**Bleach Battery Project**
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**Abstract**
A chlorine battery is a simple battery that can be made with common household items. It is created by using a glass of bleach and water, with one copper and one aluminum strip in each cup, then connecting an alligator clip from each copper to each aluminum piece.

**Introduction**
In this project we have created a simple yet useful chlorine bleach battery. Through much trial and error, this is the easiest and most efficient way of creating a chlorine bleach battery. The hypothesis is each cell should produce about 0.55 volts.

**Materials**
- Twelve four hundred mL beakers
- Bleach
- Water
- Twelve copper strips
- Twelve strips of aluminum foil
- Alligator Clips
- Volt meter

**Procedure**
1. Fill the twelve four hundred mL beakers up to the three hundred mL mark with water.
2. Add one hundred mL of Clorox Bleach to each beaker. Mix well.
3. Fold one strip of copper and one strip of aluminum over the side of each cup with as much of the metal in the solution as possible.
4. Connect an alligator clip between each cup-copper to aluminum, or aluminum to copper-so that the current will run all the way through.
5. Connect the two clips on the end to the voltage meter and read your voltage.

A battery is a simple, yet essential part of daily life. There are many cheap, realistic ways to create a battery. In the case of a chlorine battery, it is inexpensive and requires few materials. When using metal, water, and chlorine, an electric current is created when water molecules interact with the metal atoms on the surface of the metal strip. Water molecules are polar, which means one side is slightly positive, while the other is slightly negative. If one metal strip has more extra electrons than the other, the extra electrons will flow from the first strip to the second strip until they equal each other out and have the same charge. However, the electrons must have a conductive path before they are able to flow from one strip to the other. To make this possible,
a path is made by connecting one metal to a different metal with an alligator clip, thus creating an electric current.

Picture on the right shows the chlorine battery having 7.73 volts. Picture on the left shows the bleach battery lighting a led light bulb.
Battery Theory and Experiment

Contributors: Bo Drown, Brody Bass, Courtney Lashley, Evan Washington, Ryan Jones

This paper mainly focuses on the ins and outs of the battery and how it works. We do our own experiments to find some of the more simple ways to build a homemade battery.

Batteries are a result of ions moving through a circuit towards a negative or positive charge. To achieve this, you need an electrolyte where ions will be present, and a positive metal (e.g. copper) and a negative metal (e.g. zinc) in which the ions will move between the two through the circuit creating power as they are attracted and repelled by positive and negative electromagnetic forces.

Copper serves as a positive electrode or cathode and the zinc acts as relectro producing negative electrode. These objects work as electrodes causing an electrochemical reaction the generates a small potential difference. The salt water becomes an electrolyte which is a chemical medium the lets the flow of electricity pass through the cathode to the anode.

An electrode is an electronic conductor connected to a non metallic part of a circuit. Electrodes are referred as either the anode or cathode in an electrochemical cell. The anode is the electrode where current leaves the cell and oxidation happens. On the other hand the cathode is where current enters the cell and reduction happen.

**Experiment: Epsom Salt Water Battery:**

Step 1: Gather All Materials

Step 2: Pour to the 20 ML line of Salt in 6 to 8 Beakers
Step 3: Fill With Hot Water to the 80 ML Mark and Stir Until Dissolved (Repeat With All Beakers)

Step 4: Add sheet Copper to Right Side of the Beaker and Zinc strip to the Left Side (Repeat With All Beakers)

Step 5: Use Alligator Clips to All Beakers (One Clip From A Beaker’s Copper to Another Zinc)

Step 6: Add Two Clips (One at Each End) and Test the Voltage of Your Experiment

Step 7: Record Results

**Results:** The results of the experiment produced approximately 7.4 volts, which proved enough to light up two LED bulbs, as shown in figure 1.

![Figure 1: Shows lit LED bulb.](image1)

![Figure 2: Our complete working battery.](image2)
Penny Battery
By: Kira Sholes, Landon Bunch, Ciera Gariepy, Zack Rumple

Materials:
- Zinc Washers
- Aluminum Foil
- Pennies (newer than 1982)
- Vinegar
- Beaker
- Cardboard

Procedure:

Step 1: After you have all your materials, cut the cardboard into small squares the same size as the penny. Soak them in vinegar for about 30 seconds.

Step 2: Take a small to medium piece of foil and lay it flat on a hard, level surface.

Step 3: Place one washer in the center of the foil. Place a piece of cardboard on top of the zinc washer. Place a penny in the center of the cardboard. The pattern should be washer, cardboard, penny.

Step 4: Repeat the pattern a few times, stacking them one on top of the other, ending with the penny.

Step 5: Once you have created a few layers test the voltage. The best thing to use is a multimeter. Place one end on the foil and the other end on the penny.

Tip: The more “layers” you have, the greater voltage you will have. Also make sure your cardboard stays moist with vinegar.

Achievements:
The greatest voltage that we got was 15.3. We also were able to light up an LED (light emitting diode) light with the charge from our battery.

In the picture above is the most current documented voltage that we achieved.
This is a photo of the battery cell. You can see the beaker of vinegar and how the battery is set up.
This is what we used our battery cell to power.
The Penny Battery
Created by Nellie Turnbull, Jarod Coatney, Mitchell Biggers, and Skye Smolnik

Making a low voltage battery is easier than what most people think. It can be as simple as using a few household items, such as: vinegar, aluminum foil, pennies, washers, and paper.

First collect 15 pennies, then cut 15 pieces of paper into the sizes of a penny. Second, pour vinegar in a cup and put the cut up paper in the vinegar and let them soak. Third put down a piece of aluminum foil and place a penny on the aluminum base. Fourth, take a piece of paper that's been soaking in the vinegar, and set it on top of the penny as well as a washer, and set it on top of the piece of paper. Repeat the process 14 more times.

This battery produce approximately 6.7 volts and was capable of powering LED lights.
The Battery results:

(voltage is 6.66)

(LED Light changes volts to 1.93)
(The battery changes the volts from 6.66 to 1.93)
(The battery lighting up the red LED light)

(The battery lighting up the green LED light)
Voltage Produced by a Series of Pennies and Zinc Washers

BY: Austin Rhoads; Brandon Owens; Henry Wirtz; Paige Singleton
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In this series of experiments a battery capable of continuously powering a single LED was attempted to be created. When experimenting with two LEDS, one was slightly dimmed, while the other was fully illuminated. To do this pennies, zinc washers, cardboard, and vinegar were used to create this battery. Our group researched how to make a battery using simple household materials and learned that the power of a battery was actually produced by the reaction between certain metals and acid.

To get the battery where it is required questions to be asked and theories to be made. The question that was asked was “How can we get a battery to give off more volts?” This was the main question that was asked throughout the entire week of the experiment. To answer this question required experimenting. Some experiments showed what worked and some showed what didn't work.

To answer our question we experimented. The main experiment that we tried was was cutting out a piece of cardboard that was the size of a circle and soaking it in vinegar. While letting the cardboard soak a zinc washer was placed on a piece of aluminum foil and a penny was placed on top of that. Then the penny was topped off by a piece of soaked cardboard and a zinc washer. This process was repeated until a cell of ten had been created, then it was tested. A test was taken to see if the more cells of pennies, washers, and cardboard were added, the more volts would be created. This hypothesis was proven to be true.

1 In the above image you are able to see the setup of the battery as well as the greatest voltage the battery produced.
A stack of four or five was created and wrapped in electrical tape. This worked but did not give off the amount of volts needed to succeed in this project.

The more cells of pennies, washers, and cardboard were used the more volts were let off. During this experiment the least amount of volts achieved was 0.5 volts when using 1 cell. The most volts were achieved during the experiment was 16.54 volts when 25 cells were used. The question asked was “How can we get the battery to give off more volts?” Also, another liquid we could use instead of vinegar that might make it more powerful and give off more volts, was researched. Salt water, regular water, and no liquid was tried. Vinegar, because of its acidity, worked the best. So it was kept. In all this was a successful experiment because the empowerment of an LED light that was achieved was a voltage higher than 3.8 volts.
The purpose of this experiment was to create a battery out of mostly common household items. With the idea of using zinc washers, pennies, and vinegar-soaked cardboard which achieved the greatest amount of voltage. With the smallest version, being about 2 inches in altitude, one layer, acquiring 1.97 volts. The greatest amount of volts that was amounted 14.50 volts before the tower of cells eventually fell over. Though the photographic evidence of the largest cell is non-existent, there is a picture of the smaller ones.

Building a battery with pennies probably does not seem very relevant, though it was very promising considering the outcome that we achieved. This is a fun little “DIY” project that you can do on your own at home with just a few common household items. To begin with, the assignment was to make a battery with a higher voltage than 3.8. When we did a few projects that did not work out too well, and did not provide any voltage at all. In the last attempt we came across this certain battery and went through a few trials before going large scale. Our results were far greater than that of our previous experiments.

To begin, you need to gather up a few things. Some you may need to go out and buy but the rest are just normal everyday household materials.

**Materials:**
- Aluminum foil
- Cardboard
- An abundance of pennies
- An abundance of zinc washers
- White vinegar
• **A small cup or bowl**
• **Scissors(optional)**
• **Voltage meter**

Once you gather your materials, it’s time to start the project.  

**Step 1:** Tear the aluminum to the appropriate size for the project. This is in your judgement, within reason.  

**Step 2:** To start, you need to put one zinc washer on the foil. Your next move would be to place a piece of vinegar-soaked cardboard down on top of the washer. After this is done the order you need to place materials would be like so: Penny, Washer, Cardboard... etc..  

**Step 3:** For the cardboard, you’ll need to pour some vinegar in a small cup or bowl. Each piece of cardboard will need to be soaked in the vinegar for just a few seconds. To finish a cell, lay a penny on the top of the cardboard and stop stacking. When you are finished with one cell, or you get to the desired height you would like, test it on the voltage meter to make sure that you have stacked the materials correctly.  

**Step 4:** To test the voltage, you will take the black (negative) wire from the voltage meter and touch it to the aluminum foil. Then you’ll take the other red (positive) wire and touch the ending penny on the top.  

**Step 5:** When you finish, record the voltage with that first cell and from there, you stack the cells repeatedly._

This experiment resulted in the betterment of our knowledge in batteries. We tried many processes to make various batteries but we were not successful in acquiring any voltage at all until we found this idea for a battery from a fellow classmate. The vinegar used in the cell
was the electrolyte solution, and the two metals acted together in order to obtain voltage. The cardboard acted basically as a salt bridge for the cell. With more stacks of the pennies and washers, more voltage was obtained.

(First Picture: This picture shows our single battery lighting up an LED)
(Second Picture: This picture shows the voltage that our battery outputs, a total of 9.29 volts.)