

Kuwait University	Course 125 Phys. Lab. I
Physics Department	Reference B

Graphical analysis:

A graph is a diagram consisting of a line which shows the variation of two quantities relative to each other, in lab jargon we say *plot y versus x* .

In order to plot a good graph you should note the following:

- Use a sharp pencil or pen.
- Draw your graph on full page of graph paper. A compressed graph will reduce the accuracy of your graph.
- Give the graph a title.
- The dependent variable should be plotted along the vertical or y axis and the independent variable should be plotted along the horizontal or x axis.
- Choose a suitable scale for both the variables. It is not essential to have the same scale for both the quantities, but avoid scale factors like 3 or 7. The scale should neither be too wide nor too narrow. In any graph you should give for both axes the scale, the physical quantity plotted and its unit.
- If the relation between the two variables begins from zero, then zero must be taken as the origin on both the scales. Otherwise the origin on both axes should represent a quantity little less than the smallest value of the corresponding variable.
- Label axes and include units.
- Use error bars to indicate errors in measurements.
- Draw a smooth free-hand curve to pass through as many plotted points as possible. If a smooth curve does not pass through all the points, those left out should lie evenly about it.

Linear graph:

A straight line graph has a constant slope. The slope is the change in the value of the variable plotted on vertical axis (y axis) divided by the corresponding change in the value of the variable plotted on the horizontal axis (x axis).

The slope is determined by selecting two well separated points A and B on the line. Record the values of x_A , y_A and x_B , y_B . Then the slope m is given by

$$m = \frac{y_B - y_A}{x_B - x_A} \quad (1)$$

The general equation of a straight line not passing through the origin is

$$y = mx + C, \quad (2)$$

where m is the slope and C is the intercept on the y axis ($x = 0$). The intercept on the x axis ($y = 0$) can be obtained from

$$x_{ic} = -\frac{C}{m}. \quad (3)$$

Extrapolation in a graph:

The experimental observations between two variables are plotted using the graph. From that we can find out a relation at least within the range of observations.

If we assure that this relation is true even beyond this range of observed values, then we can extend the graph. This process is called *extrapolation*. It is necessary to select the origin in a proper way to cover the value to extrapolate.

Semilogarithmic graph paper:

If the graph connecting two variables x and y obeys the relation

$$y = e^x \quad (4)$$

then a semilogarithmic graph paper is used. In this graph paper one axis is divided into regular spaces and the other axis is divided in the logarithmic scale, see Figure 1.4.

Full logarithmic grid-line graph paper:

In this graph paper both axes are divided in the logarithmic scale, see Figure 1.5. This graph paper is used to obtain a straight line plot when y and x satisfy a power law relation:

$$y = x^n, \tag{5}$$

where n can be a positive oder negative integer as well as $1/2$ (square root).