NINE Steps to Wonderful Graphs

Ms. Bunney's Rules for Good Graph Making:

1. ALWAYS use a PENCIL to graph

2. Always give your graph a title in the following form: "The dependence of (your dependent variable) on (your independent variable). Underline the title.

In other words, each graph must have an underlined title stating the variables (y-axis first). Let's say that you're doing a graph where you're studying the effect of temperature on the speed of a reaction. In this reaction, you're changing the temperature to known values, so the temperature is your independent variable. Because you don't know the speed of the reaction and speed depends on the temperature, the speed of the reaction is your dependent variable. As a result, the title of your graph will be "The dependence of reaction rate on temperature", or something like that.

3. The x-axis of a graph is always your independent variable and the y-axis is the dependent variable.

For the graph described above, temperature would be on the x-axis (the one on the bottom of the graph), and the reaction rate would be on the y-axis (the one on the side of the graph)

4. Always label the x and y axes and give units.

Putting numbers on the x and y-axes is something that everybody always remembers to do (after all, how could you graph without showing the numbers?). However, people frequently forget to put a label on the axis that describes what those numbers are, and even more frequently forget to say what those units are. For example, if you're going to do a chart which uses temperature as the independent variable, you should write the word "temperature (degrees Celsius)" on that axis so people know what those numbers stand for. Otherwise, people won't know that you're talking about temperature, and even if they do, they might think you're talking about degrees Fahrenheit.

5. Try to use simple numbers when setting axes (i.e. 0, 5, 10).

6. Scale axes so as to use the ENTIRE PAGE to graph. Make sure your data is graphed as large as possible in the space you've been given.

Let's face it, you don't like looking at little tiny graphs. Your teacher doesn't either. If you make large graphs, you'll find it's easier to see what you're doing, and your teacher will be lots happier. On your graph paper you have a set number of divisions for each axis. You proceed as follows to assign the value for each division.

$$\text{Division value} = \frac{\text{largest} - \text{smallest}}{\text{number of divisions}}$$

7. Always make a line graph.

Never, ever make a bar graph when doing science stuff. Bar graphs are good for subjects where you're trying to break down a topic (such as gross national product) into it's parts. When you're doing graphs in science, line graphs are way more handy, because they tell you how one thing changes under the influence of some other variable.

8. Never, EVER, connect the dots on your graph! When plotting the line, DON'T CONNECT THE DOTS!

Hey, if you're working with your little sister on one of those placemats at Denny's, you can connect the dots. When you're working in science, you never, ever connect the dots on a graph.

Why? When you do an experiment, you always screw something up. Yeah, you. It's probably not a big mistake, and is frequently not something you have a lot of control over. However, when you do an experiment, many little things go wrong, and these little things add up. As a result, experimental data never makes a nice straight line. Instead, it makes a bunch of dots which kind of wiggle around a graph. This is normal, and will not affect your grade. However, you can't just pretend that your data is perfect, because it's not. Whenever you have the dots moving around a lot, we say that the data is noisy, because the thing you're looking for has a little bit of interference caused by normal experimental error.

To show that you're a clever young scientist, your best bet is to show that you KNOW your data is sometimes lousy. You do this by making a line (or curve) which seems to follow the data as well as possible, without actually connecting the dots. Doing this shows the trend that the data suggests, without depending too much on the noise. As long as your line (or curve) does a pretty good job of following the data, you should be A-OK.

> Straight line- set your ruler on the page and pass it through the line the data suggests. Keeping equal #'s of dots above and below the line. Let the y-intercept (or x) take care of itself. BEST FIT LINE!!!
>
> Curved line- use your elbow as a pivot and ghost your pencil over the points, fine tuning your curve with your hand. When you have it right, put your pencil down and draw the curve in 1 pass.

9. Calculating Slope

The nice thing about graphs is once we have drawn our line, we can derive some more information from the graph. We can look at the slope of the line and figure out a relationship between the y and x-variables.
The equation of the line is: $y = mx + b$ where slope is m

You should know that slope (m) = $\frac{\text{rise}}{\text{run}} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

a) Use as much of the line as possible
b) Numbers must come off of the line

So, those are the steps you need to follow if you're going to make a good graph in your chemistry class.

I've included a couple of examples of good and bad graphs below so you know what these things are supposed to look like.

Bad Graphs