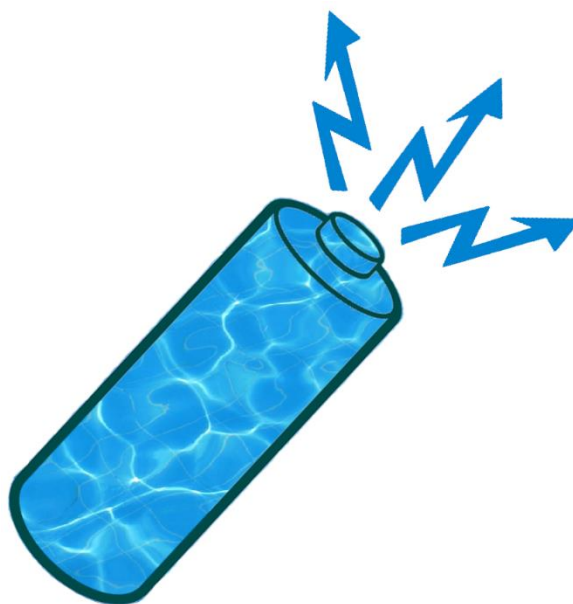


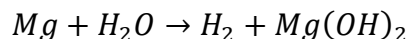
Wonder Water

Water powered cars have been the subject of numerous popular science magazine articles and websites for decades. Claims of cars that can be fueled by water are always disregarded by the scientific community, but this has not stopped companies from peddling the idea for profit. The start-up company *Watt-ery* has released a video demonstration of a car battery prototype that they claim can be powered by water. Two beakers of clear, colourless liquid both labelled "Pure Water" are placed next to one another and connected with a salt bridge. The demonstrator



in the video brought out a small motor with two wires attached. To one wire, a wide strip of magnesium metal is attached, and to the other a thin platinum electrode. The motor began to turn when the magnesium was placed into the left beaker and the platinum was placed into the right beaker.

Watching closely, you noticed that bubbles started to form around the platinum electrode and the strip of magnesium began to corrode. The demonstrator claimed that the prototype harnessed the energy of the reaction between water and magnesium metal. He also claimed that the gas bubbling off is evidence of the following reaction:



Despite a burning splint test to confirm that the gas produced was indeed hydrogen, you believe that something is fishy about the explanation that the demonstrator gave in the video and suspect that the demonstrator might be leaving out some important information.

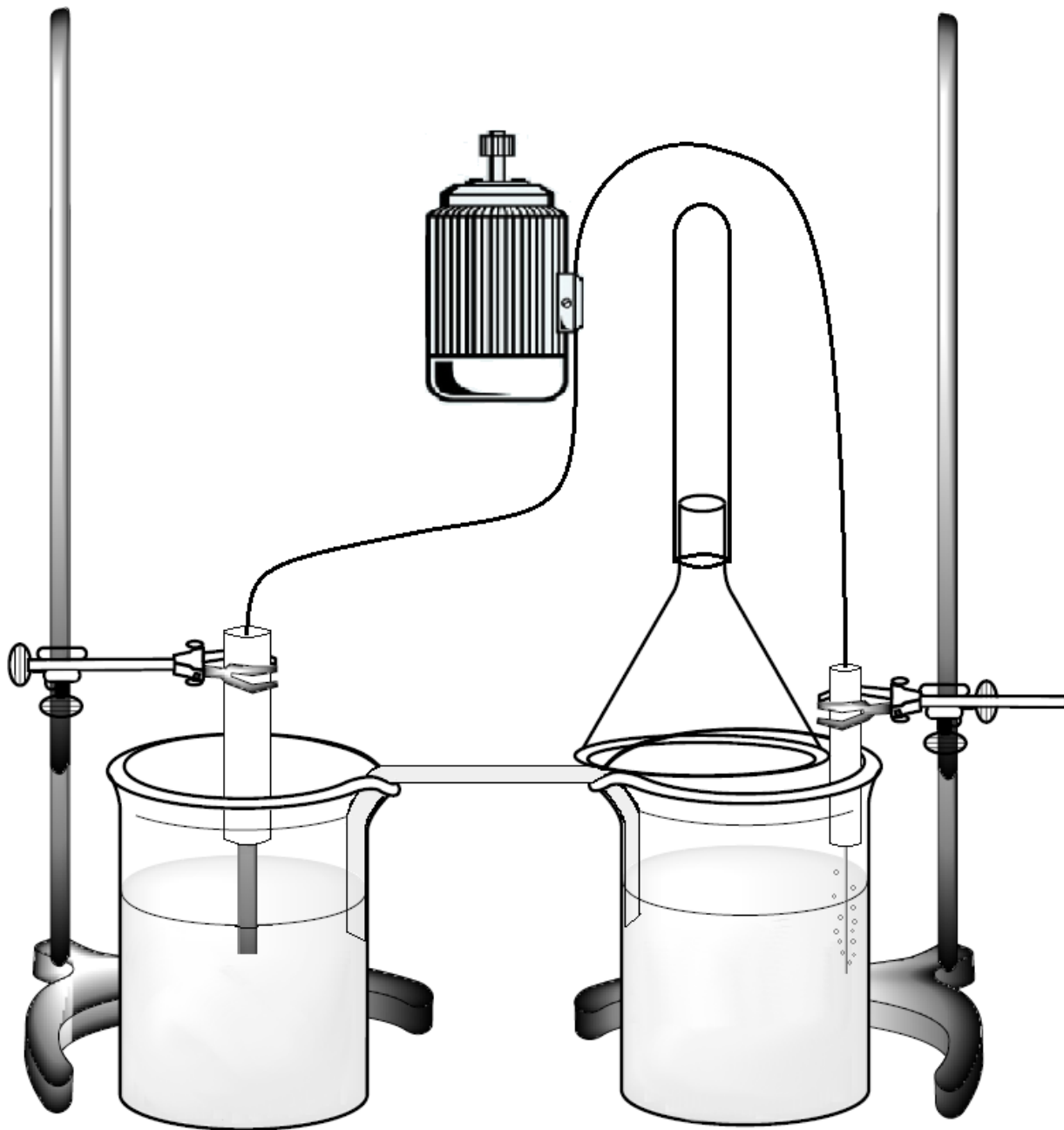


Figure 1. Setup that was shown in the demonstration. The motor is connected to two beakers with "Pure Water" inside. The gas was collected in a test tube with the use of a funnel.

How did they do it?

In your first attempt to recreate the experiment exactly as depicted by the demonstrator, nothing seemed to work. The motor did not turn, and no gas was produced at the platinum electrode.

What solutions other than water could the demonstrator be using in the video to produce such results? What is the reaction that is occurring? Write down the half cell reactions and the cell notation (assuming the experiment was done under standard temperature and pressure).

Repeat the experiment using the solutions that you have predicted and measure the voltage between the two beakers using a voltmeter.

What type of battery is being made? Completely label the diagram in Figure 1, ensuring that the anode and cathode are labelled. What would you expect the cell potential to be?

Why was the platinum electrode used even though it was not a part of the reaction used to generate electricity? How would the demonstration change if an exposed gold wire, or palladium wire was used by the demonstrator instead of the platinum electrode?

When you tried to replicate the experiment, did your reading from the voltmeter have the expected result? What are some factors that can affect the cell potential of your battery?

The demonstrator claimed that if the beakers were simply larger, the prototype battery that was demonstrated would be able to generate more voltage with no other additional changes. Explain whether or not this claim is correct.