

ELECTROLYSIS OF SALT WATER AND BATTERIES

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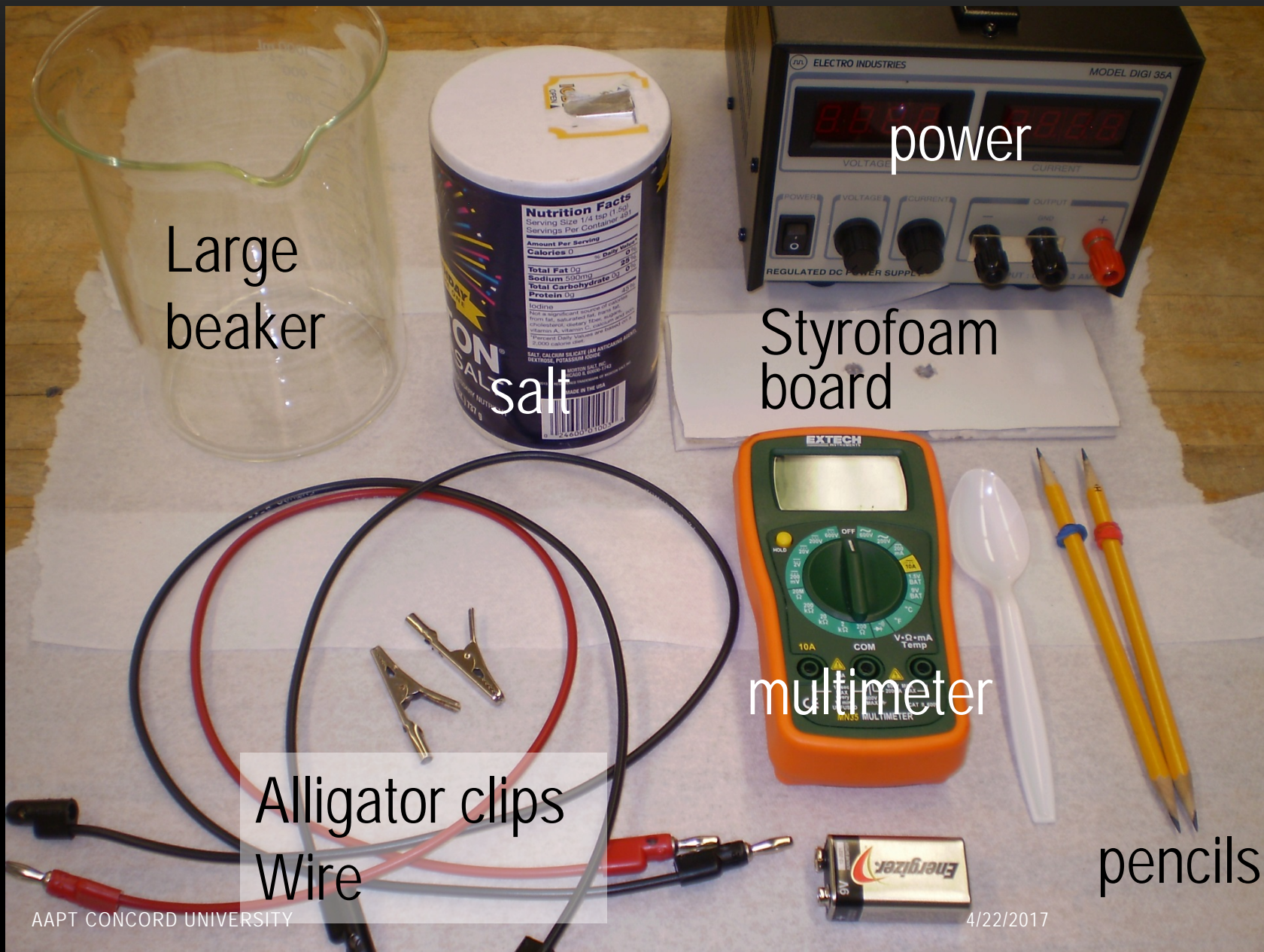
Physics & Engineering Department

West Virginia Wesleyan College

MOTIVATION

- The Physics Department is tasked with the Physical Science for Teachers class
- Labs must serve two purposes:
 - College level lab science – must do math!
 - Prepare education students to do cool science demos and lead discovery activities for elementary kids
- Activity must:
 - Be cheap
 - Be easy to set up
 - Be easy to perform
 - Be easy to scale the difficulty level
 - Work!

ELECTROLYSIS OF SALT WATER



Large
beaker

salt

power

Styrofoam
board

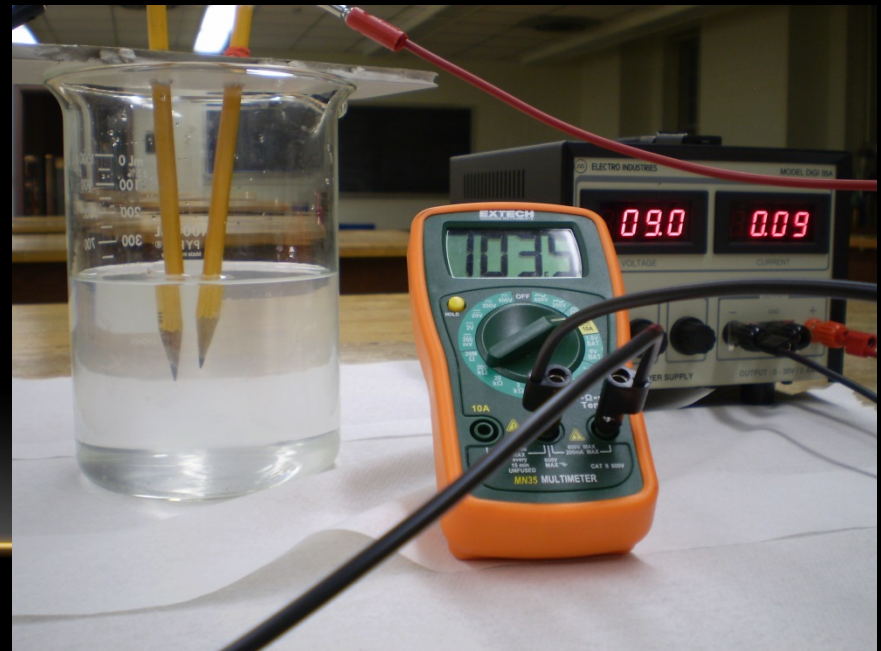
multimeter

Alligator clips
Wire

pencils

PROCEDURE

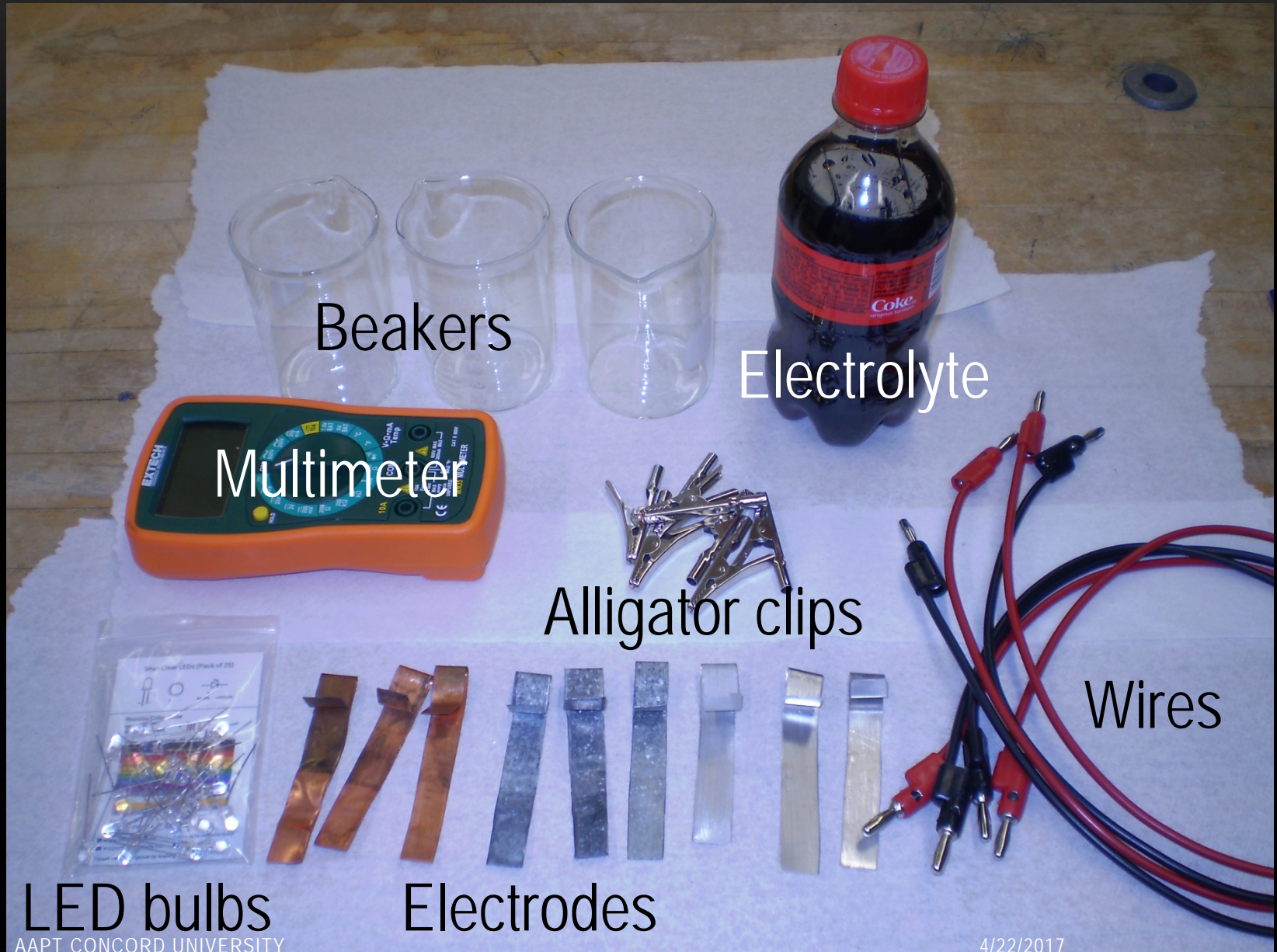
- Fill beaker about half way with water
- Add 1 spoonful of salt and stir well
- Insert pencils through foam board and place on top of beaker
- Connect leads to graphite of pencils
- Connect other end of leads to power – power supply or 9v battery
- Watch for bubbles
- May also connect a multimeter and measure amperage
- Adding more salt will increase amperage



SCIENCE

- Chemical reactions:
 - $\text{NaCl} \rightarrow \text{Na}^+ + \text{Cl}^-$ (dissolved in water)
 - $\text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^-$ (ionized by electricity)
 - $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ (reaction at cathode)
 - $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ (reaction at anode)
 - $\text{Na}^+ + \text{OH}^- \rightarrow \text{NaOH}$ (reaction in solution)
- Discovery questions
 - What causes the bubbling?
 - What happens if you add more salt?
 - What if the wires are reversed?
 - What happens if voltage is increased or decreased?

BATTERIES



Beakers

Electrolyte

Multimeter

Alligator clips

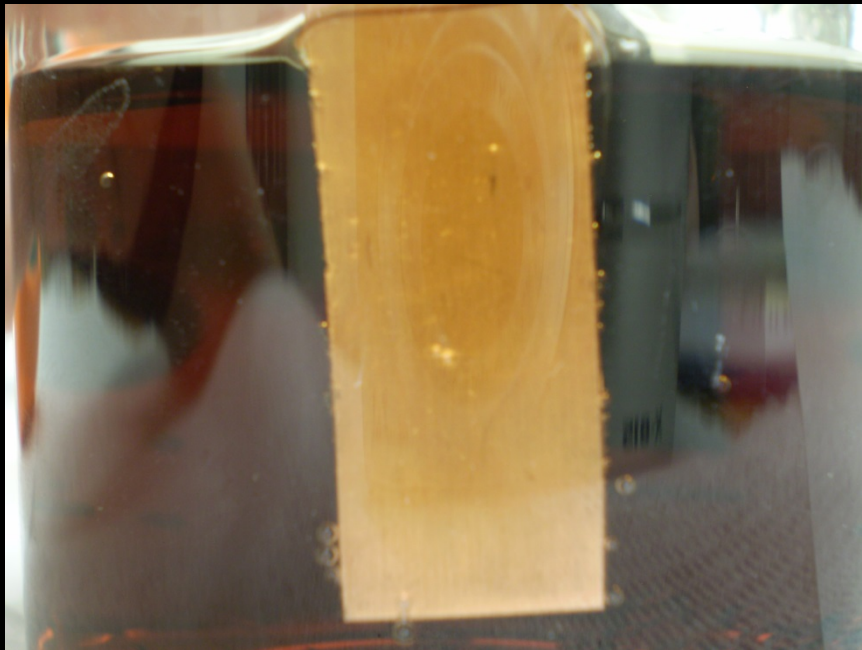
Wires

LED bulbs

Electrodes

PROCEDURE

- Pour electrolyte into clear cup
- Insert electrodes and connect to multimeter
- Measure voltage
- Watch for bubbles
- May also connect an LED bulb



SCIENCE

- Chemical reactions:
 - $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu} : E^0 = +0.34\text{v}$ (reaction in the cathode)
 - $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^- : E^0 = -0.76\text{v}$ (reaction at anode)
 - $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^- : E^0 = -1.66\text{v}$ (reaction at anode)
 - $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ (reaction at anode)
- Discovery questions
 - What causes the bubbling?
 - What if the wires are reversed?
 - What if you use different electrodes?
 - How do you build a battery?
 - Can you light a bulb?

