



instructables

## Water Purification From Scavenged Household Items Challenge



by elequa

In this Instructable, students will build their very own electrolysis water purification (aka electro-coagulation) system with a scavenger hunt of household items as materials.

There is a video guide that you can view here <https://youtu.be/5-tCYNIF8ME>

We challenge you to share your results with the community and see how the varying materials create different outcomes!

<https://youtu.be/5-tCYNIF8ME?t=50>

### Step 1: About MakeWater.org & Education Through Water Innovation

Elequa, a non-profit organization, engages students and educators to help innovate a low-cost water filtration method for people in developing countries through the Make Water program. We share stories and guides via our **YouTube channel** and **Facebook page**. With COVID-19 and stay at home orders we decided to make our program more accessible and doable with materials found around the house.

This Instructable is based on Lessons developed by

Elequa & A&M University.

[Download the in depth lesson PDF here.](#)

[Share Results with this Google Form](#)

**Consider supporting our nonprofit at [MakeWater.org](https://www.makewater.org) so we can keep creating free content, kit giveaways, and video episodes.**



## Step 2: Scavenger Hunt for Materials

You can watch this section on the video at 2:15 or [by clicking this link](#).

### **The Challenge:**

You will create and test a water purification system out of household materials you find on a scavenger hunt.

Since you may not find all the basic materials on your scavenger hunt, the list also contains alternative materials. We challenge you to mix and match these items and share your results (the good, the bad, and the ugly!) [Share your builds in this survey](#) or email [info@makewater.org](mailto:info@makewater.org) with the subject "Coagulator Build"

The most interesting builds will be featured on our [YouTube series & livestreams!](#)

### **MATERIALS CHECKLIST:**

- **Tap Water**
- **2 x Clear Cups**
- **2 x Rubber Bands**
- **Table Salt**
- **Cardboard 1½" Inch x 4½" Inch**
- **1 x 9 Volt Battery (*Energy Source*)**  
*Alternative Materials:* AA, AAA, C, or D battery + wire to connect to electrodes
- **2 x 2½" Up To 4½" Inch Screws (*Electrodes*)**  
*Alternative Materials:* Nails, aluminum foil or aluminum can cut into strips the same length
- **Acrylic Paint (*Pollutant*)** *Alternative Materials:* Food coloring, watercolor paint
- **2 x Paper Coffee Filter (*Filtration*)**  
*Alternative Materials:* Paper towel, napkin, T-shirt material

### **TOOLS CHECKLIST:**

- **Scissors**
- **Pen**
- **Spoon or Stirring Utensil**

*SAFETY NOTE:*

*Although the set up will use very low energy use caution when working with batteries especially with water. The electrolysis process that we are utilizing gives off tiny amounts of oxygen, hydrogen (which is flammable), and chlorine (when salt is used). Please make sure you are in a well-ventilated room and make sure children have adult supervision during these experiments.*



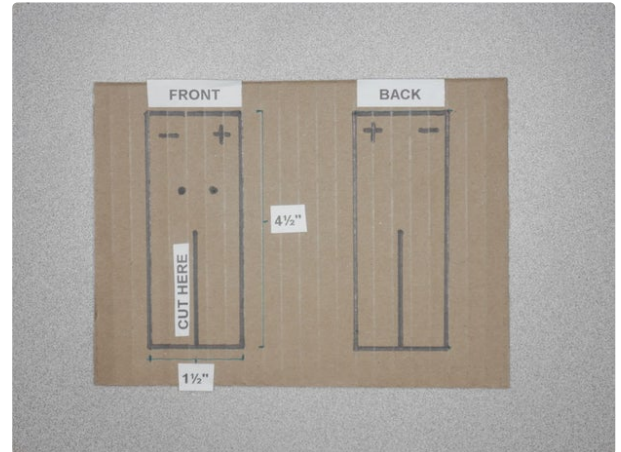
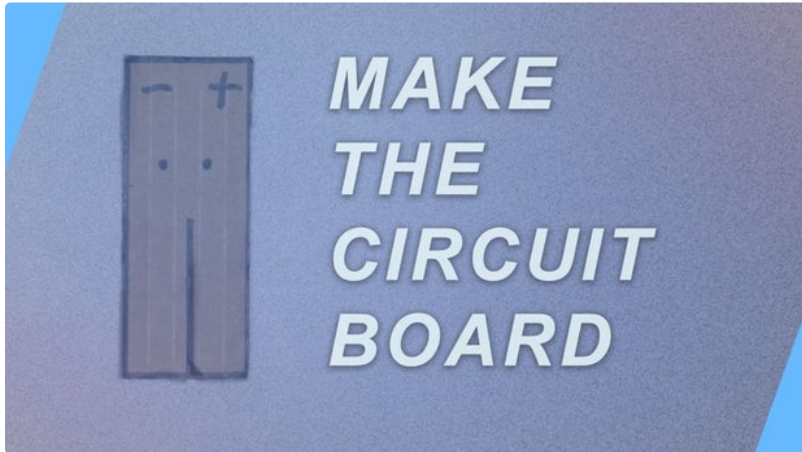
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### **Step 3: Make the Circuit Board**

You can watch this section on the video at 3:40 or [by clicking this link](#).

Note the template above and follow these instructions for the 9-volt battery power source:

1. Cut out a 1½" x 4" piece of cardboard.
2. Mark the cardboard positive at the upper right and negative on the upper left. Flip the cardboard over and mirror the same positive and negative marks (see template).
3. Place the 9-volt battery at the top of the cardboard, making sure the terminals are about 1 ¼" from the top. Mark two dots where the terminals are on the cardboard (see template).
4. An inch below the dots, mark a line down the center (see template) and cut along the line, making a slit in the cardboard.

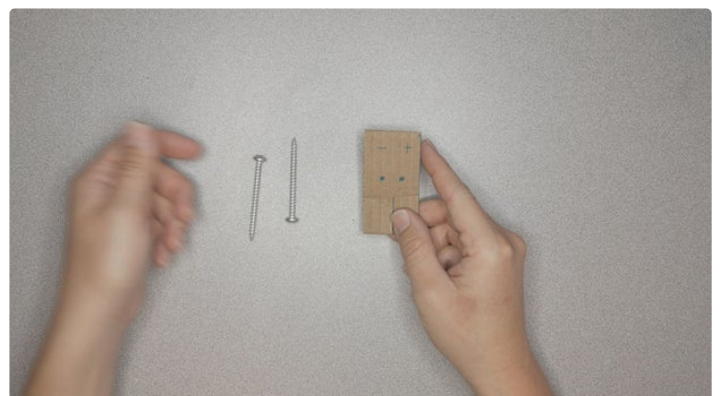
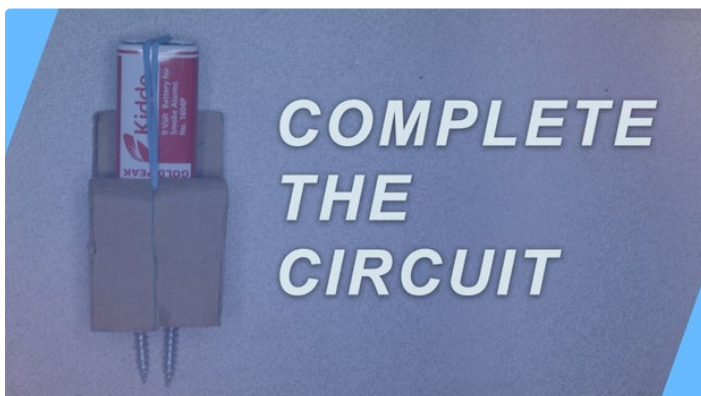


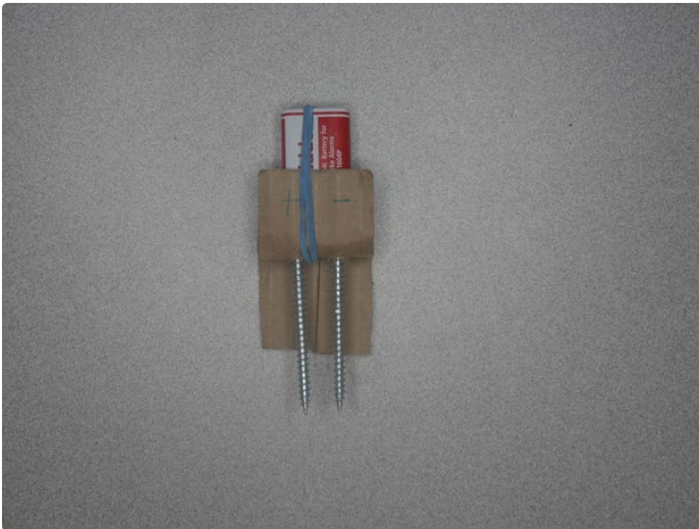
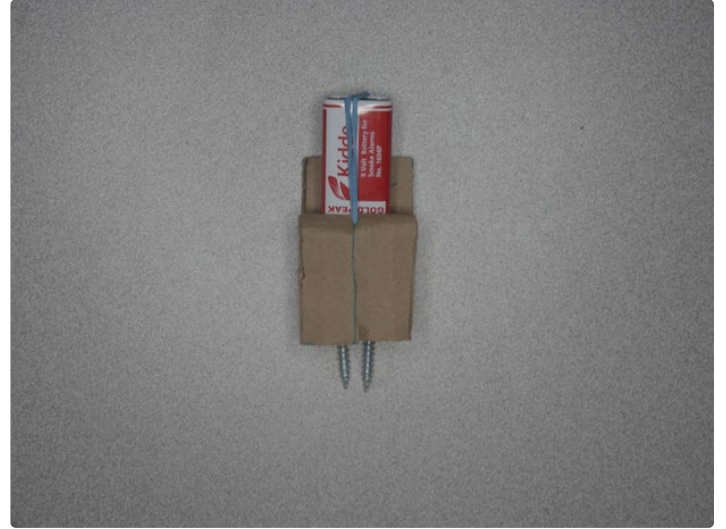
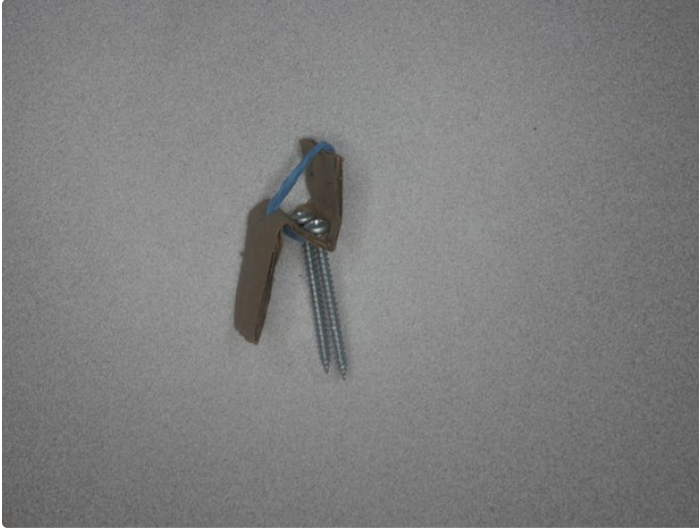
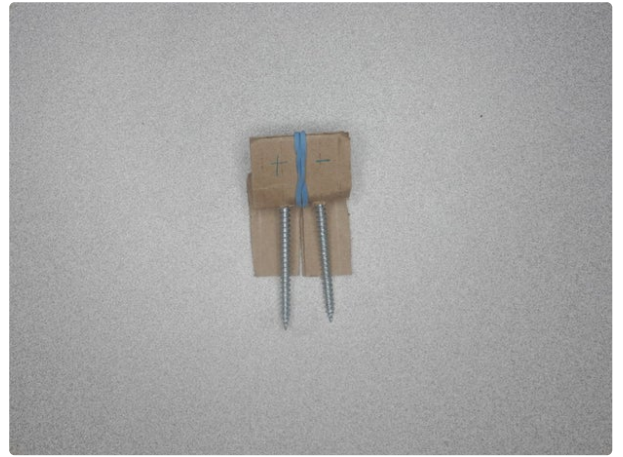
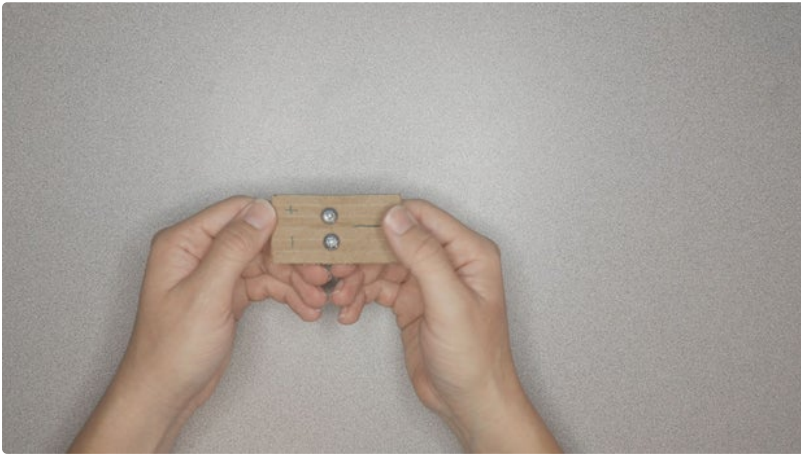
#### Step 4: Complete the Circuit

You can watch this section on the video at 4:48 or [by clicking this link](#).

Carefully insert the screws through the two dots on your cardboard.

1. Wrap one rubber band twice around the length of the cardboard, through the slit and between the two screws (**electrodes**). This will hold your battery (**energy source**).
2. Insert the 9-volt battery (**energy source**) between the rubber bands and the cardboard so that the terminals touch the top of the screws (**electrodes**) and so that the positive and negative sides match those indicated on the cardboard.
3. Fold the slit part of the cardboard down so it looks like the battery is sitting on a chair.





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## Step 5: Make Polluted Water

You can watch this section on the video at 5:52 or [by clicking this link](#).

1. Fill a cup with unfiltered tap water leaving 1 inch of space at the top.
2. Add 3 drops of acrylic paint (**pollutant**) to the cup of water.
3. Add 1/4 teaspoon (or a pinch) of salt to the water. (This is optional but will help speed up the process).
4. Stir the water until the paint is evenly distributed and the water is dark and cloudy.



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### Step 6: Testing Filtration (Control)

You can watch this section on the video at 6:21 or [by clicking this link](#).

1. Make a funnel shape with your coffee filter and place it over the mouth of one of the empty cups.
2. Pour the polluted water through the filter (**filtration**) and see if anything is caught.
3. Observe that little to no paint particles are caught in the filter and the water is still dark and polluted after filtration.
4. Pour the polluted water into one cup and clean the other cup.
5. Throw the filter away and get a clean one. Remember you can use alternatives to coffee filters.



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### Step 7: Coagulate Pollutants

You can watch this section on the video at 7:13 or [by clicking this link](#).

1. Wrap the other rubber band around your clean cup and pull it to the wide part (top) of the cup.
2. With the screw (electrodes) inside the clean cup and the folded-slit cardboard outside the cup, slide the end of the cardboard with the slit under the cup's rubber band.
3. Balance the battery and electrodes on the lip of the cup with the electrodes hanging inside the cup.
4. Pour the polluted water into the cup with the hanging electrodes until the electrodes are submerged at least half-way or more in the water but not so much that the water touches the battery or cardboard.
5. Make sure you observe bubbles flowing from at least one electrode (one will have more bubbles forming on one than the other). This means your system is working.
6. Leave the kit running for up to 3 hours (mark the time you started and ended for our survey!) and check in at 15 minute intervals to observe, take photos, or video any changes to the water.

*OPTIONAL:*

*Use a flashlight (like one on your phone) against the side of the cup to see if the water is clearing up or if coagulation (bulking of the pollutants) is occurring.*

*EXTENSION:*

Repeat procedures but change the polarity of the battery at specific intervals. For example, every 15 or 30 minutes. Note that switching polarity will change which electrode produces the most bubbles. Record your observations. Making and sharing these observations can help us understand an optimal time to swap polarity in larger purification processes.



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## Step 8: Filter Out Pollutants

You can watch this section on the video at 8:50 or [by clicking this link](#).

1. After waiting about 3 hours or when you feel that enough coagulation has occurred (note the amount of time that has passed), get your second cup and place a clean filter over it just like we did before.
2. Take out your circuit board and disconnect the battery's terminals from the electrodes. Rest your circuit board on a paper towel.
3. Pour your coagulated water through the clean filter.
4. Don't worry about filtering all the water. You just need enough to note the clarity of the water after filtration and how much of the pollutants were caught in the filter.



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### Step 9: Observe and Record Results

You can watch this section on the video at 9:21 or [by clicking this link](#).

1. Share your photos, videos, or written documentation.
2. Don't forget to fill out the [survey](#) and share what you came up with.
3. Congratulations! This was your first attempt. Now it's time to change the variables and try again!





## Step 10: Share Results, Change Variables, and Try Again!

You can watch this section on the video at 9:37 or [by clicking this link](#).

Share your results and change a variable!

So what are some variables? There are so many things you can find around the house that can do the same thing as these basic components that you saw in this video. For example: electrodes, energy source, type of polluted water and type of filtration. Those are just four things. There are many more variables you can try. What changes will you make?

1. Change one variable (it's a good idea to test only one variable at a time).
2. Repeat steps #2-9.
3. Record your observations. Did it seem to work better or worse?
4. Share your results. And don't forget to share even if something doesn't work. That's how we find out what works the best! We can also stop someone else from repeating the same experiment that doesn't work.

The good, the bad, the ugly...share everything!

Share your observations in [this survey](#). We will try and duplicate your experiments, so like all scientists, don't forget to be specific when you record your steps and data. And don't forget about the prizes and giveaways!

Share your work survey Link: <https://forms.gle/t8J5TRjN5qanHtyJ8>

