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PARTNER(S)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**PREPARATION & PROPERTIES OF HYDROGEN:**

**CHEMICAL CHANGES**

All acids contain hydrogen, which can be displaced by reaction with metals that are more active than hydrogen. Zinc is one metal that is more active.

CAUTION: Hydrogen mixed with air is dangerously explosive. NO flame should be brought near the generator while hydrogen is being collected. *Goggles must be worn at all times.*

**OBJECTIVES:**

* to prepare, collect, and describe some of the properties of hydrogen
* to collect a gas using water displacement
* to initiate and observe some chemical changes

**MATERIALS:**

* Erlenmeyer flask
* pneumatic trough
* glass plate
* wooden splints
* ring stand
* Pyrex test tubes (4)
* matches
* mossy zinc (Zn)
* rubber tubing
* thistle tube & rubber stopper
* clamp
* dilute sulfuric acid (H2SO4)

**PROCEDURE:**

* 1. Assemble the gas-generating apparatus shown in Figure 1.

Figure 1

* + 1. Clamp a ring to the ring stand.
    2. Add three or four pieces of mossy zinc to the flask.
    3. Cap the flask with the thistle tube/stopper assembly.
    4. Clamp the flask to the ring stand to insure stability.

**over**

* 1. Fill a pneumatic trough approximately ¾ full with water. Point the overflow spout of the trough into the sink.
  2. Submerge the test tubes in the water.
  3. Wrap the generator with a wet paper towel.

*Do not proceed past this point until your instructor inspects your set-up.*

* 1. Slowly add 2.5 cm of dilute sulfuric acid to the generator through the thistle tube.
  2. Invert one test tube over the end of the rubber tubing & use water displacement to collect the gas.
  3. When the tube is full of gas, keep inverted and cover with a glass plate. Stand the tube inverted on the lab table.
  4. In a similar fashion, collect two more tubes of gas.
  5. Test for hydrogen by using a burning splint. Observe any product at the end of the test tube.
  6. Disassemble the gas-generating apparatus.
     1. Remove the rubber stopper.
     2. Pour any remaining solution down the drain. *Do not allow unreacted zinc to enter the drain.*
     3. Rinse the flask and zinc with water.
     4. Dry any remaining zinc on a paper towel & return to your instructor.

**RESULTS:** *(Type all responses, using complete sentences. Any reaction may be printed.)*

1. What evidence was there for a chemical reaction between the zinc and the sulfuric acid?
2. What evidence was there for a chemical reaction between the hydrogen and something in the air? With what might the hydrogen react? What evidence is there for your hypothesis?
3. Why did the test tubes containing hydrogen “bark?”
4. Why were the test tubes stored in an inverted position?
5. List at least three physical properties of hydrogen.
6. List at least three chemical properties of hydrogen. See <http://environmentalchemistry.com/yogi/periodic/H.html#Chemical> or some other site for physical and chemical properties. *Note your source(s).*
7. Complete the equation: Zn(*s*) + H2SO4(*l*) → Consult <http://www.webelements.com/webelements/elements/text/Zn/chem.html> or some other site for the information. *Note your source(s).*