Experiment 13: Calculation of the Ideal Gas Constant

Format & Clarity of the Report: See lab report checklist. You are graded on how you format the lab and record your data, not just data collection.

Before class starts: Read the lab for the week carefully before you start writing your pre-lab. The purpose, introduction, and procedure should be neatly written in your lab book before class starts.

Spacing: You will probably use 2 pages for your purpose and procedure, 1 page for the data table, 1-2 pages for calculations, 1 page (or less for results table), 1-2 pages for the analysis statement, . If you allot an appropriate amount of space, you will not have to mix labs together if you have to do more than one in a week. You will lose points for poorly formated labs

Purpose: The title indicates the purpose of the lab.

Introduction: no introduction please

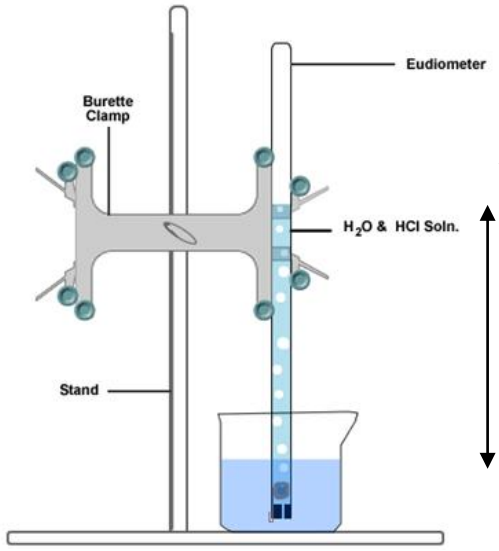
Pre-lab questions: ***No pre-lab questions***

Procedure: ***YOU HAVE TIME TO DO THIS EXPERIMENT THREE TIMES + ONE MORE TIME FOR EACH PERSON IN YOUR GROUP. YOU WILL BE GRADED ON THE PRECISION AND ACCURACY OF YOUR WORK. Do as many trials as you can***

1. ***In step 2, feed the tail of the copper cage through the hole of the stopper.***
2. ***Use an eyedropper to fill the hole with water.***
3. ***Be very carful when pouring the concentrated acid into the eudiometer. (This is also stated in step 8).***
4. ***Be careful when using the ruler for measuring the height of the column. THIS IS A SOURCE OF ERROR.***
5. ***Almost every step in this lab has a source of error.***
6. ***USE THE ANALYTICAL BALANCE, not the centigram balances.***

Qualitative Observations/ Data Collection: You should pay appropriate attention to details in this lab. The observations will help you identify sources of error. Data collection need to be done with care, Use this section to look beyond the obvious observations: ***You should describe:*** *What does the magnesium metal looks like before reacting? What happens to the copper metal? What happens to the liquid in the eudiometer? What happens when the acid hits the Mg ribbon? Did you observe the mixing of water and acid? What did it look like? What other things did you observe? Include a drawing of the set up in your observation section.*

For this experiment, you should *collect your data with the correct significant figures and units in the observation section with the correct precision and units.: mass of Mg to the nearest 0.0001 g; the volume of the gas in the eudiometer (±0.01mL); the height of the column above the level of water (±0.1cm); the barometric pressure (look at board); the temperature of the gas (±0.1°C); the vapor pressure of water at your temperature (chart given)*



Measure the volume of the gas

Measure the height of the column of solution in the eudiometerto the top of the water in the beaker

Take the temperature of the water in the beaker

Record the pressure of the atmosphere

Data Tables: *For this experiment, you should transfer your data with the correct significant figures and units from the observation section into a data table that is easy to understand: mass of Mg to the nearest 0.0001 g; the volume of the gas in the eudiometer; the height of the column above the level of water; the barometric pressure (look at board); the temperature of the gas; the vapor pressure of water at your temperature (chart is on line on my website)*

Calculations: ***For this experiment, you should calculate:*** *the moles of Mg used; the mole of Hydrogen gas produced; the pressure due to the column of water; the pressure due to hydrogen gas in Atm; the temperature of the gas in K; an experiment value of R, the average value of R. the percent difference of your values, and the % error. On page 59 of the lab manual, step 2 shows you how to convert the pressure exerted by the column of solution left in the eudiometer to a pressure in mmHg. You will use Dalton's law to find the pressure of the hydrogen gas.*

Graph: ***No graph***

Results Tables: ***The results table should show three (four) experimental values of R, the average value of R, the percent difference of your values, and the % error of your average value compared to the theoretical value.***

Results/error evaluation/summary: These should be integrated together. One or two sentences will not be enough to adequately express the observations, results, and sources of error.

Results Statement and **Error evaluation:**

YOU WILL WRITE COMBINATION OF A RESULTS AND ERROR ANALYSIS FOR THIS LAB. I have stated what you need above, but here is a checklist.

In the summary you should explore the following:

1. *What was the purpose of the lab.*
2. *Summarize the procedure of the lab. Include the balanced stoichiometric relationships for the processes that occurred during the lab.*
3. *Summarize your observations and do not confuse observations and conclusions.*
4. *Summarize your final data and include a % error AND a % difference.*
5. *What was the experimental value for R, the gas constant?*
6. *From the observations and data, draw conclusions about what you observed. Hint: if you observed bubbles, what was in them? (You cannot directly observe hydrogen gas!)*
7. *What made the water in the tube go down?*
8. *Compare the results to literature values, results of other students, and/or the results expected based on an understanding of chemistry.*

9. *Check out chapter 10; you should be able to explain microscopically what is happening and what we observe macroscopically based on gas laws and gas behavior.*
10. *At this point, you probably expected to be close to* R. *Were you? Discuss confidence in the results, (you should be within 5% using good experimental technique).*
11. *Identify sources of experimental error, and explain how the errors may have affected the results. Nearly every step in this lab can contribute some error to make the calculated value of* R *greater or less then it should be.* ***Think of three places where major errors occur that affect your variables.*** *For example, "I had a bubble of air trapped in the top of the eudiometer before the reaction started. This means the volume of solution pushed out is smaller than it should be. Since volume is directly related to* R*, my* R *is actually smaller than what I calculated."*

Re-state the purpose. Briefly describe what you did in lab and summarize your observations. You should summarize your results and explain the results support or deny the purpose. Do you think you adequately accomplished the goals of the lab? Did the results make sense? Were they what you might expect? Do not include intermediate data in the summary. The result summary is easy to read, had good grammar, and a logical flow of ideas. You should demonstrate, in the course of writing the evaluation, that you have a good grasp of the concepts presented in the lab.

Build on the results statement. Were there places where errors could occur? Think of one or two (or more) major errorsthat occurred while you performed the experiment, and discuss how those errors might have affected your results. Think about the types of tools you used. What is the inherent error? What error did you add? Mistakes often occur during the course of the lab. Did you make any? You should assess whether the values that you calculated are higher (or lower) than they should be due to errors.

You need to type your analysis: 12 pt font, double-spaced, in Standard English. Make sure you spell check and grammar check. (In the end, I should have a good sense of what you were looking for in this experiment, what you did and observed in the experiment, what your results were for the experiment. Think about it this way. " Oh no, I lost my report. That's okay, I can describe what I did, my results, and errors, etc., in the conclusion.")

FOR ANY STATEMENT: Submit a typed statement in 12 pt, serf font (i.e. Palatino, Garibaldi, or Times), using good grammar, syntax, and Standard English. Complete sentences are used: short well-worded sentences are better than long, poorly, worded sentences. The spelling has been checked. Questions that are presented throughout the lab can be answered in a coherent set of paragraphs, but the points must be addressed within**.** All of this was done in a manner that was well thought out, logically presented and interesting to read. The evaluation should be neatly trimmed and **GLUED OR TAPED** into your book (two copies, one original, one yellow).).

Post Lab Questions: The questions in the instructions should be answered clearly and completely in your lab book. You should write thoughtful answers to the questions in the lab manual using complete sentences, good grammar, and in Standard English. You might want to consider typing these answers, to give you more time to think about the quality of your answer. (No credit if you did not show your work or explain your reasoning). The answers should address the main thrust of each question. Answers involving calculations should have the correct significant figures and units. ***Answer any questions from the lab manual. In question 2 there are at least 4 assumptions. One is based on the premise of the lab. Three are experimental. There could be more, and probably are, but I am only holding you to four.***