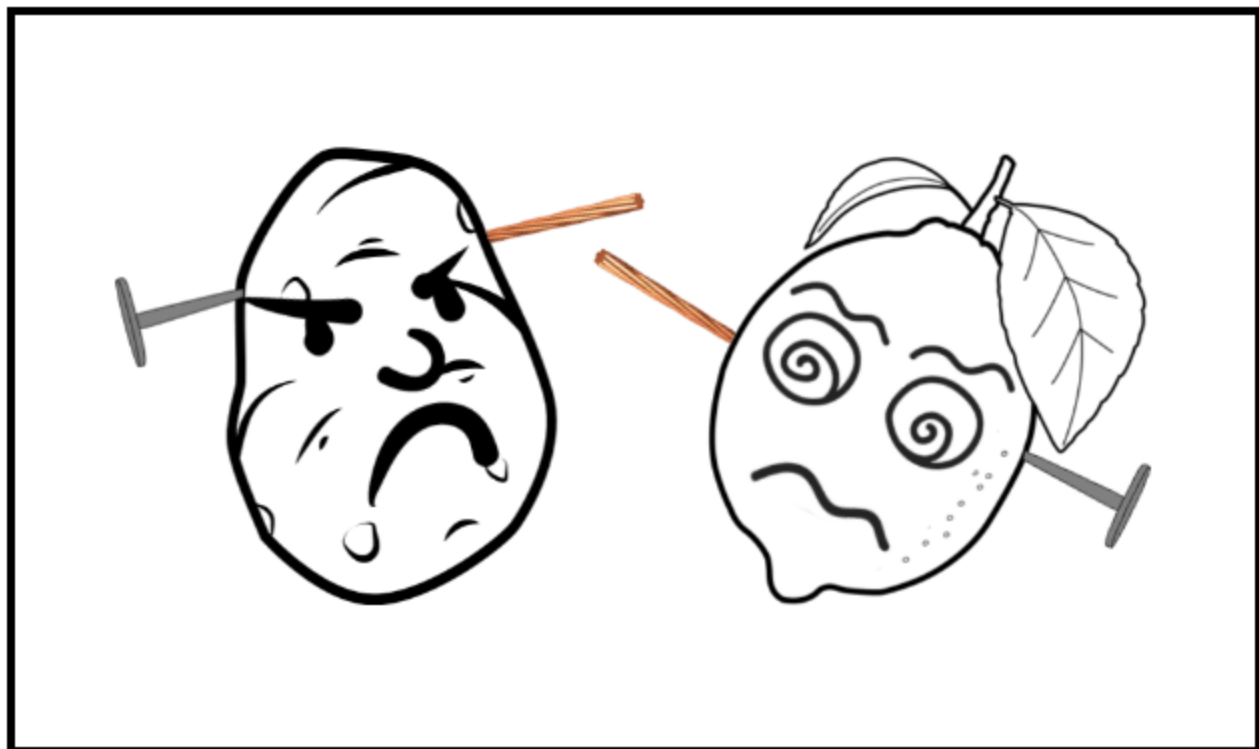


# FRANKENSTEIN'S BATTERY



LA-BOO-RATORY MANUAL

AYVA EDUCATIONAL SOLUTIONS | PASCO SCIENTIFIC

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## INTRODUCTION

As Dr. Frankenstein's assistant, you work in his laboratory, studying the principles of electrochemistry. But Frankenstein has run out of funding and cannot afford electrochemical cells for his experiments. In order to please your master, you intend to show him that electricity can be conducted using produce, but first you must answer the questions:

1. What is voltage and where does it come from?
2. How can a piece of produce be used to construct an electric cell?
3. How can the voltage be increased?

## OBJECTIVES

1. Create an electrochemical cell out of its core components.
2. Observe how voltage changes when multiple cells are connected in series.

## MATERIALS

- Data collection system
- PASCO's Wireless Voltage Sensor
- Piece of copper wire, 4-6 cm in length
- Zinc-coated (galvanized) nail
- 3 battery holders
- 3 batteries
- 3 fruits/vegetables (i.e. lemon, potato, etc.)

## SAFETY

Follow these IMPORTANT safety precaution(s) when completing the experiment:

- The produce should not be consumed after use in this lab.

## PROCEDURE

### PART 0: Produce a Monster

1. Use markers to draw monster faces on the pieces of produce; see cover page for examples.

### PART 1: Making an Electrochemical Cell

1. Select *Sensor Data* in SPARKvue.
2. Connect the wireless voltage sensor to your device.

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3. Create a digital display of voltage.
4. Choose the first fruit piece.
5. Push the copper wire and the zinc-coated nail into the fruit about 5 cm apart. Leave about 2 cm of each electrode exposed.
6. Connect the red alligator clip to the copper wire.
7. Connect the black alligator clip to the zinc-coated nail.
8. Select *Start* to begin data recording.
9. (Optional): Shout, "It's alive, it's alive!" as the voltage value increases.
10. Let the voltage value stabilize, then record the voltage value and fruit type in *Table 1* in the Results & Analysis section.
11. Remove the electrodes from the fruit, clean them off, and insert them into the next piece of produce.
12. Repeat steps 8 - 11 for 2 more pieces of produce.

### PART 2: Making a Battery, Combining Electrochemical Cells

1. Detach the leads of the voltage sensor from the alligator clips.
2. Place 3 batteries in individual battery holders.
3. Connect the voltage sensor across the terminals of one of the batteries; red to positive, black to negative (flat end of the battery).
4. Record the voltage value of a one battery in *Table 2* of the Results & Analysis section.
5. Connect a second battery holder to the first so that the positive terminal of the first is connected to the negative terminal of the second. In other words, connect the battery holders in series.
6. Connect the voltage sensor across the outermost terminals of the batteries.
7. Record the voltage value for 2 batteries in series in *Table 2*. Repeat for 3 batteries
8. Stop recording data.

## RESULTS & ANALYSIS

### PART 1: Making an Electrochemical Cell

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PRODUCE	VOLTAGE (VOLTS)

*Table 1: Produce and Voltage*

### PART 2: Making a Battery, Combining Electrochemical Cells

NUMBER OF BATTERIES	VOLTAGE (VOLTS)
1.	
2.	
3.	

*Table 2: Batteries and Voltage*

1. How does the voltage of the first piece of produce compare to the voltage of the second piece? Why do you think they are different or similar?
  
2. What could do that might increase the voltage of the pieces of produce?
  
  
3. How did the voltage change when you connected 2 batteries in series? How did it change with 3 batteries? Predict the voltage of 4 batteries connected in series.

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4. (Bonus): What is the name of Dr. Frankenstein's assistant?

*Hint:* read the introduction carefully.