

How to make a graph correctly

1. Graphs are made on a graph paper. If the graph does not take up the entire page, it should be cut and pasted into the report.
2. The graph is made with a well-tempered pencil with HB hardness or a black pen. It is permissible to use colored fineliners to mark different data series and their trend lines on one graph.
3. In the Physics Laboratory, we make graphs in the Cartesian coordinate system.
4. It is important that the appropriate physical quantity is placed on the appropriate axis of the chart. If the graph is to show the dependence $A(u)$, i.e. the dependence of the quantity A on the variable quantity u , then the value u is put on the axis x , and the value A on the axis y .
5. Both axes should be marked by placing at each of them the symbol of physical quantity and its unit written in square brackets.
6. We select the range of each axis so that it is slightly larger than the range of measurement points - the measurement points should be in the entire range. The axis range does not have to start from zero.
7. Both axes should be properly calibrated. It means that the markers of the units of the plotted quantity and the corresponding values should be placed on the axes. All the markers should be numbered on the axis with the same accuracy - this also applies to zero. However, this accuracy may be different for both axes. If necessary, at the end of the axis, write the multiplier in the format „ $\times 10^n$ ”, where n it is the exponent of the multiplier. We do not place the values of the measuring points on the axis or graph.
8. You can place auxiliary markers on the axes between the main markers, but do not mark them with numbers.
9. We entitle a graph, describing what it presents.
10. Clearly and accurately select all measuring points on the graph so that the approximate values can be read from the graph. If we present several measurement series on the graph, we place a legend on it describing the symbols used
11. It is not allowed to connect the measuring points with a broken line

a) If we know the equation describing the relationship between the presented physical quantities, then using a calculator or appropriate computer software (eg Excell, Origin) we determine the values of the parameters appearing in this equation. If a plotted relation is linear, on the basis of linear regression, we calculate two corresponding values x and y on and gently apply the designated points to the graph. We draw a straight line through these points. After drawing a straight line, two marked points should not be visible. On the graph we can apply the equation determined on the basis of linear regression, saving in place x and y the corresponding physical quantities.

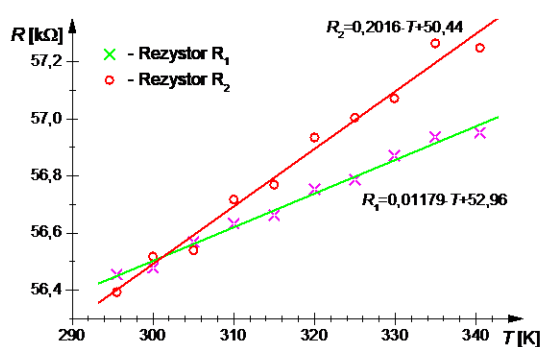
If a non-linear character is plotted, then on the basis of the determined equation we calculate the y values for several values on the x axis and apply them gently to the graph. Through the marked points we run a smooth trend line.

In case the drawn straight line or trend line does not match the experimental points, we made a mistake in the calculations or when marking the points. These actions should be repeated by performing them correctly.

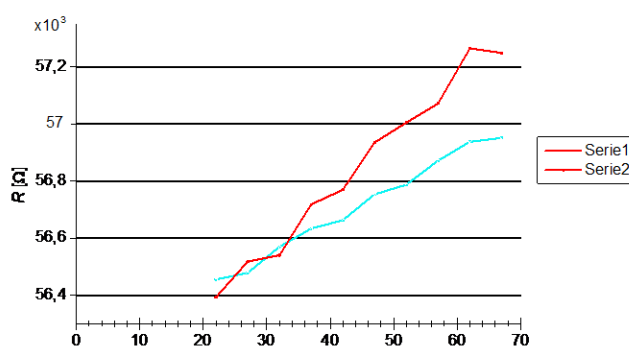
- (b) If we do not know the analytical form of the relationship that combines the physical quantities presented, then we place a smooth trend line on the graph so that the points are uniformly distributed around this line. The trend line should be drawn using a curve template.

The examples of correctly and incorrectly made graphs are shown below

Graph made correctly



Graph made incorrectly



Rys. 1 Zależność oporu elektrycznego od temperatury dla badanych rezystorów R_1 i R_2

Oh the incorrectly made graph::

- wrong range of abscissa axes was chosen - points do not occupy the entire graph,
- the abscissa axes have not been described- t [$^{\circ}\text{C}$],
- the scaling numbers of the ordinate are written with different accuracy (it should be 57,0),
- the measuring points are marked unclearly,
- the same symbol marks of the measurement points of both data series - the graph will become illegible after printing on a monochrome printer,
- the measuring points are connected by a broken line,
- the legend does not bring any information,
- horizontal lines reduce the legibility of the graph,
- the graph was not entitled.