Chemistry Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity: Graphing Practice with Gas Laws

How to Create a Graph

1. Title: This should go on the top of the graph. It is not necessary to have a long title. Usually a simple title that describes the quantities being graphed is sufficient. Examples of this would be Pressure v. Volume.

2. Defined Axes with Proper Units: Your x and y axis should be labeled with respect to the values that they are measuring. If there are units with the values then they are to be included as well.

3. Properly spaced graph: Your graph should occupy a good percentage of the graph paper. Also, you need to choose the spacing of the numbers on the axis wisely so equal spaces anywhere on the axis corresponds to equal values. Make sure that the scale is enough to contain all of the data points. Below is an example of a properly spaced axis.

|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|

0 5 10 15 20 25 30 35 40 45 50 55 60

In an improperly spaced axis, the numbers wouldn’t be in a pattern. It might look something like this.

|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|

0 5 10 15 20 30 40 50 60 70 80 90 100

Notice the different spacing between 0 and 20 and between 20 and 100.

4. Accurately plotted points: Take care to plot the points on the graph correctly according to the coordinates. Include the data points you graphed with the graph. These will go on an unused portion of the graph. If it is not possible to do this and keep the graph neat and readable, then this should be done on a separate piece of paper.

5. Smooth line plot of the points: For scientific use almost all data makes a smooth line fit. This can be either a straight or curved lines. Use a ruler to get a good straight line (you should also use a ruler on the axes), and there are tools to draw nice curves. If you plot more than one set data then make sure to note which line goes with which data. This can be done with either different colors or different types of lines with the same color.

6. The key to any good graph is that it neatly presents the data. If it is not neat, the graph is no good.

Gas Law Graphing: Boyle’s and Charles’ Law

You have obtained various sets of data points. One set shows a relationship between pressure and volume which is Boyle’s Law. The other is a relationship that includes temperature which is Charles’ Law. The objective of this lab is to graphically explore the relationships shown by these two basic gas laws.

BOYLE’S LAW

1. Graph pressure and volume (x-axis) data for both trials on the same graph. The plot should produce a smooth curved line.

2. On another graph, plot pressure v. 1/V (which is the reciprocal of volume). Use the same data values which you used in the graph in step 1. You will have to rescale the axis due to the different values for 1/V as compared to V. Calculating V should be in decimals which should be done with your calculator. The plot of this set of data will be a straight line. Plot both sets of points on the same graph with 1/V on the x-axis.

CHARLES’ LAW

1. The graph of volume and temperature represents Charles’ Law by the idea that V and T are directly related to each other so that the temperature achieved when the volume reaches 0 is the lowest possible temperature. This is called absolute zero and has a value of -273 °C. From your given data, graph temperature in Celsius on the x-axis v. volume. The plot is a straight line. At the time of the original experiment, it was not possible to achieve temperatures much below zero, so much extrapolation was needed, along with algebra.

On the graph, you will have to do the following.

a. Extrapolate the line of the graph until it intersects the x-axis. This is your graphed value of absolute zero. It is important to read this value off the graph as accurately as you can.

b. Determine the slope of the line using the data points only. Do not use the absolute zero point to calculate the slope.

c. Now calculate the value of absolute zero by using the point slope formula which is

slope (m) = change in y / change in x

d. Determine the percent error for the graphed value of absolute zero that you read off the graph in part a.

e. Determine the percent error for the value of absolute zero that you calculated in part c.

Data for the graphs.

**Boyle’s Law**

Trial 1 Trial 2

Pressure Volume Pressure Volume

13.25 30 6.00 30

16.50 25 9.75 20

21.00 20 13.25 15

27.50 15 20.50 10

39.50 10 36.00 5

NOTE: Each trial needs to be graphed individually. Do not mix the data for trial 1 and trial 2 on the same line, meaning your Boyle’s Law graph will have two lines.

**Charles’ Law**

Volume (L) Temperature (°C)

12.75 0

14.00 25

14.50 37

16.00 70

16.75 87

Attach this page to the graphs you created.

Show your work for full credit.

\_\_\_\_\_\_\_\_\_\_ 1. What is the value for the extrapolated value of absolute zero that you obtained from your graph ?

\_\_\_\_\_\_\_\_\_\_ 2. What is the slope of the graph ?

\_\_\_\_\_\_\_\_\_\_ 3. What is the value of absolute zero according to the point slope formula ?

\_\_\_\_\_\_\_\_\_\_ 4. What is the percent error for the value of absolute zero that you read off of the graph ?

\_\_\_\_\_\_\_\_\_\_ 5. What is the percent error for the value of absolute zero that you obtained using the point-slope formula ?