



# Electrochemistry



## Goals

- ✓ Assemble and run a salt water battery
- ✓ Maximize the generated electric current
- ✓ Make calculations based on data



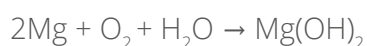
## Background

Electrochemistry is a branch of scientific study that has been around for hundreds of years. Almost as soon as experiments with electricity were developed, it was recognized that there were chemical processes that could produce an electric current.

Now we know that electrochemistry is involved in your own brain, and that the thoughts, feelings, and memories you have would not be possible without a near-constant movement of electrically charged ions in and around the cells of your brain.

Electrochemistry is closely related to redox reactions. All electrochemical reactions involve two electrodes: an anode and a cathode. The anode is defined as the electrode where oxidation occurs and the cathode is the electrode where the reduction takes place. So the anode is negatively charged and the cathode is positive.

In our battery, the anode is made of magnesium, while the cathode is actually the air around it, so the overall reaction is:



Between the two electrodes is an electrolytic solution of salt water. Can we change the electrical output of the battery simply by changing the solution?

During this activity, you will use different solutions of salt in water determine the effects on the battery's electric current.



## Procedure

1. Look at the two parts of the battery and how they fit one inside the other. Does it matter which way you put one inside the other? How will you get them apart once you put them together?
2. The large flat piece with the blue top is the anode for our experiment. Electrons will be flowing out from the anode into a wire once you start the battery. Where would you attach a wire on the anode? What color of wire do you think you should use?
3. Measure out 15 mL of salt water using the graduated cylinder and use the syringe to transfer it to the bottom part of the battery. Why do you think we don't fill it up all the way?
4. Take your anode and clip it into the bottom part of the battery. Where should you put wires to let electrons start flowing through your fuel cell?
5. You have two red wires, but only one needs to connect the battery to the fan motor. Where would you put the other red wire?



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6. Attach the black and one red wire to the fan. Attach the other red wire to two red sockets on the front and back sides of the anode. This should start the fan running. Write down anything you observe in the Observations section below.
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### Observations



### Experimentation

1. Run your battery like you did in the Procedure section, but this time measure out different volumes of salt water to see what happens to the motor. Record your observations below.

Volume (mL):	Time (sec):	Observations:
5		
7		
10		
12		
15		
18		

2. How can you maximize the amount of electric current generated by your battery? Using the volume that worked best in the previous experiment, work with your group to think of ways that you can make the motor move faster by generating more electricity. Change the characteristics you think might have an effect and record your observations below:



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Trial:	Observations:
1	
2	
3	
4	
5	
6	
7	
8	



### Measurement

For this section, you will need a multimeter or the Horizon Renewable Energy Monitor. For an introduction to using a multimeter, [click here](#).

1. Measure the current in Amps and the voltage in Volts while running the battery with different volumes of salt water. Record your answers below:

Volume (mL):	Current (A):	Voltage (V):
5		
7		
10		
12		
15		
18		



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2. Voltage is equal to the current multiplied by the resistance ( $V = IR$ ), so according to your data what is the resistance of the fan motor?

Resistance: \_\_\_\_\_  $\Omega$

3. Construct an explanation of what you observed as you tested salt water solutions of different volumes.



### Analysis

1. Make a scientific claim about what you observed while running your battery.
2. What evidence do you have to back up your scientific claim?
3. What reasoning did you use to support your claim?



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4. Design an experiment that would determine the effect of the size of the anode on the performance of the battery. Describe your experiment below:



### Conclusions

1. Based on your observations, what is the relationship between the volume of the salt water solution and the amount of electricity generated by the battery?
2. What other factors did you identify that affected the output of the battery?
3. Based on your experiments, what would be the best possible conditions for maximizing the electrical output of the battery?