Grades 6 and Up

SMART CHARGING
BE A BATTERY CHARGING RESEARCHER
Instruction Sheet

Imagine: your friend is getting ready to head out for the day and their phone gives them a low battery charge warning. They only have ten minutes before they must leave. They have several charging cables to choose from, all different lengths-- *Which one should they choose? Is there an optimal length to charge your phone? How much can you increase the charge on your phone in 10 minutes? Are there any other factors at play?*

In this activity, you will measure how much your phone's battery charges in 10 minutes. You will then submit your results to the Argonne Smart Charging Data Form. Your submission will be one data point within a larger experiment tested by students from all over! Your findings will help answer the questions above.

Image Source: Argonne National Laboratory

MATERIALS

Make sure you have permission to use the materials from an adult!

- ☐ **Cellphone**
  - If you don't own your own device, ask to borrow one from your parent/guardian.
- ☐ **Charger Block**
- ☐ **Charging cable**
- ☐ **Timer/Clock** (must be a different device from the one you are investigating)
- ☐ Argonne Smart Charging Data Form

INTRODUCTION

Our Argonne researchers work with batteries all the time. Recently, they've been studying how different materials affect battery capacities, recharging rates, and longevity of batteries.

Many batteries we use today are considered "secondary" batteries, also known as "rechargeable". Secondary batteries, like those found in your phone, use a chemical reaction to generate electricity to power your device. When plugged into a charger, the electricity from the wall reverses the chemical reaction, thus "charging" the battery. You can watch this VIDEO from TED-Ed for more details on batteries and charging.

The current and resistance are two variables that will impact charge time. **Current** is the flow or movement of electrons in the circuit and **resistance** is a force that opposes current, meaning it makes it more difficult for the electrons to move. **Basically, the lesser the resistance the faster the current, which means the faster the charge!**

There are a number of factors that impact resistance such as the length of the circuit. *How do you think length impacts resistance? Which cable has more, shorter one or a longer one? Are ther other factors to consider?* **Try the experiment below to help us find out!**

ACTIVITY HIGHLIGHTS

- ☐ **Explore and learn more about batteries!**
- ☐ **Prepare your materials**
- ☐ **Pick an experiment or observation**
- ☐ **Share your results with Argonne Education!**

U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

September 2021

SMART CHARGING
BE A BATTERY CHARGING RESEARCHER
Data Sheet

Procedure

You will do one trial for each cable.

1. Gather the materials and open Argonne Smart Charging Data Form .
2. Log the length of your cable.
3. Under observations and notes, document the characteristics of your cable and phone. Some things to think about are:
    a. How thick is the cable?
    b. What is the brand and age?
    c. What is the condition? Is their any damage?
4. Collect your data!
    a. Log the starting % on your phone.
    b. Charge your phone for 10 minutes.
    c. Make obserations and take notes! For example, note if you received any texts during charging.
    d. Log the end %.
    e. Determine the percent increase that occured in the 10minutes of charge time:

$$End\ \% - Start\% = Percent\ Increase$$

5. Analyze your data.
    a. What other factors might have influenced your results?
    b. Were there any apps running while charging?
    c. Did you receive any notifitions while charging?
6. Share your findings with Argonne Education! Submit your results on the Argonne Smart Charging Data Form.
7. Feel free to do more trials or try the experiment with a different phone and/or cable. Submit all you findings.