Name: _____ Date: _____

Molar Volume of a Gas

Objective: To use the gas laws as a means of verifying that one mole of hydrogen gas occupies 22.414 L at STP.

Materials:

magnesium	hydrochloric acid

_____ cm of Mg = _____ g

Equipment:

eudiometer	buret clamp
ring stand	beaker
rubber stopper with copper wire	ruler
barometer	thermometer

Procedure:

1. Obtain a piece of magnesium approximately 3 cm in length. Record the exact length to the nearest 0.01 cm. If available, the analytical balance may be used to measure the magnesium. This will prevent a conversion of strip length to grams.
2. Wrap the magnesium strip around the copper wire that is inserted in the rubber stopper.
3. Under the hood, add approximately 4 mL of concentrated hydrochloric acid to the eudiometer. Fill up the rest of the eudiometer with distilled water. Allow a bubble to form on the mouth of the eudiometer. Place it (mouth up) in the buret clamp.
4. Fill a 600 mL beaker (or larger) with tap water and place under the eudiometer. Use a thermometer to find the water's temperature and record. Have a partner record the barometric pressure in the room at this time.
5. Place the stopper in the mouth of the eudiometer so that the magnesium strip is on the inside of the eudiometer. Make sure there is no air bubble in the eudiometer. Overflow of water will occur – this is okay, the acid is denser than water and remains at the bottom of the eudiometer until inverted.
6. Place a thumb over the hole in the stopper and invert the eudiometer, placing the mouth in the beaker and under the surface of the water. Have a partner open the buret clamp so the eudiometer can be secured quickly. Slide the eudiometer down so that it rests on the bottom of the beaker. It takes at least thirty seconds for the acid to reach the opening of the eudiometer.
7. When the magnesium is gone, adjust the eudiometer so the water level is equal to the water level in the beaker. Allow a minute to pass and record the volume of the hydrogen gas in the eudiometer.
8. Repeat until at least four trials are complete.

Calculations:
Write the equation for the reaction.

For each trial performed, perform steps one through seven.

1. Determine the mass and number of moles of magnesium used.
2. Determine the theoretical number of moles of hydrogen produced.
3. Convert the barometric pressure to kilopascals.
4. The hydrogen gas collected is considered "wet" because it was produced over water. Therefore the barometric pressure is a reading of the sum of the partial pressures of the "dry" hydrogen gas and water vapor. Look up the vapor pressure at the temperature recorded in your data table. Use this value and Dalton's Law of Partial Pressures to find the partial pressure of the dry hydrogen gas.
5. Convert your temperatures to Kelvin.
6. Use the Combined Gas Law to determine the volume of gas that would have been produced at STP.
7. Use Avogadro's Law to determine the volume one mole of gas would occupy at STP.

8. Perform a Q-test on the values found in the last step. If an outlier fails, it may be thrown out.
9. Find the average of all values that remain and find the percent error with respect to the average.

Data:

Mass (g)	P (mm Hg)	T (°C)	Vol H_2 (mL)
0.0325	758.5	18.4	33.45
0.0355	759.1	18.6	34.18
0.0394	759.7	18.8	35.26
0.0364	760.3	19.1	36.84