**Preparation and Properties of HydrogenC:\Users\Schuler\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\4YDDPHSY\MC900412684[1].wmf Names\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Background Information:**

Hydrogen is the most abundant element in the universe and, as you have discovered, was the main component in the synthesis of other elements. Our own sun as well as trillions of others stars in the universe “burn” hydrogen to produce energy as well as the other elements. It is estimated that 90% of the visible universe is composed of hydrogen.

Scientists have been producing hydrogen for years before it was even recognized as an element. It was produced as early as 1671 while scientists were experimenting with iron and acids. When hydrogen burns, it produces water. This property is how it got its name which is derived from the Greek translation meaning “water former”.

In this experiment you will react calcium (active metal) with water. Hydrogen will be collected in glass bottles using a technique called water displacement. We will use our collected hydrogen to run a variety of tests to see what type of properties it displays.

**Pre-Lab Questions:**

1. What is the atomic make-up of hydrogen? (Hint: use the periodic table to find the mass number, atomic number, number of protons, neutrons and electrons)
2. What are the four evidences of a chemical change?
3. What is the difference between physical vs. chemical properties?

**Procedure:**

1. At your lab station, you will find the apparatus for generating and collecting hydrogen. Set up your generator and water trough based on your teachers instructions. Attach all the tubes properly.
2. Fill your flask with about 150 ml of water. Your teacher will come over and add 2-3 pieces of calcium to the flask.
3. While you wait for your teacher, fill your trough with 3 collecting bottles filled all the way to the top with water. Cover each bottle with a glass plate and invert them into the trough, then remove the glass plates.
4. After the calcium is added to the water in your flask, immediately put the stopper in to the flask and unclamp the tubing leading from the flask to the trough.
5. Move the bottle over the area where the gas is coming out. Switch out the bottles as they become full and allow the reaction to run until all of your bottles are completely filled with hydrogen gas.
6. When all of the bottles are full of gas, allow them to stay upside down in the trough for 1 minute and observe them. Write your observations in Experiment 1.
7. After making your observations, slide the glass plates between each bottle and the trough and remove the bottles, making sure to keep them covered. Place the bottles upside down on the table, with the glass still covering the mouth.
8. Follow the directions for each of the experiments on the following page.

**Determining the Properties of Hydrogen:**

Experiment 1-

To test the solubility of hydrogen, observe the bottles of hydrogen still in the trough for 1 minute. Observe how much water rises into the bottles. Record your results in the data analysis section.

Experiment 2-

Lift and hold one of your collecting bottles of hydrogen gas mouth downward with the glass plate still covering the mouth. Light a match or splint and hold it using the tongs. Observe how the flame interacts with the hydrogen in the air outside of the bottle. Then, slowly remove the glass plate and insert the match or splint into the bottle. The splint should be inserted about ½ its length. Hold it in the bottle for a few seconds. Carefully observe what happens at the **mouth** of the bottle. Remove the match and douse the flame. DO NOT PUT MATCHES IN THE SINK.

Experiment 3-

Hold a second bottle of your hydrogen gas, glass plate removed and mouth upward for 1 minute. After 1 minute, bring a burning splint or match to the mouth of the bottle. Record your observations in the data analysis section. Douse the burning splint or match as before.

Experiment 4-

Stand a third bottle of your hydrogen gas mouth upward but still covered by the glass plate. On top of that bottle, place a clean, **dry** bottle (not filled with hydrogen) and then slide the glass plate out of between the two bottles. Leave the bottles like that 45 seconds. Hold a burning match with the tongs and put it to where the two bottles meet and slowly lift the top bottle. Record your observations. Douse burning match.

**Data Analysis:**

|  |  |
| --- | --- |
| **Experiment:** | **Observations:** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

1. What did you observe in the generator that led you to believe that a chemical reaction was taking place?
2. Write a chemical equation for the reaction used to generate hydrogen:

**Individual Experiment Questions**:

Experiment 1-

1. How much water rose into the bottles?
2. Circle the correct response: We can conclude that hydrogen **is or is not** soluble in water.

Experiment 2-

1. Why does the hydrogen inside the bottle not act like the hydrogen (in the air) outside the bottle?
2. Circle the correct response: We can conclude that hydrogen **does or does not** burn, and **does or does not** support combustion.

Experiment 3-

1. What physical property of hydrogen is observed here? (Hint: why do we invert the bottles to store the hydrogen?)

Experiment 4-

1. What reaction did you observe at the mouth at the bottle?
2. Write a chemical equation for the reaction between H2 and O2:

**Follow up:**

1. What was the source of hydrogen in this particular lab?
2. What does the word hydrogen mean?
3. Write down at least 5 properties of hydrogen that you observed today (color, odor, density, solubility etc):