

General Chemistry
Mr. MacGillivray
Lab Investigation:
Investigating the Properties of Hydrogen and Oxygen

I. Purpose

The student will generate hydrogen and oxygen gases

1. The student will observe the chemical and physical properties of these two gases
2. The student will be able to distinguish between these two gases on the basis of flammability and density

II. Materials

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| 1. Safety goggles | 5. 2 mossy zinc (Zn) pellets |
| 2. 3 test tubes | 6. Dilute hydrochloric (HCl) acid |
| 3. 3 wooden splints | 7. 3% hydrogen peroxide (H ₂ O ₂) solution |
| 4. Manganese dioxide (MnO ₂) powder | |

III. Procedure:

1. Listen carefully to the pre-lab safety lecture.

Investigating Oxygen Gas

1. Place a small amount (the size of a large pea) of MnO₂ into a test tube.
2. Add hydrogen peroxide to the test tube until the tube is one-third full.
3. After the reaction has occurred for three seconds, place your thumb over the top of the test tube.
4. The other partner should light a wooden splint, let it burn for a few seconds, and then blow it out. The splint should be glowing after you blow it out.
5. While the splint is still glowing, place it into the test tube. Do not stick it into the liquid, because this will just extinguish the splint.
6. Record your observations: _____

Investigating Hydrogen Gas

7. Carefully place 2 Zn pellets into a test tube that contains no MnO₂ or H₂O₂.
8. **While the second partner is doing step 9**, one partner should pour the hydrochloric acid into the tube until it is half full. Use a second, inverted test tube to catch the gas that is generated by the reaction test tube.
9. The second partner should light a glowing splint after the reaction in step 8 has been going for three seconds.
10. Do not blow out the flaming splint. The second partner should put this burning splint into the INVERTED test tube, and then slowly withdraw it. (You may not have to withdraw the splint. It may react before you can withdraw it. That is OK.)
11. Observations: _____

IV. Disposal:

1. Pour all liquids carefully down the sink. Make sure that all liquids make it down the drain; do not leave residue in the corners/edges of the sink. Leave the water on for three minutes after you rinse out the sink.
2. Pick the unreacted zinc out of the sink with your fingers after it has been rinsed thoroughly.
3. All solids should go in the trash. Only solids that are cool enough to touch should go in the trash. When in doubt, run the splint under water.
4. Wash your hands thoroughly with soap and water.

V. Questions

1. List one chemical property of oxygen gas:
2. List three physical properties of oxygen gas:

3. List one chemical property of hydrogen gas:
4. List three physical properties of hydrogen gas:

5. Write the chemical equation for the reaction of hydrogen peroxide with manganese dioxide:

6. Write the chemical equation for the reaction of zinc with hydrochloric acid:

7. Write the chemical equation for the reaction of hydrogen gas with oxygen:

8. Why did we have to invert a test tube over the reaction tube containing Zn and HCl?

9. Why was it **not** necessary to invert a tube over the oxygen-generating reaction?

10. How would this experiment be affected if we tested for hydrogen the way we tested for oxygen, and vice-versa?

11. What is the density of air?
What is the density of oxygen gas?
Is air pure oxygen?
What is air made of?
What can we infer about the density of these other components of air?

12. Look up the densities of H₂ and He. Which is less dense?
Why do we use the denser gas for blimps, zeppelins, and balloons?
Which has the more desirable chemical properties for this purpose?
Which has the more desirable physical properties for this purpose?