

12 • Gases and Their Properties

M O L A R V O L U M E O F H Y D R O G E N

Purpose: The purpose of this lab is to experimentally determine the molar volume of a gas at STP.

Apparatus:

ring stand	ring	400-mL beaker
eudiometer tube	3M HCl	4-5 cm of Mg ribbon
15 cm of copper wire	graduated cylinder	ruler
centigram balance	distilled water	tap water

Procedure:

- As a class, determine the mass of 1 meter of Mg ribbon. Put on goggles.
- Obtain a piece of ribbon between 4.5 and 5.0 cm long. Record its length (± 0.01 cm).
- Fold Mg ribbon in half and wrap with copper wire as shown in class. Leave a 15 cm wire “handle.”
- Place about 15 mL of 3M HCl in eudiometer tube. Gently fill the tube to the top with water.
- Insert Mg ribbon/copper wire into tube so metal will be below the numbers when inverted. Insert stopper to hold the wire in place.
- Fill 400-mL beaker about $\frac{2}{3}$ full of tap water.
- Place finger over stopper and invert eudiometer tube in the beaker. Observe.
- When reaction has stopped, tap tube to release any bubbles clinging to the side of the tube. Without losing any liquid, transfer eudiometer tube to a battery jar and equalize inside and outside pressure. Record volume of gas inside tube.
- Obtain matches and wood splint. Test gas to verify that it acts like hydrogen. Keep wood splint for others.
- Clean apparatus and station.

Data:

mass of 1 meter Mg = _____ g
 length of Mg ribbon = _____ cm (read to 2 decimal places)
 room pressure = _____ mmHg
 room temperature = _____ °C
 volume of H₂ = _____ mL (*read this in the grad. cylinder with liquid levels equalized*)
 equilibrium vapor pressure of water at today's temperature = _____ mmHg (from “CRC”)

Questions and Calculations:

- Write a balanced chemical equation for the reaction between Mg ribbon and hydrochloric acid.
- Calculate the number moles of H₂(g) formed beginning with the length of magnesium ribbon used.
- Show your calculation of the partial pressure of hydrogen gas inside the tube. This is the pressure you should use for the room pressure of the hydrogen gas. [Note that another definition of partial pressure is the pressure the hydrogen gas would exert if it were alone in the tube. This is also called the pressure of dry hydrogen.]

