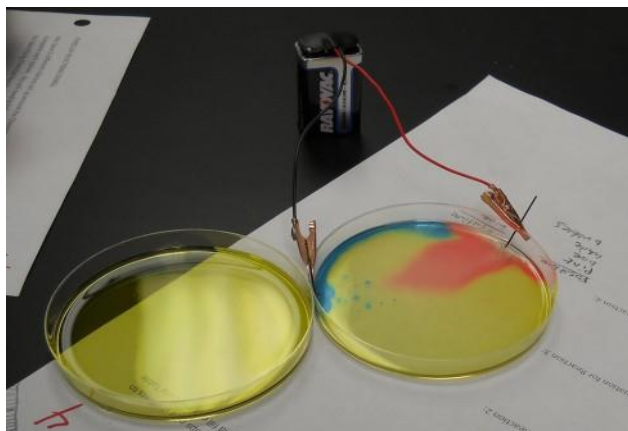
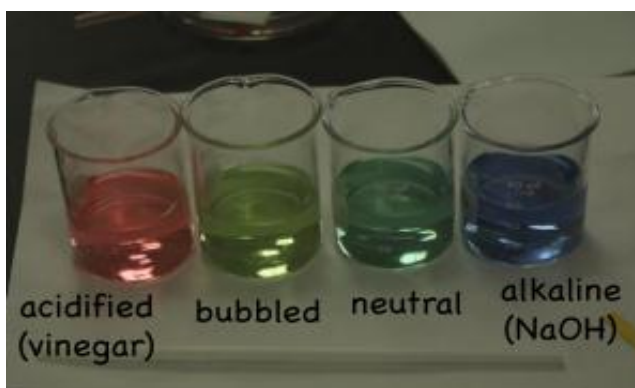


ELECTROLYSIS WITH UNIVERSAL INDICATOR



The universal pH indicator turns red for acids and blue for bases.

Ms. Wilson's chemistry class did a beautiful electrolysis experiment by mixing a universal pH indicator into the salt solution. The indicator changes color based on how acidic or basic the solution is; we've used this behavior to show how blowing bubbles in water increases its acidity.



Changing colors of universal indicator show how blowing bubbles acidifies water (light green-second beaker) from neutral pH (dark green-third beaker) standard. For comparison, the first beaker (red) is acidified while the last beaker (blue) is made alkaline.

In this experiment, when electrodes (graphite pencil “leads”) are placed into salt (NaCl) water and connected to a battery, the sodium (Na) and chloride (Cl) split apart.



The positive sodium ion (Na^+) migrates toward the negative electrode, where it gets an electron and precipitates on the electrode as a plating. This is called electroplating and is done to give fake gold and silver jewelry a nice outward appearance.

Similarly, the water (H_2O) also dissociates into hydrogen (H^+) and hydroxide (OH^-) ions.



Hydrogen bubbles forming at the negative electrode.

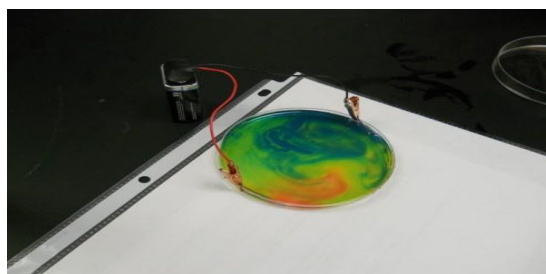
The positive hydrogen ions (H^+) go toward the negative electrode where they get an electron from the battery and are liberated as hydrogen gas (when they bond to another hydrogen you get H_2 gas).

However, releasing the positive hydrogen ion, leaves behind hydroxide ions in the area around the positive electrode.

The opposite happens at the positive electrode, with hydrogen ions left behind in the solution.

Since acidity is a measure of the excess of hydrogen ions in solution (H^+), the left behind hydrogen ions make the solution near the positive electrode acidic, which turns the indicator solution red. The OH^- left near the negative electrode make the solution basic, which shows up as blue with the indicator.

If you gently shake the petri dish you end up with beautiful patterns like this:



Swirls.

And this:



After the electrodes have been disconnected.

Note: if the solution is mixed completely the hydrogen and hydroxide ions react with each other to make water again, the solution neutralizes, and becomes uniform again.

Note 2: This is an experiment that I should also do in physics. It should be interesting for students to see this experiment from two different perspectives to see how the subjects overlap.

Source: <http://montessorimuddle.org/2013/02/14/electrolysis-with-universal-indicator/>