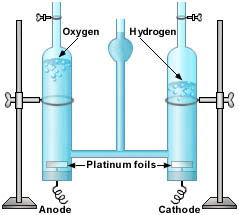
**Lab #24: Electrolysis of Water**

*Materials*

* 2 mL bromthymol blue indicator solution
* 30 mL, 0.5M Sodium Sulfate solution
* battery
* battery cap with alligator leads
* 2 clamps
* ring stand
* U-shaped tube

Electrochemistry is the study of the relationship between electrical forces and chemical reactions. The purpose of this experiment is to investigate the electrolysis of water. An electric current will be passed through a solution containing water, sodium sulfate (Na2SO4) and bromthymol blue.

The alligator clips act as conductors and provide a surface for the chemical reaction. Sodium sulfate (Na2SO4), an ionic compound, is needed to improve the current flow through the solution. Bromthymol blue, an acid-base indicator, will help to identify the changes occurring in the solution. Bromthymol blue is yellow in acidic solutions, blue in basic solutions and various shades of green in intermediate pH values.



Hydrogen and oxygen can be combined in a fuel cell to produce electrical energy. A fuel cell uses a chemical reaction to provide an external voltage, as does a battery, but differs from a battery in that the fuel is continually supplied in the form of hydrogen and oxygen gas. It can produce electrical energy at a higher efficiency than just burning the hydrogen to produce heat to drive a generator. It's only product is water, so it is pollution-free! This is even being sampled in car manufacturing to create a better, more efficient car!

**Part 1: Pre-Lab Questions:**

1. *What is involved in the electrolysis of water?*
2. *Does running electricity through water produce a physical or chemical change? How would you know?*
3. *What do you think electrochemistry is used for?*

**Part 2: Electricity and water**

1. Attach the battery cap with alligator clips to the battery. Put 30mL of a 0.5M sodium sulfate solution in a U-tube.
   1. Observe and record all changes as the current flows through the solution. ***Be specific*** – compare the changes at the pencil lead electrodes attached to the positive (+) and negative (-) terminals of the battery.

**Part 3: Switch the leads**

1. Remove the pencil leads and switch them. Allow the current to flow through the solution for about 5 minutes.
   1. Record your observations of the solution after 5 minutes below.

**Part 4: Thinking about what you observed**

1. Write down at least three observations that indicate a chemical reaction has occurred during the electrolysis of water.
2. Why do you think the indicator changed colors when the current was running through it?
3. According to the pre-lab reading, which gas is an acid? How do you know?
4. Which is a base? How do you know?
5. Why do you think the indicator changed colors when you switched the leads?
6. Which electrode, positive (+) or negative (-) produced more gas? The reaction for water to create hydrogen and oxygen gas is written below. Why do you think this electrode produced more gas?

**2H2 + O2 🡪 2H2O**

1. Which requires more energy, changing the state of water or producing hydrogen and oxygen gas from water? Please provide evidence for your explanation! (Hint: Use pages 105 and 110 in your textbook as a guide to help you answer this question.)