GRAPHING EXPERIMENTAL DATA

Appendix IV

A graph is a pictorial display of data. The shape of a graph often reveals a relationship that may not be readily apparent from the raw data itself. Usually a graph is made from data arranged in two columns, one of which you, the experimenter, control. Suppose, for example, you turned up the voltage in a circuit. This data would be called the ***independent*** variable. The other column is one which varies because it depends on the independent variable. For example, if the current went up because the voltage was turned up, this data would be called the ***dependent*** variable. When plotting data on a graph, the independent variable should be plotted on the horizonta1 axis, with the dependant variable on the vertical axis.

Always use graph paper for your graph. Number the division lines in such a way that your graph will take up more than half a page. Use multiples of 1, 2, 4 or 5, 10, 15. It is not always necessary to begin with zero. For example, for data ranging from 500 to 700 volts, 500 would be the most convenient starting point. The scale used on each axis is determined by trial and error, to find what is the best.

PLOTTING DATA ON A GRAPH

1. Label both axes with two things: what quantity you are plotting and the units.

2. Plot your data by marking dots where the data points from each axis intersect.

3. Draw a smooth line or curve through the points, not necessarily touching the points, but among them (see graph on the next page). The purpose of this line is to estimate where the points would have been if there had been no experimental error. If the points seem to describe a linear relationship then use a straight-edge to draw a perfectly straight line among the points, such that there are about as many points on one side of the line as on the other. If the relationship appears non-linear, then draw a smooth, free-hand curve among the points.

4. Write the title of your graph at the top. The title should list the dependent vs independent variables. For example, "Current vs Voltage".

CALCULATING SLOPE OF A GRAPH

Slope of a straight-line graph is a measurement of how high the line rises compared to how far it extends, or simply

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

Mathematically, slope of a line can be calculated as

$$\text{slope} = \frac{?y}{?x} = \frac{y_2 - y_1}{x_2 - x_1}$$

where x_1 and y_1 are the Cartesian coordinates of the first point and x_2 and y_2 are the Cartesian coordinates of the second point. The points selected for the slope calculation should intersect the line, even though some of the data points do not.

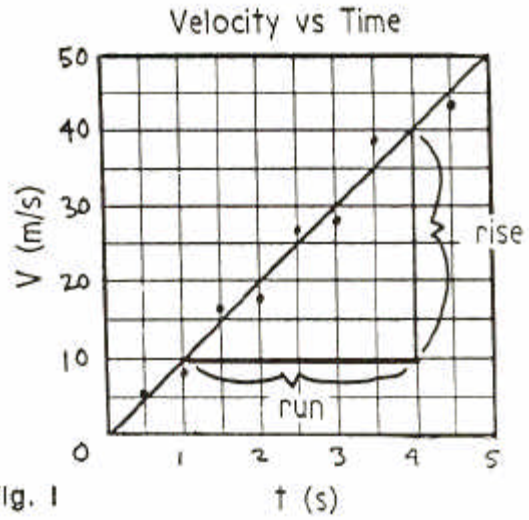

Fig. 1

The units of the slope are very important and give an indication as to the what the quantity calculated represents. For example the slope of the graph above can be calculated as

$$\text{slope} = \frac{?y}{?x} = \frac{40\ \text{m/s} - 10\ \text{m/s}}{4\ \text{s} - 1\ \text{s}} = \frac{30\ \text{m/s}}{3\ \text{s}} = 10\ \text{m/s}^2$$

where the units indicate that the slope represents acceleration of the object.