When magnesium metal reacts with hydrochloric acid, hydrogen gas is produced. The volume of this gas can be measured by using a eudiometer. A eudiometer is a giant test tube that has graduated volume measurements. Knowing the number of moles of magnesium used, you can calculate the volume of hydrogen produced per mole of magnesium consumed. The balanced equation for this reaction also allows you to determine the volume that one mole of gas occupies as a recorded temperature and pressure.

Procedure

Half fill a tall cylinder with tap water, and place about 1O0mL of tap water in a 25O-mL beaker. Obtain ~1OmL of 3M hydrochloric acid in a graduated cylinder. Acquire a piece of magnesium ribbon and measure and record its mass to the nearest 0.OOlg. Roll the magnesium ribbon into a loose coil. Tie the coil with a piece of thread in such a manner that all of the loops of the coil are tied together.

With a funnel, carefully pour ~10mL of 3M HCl (aq) into the eudiometer. Using the room temperature water in the 250-mL beaker, very slowly pour water from the beaker into the eudiometer which is in a slightly tipped position. Be careful to layer the water over the acid so that they do not mix thoroughly. Add enough water to fill the eudiometer completely.

Using the thread, lower the magnesium coil into the water in the eudiometer to a depth of ~5cm. Insert the rubber stopper into the mouth of the eudiometer to hold the thread in position. The stopper should displace some of the water from the tube—this ensures that no air is left inside the tube.

Cover the hole in the stopper with your finger and invert the eudiometer in the tall cylinder jar. Allow the stopper end of the eudiometer to rest upon the bottom of the cylinder. The acid flows down the tube and reacts with the magnesium ribbon. Answer and explain your answers to the following questions in the discussion of your results part of your summary:

1) Why does the acid flow down the tube?
2) Is the acid becoming more dilute or more concentrated?
3) What are your observations of the reaction?

When the magnesium has completely disappeared and the reaction has stopped, adjust the eudiometer's position in the cylinder until the liquid levels inside the eudiometer and cylinder are the same. You may add water to the cylinder if necessary.

From the markings on the eudiometer, record the volume of hydrogen that is liberated to the nearest 0.01mL. Record the temperature of the water in the cylinder to the nearest 0.1°C and assume that this is the temperature of the hydrogen gas that has been produced.

Record the vapor pressure of water at the observed temperature from the *Handbook of Physics and Chemistry* at my desk in the front of the room. Record the barometric pressure from the board.

Repeat the above procedure one time.

Look at my website under Chemistry II AP Labs for the style guide or at your most recent lab report for guidance. This report will by worth 80 pts.

- ☐ Your Discussion section should include the following:
  - Write the balanced reaction. (4 pts.)
  - Calculations—**show all work!**
    These calculations are to be done for each trial.
    1. Determine the number of moles of magnesium ribbon consumed in the reaction. (6 pts.)
    2. Using the balanced equation's mole-to-mol ratio of Mg to H_2, determine the number of moles of hydrogen gas that were produced. This will be **n.** (4 pts.)
    3. Determine the corrected pressure of the hydrogen gas that was collected over water by subtracting the vapor pressure of water at your specific temperature from the barometric pressure recorded from the board. This will be **P**. (4 pts.)
    4. Using your experimental values of **T** (in K), **n**, and **P**, and the ideal gas law formula, determine the volume (in L) of hydrogen that should have been produced in each trial. Find the average of the volumes (in L) that should have been produced. (13 pts.)
    5. Determine your percent error using the volume (in L) of H_2 gas that should have been produced as your accepted value and your experimentally determined volume (in L) as your observed value. (9 pts.)