Using Microsoft Excel for plotting graphs

Most of the experiments that you will be performing in the lab will require you to study and measure various characteristics of certain electronic devices, each for different operating conditions. So, by the end of each experiment you will end up with too many readings to be plotted manually on graph papers. Hence to ease this task, you can use tools like Microsoft Excel, GNUplot etc. This manual will help you get familiarized with using Excel for the same. Most of the points also hold for Open Office. However, you are free to explore different options and play around with other tools as well.

To explain it more efficiently we'll take help of an example "I-V characteristics of a resistor" (the actual experiments in the Lab will not be as simple though :P). In this experiment, we vary the 'Voltage' across the resistor and measure the corresponding 'Current' flowing through it.

A series of snapshots of the sample excel file are given here for better understanding.

A. <u>Plotting a graph for a single condition:</u>

1. First thing to note here is that the independent variable (variable on the x-axis) should form the first column of the data, the dependent variable (variable on y-axis) follows in the next column. As you can see in the example that the column in which values of Current through the resistor (dependent variable) are entered follows the one in which values of Voltage across the resistor (independent variable) are entered. Refer Figure 1.

	A	B	C	D
1	I-V characteristics of a single resistor:			
2				
3		V (Volt)	I (Amp)	
4		0	0	
5		1	0.01	
6		10	0.11	
7		20	0.19	
8		50	0.49	
9		60	0.61	
10		75	0.77	
11		100	1.05	
12				

Figure 1

2. Now select the cells containing the data to be plotted and click on "Insert" option in the tool bar and focus on the "Charts" sub-option. You will get various options to insert, viz. bar graphs, pie charts, etc. However, for most of the cases "Scatter" plots will be used. Refer Figure 2.

3. Again under "scatter" you have options like 'markers only' or 'smooth/ straight lines with/ without markers' and so on. Use the 'smooth lines without markers' option, this would reduce the mess. Refer Figure 3.

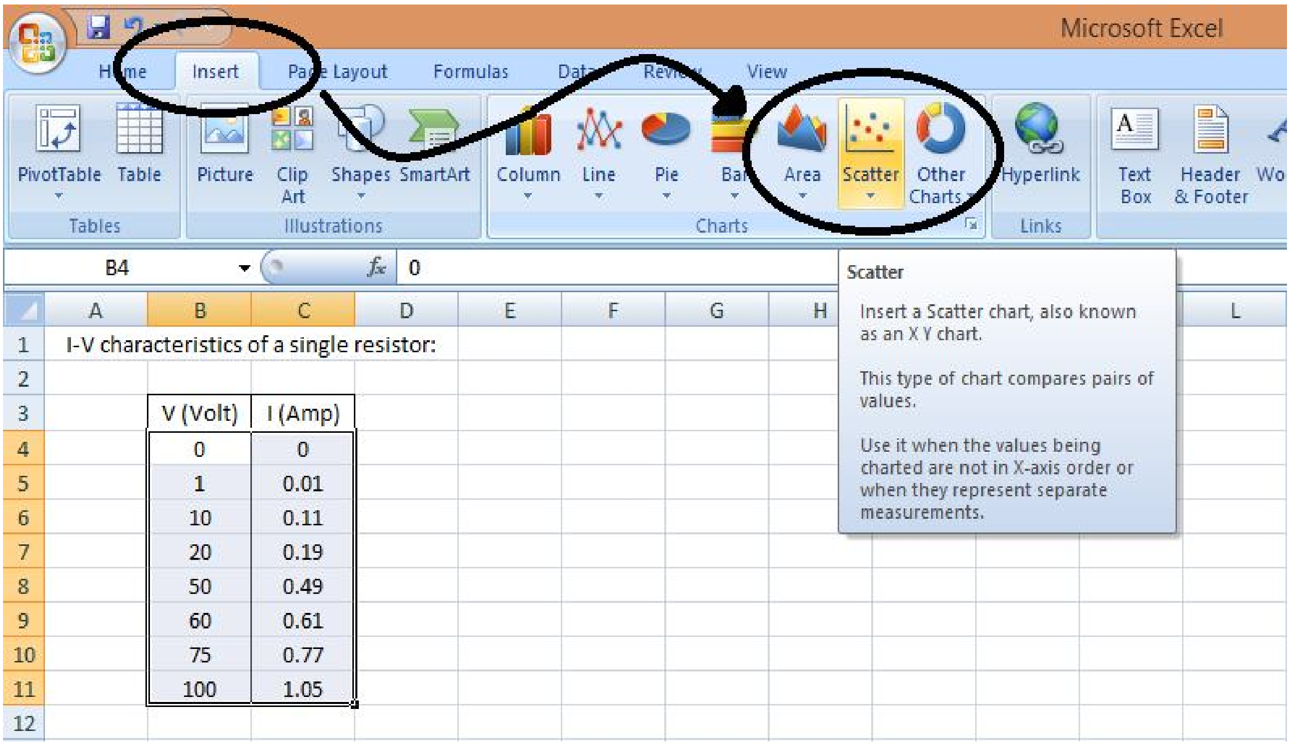


Figure 2

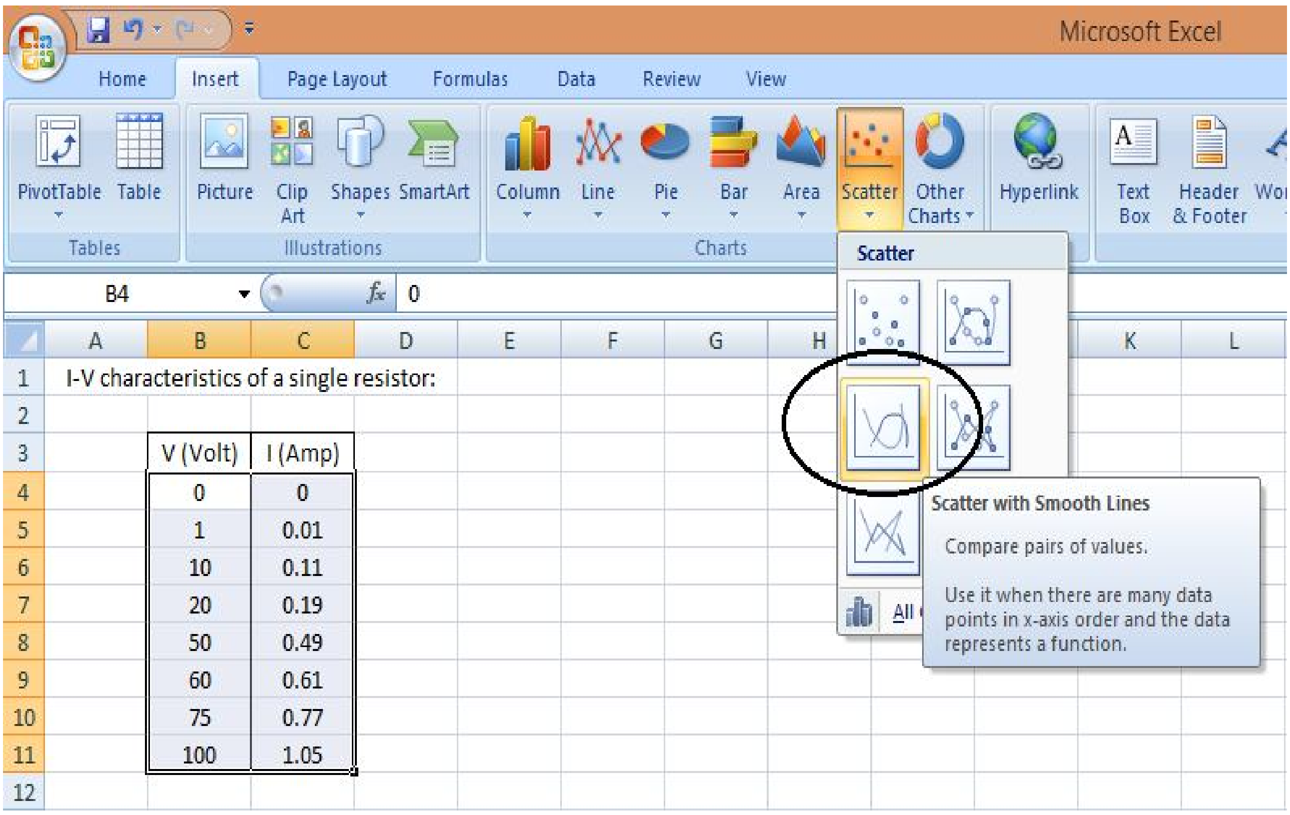


Figure 3

4. After clicking on the option mentioned in step-3, we get the expected graph. Refer Figure 4.

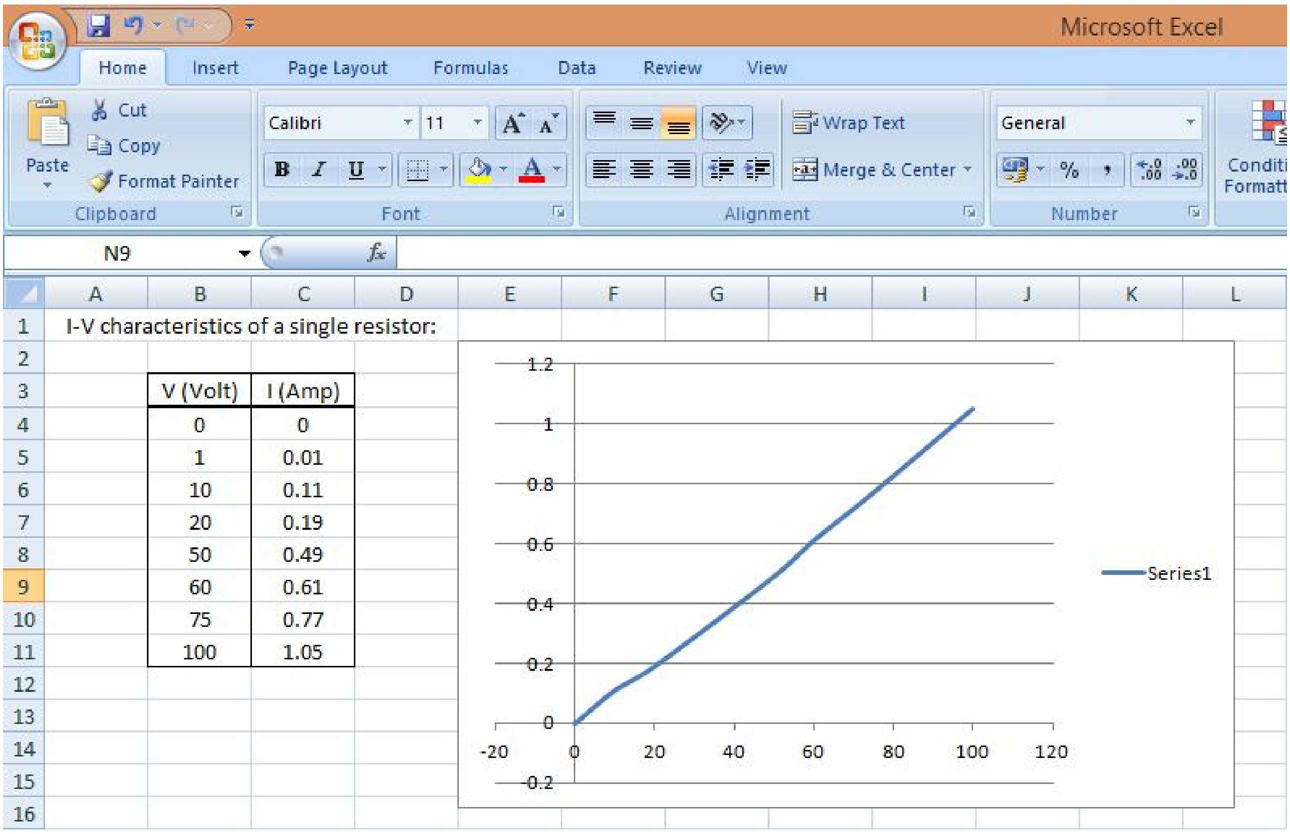


Figure 4

5. The graph is not yet complete, because it still misses the key identifiers like graph title, x- and y- axes labels. To add these, left-click on the graph area and then click on "design" option in the tool bar, then select "layout-1". Refer Figure 5.

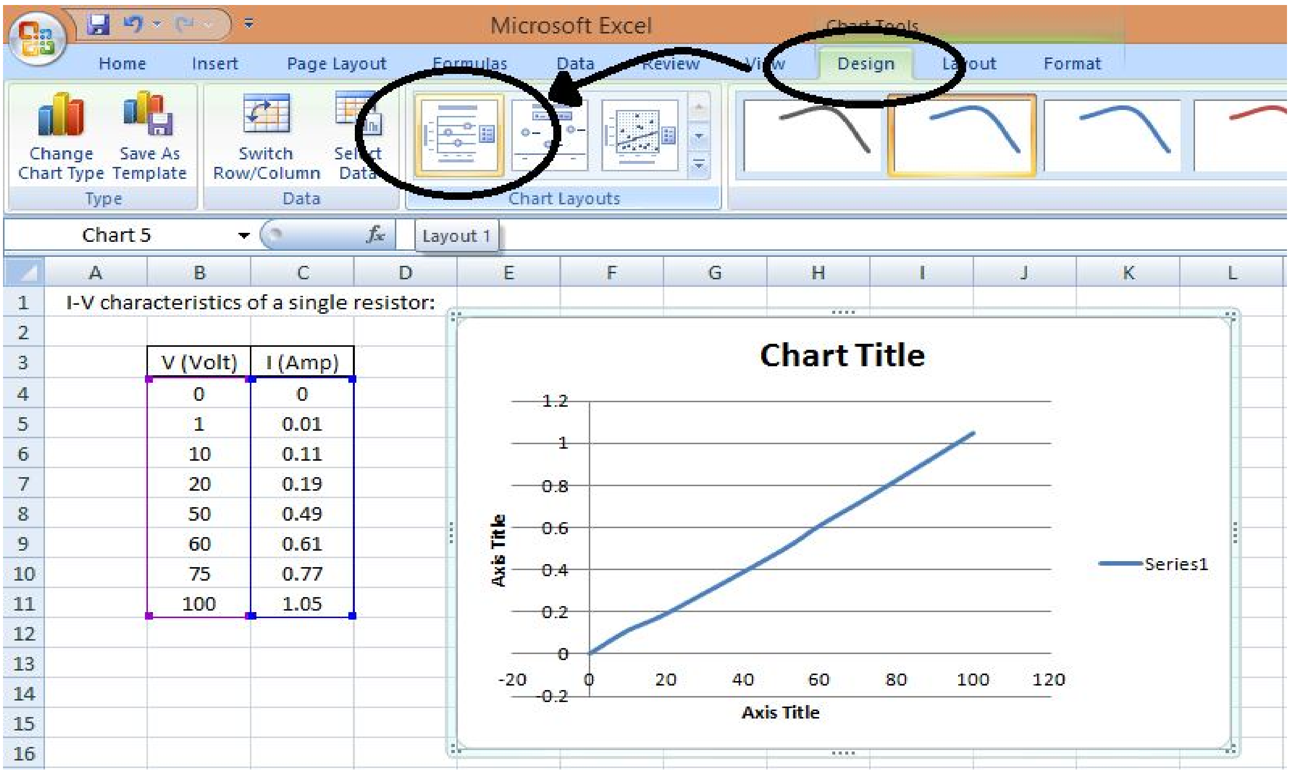


Figure 5

6. You can now double-click in the respective text-boxes and fill in the title and labels. Refer Figure 6.

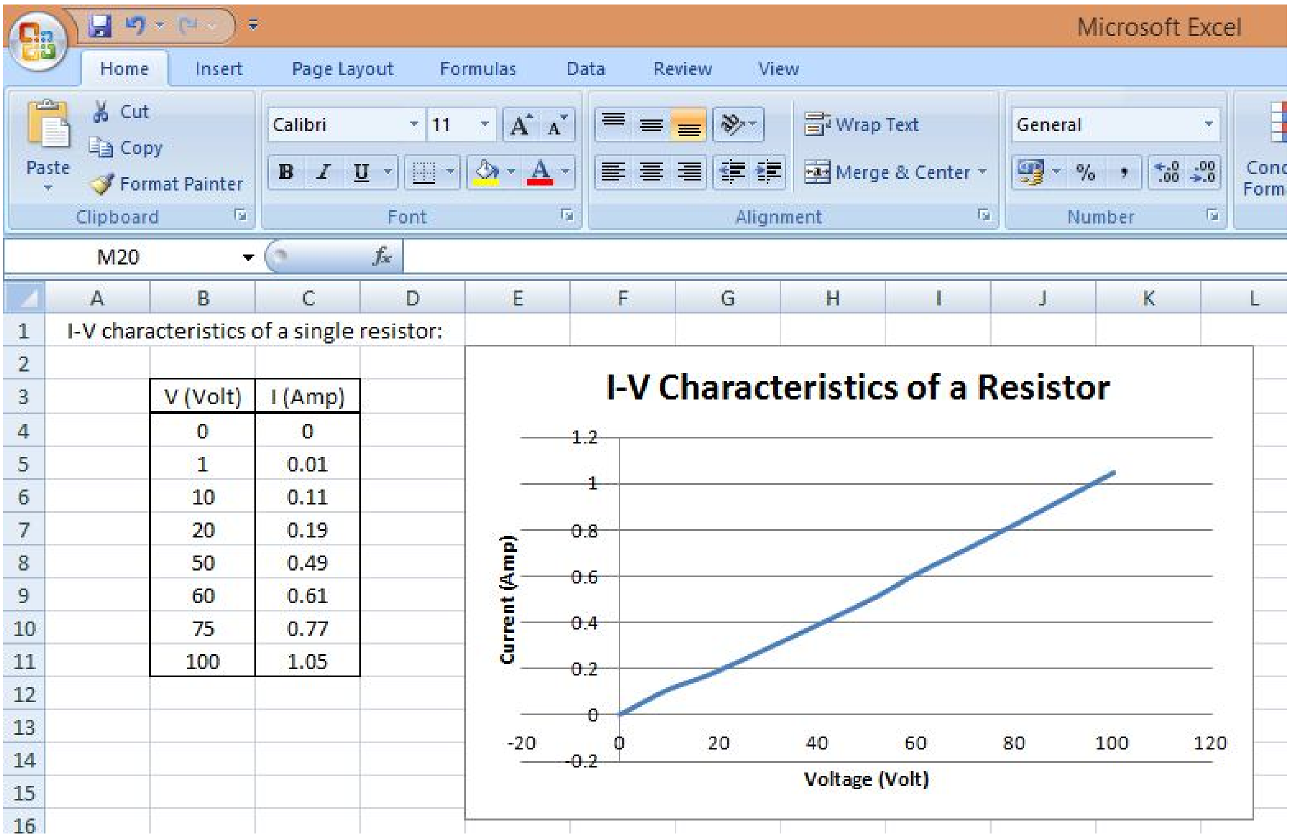


Figure 6

7. Now, as a part of the post-lab work, it is expected that you determine the value of this resistor; which is nothing but the inverse of the slope of this graph. But as you can see that due to measurement, machine or human errors; the graph is not exactly linear as expected, but it deviates slightly for the exact values. Hence finding the values of slope at every point is difficult and unnecessary. Because you can simply use the ‘Add Trendline’ option and make you work easier. For that you should right-click on the graph (exactly on the blue line) and select the Trendline option. This will put a most-fitting straight line through the end points of the graph. Refer Figure 7.

8. A ‘Format Treadline’ window will pop-up on the screen. By default a ‘linear’ treadline will be selected, you may change it as per the requirements; but for this experiment it will suffice. You may also add the equation of the straight line (it will be in the form of: y = m*x + c). Refer Figure 8. The black coloured straight line is the required Trendline.

9. The final plot will be as shown in Figure 9. The value of the slope (as seen from the equation of the Trendline) is 0.0104 and its inverse is 96.15. Thus the value of the resistor used is 96.15Ω (which is very close to the actually used 100Ω resistor).

Please note that for other versions of Microsoft Office, the appearance of the tool bar and pop-up windows, etc. will be different. But the underlying procedure remains the same.

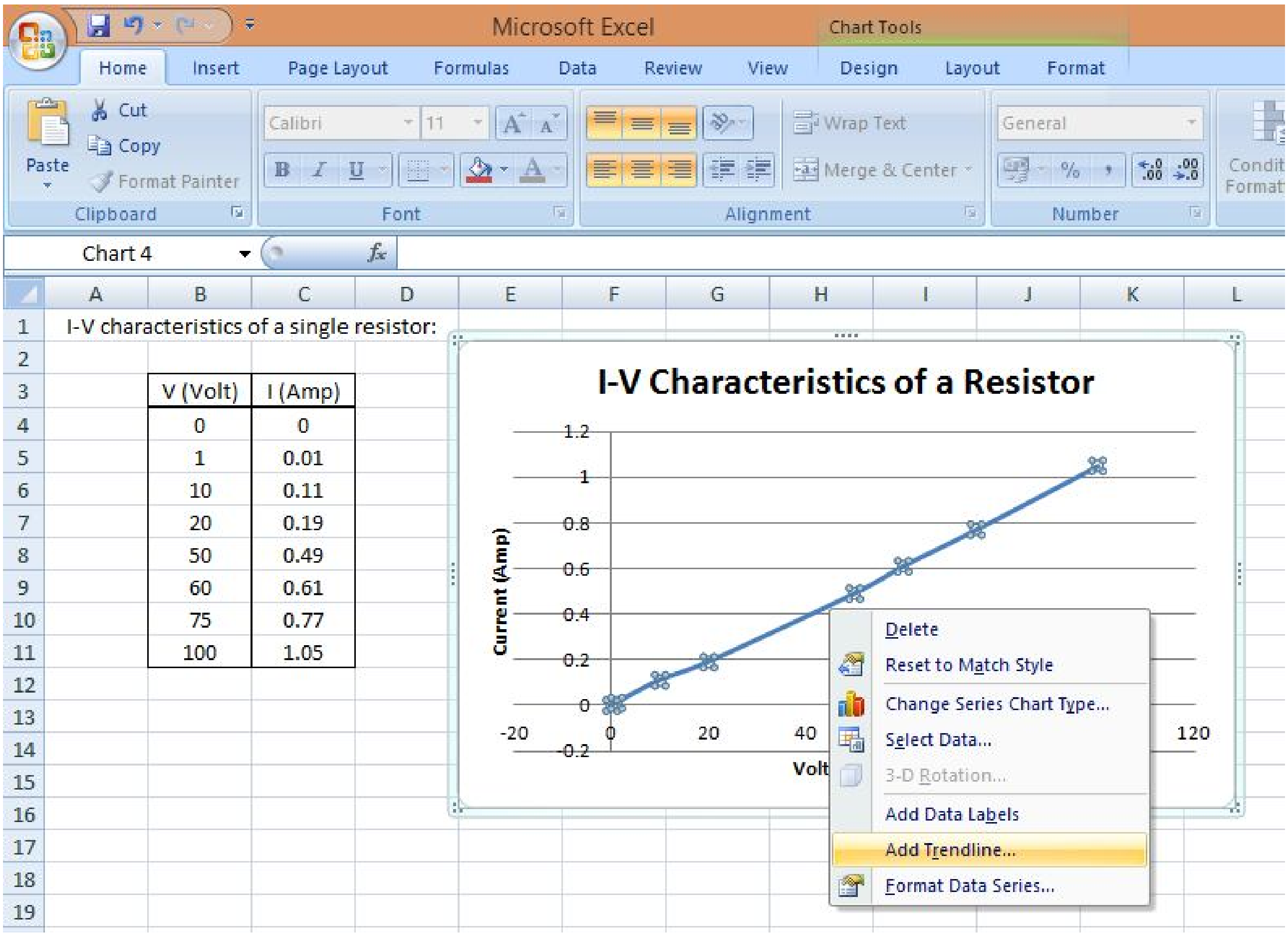


Figure 7

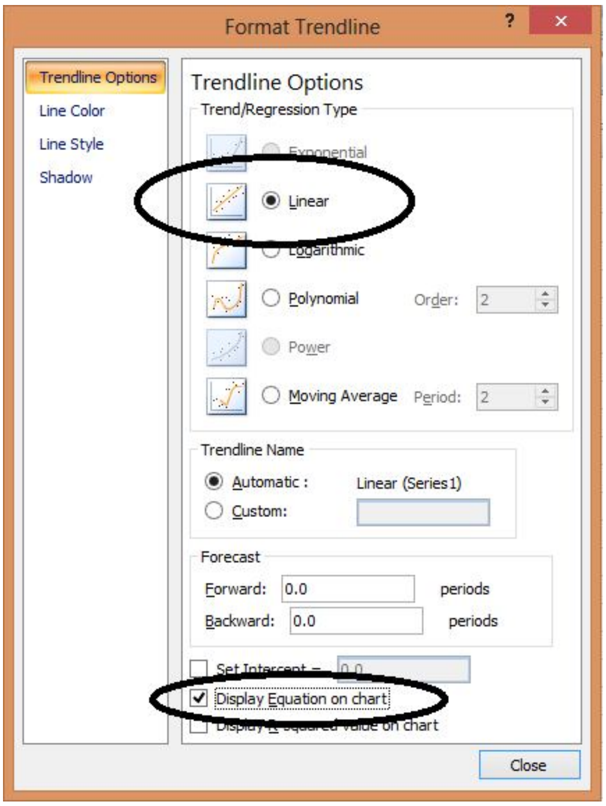
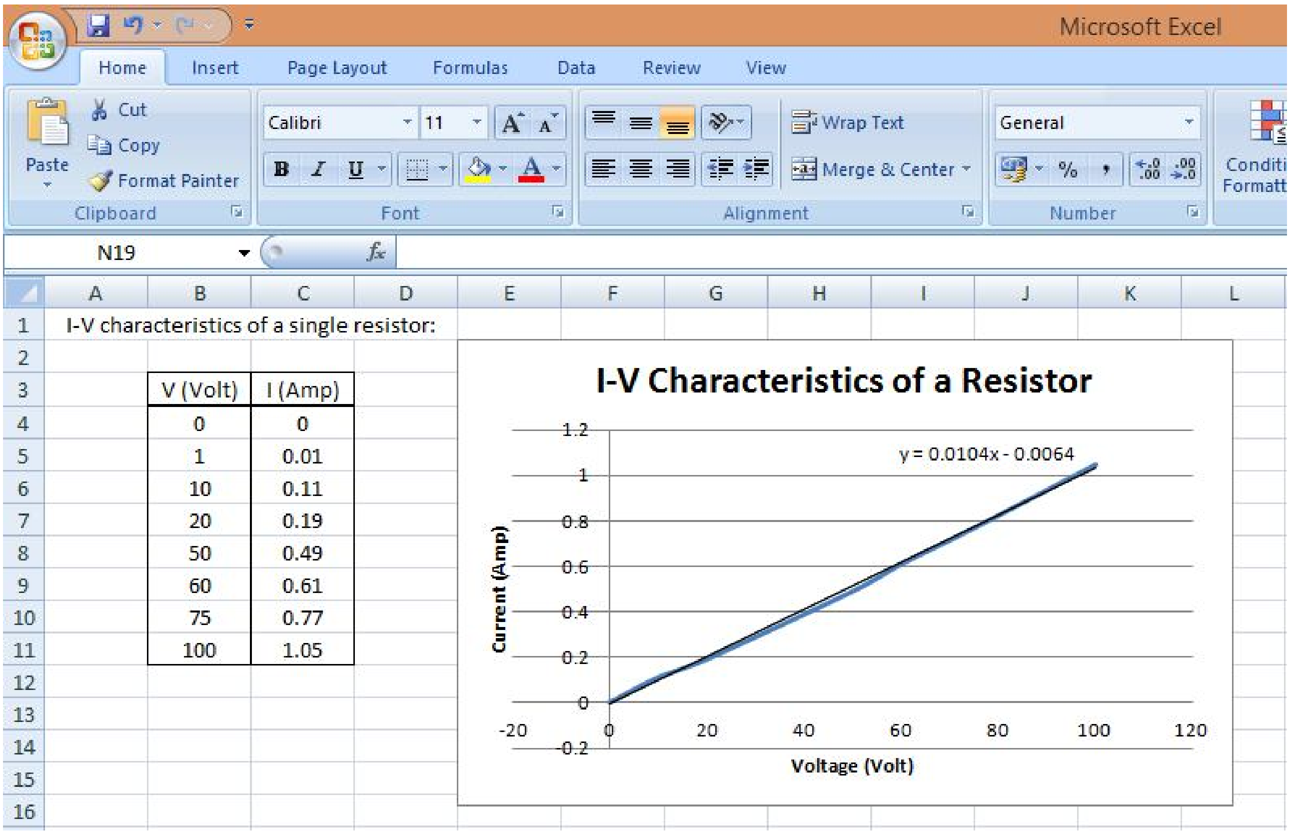


Figure 8

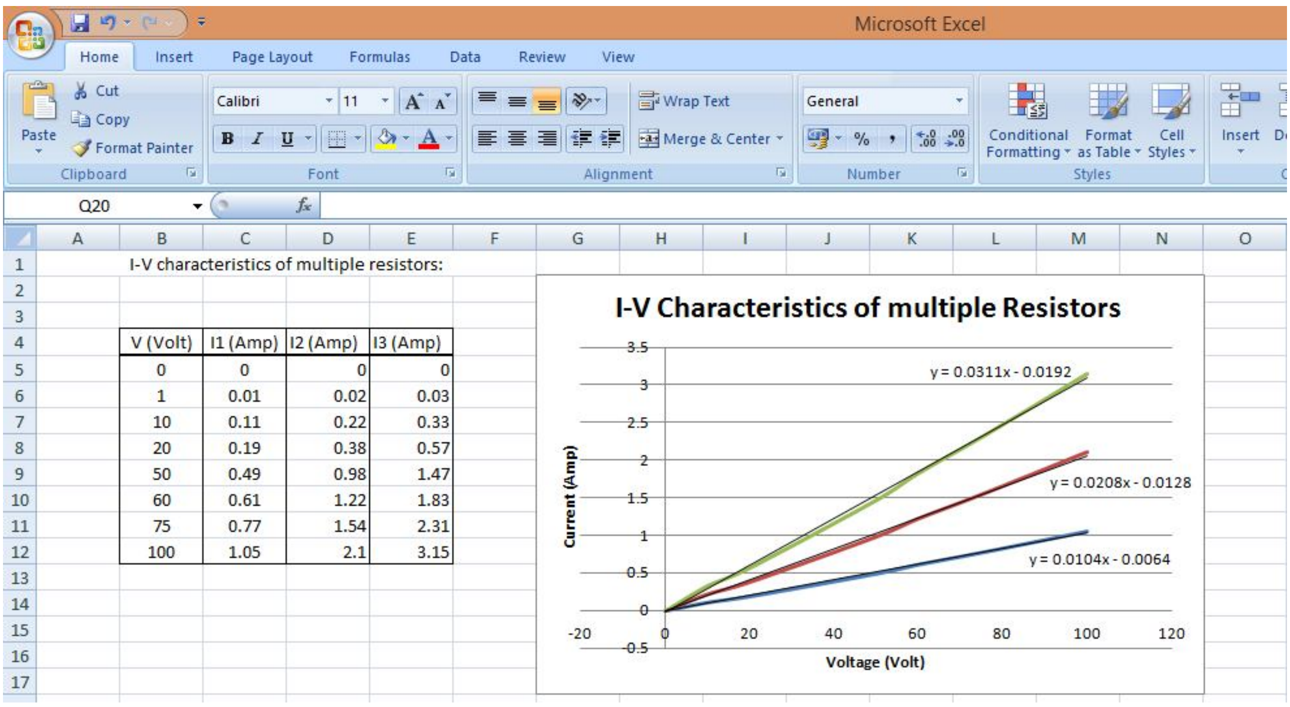


V (Volt)	I (Amp)
0	0
1	0.01
10	0.11
20	0.19
50	0.49
60	0.61
75	0.77
100	1.05

Figure 9

B. <u>Plotting a graph for a multiple conditions:</u>

For the same values of voltages, if we test different resistors; then we get multiple set of I-V readings and we expect to plot them all on the same graph. To do so, follow the same procedure, except that now you will have multiple columns of dependent variables succeeding that of the independent variable. Select all these cells and follow the steps enumerated in the previous section. The end result is shown in Figure 10.



V (Volt)	I1 (Amp)	I2 (Amp)	I3 (Amp)
0	0	0	0
1	0.01	0.02	0.03
10	0.11	0.22	0.33
20	0.19	0.38	0.57
50	0.49	0.98	1.47
60	0.61	1.22	1.83
75	0.77	1.54	2.31
100	1.05	2.1	3.15

Figure 10