Lab report: gas laws essay

Lab: Gas Laws Purpose: Obtain a reference of temperatures effect on gas using Charles' law when heating a capillary tube in water on a heated hot plate. Then, cooling the same capillary tube with ice while measuring the temperatures cooling effect on the gas bubble inside the capillary tube. Measurements of temperature change are taken with microLAB sensor and graphed using microLAB software. A final determination of experiments determined absolute zero versus actual absolute zero will be calculated to determine percentage of error in experiments data using Charles' quantitative law of V1/T1= V2/T2.

Obtain a reference of pressures effects on gas using Boyle's law using a gas sample of standard " air" within a syringe and measuring pressures increase and decrease in association to changing volume. Measurements are obtained through microLAB sensors and graphed using microLAB software where a correlation coefficient of P vs. 1/V can be determined to represent pressure and volume's relationship to each other in the experiment. Procedure / Observations: Entered microLAB gas laws program, chose Charles' Law and labeled y-axis as temperature variable in Celsius, and x-axis as volume in mL.

Read the capillary tube's gas bubble at the base of the bubble, recorded as 5. 8. Then placed the sealed end of a capillary tube into a 400 mL beaker 2/3 full of room-temp water. The capillary tube's plug keeps the small amount of air trapped between plug and sealed end. The weight of the plug plus the constant atm applied maintains a constant pressure on the trapped gas. Turned on hot plate to setting 5, placed 400 mL beaker of water with capillary tube onto hot plate allowing temperature of water to rise to 80 C while stirring occasionally.

Once water temperature was found to have reached desired temperature of 80 C the capillary tube's gas bubble was read at the top of bubble in order to deduct from initial reading to determine the changes forced on gas bubble from increase in temperature, the capillary tube's gas bubble read 3. 4 at the top, then deducted the 3. 4 reading at the top of gas bubble from the 5. 8 reading taken prior to heating and from the base of the gas bubble. The difference was 2. 4, which was entered manually into microLAB, temperature was read simultaneously as data of gas change was entered into microLAB.

Set timer to read temperature and gas changes every minute. Removed the beaker containing 400 mL water, with capillary tube still inside with sealed end still resting on bottom of beaker, from the hot plate to speed cooling process because the hot plate, although turned off was still heating the water. One minute passed, gas bubble read 3. 4, deducted again from bottom reading of gas bubble taken at the beginning of experiment; difference was a staggering 2. 4, no change.

Added approximately five circular chips of ice to water in 400 mL beaker, allowed chips to dissolve within one-minute time frame, read top of gas bubble in capillary tube to be 3. 5, then deducted from our initial base reading at the beginning of 5. 8 and found the difference to be 2. 3. Input data to microLAB and temperature was read simultaneously as " enter" was hit. Added another 5 circular chips of ice to ice to water in the 400 mL beaker, allowed ice to melt while stirring during one-minute interval.

Measured top of capillary tubes gas bubble to be 3. , deducted from initial reading at base of gas bubble, in the beginning of experiment of 5. 8, and found a difference of 2. 3. A change had not occurred. Repeated the process of adding ice to water, assisting ice to melt completely by stirring, measured change in gas bubble formed inside capillary tube and input data into microLAB until the temperature reached 5 degrees Celsius. Please reference attached graph labeled Charles' Law. Used data obtained from microLAB software to determine Correlation coefficient (V vs. T) of R = 0. 92.

Were able to determine that absolute zero of experiment by taking the product of 122. 405 (y axis) and 0 (slope intercept), with the sum of -209. 54 (x axis) to find our absolute zero of -209. 54 degrees C. Using the actual/theoretical percent yield equation was able to find the percent error of 23%. Boyle's law experiment started with opening a new microLAB program within in the gas law program labeled Boyle's law. Set pressure plot to y-axis with factory calibration, set volume plot to the x-axis in mL. Connected syringe to pressure connection in from of microLAB. Set syringe to 30. mL, taking into account the 4 mL of sample gas contained in the hose for a total gas quantity of 34. 0 mL. Took measurements of pressure at volume settings from 34 mL, 29 mL, and 25 mL while applying pressure, and then measured from 25 mL, 29 mL, and 34 mL while pulling and applying suction. MicroLAB measured the pressure and volume changes, please reference attached graph labeled Boyle's law. Found the correlation coefficient (P vs. 1/V) to be . 999, information was given as a quantitative value from microLAB. Data: Please see attached graph labeled Charles' law (122. 405)(0)+(-209. 4)= -209. 54 (-209. 54)-(-273. 15)/273. 15= 63. 61 (63. 61)(100%)= 0. 23%

Please see attached graph labeled Boyle's law Data Analysis: Charles' law experiment and data show that there is an equal relationship between temperature and volume in relation to gas. When temperature increases, so does the volume. Similarly, when temperature decreases so does the volume. It makes sense since on a molecular level the gas particals are moving faster at higher temperatures, thus causing an expansion of the gas to occur as observed in the increased gas bubble inside the capillary tube.

Boyle's law experiment and data displayed similar findings where the pressure and suction were applied and same amount of energy was recorded being placed on the gas at the same measured intervals without change. The graph displayed a visual of the inverse relationship between pressure and volume in relation to gas laws and how where one increases and the other decreases. Conclusion: Experiment was intended to find a reference of temperatures effect on gas using Charles' law when heating a capillary tube in water on a heated hot plate. Then, cooling the same capillary tube with ice while measuring the emperatures cooling effect on the gas bubble inside the capillary tube. Measurements of temperature change are taken with microLAB sensor and graphed using microLAB software. A final determination of experiments determined absolute zero versus actual absolute zero will be calculated to determine percentage of error in experiments data using Charles' quantitative law of V1/T1= V2/T2. We were able to determine the percent error to be 23% and observe a linear display of the relationship between temperature and volume where as one increases, so does the other. The same relationship was observed in the decrease of temperature and volume.

Experiment was meant to obtain a reference of pressures effects on gas using Boyle's law using a gas sample of standard " air" within a syringe and measuring pressures increase and decrease in association to changing volume. Measurements are obtained through microLAB sensors and graphed using microLAB software where a correlation coefficient of P vs. 1/V can be determined to represent pressure and volume's relationship to each other in the experiment. Found that pressure and volume are inversely proportionate to each other, while one doubles, the other halves.