.
- In the Graph:
  - The axes must be labeled with units. Origin must be marked and its coordinates must be given.
  - Take care in choosing the correct scale. Scales should be uniform and convenient. The plotted points must cover more than half of the graph sheet.
  - The plots should be clear small dots, which should be encircled. The plots (i.e. points) must be correct to the nearest division of the graph sheet and must fall on the grid.
  - A best-fit straight line is the aggregate of all the points; hence it should be symmetric to all plots and extended on both sides. A thin uniform best-fit line should be drawn.
  - In case of scattered points, draw a mean graph, such that the non-linear points are symmetrically spaced about the line drawn.
  - Calculate the slope taking two unplotted points on the straight line, which are widely separated and indicate those points. Do not calculate slope from the observation table.