Dougherty Valley HS Chemistry
Gas Stoichiometry Lab

Purpose: How many grams of Aluminum do you need to make a certain number of liters of Hydrogen Gas?

Pre-Lab: [*To be complete on a separate sheet of paper*]
[1] Find the entire volume of a 100 ml graduated cylinder (all the way to the lip of the cylinder). To do this, use two or more graduated cylinders (don't fill past the top mark). Convert the milliliters to liters. **Note**: the temperature of the room (thermometer in the front of the class). Consider this the temperature in your flask.
Volume of the Flask: _____ ml, _____ L **Temperature**: _____ °C, _____ K

[2] Note the pressure in the room using the barometer. Since the H_2 gas will be collected over water, you need to take out the partial pressure of the water vapor and find only P_{H_2} (equation page 366 & chart page 859).
Measured Pressure (P_T): _____mmHg **Partial Pressure of H_2O from chart**: _____kPa, _____atm

Calculated pressure: _____ atm $\boldsymbol{P_{Total}} = P_{H_2} + P_{H_2O}$; $\boldsymbol{P_{H_2}}$ = _____ atm

[3] Determine how many grams of aluminum you will need to exactly fill your graduated cylinder to the 50ml mark with H_2 gas. Use the numbers above, the formula equation, PV=nRT, and your gas stoichiometry skills. Assume OH^- and water to be in excess.

$$\mathbf{2Al_{(s)} + 2OH^-_{(aq)} + 6H_2O_{(l)} \rightarrow 3H_{2(g)} + 2[Al(OH)_4^-]_{(aq)}}$$

Procedure: [Create a flow chart of the procedure with picture/diagrams]
[1] Cut a piece of aluminum and measure the mass so that it is equal to your calculation above and record in your data table the exact mass of aluminum.
[2] Obtain 50ml of 2M NaOH in the beaker provided. **CAUTION:** NaOH is caustic and can burn your skin.
[3] Set up apparatus as seen on the front lab bench. Be sure to check all connections with tubing so that you don't have any leaks.
[4] Invert your 100ml graduated cylinder and place it in the sink. Be sure that your graduated cylinder is completely filled with water and that there are no air bubbles.
[5] Crumple up your aluminum foil loosely and put it into a test tube.
[6] Be sure that the end of your J-tube is in the graduated cylinder
[7] Measure out 15ml of NaOH in a 25ml graduated cylinder and add that amount to your test tube and QUICKLY put the stopper into the test tube. Allow the reaction to proceed for 7-10 minutes or until the all of the Aluminum has been dissolved.
[8] Once the reaction has ended, wait 2 minutes then lift your graduated cylinder up or down so that the level of the water in the cylinder is equal to the level of the water in sink. This will equalize your pressure. Record the volume of gas collected in your data table. Record the temperature of the water in the sink and record in your data table.
[9] Using a different stopper, reach into the water and plug the hole of the cylinder. Lift the cylinder out of the water and stand upright. Light a wooden splint and test for presence of hydrogen by holding near the stopper…lift the stopper off and insert your lighted wooden splint.
[10] Repeat steps 4-9 two more times and record data in your data table.

Observations:
Did your cylinder fill up perfectly with hydrogen to the correct amount? Was there too much or too little (below or above the 50ml mark)?

Write your observations in the table below. Be detailed in what you saw, did, mistakes, hear, feel, etc…

Data Table	Trial 1	Trial 2	Trial 3	Average
Mass of Aluminum foil used				----------
Temperature of water in sink (K)	____°C, ____ K	____°C, ____ K	____°C, ____ K	----------
Volume of hydrogen gas collected				
Mole of hydrogen gas collected*				
Grams of hydrogen gas collected*				

*Show calculation for Trial 1 only.

Calculations:
[1] Calculate the number of moles of H_2 collected from volume of H_2 collected.
[2] Calculate the number of grams of H_2 collected.
[3] Calculate the average volume of H_2 gas collected, number of moles of H_2, and number of grams of H_2

Questions:
[1] You collected gas after is has bubbled through water, what might happen to some of the gas as it goes through the water?
[2] Evaluating the pressure and temperature at which your experiment was done, and the polarity of the gas. Would you expect the gas in your experiment to behave as an ideal gas or a real gas? Explain.
[3] What <u>two</u> gases <u>must</u> have ended up inside the large flask while the water was being displaced? Explain why.
[4] Why is it important to lift your flask, so that when it is full of hydrogen, the level of the gas and the water are almost the same?
[5] Describe the most likely reason why too great a volume of gas would form in this experiment, assuming the correct amount of aluminum was used. Include specific references to PV=nRT. (Hint: think about which variable would change due to a chemical reaction).
[6] Describe 2-3 different errors you made during the experiment that would through off your results. Explain how they threw off your results clearly.
[7] What should you have learned regarding gases from this experiment?
[8] Draw the setup you used during the experiment and label all parts.