Battery Lab

I. **Author:** Abigail King
Date of Experiment: 4/30/24
Date Report Submitted: 5/6/24
Class: Chemistry

II. **Problem Statement:** The purpose of this lab is to build and test Zn-MnO2 batteries (LeClanche Cells) and demonstrate Coulomb's and Faraday's Laws.

III. **Materials and Method**:

- Cylindrical Leclanche battery
- Ammonium chloride NH_4Cl
- 250 mL beaker
- Metal cutting scissors
- Scotch tape
- Voltameter (positive and negative end)
- Paper towels
- Screwdriver
- Spoon
- Glass stirring rod
- Clothespins

First we took the metal cover off of the battery. Then, we removed the zinc can and cut it into strips. Using the screwdriver, the manganese dioxide filling (cathode) was dug out of the battery and set aside. The other parts of the battery were also separated, discarding all but the carbon rod (electrode). Next we built our own batteries. We folded a paper towel long-ways two times. On one end we horizontally placed a carbon rod and a zinc strip touching end-to-end and placed a small pile of manganese filling on this. We rolled the paper towel up, starting on the same end as the carbon-maganese-zinc pile. Then we mixed 26 grams of ammonium chloride (NH_4Cl) in 100 mL of water. Small amounts of this solution was slowly poured, using a spoon, over the paper towel in between each rotation of a roll. Just enough solution was added for the paper

towel to be damp but not soaked. We taped the final roll closed tightly using scotch tape. (see image 1). Finally, with the voltameter, holding the black wire (-) against the zinc strip and the red wire (+) against the carbon rod, we observed how many volts we could generate with our battery. We also attached multiple cells together using clothespins (see image 2)

Image 1

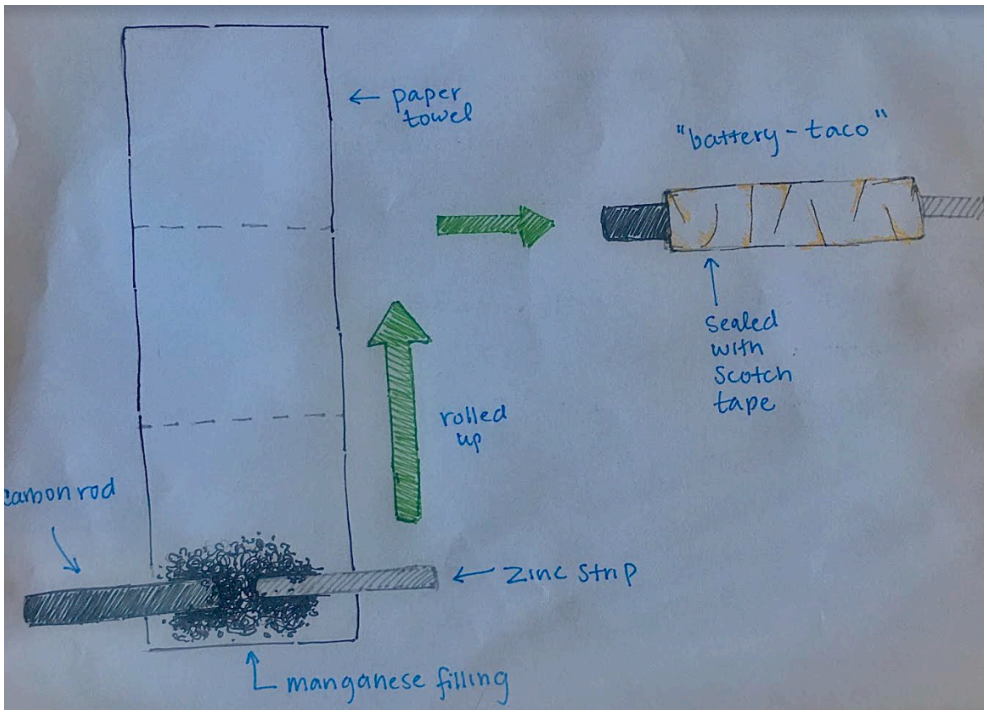
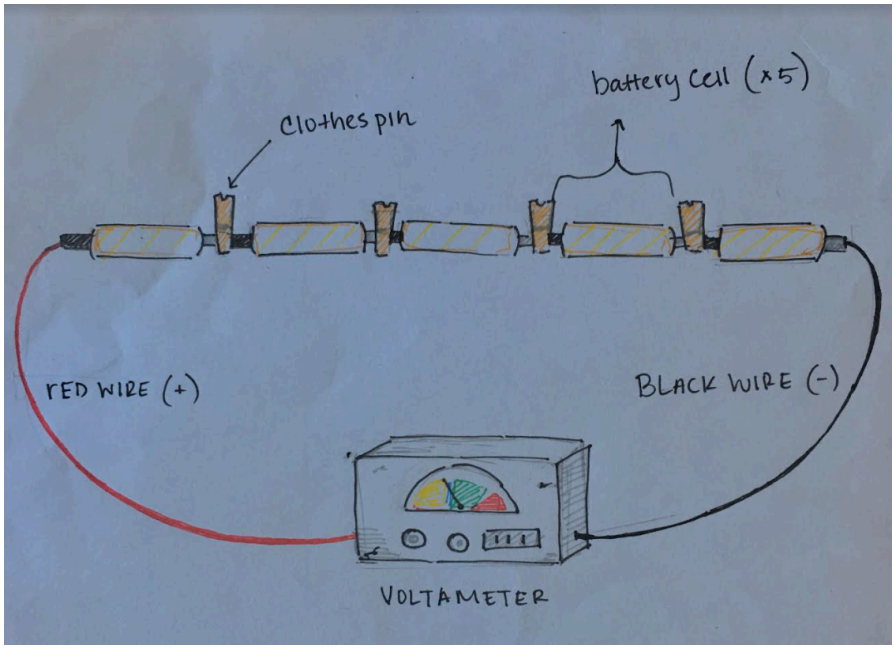


Image 2



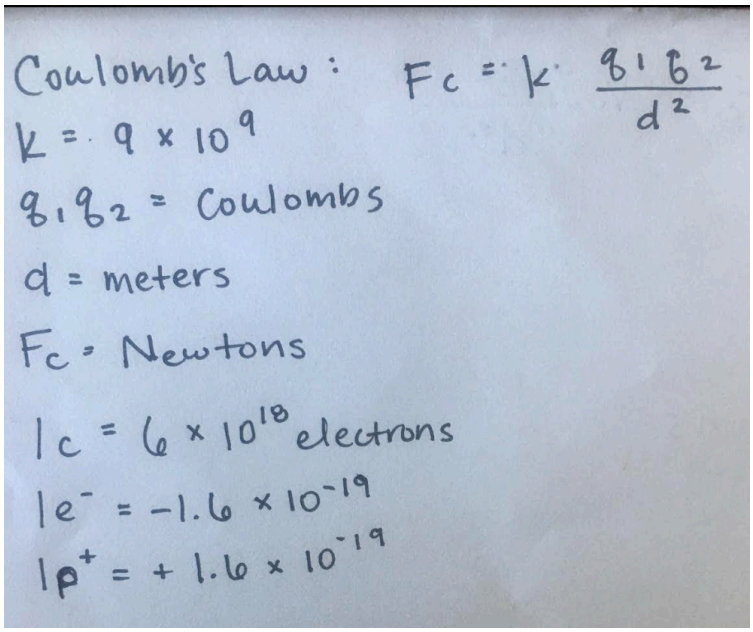
IV. Results:

The theoretical voltage generated by a battery was 1.71 V and the practical voltage generated was approximately 1.5 V. We attached multiple battery cells with clothespins and with five cells, generated 7 volts of electricity.

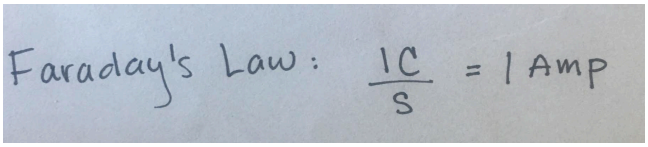
V. Conclusion:

We were able to generate electricity using Coulomb's and Faraday's principle. (shown below)

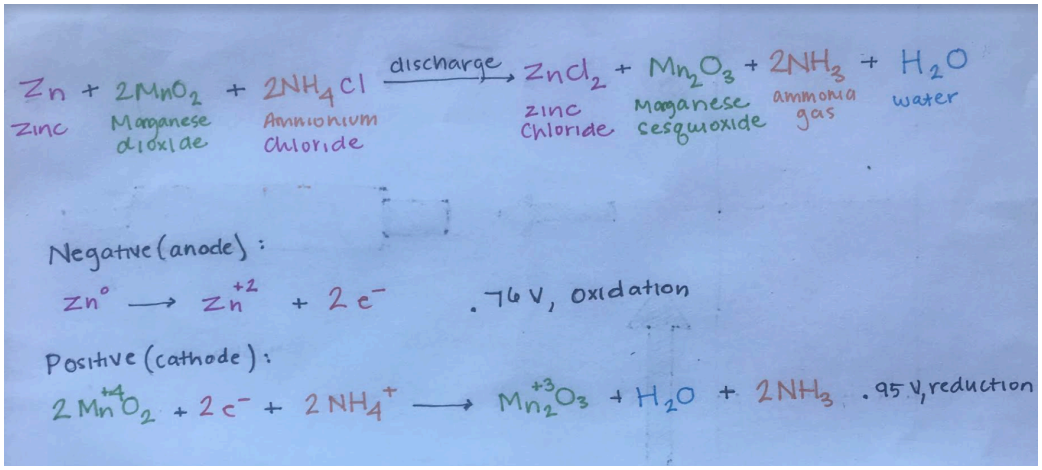
Coulomb's law states that the magnitude of the electrostatic force of attraction or repulsion between two electrically charged bodies is directly proportional to the product of the charge of the charged bodies and inversely proportional to the square of the distance between the center of the charged bodies.



Faraday's law states: the emf in a circuit is equal to the rate of change of the magnetic flux through the circuit applies whether the flux changes because the field changes or because the circuit moves (or both).



The reaction within and between battery cells is as shown below, the result being volts being generated through a oxidation-reduction reaction.



These batteries require four basic components in order to operate: Anode – this is the negative (-) side, Cathode – this is the positive (+) side, Electrode – an electrical conductor used to make contact with a nonmetallic part of a circuit, and finally an electrolyte – this is a liquid or gel that contains ions and can be decomposed by electrolysis, and in this instance, a battery. In our battery, the zinc strip acts as our anode, the manganese filling as our cathode, ammonium chloride as our electrolyte and finally the carbon rods acts as an electrode. In conclusion, we can generate electricity rather simply, using basic properties of electro-chemistry.

Dry Cell Battery Lab Report

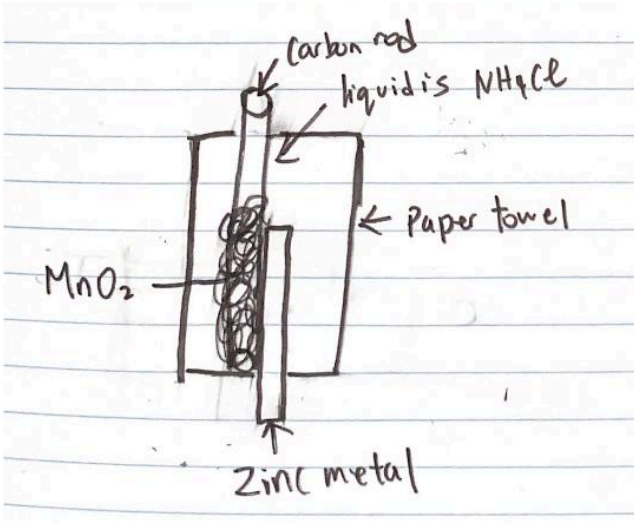
I. Author: Judy Zhu
Date of Lab: 4/30/2024
Date Due:5/6/2024
Class: AP Chemistry

II. Attempting to make a dry cell battery

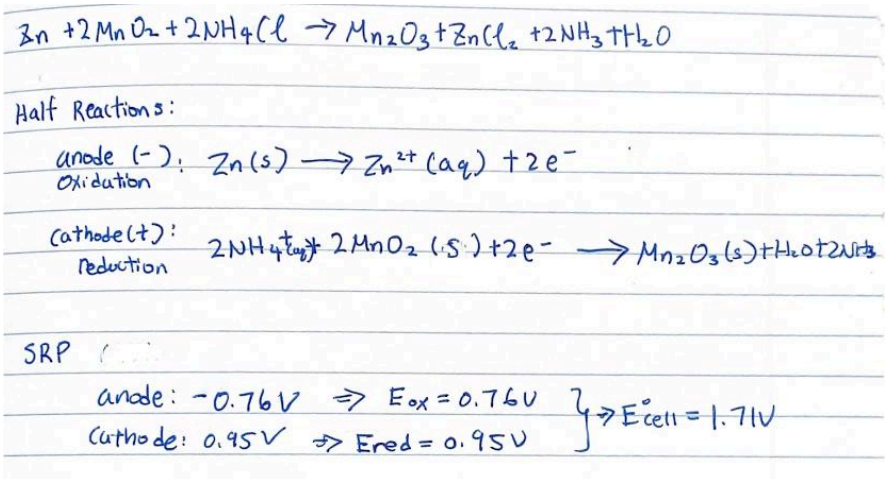
III. Materials & Methods:

1 piece of paper towel
NH_4Cl
Carbon Rod
Zinc metal
MnO_2
Tape

First, we mixed 26.0 grams of ammonium chloride into 74 ml of water. We then took apart a zinc battery and extracted the manganese dioxide, carbon rod and zinc cartridge. Then, we put the carbon rod and manganese dioxide into the paper towel and rolled it up twice. After sprinkling some of the ammonium chloride solution onto the paper towel, we rolled it up more with a piece of zinc in it. Finally, we taped the battery shut with tape.



Batteries:



Reactions:

IV. Results

In the end, my battery yielded 1.5 volts, which was 0.21 volts off from the theoretical amount. When we connected 5 batteries, we got 7 volts in total, which was able to light a light bulb and power a small fan.

V. Conclusion

In conclusion, the experiment was relatively successful, although the voltage would be closer to 1.71 V if the room was at standard conditions (which was likely not the case). I learned that it was possible to make a battery function from using manganese oxide as a cathode and the zinc metal as the anode. I also learned that the carbon rod is used to increase conductivity and to retain the moisture.