Stoichiometric Production of Hydrogen Gas **Name _____**

Objective: To determine the amount of Mg needed to produce 1.00 grams of hydrogen gas.

Introduction: Magnesium will displace hydrogen in a single replacement reaction with hydrochloric acid. From the balanced equation for the reaction, the theoretical amount of magnesium needed to produce 1.00 grams of hydrogen can be calculated. In the following procedure, the amount of Mg needed to produce 1.00 grams of hydrogen will be experimentally determined, then the results will be compared to the theoretical amount to find the percent error.

Materials: Eudiometer, bucket of water, magnesium ribbon, concentrated hydrochloric acid, thin copper wire, burette clamp.

Procedure: Record all data in the appropriate lines on the reverse side of this page.

1. Your instructor has written the mass of 1.00 meters of that ribbon on the board. **Record that value in line 1 of the back data table.**
2. Cut a piece of Mg ribbon between 3 and 3.5 cm long, then measure the length precisely to the nearest tenth of a cm. **Record that length in line 2 of the data table.**
3. Use that as a conversion rate to determine the mass of your sample. **Record that mass in line 3 of the data table.**
4. Roll the Mg ribbon into a loose coil, then thread the copper wire through the middle of the coil.
5. Secure the loose end of the copper wire to your eudiometer, leaving the Mg outside the tube.
6. Your instructor will pour 5 mL of concentrated HCl into the eudiometer. Return to your lab station and carefully pour water at a slant into your tube until the tube is completely filled with a domiscus over the top. (Typically one adds acid to water, but we don't want the two to mix).
7. Move the tube to a vertical position and lower the Mg coil into the water in the tube to a depth of around 5 cm. Add extra water to completely fill the tube if any escapes.
8. Place your thumb over the tube to prevent air from entering, then bring the tube over to one of the buckets of water in the lab area. Quickly invert the tube and lower it into the water, then remove your thumb. Allow the tube to rest on the bottom of the bucket and use the burette clamp to hold onto the tube so that your hand does not heat the gas inside the tube.
9. You will note that the acid slowly sinks in the tube, eventually making contact with the ribbon and reacting with it to produce bubbles. When the reaction has stopped (Mg is gone), bring the tube up until the water level inside the tube matches the water level outside the tube. Record the volume of hydrogen in the tube as accurately as possible. **Record that value in line 4 of the data table.**
10. Find the temperature of the water in the bucket and assume it is also the temperature of the hydrogen. **Record the temperature in line 5 of the data table.**
11. **Record the current barometer reading in line 6.**

Data Table:

1. **1 meter magnesium ribbon** = _____ g
2. **Length of Mg ribbon used** = _____ cm
3. **Mass of Mg used (show your steps in converting)** = _____ g
4. **Volume of H_2 collected** = _____ mL (cm^3)
5. **Temperature of H_2** =_____ ^0C
6. **Current barometer reading** = _____ kPa
7. **Vapor pressure of water at recorded temperature** =_____ kPa
8. **Pressure of the dry H_2** = _____ kPa
9. **Volume of H_2 at STP (using combined gas law)** = _____ mL (cm^3)
10. **Mass of H_2 produced (using the ideal gas law)** = _____ g
    (P#8)(V#4 in liters!) = (n)(R8.31)(T#5 in K!) Convert n to grams for H_2
11. **Experimental mass of Mg needed to produce** = _____ g

    1.00 g of H_2 gas (__ g of Mg#3/ ___ g of H_2#10) = X g of Mg/1.00 g H_2)
12. **Theoretical mass of Mg needed to produce**
    1.00 g of H_2 gas (write a balanced equation and use stoichiometry) = _____ g
13. **Experimental error** (experimental – theoretical) = _____ g
14. **Percentage error** (error/theoretical) = _____ %