**Electrolysis of Water Lab**

Electrolysis is the driving of a non-spontaneous chemical reaction by passing a direct electric current through an electrolyte. In electrolysis, positive ions migrate to the cathode and negative ions to the anode. The reactions occurring depend on electron transfer at the electrodes and are therefore redox reactions. At the anode (+) negative ions in solution may lose electrons to form neutral species. Alternatively, atoms of the anode can lose electrons and go into solution as positive ions. The process is oxidation. At the cathode (-) positive ions in solution can gain electrons to form neutral species. Cathode reactions are reduction reactions. Electrolyte: A liquid that conducts electricity as a result of the presence of positive and negative ions.

Electrode: A conductor that emits or collects electrons in a cell. Usually an inert material such as platinum.

**Pencil Electrolysis**

**Procedure:**

1. Fill the beaker about one-third full with the distilled water. Then add about 1.5 mL (1/4 tsp.) Epsom salt to the water. Be sure to stir the Epsom salt in the water until it is completely dissolved. Note: The dissolved Epsom salt just helps the water conduct electricity better. Chemists have found in many experiments that the salt does not change or take part in the chemical reaction.
2. Attach one end of the wire to one end of the pencil. Connect the other end of the wire to one of the terminals of the 9-V battery.
3. Attach one end of the other wire to one end of the pencil. Connect the other end of the wire to the other terminal of the 9-V battery.48
4. Place the tips of both pencils in the water in the beaker. Move the pencils until the tips are close together, but not touching each other.
5. Use a magnifying glass to observe what happens near the pencil connected to the negative and positive terminal of the battery.
6. In Table 1 draw a picture and describe what you see happening in the liquid near the (negative) and (positive) pencil. You may need to watch closely for a longer time for the positive pencil.

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| Table 1: What Happens near the Negative (-) and Positive (+) Battery Terminals |
| Draw a picture and describe what happens near the pencil attached to the **negative** (-) end of the battery. | Draw a picture and describe what happens near the pencil attached to the **positive** (+) end of the battery. |
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**Questions**:

Discuss the following question with your team and then write your best answer.

1. What is the evidence that an interaction occurred in your experiment?

**Electrolysis of Water**

While you were completing your experiment, your teacher used special equipment to collect the gases. The equipment is called electrolysis equipment. The process you have been investigating is called electrolysis. Instead of pencils, this equipment uses thin, steel or platinum rods. The gas bubbles are collected in two test tubes.

**Questions**

1. Do you think that the gases collected near the two battery terminals are the same or different gases? Why?
2. What gas or gases do you think are made near each terminal? Explain your reasons.

**The Flame Test**

Your teacher will show you a video or demonstrate the flame test for the two gases. Record the results of these tests in Table 2.

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| Table 2: Flame Test of Two Gases |
| Flame test of gas collected from the **negative** (-) battery terminal | Flame test of gas collected from the **positive** (+) battery terminal |
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**Questions**:

1. What gas do you think is made near the rod attached to the positive terminal of the battery? What is your evidence?
2. Is the gas made near the rod attached to the negative battery terminal the same gas or a different gas?
3. Chemists have done further tests of the gas made at the rod attached to the negative terminal. This gas has a boiling point of –252ºC. The mass of one liter (density) of this gas is 0.08 g. Look at the Table of Densities and Table of Melting and Boiling Points What is this gas?
4. The gas collected at the rod attached to the positive terminal has a boiling point of –183ºC. The mass of one liter of the gas is 1.33 g. What is the gas?
5. Is the electrolysis of water a physical interaction or a chemical interaction? What is your evidence? (Electrolysis is the change or changes that occur in a solution or a melted compound due to the passage of an electric current.)
6. If the interaction is chemical, then write a word chemical equation for the reaction.