PHYSICS PAPER 2 (PRACTICAL)

Answer **all** *questions.*

You should not spend more than one and a half hours on each question.

Question 1 **[10+2]**

This experiment determines **resistivity** of the material of the given wire. It is based on **Wheatstone Bridge** principle.

You are provided with:

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

(b) A coiled resistor **P** on a wooden frame with terminals.

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

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

(e) 2V d.c. source **E**.

(f) A jockey **J**.

(g) A plug key **K**.

(h) A specimen wire **W**.

(i) A micrometer Screw Gauge

(j) A few connecting wires

(A) (i) Arrange the circuit as shown in ***Figure 1*** below. Make sure that all connections are tight.

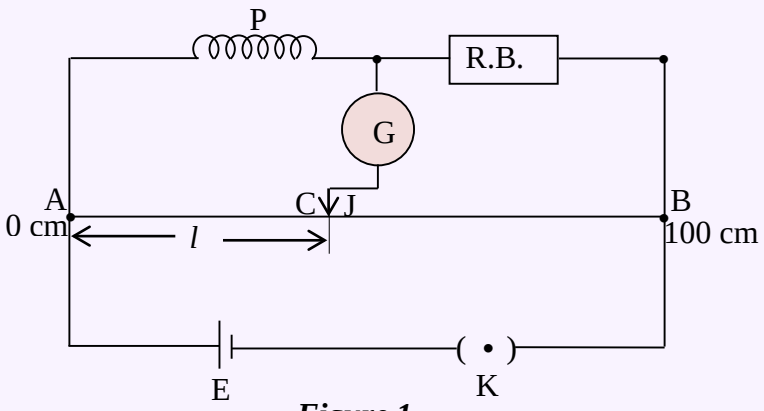

Figure 1

(ii) Keep the value of E at 2V.

(iii) Close the key K. Take out a 1Ω plug from the resistance box R.B so that $x = 1\Omega$.

(iv) Place the jockey J gently at different points on the wire AB till at a certain point C, the galvanometer G shows no deflection. Note and record the length AC = *l in cm*, correct upto **one decimal place**.

(v) Repeat the experiment to obtain **five more** values of l with x = 2Ω, 3Ω, 4Ω, 5Ω and 6Ω.

(vi) For **each value** of x, calculate $y = \frac{100}{l}$ correct upto **two decimal places**.

(vii) Tabulate all **six** sets of values of x, l, and y with their units.

(viii) **Show any one of the readings in (vii) above, to the Visiting Examiner.**

(ix) Now plot a graph of y vs x.

(x) Draw the line of best fit.

(xi) Determine its slope S, using:

$$S = \frac{change\ in\ y}{change\ in\ x}$$

and record its value in your answer booklet.

(B)(i) Determine the **least count** of the given Screw Gauge and record its value in mm.

(ii) Using this Screw Guage, determine the diameter 'd' of the given specimen wire W in mm and record its value in your answer booklet.

(iii) Now calculate K where:

$$K = \frac{\pi d^2}{200S} \times 10^6$$ (where S is the value of the slope determined in Q.1A.)

and record its value in your answer booklet.

(Note: K is a measure of resistivity of the material of the given specimen wire.)

Comments of Examiners

(A)(i) **Record**

- In some cases the correct trend of the experiment was not observed.
- In several cases, l was not expressed up to one decimal place.
- Calculation of y was not corrected up to two decimal places.
- Many candidates did not write the units of x, l and y.

(ii) **Graph**

- A number of candidates did not know how to draw the best fit line.
- Candidates did not seem to know how to draw a graph – a thick line was drawn; proper scale was not taken, the origin not marked by two coordinates, etc.

Suggestions for teachers

- Teach students how to write the least count of any instrument with proper units. Stress upon the fact the observations must be consistent with the least count.
- Show students different instruments such as, the metre scale, Vernier callipers, screw gauge, ammeter, voltmeter, etc. and tell them to write the least count. Teach students how to write observations in consistence with the L.C of the instrument, with correct unit.
- Tell students about d.p, s.f and how to round off value up to 1 d.p, 1s.f, 2s.f , etc.

(A)(iii) **Deduction**

Mistakes were made by many candidates in calculation of the Slope.

(B) (i) **Record**

- A number of candidates wrote absurd values of least count/ wrong unit of was written.
- In some cases, the diameter was not recorded correctly or the value was not consistent with Least Count.
- Many candidates made mistakes in calculation of K; in a few cases incorrect values were obtained due to wrong substitution of diameter (d) or Slope (s).

Suggestions for teachers

– Enough practice must be given in practical work and the mistakes made by students during practical must be brought to their notice so that the same can be rectified. Give special emphasis on measurement, unit, significant figures, etc., so that mistakes are minimised.

– Give sufficient practice in graphical skills which include: (i) Proper labelling with unit, (ii) Marking of origin with two coordinates without kink, (iii) Choice of a uniform and convenient scale (tell students about inconvenient scale, e.g. 1 div. =0.3,0.33,0.67,0.66 etc. not to be taken) (iv) Meaning of correct plotting (vi) Concept of best fit and how to draw the best fit line. (vii) Determining the Slope (for slope take two unplotted points on the line that are widely separated.)

– Instruct students to read the question paper carefully and underline the important points in pencil.

MARKING SCHEME **Question 1 A.**	
RECORD [R]	
(i)	Five correct sets of x and l [Correct set means, l decreases as x increases]
(ii)	Correct calculation of y, at least in 3 sets, up to 2 d.p. (with or without rounding off).
GRAPH [G]	
(i)	Axes labelled correctly, covering more than 50% of either axis, with or without the units. The scale should be convenient and uniform, starting from the origin. (If the scale taken is uniform on both the axes, without the origin marked, it can be considered correct.) Kink not allowed. Interchange of axis allowed.
(ii)	At least four points plotted correctly. Correct plot means, plotted points may be $\pm$ 50% of the one division on both the scales from the actual point to be plotted. Blobs (●) are a misplot.

(iii)	The best fit line should be thin and uniform, with respect to any four plots, where line should be extended on both the sides. For best fit line, four points must lie within 1.0 cm on either side of the line drawn.
DEDUCTION [D]	
(i)	For correct calculation of the slope of the best fit line, using two distant points (separated 50% or more than 50% of the line segment between first and last plot), taking at least one unplotted point.
(ii)	Correct calculation of slope
Question 1 B.	
RECORD [R]	
(i)	Record of the least count of screw gauge in mm. (L.C. may be .01mm, .005mm etc. or as per the report of the Physics Practical) and record of the diameter (in consistence with L.C with/without unit).
(ii)	Correct calculation of K by substituting the value of the slope S recorded in Question 1A and value of the diameter (ignore unit)

Question 2 **[8]**

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

You are provided with:

(a) A lens holder

(b) A convex lens

(c) Two optical pins

(d) 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.*

(i) Arrange the object pin **O**, the image pin **I** and the lens **L** on an optical bench or table top as shown in ***Figure 2*** so that the tips of **O** and **I** lie on the principal axis of the lens.

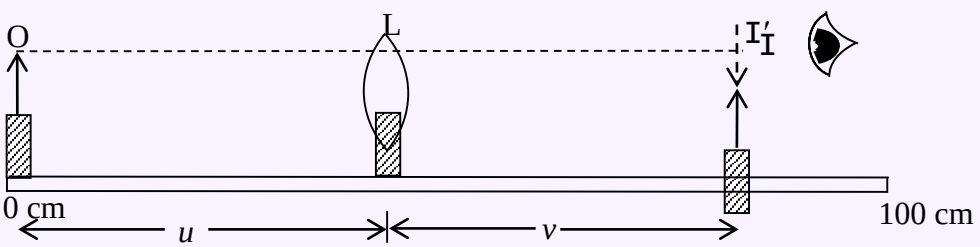

Figure 2

(ii) Keep the object pin O at 0 cm mark and the lens L at 60·0cm mark, so that the object distance between O and L = u = 60·0 cm.

(iii) Look at the object pin through the lens, from a distance. You should see an inverted and diminished image I′.

(iv) Adjust the position of the image pin I, so that there is no parallax between I and I′. Ensure that **tip to tip** parallax is removed.

(v) At **no parallax**, note the position of the image pin I on the metre scale, correct upto **one decimal place**.

(vi) Determine the image distance v = distance between L and I, correct upto **one decimal place**. Record this value of v in your answer booklet.

(vii) Repeat the experiment for **four more** values of u, i.e. u = 50 cm, 40 cm, 30 cm and 20 cm. Each time, remove the parallax and find v.

(viii) For each value of u, calculate $p = uv$, $q = u + v$ and $f = \frac{p}{q}$.

(ix) Tabulate all **five** sets of u, v, p, q and f with their units.

(x) **Show the image position when the parallax has been removed, in any one of the readings in (ix) above, to the Visiting Examiner**.

(xi) Find **F**, which is the **mean** of all the **five** values of f.

(xii) Record the value of **F** correct upto **one decimal place** with its unit, in your answer booklet.

Comments of Examiners

Record

- A number of candidates were not able to remove parallax error completely;
- The trend of the experiment was not observed in several cases;
- Several candidates did not record 'v' up to one decimal place; the unit was also missing in several cases.
- Many candidates did not take the values of u within given range as per Question paper.

Deduction

- Several candidates made errors in calculation of 'f'. A few candidates did not round off '' to one decimal place.
- In some cases, the unit of 'f' was not written.

Quality

- A number of candidates lost marks as they did not express mean focal length F upto 1d.p (after proper rounding off) and also without proper unit.
- In some cases, the focal length F obtained was out of the specified range.

Suggestions for teachers

– Tell students to read the question paper carefully and underline the important points. Instruct them to follow the instructions given in the question paper.
– Explain the concept of parallax error and give enough practice in the removal of parallax error.
– Tell students the trend (e.g. u α 1/v) and give them enough practice.
– Stress upon the importance of units, decimal place, significant figures and rounding off.
– Instruct candidates that the final results must be expressed in proper d.p. or s.f. as per the question.

MARKING SCHEME **Question 2**	
RECORD [R]	
Five correct sets of *u* and *v*. [Correct set means v decreases as u increases]	
DEDUCTION [D]	
(i)	Correct calculation of *p* & *q* in at least six values.
(ii)	Correct calculation of ***f*** in at least three sets.
(iii)	Correct calculation of F
QUALITY [Q]	
Candidate's F lies between the range 7.5cm to 12.5cm (F is expressed up to one d.p., with proper rounding off and with the unit)	

GENERAL COMMENTS:

(a) Topics found difficult by candidates in the Question Paper:

- Removal of parallax error.
- Proper knowledge of d.p, s.f. and rounding off to required d.p. or s.f.
- Record of observation in consistence with L.C of the instruments.
- Graphical skills - marking of origin, choice of scale, correct plotting, drawing the line of best fit, finding the slope.

(b) Concepts in which candidates got confused:

- Concept of parallax error.
- Concept of best fit line.
- Concept of circuit diagram. (Not able to make the correct circuit because of which the trend was found to be wrong).

(c) Suggestions for candidates:

- Read the question carefully and follow the instructions, using only the formula given in the question paper for all the calculations.
- Do not waste time by writing unwanted things like apparatus required, theory, circuit diagram etc.
- Understand the theoretical concepts behind the experiment and understand the trend of the two variables in the experiment.

- Learn the correct use of instruments such as, meter scale, optical bench, Vernier callipers, screw gauge, ammeter, voltmeter and galvanometer;
- Ensure that all observations are consistent with L.C. of the measuring instrument and recorded in tabular form with unit. Note down the L.C. of the instruments used before starting the experiment.
- All values calculated should be calculated upto the decimal place or significant figures asked for the in the question.
- Scale should be uniform and convenient with axes properly labelled.
- Plots should be small encircled dots, correct to the nearest division of the graph sheet.
- Line of best fit means the aggregate of all plotted points drawn symmetrically and extended on both sides of the last plotted points.
- Slope calculation should be from two widely separated, unplotted points lying on the best fit line.
- The scale of the graph should be such that at least 2/3 of the graph paper is used.