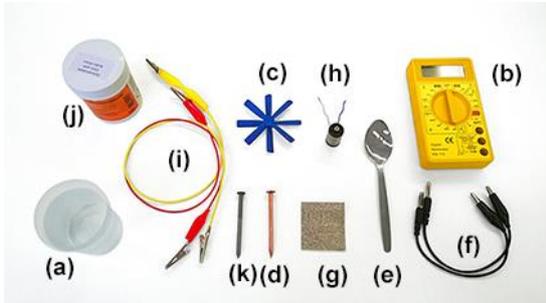


## Electricity 3: We create our own voltage source

### 1 Apparatus and materials

#### Your materials



- 1 digital multimeter (b)
- 1 dual propeller for small solar motor (c)
- Plastic cup, 100 ml (80 ml water) (a)
- 1 copper nail (d)
- 1 spoon (e)
- 1 measuring cable assembly, banana plug to alligator clip (f)
- Sandpaper (g)
- 1 solar motor, small, bell-type armature (h)
- 2 connecting cables, alligator clip to alligator clip (i)
- Citric acid (j)
- 1 zinc nail (k)

#### 1.1 Safety information

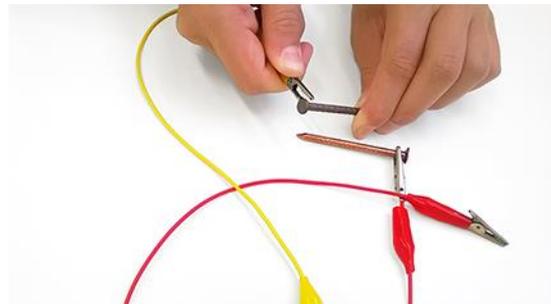
The materials may be used only as instructed by your teacher or as described in the experimentation instructions.

### 2 Preparing the experiment

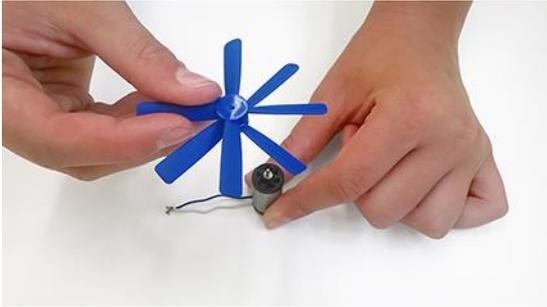
#### 2.1 Electrical circuit



1. Place one spoonful of citric acid in the plastic cup with the water and stir.



2. Clip one connecting cable to the copper nail and the second cable to the zinc nail.

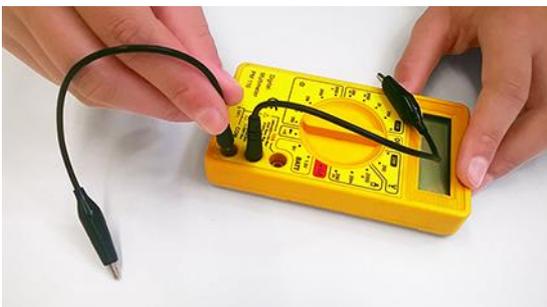


3. Press the dual propeller onto the solar motor.

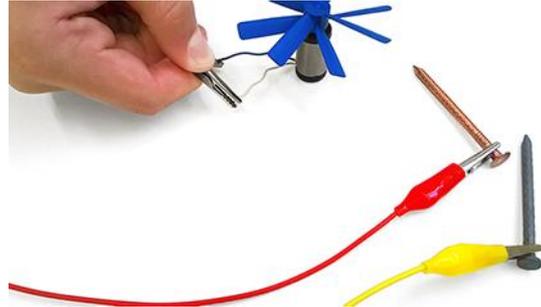


**Note:** The alligator clip must be attached to the exposed wire.

## 2.2 Digital multimeter



1. Insert the measuring cables in the two lower connection jacks.



4. Attach the free alligator clips of the connecting cables to the solar motor.

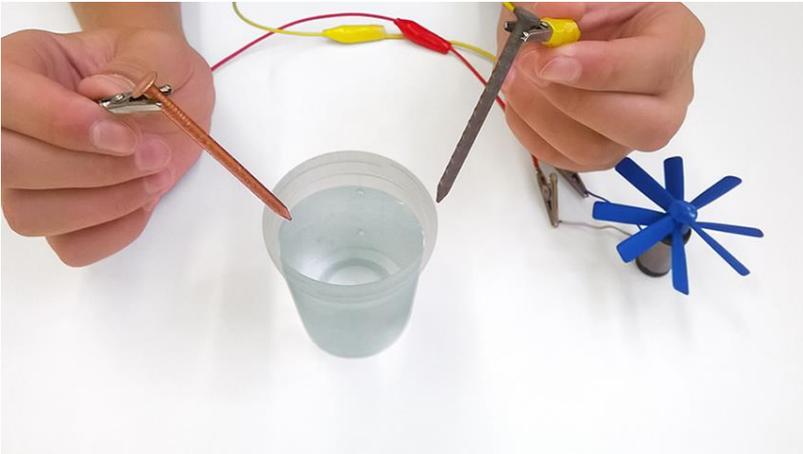


2. Set the digital multimeter to 20 volts.

### 3 Conducting the experiment

#### 3.1 Assignment 1

What will happen if you hold both nails in the liquid?  
Write down your guess.



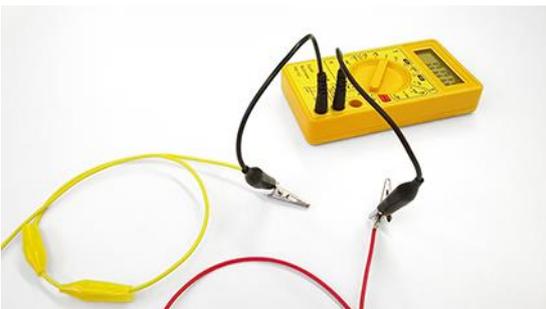
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#### 3.2 Assignment 2

Measure the voltage generated by the zinc-copper battery.

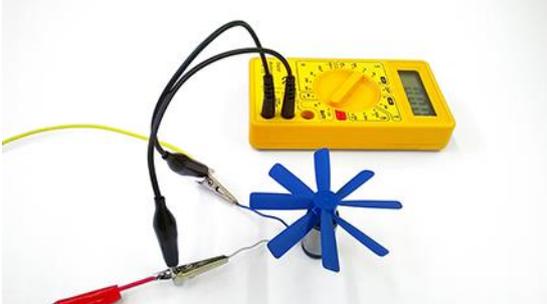


1. Connect the digital multimeter to the two alligator clips in place of the solar motor.
2. Use the sandpaper to sand the two nails before you hold them in the liquid.

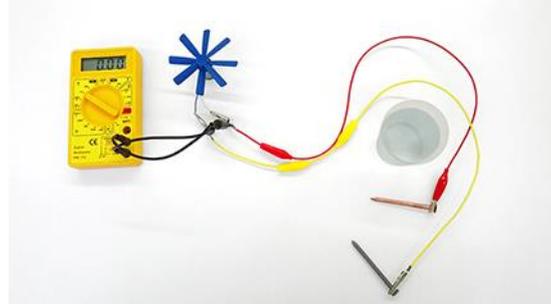
The zinc-copper battery generates a voltage of \_\_\_\_\_ volts.

### 3.3 Assignment 3

How does the voltage change if you connect the solar motor with the dual propeller to the electrical circuit?



1. Attach the alligator clips to the solar motor's cables.



2. Use the sandpaper to sand the two nails before you hold them in the liquid.

### 3.4 Assignment 4

Read the following text and mark the correct answers with an X.

An electrical voltage is produced by a chemical process between the metals and the citric acid solution.

This voltage can be used to

- drive a load, e.g., a motor with a propeller.
- drive a solar cell.

This home-made battery

- produces useful voltage for only a very short time.
- can be used for a very long time.

For this reason, the battery we built

- is good to use.
- is of little use.

Without a load (motor), the battery maintains

- the voltage only for a short time.
- the voltage.

Batteries drain if you connect loads. Without loads, batteries maintain their voltage for a long time.