

Graphing

Part I: Directions for graphing by hand:

1. Use Graph Paper. (Graph paper has gridlines.)
2. Draw the x axis.
 - a. Use the x-axis for the independent variable (that which is experimentally varied; also known as the manipulated variable).
 - b. Decide on the limits of the axis (maximum and minimum values). The axis does not have to start at zero unless you have data in this region.
 - c. Select divisions on the axes which are easy to read. Hence one square may equal 1, 2, 5, 10, or 10, 20, 50, 100, but never 3.75 or some other "odd" number.
 - d. For greatest accuracy, select scales so that the graph nearly fills the page.
 - e. Label the axis with numbers at appropriate intervals.
 - f. Label the axis with the variable name and the units. For example: "Pressure (torr)"
3. Draw the y-axis.
 - a. Use the y-axis for the dependent variable (that which is a function of the independent variable; also known as the responding variable).
 - b. Decide on the limits of the axis (maximum and minimum values). The axis does not have to start at zero unless you have data in this region.
 - c. Select divisions on the axes which are easy to read. Hence one square may equal 1, 2, 5, 10, or 10, 20, 50, 100, but never 3.75 or some other "odd" number.
 - d. For greatest accuracy, select scales so that the graph nearly fills the page.
 - e. Label the axis with numbers at appropriate intervals.
 - f. Label the axis with the variable name and the units.
4. Mark the data points with a small dot. (Pencil may be used before being inked for permanency.) Draw a small circle around the point or darken to make more visible.
5. Title the graph in a descriptive manner. For example: "Steve's Pressure vs. Volume"
6. Using a ruler, draw a straight line that is as close to the data points as possible. The line **does not** have to start at the origin. A straight line follow the equation $y=mx+b$
7. Make up two points that are exactly on the line. Write down their x and y values.
8. The slope is $(y_2-y_1)/(x_2-x_1)$ and is m in our equation. The intercept, b, is value of y where it crosses the y axis.
9. Write down the equation on the graph.

Graph 1 (Do in class)

Concentration of permanganate vs. absorbance at 540 nm

Molarity	Absorbance
.00016	.356
.00013	.301
.000096	.215
.000064	.140
.000032	.076
.000016	.045

Working with numbers that are so small is difficult. You might want to convert them to $__ \times 10^{-5}$ M for graphing by hand. Just remember this when you are doing your slope, and to include a note in your axis label.

Graph 2 (Do this graph at home)

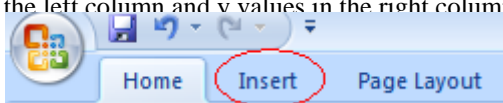
(Put Temperature on the X axis. Make the X axis run from -300 to +300 degrees C.)

Temperature vs Volume

Temperature (C)	Volume(L)
-173	8.21
-123	12.31
-73	16.42
-23	24.63
27	28.73
77	32.84
127	36.94
227	41.05

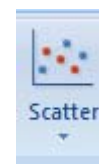
Part II Graph by computer:

1. Type your data into Excel with x values in the left column and y values in the right column.

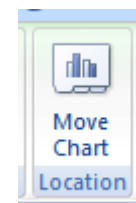


2. Select your data and click on the Insert tab.

3. Select scatter graph, and then select the one with the points not connected.



4. In the upper right hand corner you will see a button labeled 'Move Chart'. Click that button. Choose to put the chart as a new sheet.



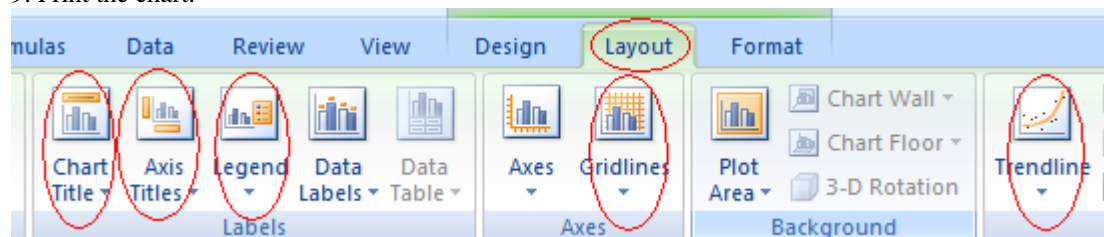
5. Under the *Layout* tab, click on the *Chart Title* button. Input your title. Click on the *Axis titles* and label your x and y axis (example: "Pressure (torr)")

6. Click *Gridlines* and select major gridlines for both the x and y axis.

7. Click *Legend* and select "None".

8. Click *Trendline*. Select "Linear Trendline" as the type of line. Click *Trendline* again and select "More Trendline Options". At the bottom, select "display equation on chart". Edit the chart to make it aesthetically pleasing.

9. Print the chart.



Graph the same data you graphed by hand.

Lab Write-up.

- 1) Turn in all 4 graphs. (2 by hand and 2 by computer.)
- 2) Answer the following post lab questions on a separate sheet of paper.
 - a. This data was experimentally determined. Why don't all the points fall on a straight line? (*Answer in complete sentences and use one possible example.*)
 - b. From graph 1 (Molarity vs. absorbance), the last two data points are shown below.

.00016	.356
.00013	.301

 - i. What would be the slope if we used these data points?
 - ii. What is the percent difference? $(2208.6 - \text{slope from i}) / 2208.6 * 100$
 - c. From the temperature vs. volume graph by computer, what is the volume at:
 - i. 0° C
 - ii. -273 °C
 - iii. -300 ° C