PHYSICS

Paper – 2

(PRACTICAL)

Three hours and a quarter

(The first 15 minutes of the examination are for reading the paper only.

Candidates will NOT be allowed to write or start working on the apparatus

during this time).

ALL ANSWERS MUST BE WRITTEN IN THE ANSWER BOOKLET PROVIDED SEPARATELY.

Read the questions carefully and follow the given instructions.

If squared paper or graphs is used it must be attached to the answer booklet.

Marks are given for clear record of observations actually made and correct significant figures and units wherever applicable.

A statement of the method is NOT necessary. The theory of the experiment is not required unless specifically asked for.

Candidates are advised to record their observations as soon as they have been made.

All workinsg, including rough work, should be done on the same sheet as, and adjacent to, the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [ ].

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*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 a lens by combining it with another lens.

You are provided with two convex lenses marked A and B. Determine the

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appropriate focal length (f) of lens A by projecting the image of a distant object on the wall. Measure the distance f between the wall and the lens when a sharp image is obtained. Record the value of f. Repeat this procedure and obtain the mean of 3 observations as the approximate focal length of lens A. Record the value of f.

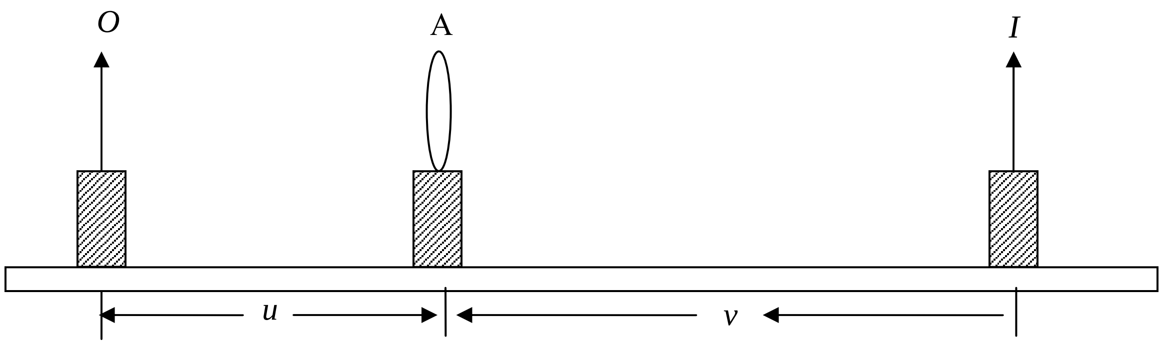

Figure 1

Now arrange the lens A on the optical bench between the object pin O and the image pin I as shown in figure 1. The tips of the two pins and the optical centre of the lens should be at the same horizontal level. Adjust the position of the lens until the inverted image of object O is seen. Adjust the position of the image pin I until the parallex between the inverted image of O and the image pin is removed. At the no parallax position, measure and record the values of u and v (see figure 1).

Determine $F = \dfrac{u\upsilon}{u+\upsilon}$ and record its value up to three significant figures.

Adjust the distance between the object pin O and the lens A to equal 2F and take care to ensure that this separation is maintained constant throughout the experiment. Now arrange the lens B between A and the image pin I as shown in figure 2. The tips of the two pins and the optical centres of the two lenses should be at the same horizontal level.

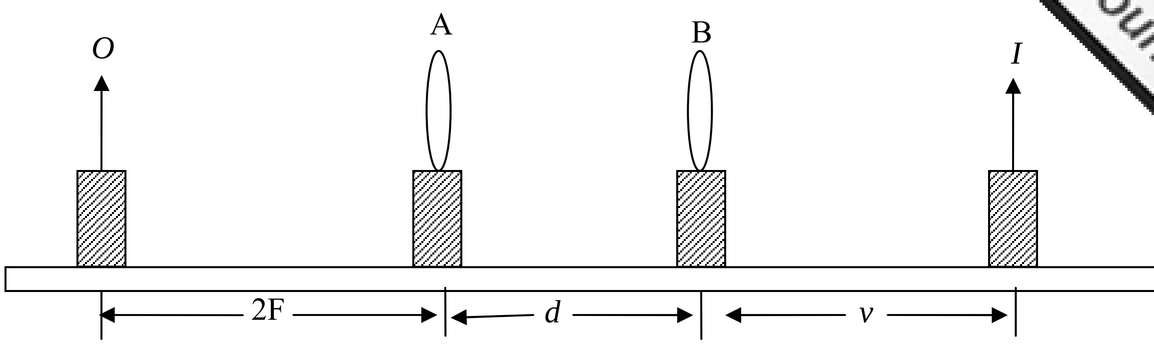

Figure 2

Adjust the position of the image pin I until there is no parallax between pin I and the real image of the object pin O as seen through the combination of lenses. At the no parallax position record the values of d and v (see figure 2). Repeat the experiment to obtain four more sets of corresponding values of d and v with d values in the range of 10 cm and 30 cm.

Tabulate d, v, $x = \dfrac{100}{v}$ *and* $y = \dfrac{100}{2F - d}$

Compute x and y up to three significant figures.

Plot a graph of y against x and determine its slope (change in $y \div$ change in x). From the graph read and record x_0 the value of x when $y = 0$. Record the power of the lens B, $P = x_0$.

Question 2.

In this experiment you are required to measure current and voltage and calculate the resistance per unit length of the given wire.

Set up the circuit as shown in figure 3.

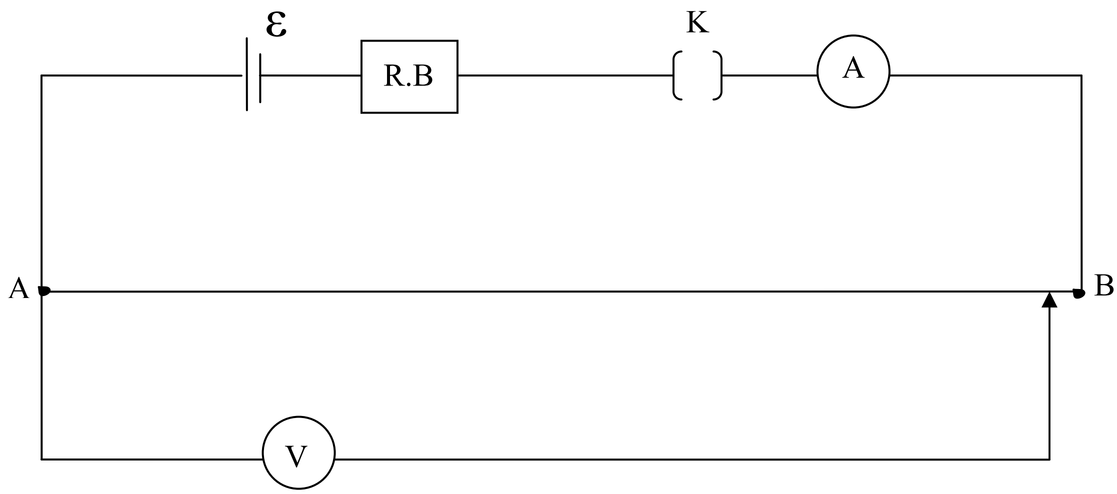

Figure 3

The source of e.m.f is an accumulator or battery eliminator of e.m.f 2 to 4.V. The resistance box R.B is of range 0 to 10 Ω or more. The ammeter (A) is of 500 mA or 1A.

The wire AB is of uniform cross section and is mounted on a board with a meter scale by the side of it; AB = 100 cm. The voltmeter is of range 2 or 3V.

Record the zero error (if any), least count and range of the ammeter and voltmeter. Take out any plug from the resistance box to introduce a resistance R. Plug in the key K. The ammeter should not go out of scale. If it does, increase R in the resistance box. Touch the jockey J at B (far end of the wire) and note the reading of the voltmeter. Adjust the resistance in R.B to make the reading of the voltmeter maximum with ammeter reading within scale. Note down the resistance (R) in the box, reading of ammeter (I) and the reading of voltmeter (V). Tabulate your observations neatly with proper units. Vary the resistance R in the box and repeat the observations (R, I and V) with the jockey touching B. Take five sets of readings in all.

Plot a graph showing the variation of the potential difference V with changes in the current I.

Obtain the slope $s = \frac{\Delta v}{\Delta I}$. This is the resistance of the wire AB.

Calculate $r = \frac{S}{100}$, the average resistance per unit length of the wire AB.

Record your final result with proper unit and significant figures.

Question 3. **[5]**

This experiment is to measure the e.m.f of the dry cell.

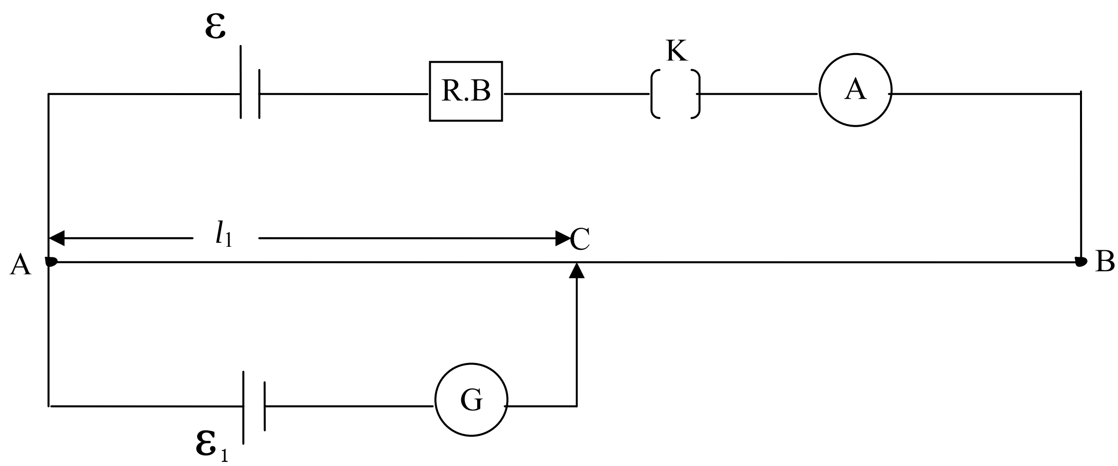

Figure 4

The circuit of figure 3 is modified as shown in figure 4. The e.m.f ε may be kept approximately 3 - 4 V only. The voltmeter has been replaced with a fresh dry cell (ε_1) and a centre zero galvanometer G. Set up the experiment as shown in figure 4..

Take out the 1 Ω plug from the resistance box and plug in the key. Touch the jockey J for a moment only near the end B and then at some point nearer to A. The deflection of the galvanometer must be in opposite directions. (If not, increase the current in the ammeter by reducing the resistance in the box even to zero and/or by increasing the e.m.f of the source.) Get the position C for jockey J to give zero deflection in the galvanometer. Measure the length AC = l_1 cm and read current I_1 in the ammeter.

Calculate $R^{/} = l_1 r$ and $V = I_1 R^{/}$. Here r is the result obtained in question 2. Record your observations in rows.

Obtain the e.m.f $\mathcal{E}_1$ of the dry cell from the above result. Record your result for the e.m.f of the dry cell.

Answer the following question briefly.

1. Which law of electricity is used when you assumed the graph in question 2 to be a straight line? Is this a universal law?

2. In this experiment, a null method was used for determining the e.m.f of the dry cell. Why is the null method superior to a deflection method to measure the e.m.f of a cell?
