



ACTIVITY

Aim

To plot a graph for a given set of data, with proper choices of scales and error bars.

MATERIAL REQUIRED

Given data, graph paper, sharp pencil, ruler and rubber.

DATA

Load (gf)	100	200	300	400	500
Extension (cm)	0.05	0.18	0.26	0.33	0.47

THEORY

Graph is basically a representation of variation of one physical quantity with relative variation in the other physical quantity. It also helps to calculate the average value of a related physical quantity.

While plotting a graph it is important to select appropriate scales on both the axes of the graph. The scale should be so selected that the graph covers most of the graph sheet and the plotted points are easily distinguishable. When the probable error is shown on the graph sheet itself by making a bar around the plotted points, then we call it as error bar. For example, if a quantity 'x' is measured by a measuring device, then the error in measurement is equal to half of the least count 'l' of the measuring device. Thus, the quantity is represented as $(x \pm \frac{l}{2})$ units.

PROCEDURE

A. Identifying Dependent and Independent Variables

1. Designate the load as the independent variable and represent it on the X-axis.
2. The extension is considered the dependent variable and is plotted on the Y-axis.

B. Choosing Appropriate Scales for Load and Extension

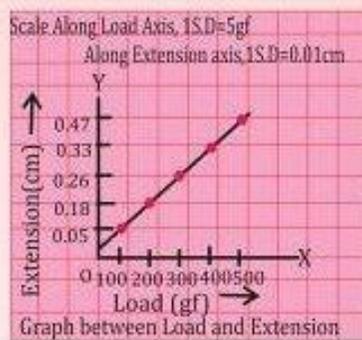
3. Determine the load range ($500 - 100 = 400$ gf) and extension range ($0.47 - 0.05 = 0.42$ cm).
4. Given that the load range is greater, align the load-axis parallel to the longer side and the extension-axis to the smaller side of the graph paper.
5. Since the data comprises positive values, place the origin at the lower left corner of the graph paper.
6. On the load-axis (X-axis), set one small division (1 S.D.) as 10 gf, and along the extension axis (Y-axis), establish 1 S.D. as 0.01 cm.

C. Plotting Data with Error Bars

7. Mark points such as 100, 200, ..., 500 gf on the load axis and points like 0.10, 0.20, 0.30, ..., 0.60 cm on the extension-axis.
8. For the first data point (load = 100 gf, extension = 0.05 cm with an accuracy of ± 0.2 cm), plot a dot on the graph paper and encircle it. Display error bars corresponding to the upper and lower limiting values of the extension ($0.05 - 0.02$ and $0.05 + 0.02$, i.e., 0.03 and 0.07 cm).

9. Repeat the process for the remaining data points, ensuring they form a straight line. Some data points may deviate slightly from the expected straight line.
10. Connect the data points with a straight line, evenly distributing points that deviate above and below it.
11. Include the graph title, such as 'Graph between Load and Extension', and indicate the scales along the two axes on the graph paper.

OBSERVATION AND CALCULATION



RESULT

The figure displays the graph depicting the relationship between load and extension for the provided dataset, accompanied by error bars.

PRECAUTIONS

1. Mark the points using a sharp pencil.
2. The lines, such as axis should be drawn using a ruler.

VIVA VOCE

- Q1. What is the error bar in this experiment?**
Ans. The graphical representation of the instrumental probable error by a bar around the plotted point is called error bar.
- Q2. Differentiate between independent and dependent variables.**
Ans. Independent variable is one which varies arbitrarily, while the dependent variable is one which or whose value depends on independent variable.
- Q3. What do you mean by the term graph?**
Ans. Graph is a straight line or a curve which shows the variation of two variable quantities of which one varies because of the change in the other.
- Q4. What is the significance of the graph?**
Ans. Graph helps us in achieving:
 (i) The calibration of certain instruments and to find out their exact readings.
 (ii) The value, which is not observed usually while performing the experiment.
- Q5. Give any example in which independent variable is taken along Y-axis instead of X-axis?**
Ans. $L-T^2$ graph for a simple pendulum is an example in which independent variable is taken along Y-axis instead of X-axis.