

# PREPARATION OF HYDROGEN

**Source:** from *Microscale Gas Chemistry*, Educational Innovations, copyright Bruce Mattson, 2003  
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## General Safety Precautions

Always wear safety glasses. Gases in syringes may be under pressure and could spray liquid chemicals. Follow the instructions and only use the quantities suggested. **CAUTION!** Hydrogen forms explosive mixtures with air.

## Toxicity

Hydrogen is relatively non-toxic; however, it is a simple asphyxiant if inhaled in very large quantities. We will not be generating large quantities of hydrogen.

## Syringe Lubrication

We recommend lubricating the black rubber seal of the plunger with silicone oil.

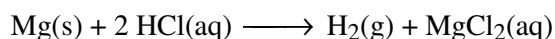
## Equipment

Gas Generator Kit

## Chemicals (needed for each syringe full of hydrogen produced)

0.05 G SOLID MG TURNINGS OR RIBBON (APPROXIMATELY 6 CM RIBBON = 0.05 G)  
3 - 5 ML 2 M HCL(AQ)

THIS QUANTITY OF MAGNESIUM WILL PRODUCE APPROXIMATELY 50 ML OF H<sub>2</sub>. THE PRODUCTION OF H<sub>2</sub> IS *VERY* FAST AND IT TYPICALLY TAKES LESS THAN 30 SECONDS TO FILL A SYRINGE. THE REACTION IS:



## Generating hydrogen gas samples

Samples of hydrogen are generated by the In-Syringe Method. A summary of these steps is provided here:

### 1. Wear your safety glasses!

### 2. Lubricate the seal

Lubricate the black rubber seal of the plunger with silicone oil.



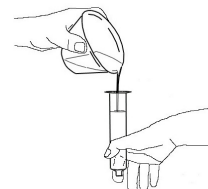
### 3. Measure out 0.05 g Mg

Place the magnesium directly into the vial cap.



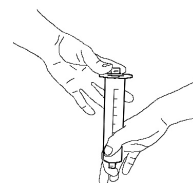
### 4. Fill the syringe barrel with water

Fill the barrel completely with water. Place your finger over the hole to form a seal.



### 5. Float the vial cap

Float the vial cap containing the solid reagent on the water surface.



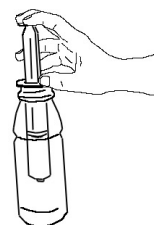
### 6. Lower the cap by flotation

Release the seal made by finger to lower the cap into the syringe barrel without spilling its contents.



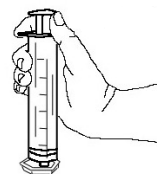
### 7. Install the plunger

Install the plunger while maintaining the syringe in a vertical position. The plunger has a plastic “rib” near the rubber seal that snaps past the “catch” — a small ridge just inside the mouth of the syringe. Usually it takes a firm push to move the rib past the catch. After that, the plunger should move smoothly.



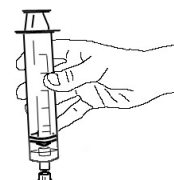
### 8. Draw 3 - 5 mL 2 M HCl(aq) into syringe

Pour the 2 M HCl(aq) into a small weighing dish. Draw 3 - 5 mL of the solution into the syringe.



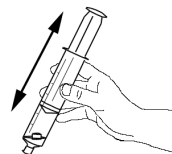
### 9. Install syringe cap

Push the syringe into the syringe cap.



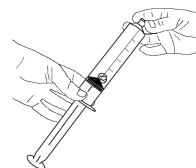
### 10. Generate the gas

Shake the device up and down in order to mix the reagents. Gently help the plunger move up the barrel.



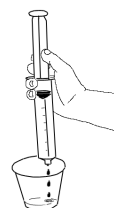
### 11. Remove cap to stop gas collection

Remove the syringe cap with the syringe held “cap-up” as shown. Assume contents are under positive pressure.



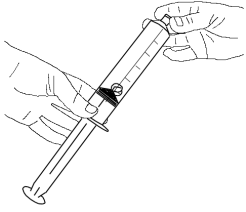
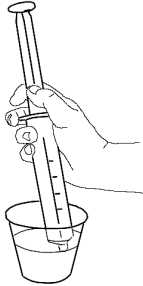
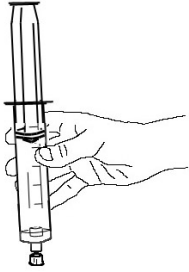
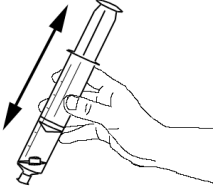
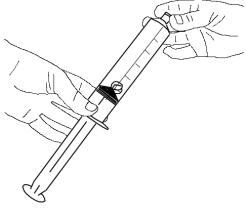
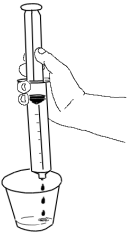
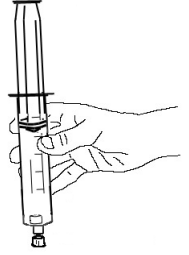
### 12. Discharge reagents

Discharge the liquid reagent into the plastic cup. Immediately cap the syringe to prevent loss of gas.



## Wash away contaminants

Hydrogen-filled syringes must be washed in order to remove traces of unwanted chemicals from the inside surfaces of the syringe before the gases can be used in experiments. Follow the procedure outlined summarized here.

<p>1. remove the syringe cap,</p> 	<p>2. draw 5 mL water into the syringe,</p> 	<p>3. cap the syringe,</p> 	<p>4. shake syringe to wash inside surfaces,</p> 
<p>5. remove cap,</p> 	<p>6. discharge water only, and finally</p> 	<p>7. recap the syringe.</p> 	<p>8. Repeat? Repeat these Washing Steps if necessary. (All traces of the reactants should be washed away.)</p>

## Disposal of hydrogen samples

Unwanted hydrogen samples can be safely discharged into the room.