

# Gas Generator Bottle

## Introduction

This gas generator setup provides an easy way to generate and collect gas. Specific instructions are provided for the generation of hydrogen gas using zinc and acid.

## Concepts

- Generation of gases
- Water displacement

## Materials

Hydrochloric acid solution, HCl, 3 M	Glass plates
or Sulfuric acid solution, H <sub>2</sub> SO <sub>4</sub> , 3 M	Glass tubing
Mossy zinc, Zn, 6 g	Pneumatic trough
Water, tap	Rubber tubing
Bent glass tubing*	Silicone grease packet*
Gas collecting bottles or tubes, 3 or 4	Thistle tube*
Gas generator bottle*	Two-hole rubber stopper*

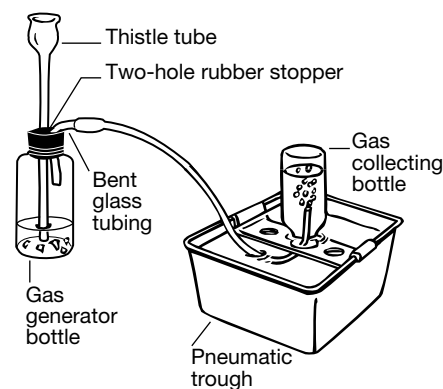
\*Materials included.

## Safety Precautions

Hydrochloric acid solution is toxic by ingestion and inhalation and is severely corrosive to skin, eyes and other tissues, as is sulfuric acid solution. Hydrogen gas is a highly flammable gas and a severe fire hazard. Exercise extreme caution when testing the gas and keep the gas generator away from flames. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. This activity requires the use of hazardous components and/or has the potential for hazardous reactions. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

## Procedure

1. Set up the apparatus as shown in the figure to the right. Lubricate the glass tubing and thistle tube with silicone grease before inserting into the stopper. Make sure the water level is above the platform. Prepare bottles for collecting gas by water displacement. To do this, fill each gas collecting bottle (or tube) over the brim with tap water, and then cover each with a flat glass plate. At this point, invert two of the bottles into a water-filled pneumatic trough, removing the covers once the openings are under water.
2. Place about 6 g of mossy zinc (about 1–2 cm deep) into the gas generator bottle and replace the stopper.
3. Check all connections to be sure the gas delivery tube (bent glass tube) leads to the water-filled gas collecting bottle (via rubber tubing and glass tubing).
4. Carefully pour 3 M HCl solution or 3 M H<sub>2</sub>SO<sub>4</sub> solution through the thistle tube until the acid level in the flask is at least ¼ inch above the bottom of the thistle tube. A vigorous reaction with the zinc begins immediately.
5. Allow the gas that evolves to escape into the water of the trough for about 30 seconds (to flush out air from the system), and then collect three or four bottles of gas by water displacement. As each bottle is filled with gas, lift it from the trough, still inverted, and slip a glass plate over the mouth of the bottle. Place the bottle on the table with the mouth of the bottle down.
6. Use the hydrogen gas in the bottles to perform your experiments involving the testing of hydrogen gas.



## Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulation that may apply, before proceeding. The gas generator bottle should be carefully disassembled away from any flames. The acid solution should be diluted by pouring it into a large beaker of water and then neutralized before flushing it down the drain with water according to Flinn Suggested Disposal Method #24b. The zinc can be rinsed with water and saved for reuse, or disposed of according to Flinn Suggested Disposal Method #26a.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

***Unifying Concepts and Processes: Grades K–12***

Constancy, change, and measurement

***Content Standards: Grades 9–12***

Content Standard B: Physical Science, structure and properties of matter, chemical reactions

## Tips

- Whenever hydrogen gas is generated and tested in the same laboratory, there is a possibility of a tremendous explosion if the testing flames get too near to the gas generator. It is suggested that you designate and label the gas generation area as the “No Flames Area” and the hydrogen gas testing area as the “Test Area.”
- Add additional acid as needed through the thistle tube to produce the desired quantity of gas.
- Caution students that acid may begin to rise up the thistle tube due to back pressure. Release the pressure by simply loosening the stopper.
- You may want to describe and demonstrate the method of gas collection called water displacement, as it may be new for some students. A gas can be collected if a bottle or tube is filled with water and inverted in a water trough. The water in the bottle or tube will be displaced by the generated gas. As the gas fills the bottle or tube, the water level falls.
- If the glass tubing or thistle tube seems too loose in the stopper or if gas seems to be leaking out, seal it up with some silicone grease (or glycerin or vaseline).

## Materials for the *Gas Generator Bottle* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP1558	Gas Generator Bottle
AP1311	Trough, Pneumatic, Polypropylene
AP8334	Trough, Pneumatic
GP9148	Gas Collecting Bottles, Flint Glass
AP8264	Glass plates, 3" × 3"
S0417	Sulfuric Acid Solution, 3 M, 500 mL
H0034	Hydrochloric Acid Solution, 3 M, 500 mL
Z0003	Zinc, Mossy

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.