combined gas law above. \( P_{\text{lab(total)}} \) is the atmospheric pressure in the laboratory and equal to the pressure of the gas mixture in the cylinder. The partial pressure of water (\( P_{\text{lab(H}_2\text{O)}} \)) depends only on the temperature. The partial pressure due to water vapor at different temperatures can be obtained from the following Website:

http://antoine.frostburg.edu/chem/senese/javascript/water-properties.html

For example, if the atmospheric pressure in the room, \( P_{\text{lab(total)}} \), is 757.6 mmHg and you conducted the reaction at 23.0ºC, the pressure of the hydrogen gas is found as follows:

\[
P_{\text{lab(H}_2\text{)}} = 757.6 \text{ mm Hg} - 21.1 \text{ mm Hg} \\
= 736.5 \text{ mm Hg}
\]

Remember the addition/subtraction rule for sig figs!

Thus, you can calculate \( V_{\text{STP}} \), and the moles of hydrogen (n) are calculated using the mass of magnesium and the mole-to-mole ratio from the balanced chemical equation, as shown below:

\[
\text{# of moles of H}_2 = 0.0791 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} \times \frac{1 \text{ mol H}_2}{1 \text{ mol Mg}} = 0.00325 \text{ mol of H}_2
\]

At last, you can calculate the molar volume at STP: \( \frac{V_{\text{STP}}}{n} \).

Calculations

Procedure

1. Work in groups of two students unless otherwise instructed.

2. Obtain a plastic trough, a large funnel, and a 100 mL graduated cylinder from the stockroom. Return this equipment clean when finished with the lab. Fill the trough about 2/3 full of water. Place the cylinder horizontally into the water and allow it to fill completely with water. There should be no air bubbles in the cylinder.

3. Using the provided steel wool or sandpaper, lightly scrape the outside of a Mg strip to remove oxide coating. Weigh the Mg strip on an analytical balance, and record its mass on the data sheet. Be sure to get 3 significant figures in the mass of Mg. Obtain the atmospheric pressure in the room by reading it off of the electronic barometer.

4. Prepare the Mg for reacting by folding it up to about the size of a jelly bean. Wrap it up in a small square of cheesecloth and close it all up with a piece of copper wire. (See Figure 2 at the top of the next page.) The cheesecloth and copper will not react with the acid -- they are used to weigh down and contain the Mg. (This “wrapping” of the Mg will be demonstrated in the prelab discussion.)
5. Measure about 50 mL of 6M HCl solution into a 100 mL beaker. You can get more if needed, but please don’t take more than 50 mL at a time, to conserve materials.

6. You are now ready to conduct the reaction. Place the Mg ‘packet’ under water in the small, slanted indentation at the bottom of the trough.

7. Stand the graduated cylinder upright (bottom up) so that the mouth is directly over the Mg. Trap part of the cheesecloth under the graduated cylinder as shown in Figure 4. This keeps the cheesecloth from floating up as it reacts. There should be no air bubbles in the cylinder. One student will holds the graduated while the reaction occurs. Position the tip of the funnel so that the acid will be delivered as directly as possible to the Mg. Begin by slowly adding about 25 mL of HCl through the funnel. You should see bubbles immediately start to form, and these bubbles should be completely captured within the graduated cylinder. When the reaction slows, add another portion of acid, and repeat until all the Mg has disappeared and no more bubbles are being formed.