LAB: Charles' Law & Ideal Gas Law

Students: Please read the following information given below, and then come to class on your lab day with the following already prepared in your notebooks:

1) Date, 2) Partner, 3) Title, 4) Purpose, 5) Materials, 6) Safety, 7) Procedures/Observations, and 8) Data & Calculations (collect data in your notebooks)

The last page needs to be printed out. This page will be turned in. You must write up your own data tables. Data for this lab should be collected in your notebooks. Three computer generated tables (two for Charles' and one for Ideal) along with the last page should be completed. The data, calculations, and questions will be due one week after performing the lab in class (your next lab class).

Charles' Law states that at a constant pressure the volume of a given quantity of gas is directly proportional to it's temperature. If the sample of gas is heated, its volume will increase. The mathematical relationship is V = bT (V = volume and is equal to b = the proportionality constant time * T = temperature). Remember T represents absolute temperature measured in Kelvin. Knowing the volume and the temperature, one can calculate the proportionality constant

$$V = bT$$

Please use the following procedures.
First, lower the volume on your computer! If I hear anyone's computer make noise, you will lose lab points!

Future Lab should be open, Select Charles' Law Experiment, then Standard Setup 1
The Toolbar should be opened, and a piston chamber, hot plate, a pressure gauge, two connecting tubes, a Magic Meter, a thermometer, and a helium tank should be selected.

Place the piston chamber on the hot plate. One of the connecting tubes should be connected to the lower left side of the piston chamber and to the pressure gauge. The other connecting tube should be connected to the lower right side of the piston chamber and to the helium tank.

5 liters of helium gas should now be added to the piston chamber. VERY SLOWLY click on the gas tank's silver button 5 times to release the gas from the tank. Measure and record the pressure and volume.

The thermometer should then be placed over the piston chamber until it snaps into place. Double click on the Magic Meter, and it should be set to measure volume. Record the volume and temperature.

Double click on the hot plate to open its Property Box. The user-defined temperature should be INCREASED by 10 degrees. Once the temperature inside the chamber has stopped changing, the new temperature and volume (using Magic Meter) should be recorded.

How has the increase in temperature affected the volume of the gas

The temperature should be increased three more times at increments of 10 degrees. The new temperatures and volumes should be recorded at each increment.

Calculate the ratio of V/T for all data. Calculate the average and report the value.

This experiment should be repeated using another gas. Once the data has been collected, calculate the ratio for Volume L/ Temperature K (showing work).

LAB: CHARLES' LAW & IDEAL GAS LAW

DATA TABLE: remember final handed in one must be computer generated

Here is the only help that will be given for the construction of the two data tables (one for each gas).
The data table should consist of 5 columns; 1)trials, 2)volume, 3)pressure, 4)temperate, and 5)L/K

In the previous experiments, three different variables: volume, pressure, and temperature were used. These variables can be combined into one single expressions, resulting in the **Ideal Gas Law**. It is written as PV = nRT, where n = the number of moles, R = is the universal gas constant with a value of 0.0821 L atm/Kmol. This equation involves all the important characteristics of a gas. Knowing any three of the variables allows one to calculate the fourth.

$$PV = nRT$$

Please use the following procedures.
First, lower the volume on your computer! If I hear anyone's computer make noise, you will lose lab points!

Future Lab should be open, Select Ideal Gas Law Experiment, then Standard Setup 1

The Toolbar should be opened, and a piston chamber, a pressure gauge, two connecting tubes, any single gas tank, a thermometer, any size mass, and a Magic Meter.

Attach one end of a connecting tube to the pressure gauge and the other end to the lower left side of the piston chamber. Attach one end of the other connecting tube to the gas tank and the other end to the lower right side of the piston chamber.

4 liters of gas should now be added to the piston chamber. VERY SLOWLY click on the gas tank's silver button to let the gas into the chamber. Measure and record the pressure and volume of gas.

Place the thermometer over the piston chamber until it snaps into place. Measure and record the temperature of the gas.

Increase the pressure by adding any mass to the piston chamber. Measure and record the new pressure and volume. Repeat this step 3 times using different size masses.

Once the data has been collected, calculate the number of moles (showing work).

DATA TABLE: (Remember final data table tht will be handed in must be computer generated!)

Here is the only help that will be given for the construction of the data table. The data table should consist of 5 columns; 1) trials, 2) volume, 3) pressure, 4) temperate, and 5) moles (in which you will calculate-showing work).

CP CHEMISTRY MRS. PITTENGER

Name_____ Date_____

Period_____ Lab Group #_____

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QUESTIONS: (answer in complete sentences, and show calculation next to problem when needed)

Charles' Law:

1. How has the increase in temperature affected the volume of the gas? Explain thoroughly.

2. The relationship between volume and temperature can be stated as _____
   a. volume increases as temperature increases.
   b. volume decreases as temperature increases.
   c. volume remains constant as temperature fluctuates.
   d. there is no relationship between volume and temperature.

3. The initial value of b before you heat the gas inside the piston chamber is _____
   a. 0.20 L / K
   b. 0.017 L / K
   c. 58.2 L / K
   d. 27.1 L / K

4. The value of b after increasing the temperature of the gas inside the piston chamber by 10 degrees is _____
   a. 0.20 L / K
   b. 58.2 L / K
   c. 0.017 L/K
   d. 27.1 L / K

5. Volume and temperature are _____
   a. not proportional.
   b. inversely proportional.
   c. directly proportional

6. As the temperature inside the piston chamber increases, the value of b _____
   a. decreases
   b. becomes zero
   c. increase
   d. stays the same

7. If b is 0.10 L K and temperature is 273 K, the volume is _____
   a. 35 L
   b. 45.3 L
   c. 28.3 L
   d. 27.3 L

Ideal Gas Law:

8. The number of moles of gas in the piston chamber is _____
   a. 16 mol
   b. 8 mol
   c. 0.40 mol
   d. 0.16 mol

9. Increasing the pressure inside the piston chamber _____
   a. causes an increase in the number of moles inside the chamber.
   b. causes a decrease in the number of moles inside the chamber.
   c. causes the number of moles to become zero.
   d. has no effect on the number of moles inside the chamber.

10. If you add more gas to the piston chamber, the volume will _____
    a. remain constant because there is no increase in temperature.
    b. increase.
    c. decrease.
    d. reach zero.

REMEMBER TO SUBMIT 3 COMPUTER GENERATED CHARTS ALONG WITH THESE QUESTIONS