Determination of K_{eq} Lab Feedback Rubric

Category	General	Pts	Specific	Self Assessment
Lab Title, Topic	Topic is not the same as the title of the chapter!	1	Molar Volume of Hydrogen, Gas Collection over water / Molar Volume	
Purpose/Question/ Problem/Goal /Hypothesis	Relevant, thoughtful	1	Purpose is to determine molar volume of Hydrogen Gas at **STP**	
Key vocab terms and equations		2	Molar Volume, Avogadro's Number, STP, Dalton's Law, Combined Gas Law, Ideal Gas Law, Equations used in experiment	
Key concept explained	All relevant concepts explained in a detailed and scientific way that demonstrates the connection to the material taught in the chapter.	3	Collecting Gas over water: Use Dalton's Law to target gas collected by removing water vapor. Collecting gas by water displacement, etc…	
Lab equipment, setup, named lab techniques	All-important items included, labeled, explained	2	Eudiometer Tube/Grad. Cyl., Beaker, Thermometer	
Sig figs related to the equipment		1	NA – Points automatically given unless you wrote something that did not apply. You should know this box was not applicable to the lab being done. Don't make up nonsense just to fill a box!	
Experimental results	Reported in a succinct and direct way.	2	Calculated Molar Volume of your sample with unit L/mol – both trials. Post lab asks for average, which comes after experimental results	
Accepted values/results	Relevant accepted values/results reported	2	Must state 22.4(2) L/mol as accepted	
% Error Calculation	Done correctly, work shown, answer reported	2	Must show work for % error: $\frac{\lvert calculated - accepted \rvert}{accepted} x\ 100$ – - - - Both trials	
Sample calculations	Sample calculation shown for each type of calculation, work shown, numbers and units included, done correctly, answers reported.	4	*Must show all calculations for one trial. UNITS!* Mass of Mg, **#1** Stoichiometry from mass of Mg to moles of H_2, **#2** Dalton's Law for P_{H_2}, **#3** Using answer from #2 – calculate Volume of H_2 at STP, **#4** Determine molar volume using answer from #3 divided by answer from #1	

Possible Lab errors	Relevant lab errors reported. No mention of "human error" or "calculation mistakes" etc…	3	• Pressure not equalized inside tube • Reaction does not go to completion • All gas produced by reaction does not reach tube • Gas bubbles adhere to side of tube • **Detailed** • If mention "human error" – 1 pt deduction ➢ *Sadly many of you used "errors" from the discussion Q's and couldn't or wouldn't think of your own*.	
Mathematical impact of lab errors	Identifies if errors result in higher or lower final results, explaining mathematical reasoning	3	Effects of the errors on ending value (higher or lower) and why…	
Example test question on topic	Thoughtful, relevant possible test question on this topic	2	Question needs to be detailed, complex enough to show thought/processing of the scientific concepts being taught during the chapter – not just a simple "what color flame does calcium make" type question. See HERE for Costa's Levels of Questioning. Question should be level 2 or 3 – did not hold you accountable this time.	
Solved Example test question	Work shown, done correctly, explanation given if not a mathematical problem.	2	Answer needs to be detailed and correct. If Math, must show all work to prove answer	
Data Tables	Professional, large, rows/columns labeled, data legible	12	• Data tables were already made: must include descriptive title along with the full reaction (reactants and products). This was to see if you recorded your data in a detailed way. Correct UNITS! • No Full Rxn – 3 pt deduction • No Title – 5 pt deduction • Lacking description in title – 2 pt deduction ○ Includes "…to determine Mol. Vol. of H_2"	
Discussion questions	One or more questions will be evaluated for completion and/or accuracy.	10	This time it was for completion and displaying a reasonable amount of **detail/effort consistent with an AP level class**. Points were deducted for copying the questions instead of paraphrasing, or for not paraphrasing at all. Correct work shown (if applicable) with units	
Professionalism	Neat, legible, demonstrates deep level of thought/detail/effort.	7	Points deducted if the legibility detracted from my ability to grade the assignment. Points also deducted for a blatant disregard for the level of thought and detail required of an AP level course. This category is also used for strange/unique issues that do not fit nicely into another category.	

Discussion Questions – The highlighted ones were graded.

- ☐ #'s, 1-6, 8, 11 for completion, detail, thought AND accuracy
- ☐ All were graded for completion, detail, and thought

#1-6 were calculations and all work should be shown, ez to follow your set up, including units.

[1] Must use Stoichiometry to determine moles H_2 produced with mole ratio

[2] Dalton's Law

[3] Combined gas law WITH partial pressure determined in #2

[4] Solve for molar volume # STP: volume H_2 (answer to #3) / moles of H_2 (answer from #1)

[5] Average Molar Volume. Must show percent error using equation shown on Lab Protocol pg. 6

[6] Calculate mass of 1 L of H_2 @ STP.

#7: Since the tube should be 100% full of water at the beginning of the experiment, any air leaking into the tube prior to the experiment would add to the total volume of collected gas at the end of the experiment. The effect this would have would be a larger calculated volume of Hydrogen gas at STP, which would lead to a larger molar volume of Hydrogen at STP. The reaction produced X amount of Hydrogen gas collected in the tube, any extra air (gas) present would be counted a Hydrogen Gas in the calculations. The calculated molar volume would be higher than it should be.

#8: Oxidized Mg is MgO. When it reacts with HCl, the products are $MgCl_2$ and H_2O. If the measured Mg with MgO on the surface is used, the amount of H_2 gas will be LESS than what should have been produced based on the mass of Mg measured as all Mg. Less H_2 Produced would lower the volume of gas collected, which will decrease the volume of H_2 at STP. Then dividing by a larger mol number from the Mg will create a **LOWER Molar Volume**.

#9: Mg is reacting to become Mg^{2+} therefore is losing electrons and therefore **OXIDIZED**. H of HCl is H^+ and when reacting with Mg becomes H_2 gas. H^+ is gaining electrons, therefore it is being **REDUCED**.

#10: The tube is only 50 mL in volume to collect gas. For this reaction, Mg must be the limiting reagent so that the amount of H_2 gas produced is controlled and not going to be greater than 50 mL

#11: Changing the mass of Mg from trial 1 to trial 2 would **NOT affect the Molar Volume at STP**. With larger mass of Mg would relate to larger volume of H_2 produced. And when determining Molar Volume, the student would be dividing a larger volume by a larger mol number of H_2. If both Volume and moles increase and because of Avogadro's Law, molar volume at STP does not change.