goHunterdon
Promoting Sustainable Transportation

Battery Power Lesson Plan 2020

Objective: Students will learn about batteries and voltage and apply the knowledge in the building of their Electric Vehicle Challenge vehicles.

Time: 30-45 minutes

Materials: AAA, AA, C, D, and 9V batteries, digital multi-meters, battery holders

Background: As of December 2019, New Jersey has over 30,000 registered electric vehicles, an increase from only 338 just seven years ago. New Jersey's Energy Master Plan includes a goal to have 330,000 electric vehicles on the road by 2025, only 5 years from now, in order to meet emissions reductions targets. To understand how battery electric vehicles work, it is important to learn that different batteries have different voltages and currents and that those characteristics work within electric circuits to make electric engines run, causing the vehicles to move. The battery packs used in students' Electric Vehicle Challenge cars, will provide electricity to power their vehicles down the track.

Explain electric circuits, voltage, current, as needed.

Procedure:

1. Use worksheets to record data and observations.
2. Distribute and set up multi-meters by placing the black lead into the port labeled COM (common) and by placing the read lead into the VΩ port. Set the knob to 20 in the V ⎓ (direct current) area of the dial. The display should read "0" with the leads not touching anything. You may need to turn the multi-meter on if there is no display.
3. Give out one of each type of battery so that students have one AAA, AA, C, D, and 9V battery to test. Do students have any predictions about size of the battery and its performance? What about battery shape? Is it important?
4. Ask students to observe their batteries and find the positive (+) and negative (-) sides of each one. They should also find the voltage of each battery on its label and record it on their worksheets.
5. Measure the voltage of each battery type and record the data on the worksheets. Use the multi-meter to do this by placing the tip of the red probe on the positive (+) end (also called a pole) and the tip of the black probe on the negative (-) pole and reading the number on the display. Have them try doing it backwards by reversing the red and black probes on a battery. What happens?
6. Give students time to fill in their worksheets.
7. Look at the data sheets and discuss students' results versus their predictions. Students may ask why their measured voltage doesn't match the labeled voltage. Explain that batteries have a higher charge when they are newer and the voltage drops over time. They are designed to have something in the circuit that uses the electricity they produce (called a load), so without that load their voltage is higher.
8. EXTENSION: Students can try connecting a few 1.5V batteries end to end in series and use the multi-meter to measure voltage within the series and at the ends. You can ask them to make a prediction of what will happen, try it, and then discuss that batteries connected in series add their voltage together.

Name: _____

Battery Power Worksheet

Predictions:

Do you think the size of the battery has an effect on its voltage? What about the shape?

Battery Type	Labeled Voltage (V)	Measured Voltage (V)

1. On AAA, AA, C, and D batteries, where are the poles located?
2. On 9V batteries, where are the poles located?
3. What happens when the multi-meter connects to both poles?
4. What happened when the probes of the multi-meter were placed on the opposite poles?
5. Which battery had the highest voltage?
6. The battery with the largest size measured how many volts?
7. The battery with the smallest size measured how many volts?

Name: _____