

THE SCIENCE & SAFETY of LITHIUM-ION BATTERIES



Grade Level: 3–5

Subject: Science / Safety / Engineering

Time Needed: 45 minutes

Standards Alignment:

- **4-PS3-4:** Energy conversion and device testing
- **4-ESS3-1:** Energy use, natural resources, and environmental impact
- **3-5-ETS1-1:** Real-world engineering problem-solving

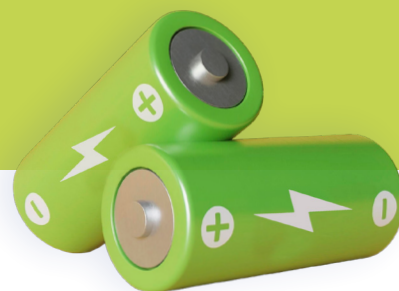
Learning Objectives

By the end of this lesson, students will:

- Understand what lithium-ion batteries are and where they are used.
- Explain why these batteries are powerful but potentially dangerous.
- Describe the concept of **thermal runaway**.
- Identify key safety habits to prevent battery-related fires.

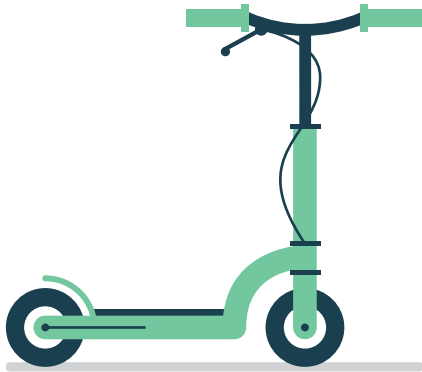
Materials Needed

- **Video:** [*The Power \(and Danger\) of Lithium-Ion Batteries*](#)
- Lithium-ion battery and thermal runaway charts
- Dominoes, wooden blocks, or other stackable items (1 small set per group)
- Safe and damaged charging cord signs
- Chart paper or whiteboard
- Markers or crayons



Hook: POWER ALL AROUND US

(5 minutes)



Prompt:

Ask, "What do your tablet, electric scooter, and video game controller all have in common?"

Class Activity:

Brief class brainstorm. Then introduce the core idea: "They're powered by lithium-ion batteries, small but super powerful energy sources. But you have to use them safely."

VIDEO VIEWING & GUIDED QUESTIONS

(10 minutes)

Play: *The Power (and Danger) of Lithium-Ion Batteries*

ASK STUDENTS TO LISTEN FOR:

- What makes lithium-ion batteries powerful?
- What makes lithium-ion batteries dangerous?
- What happens when they aren't used safely?

POST-VIDEO DISCUSSION

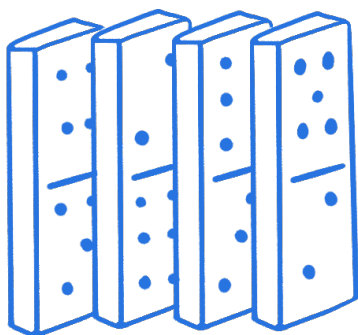
- What did you notice?
- What surprised you?
- Why is charging lithium-ion batteries safely important?



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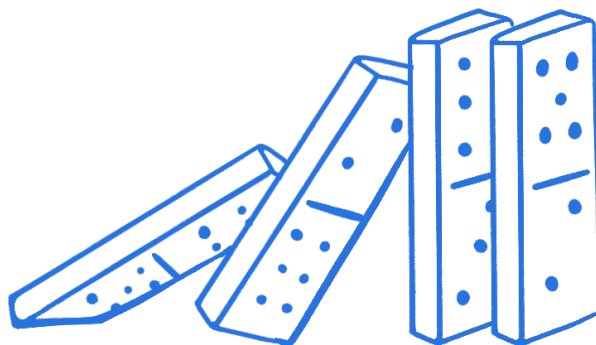
HANDS-ON DEMO: CHAIN REACTION

(10 minutes)



Setup:

- Students get into small groups and line up dominoes or blocks in a straight or curved row.



Activity:

- Knock over the first domino and observe the chain reaction.

Discussion:

Share the lithium-ion battery chart with students to help with understanding.

Ask some of these questions:

- What caused all the dominoes/blocks to fall?
- Could you stop it once it started?
- How is this like the boiling pot example from the video?
- Can you think of a time when a device got really hot while charging or being used?
- How can we prevent battery overheating in a similar way, through safe habits?

Explain that the falling dominoes represent what happens inside a battery during **thermal runaway**, a chain reaction that can't be stopped once it begins.



ACT IT OUT: BATTERY ROLE-PLAY

(10 minutes)

Help students visualize how lithium-ion batteries work, i.e., what happens when they overheat and how they go into thermal runaway.

Assign Roles:

- **Anodes:** "We send out energy!"
- **Cathodes:** "We collect the energy!"
- **Lithium Ions:** "We move the energy from one side to the other!"
- **Separator:** "I keep the Anodes and Cathodes from touching but let electricity flow safely."
- **Instructor:** "I give directions in the scenes."

Set the Scene:

- Place Anodes and Cathodes on opposite sides of the room.
- Lithium Ions line up in the middle, ready to move.
- Separator stands between them, controlling movement.
- Instructor stands out of the way.

Activity Rounds:

NORMAL BATTERY USE

- The **Instructor** calls out, "Go!"
- **Lithium Ions** walk calmly back and forth between Anodes and Cathodes, simulating a stable energy transfer.
- **Separator** stands between Anode and Cathode to make sure the Lithium Ions are walking, not running back and forth.

Teacher: Let this play out for about 1 minute and then tell students to stop. Reinforce that this is what happens when everything inside a battery is working as it should.



OVERHEATING BATTERY

- **Instructor** holds up a piece of paper that reads "DAMAGED CHARGING CORD."
- Everyone begins moving quickly and chaotically.
- **Instructor** calls out "Pause" and holds up a piece of paper that reads "SAFE CHARGING CORD."
- **Separator** steps back in the middle and holds out their arms. They call out, "Let's keep the battery safe!"
- All movement stops and then returns to normal, with the **Lithium Ions** walking calmly back and forth between the Anodes and Cathodes.

Teacher: Let this play out for about 30 seconds and then tell students to stop. Reinforce that by charging safely, we can prevent overheating batteries. The separator keeps the anodes and cathodes separate so the lithium ions can flow safely back and forth.

**SAFE
CHARGING
CORD!** 

THERMAL RUNAWAY

- **Instructor** holds up the piece of paper that reads "DAMAGED CHARGING CORD."
- The **Separator** steps aside and calls out, "I'm melting and can't stop them!"
- Everyone begins moving quickly and chaotically to demonstrate thermal runaway, when the battery gets too hot and energy moves out of control.
- **Instructor** calls out, "Thermal runaway!"

Teacher: Let this play out for about 30 seconds and then tell the students to stop and return to their seats.

**DAMAGED
CHARGING
CORD!** 

ASK: HOW CAN YOU HELP PREVENT THERMAL RUNAWAY? GO OVER THE SAFETY TIPS LEARNED FROM THE VIDEO.

- Always charge on a hard, flat surface.
- Use the charger that came with your device.
- If you need a new charger, buy one from the manufacturer or one that they have approved. Don't buy off-brand chargers.
- Don't use damaged cords when charging.
- Unplug the charger when the battery is fully charged.
- Don't leave devices in the sun or in a hot car. Always charge them in a place that's not too hot and not too cold.



SAFE
CHARGE
CORD!



DANGER
CHARGING
CORD! 





EXIT ACTIVITY: CHARGE INTO FIRE SAFETY™ POWER MOVE

Each student names one charging habit they'll commit to using. It's their personal "power move" to stay safe with devices.

My Fire Safety Power Move:



My Fire Safety Power Move:



My Fire Safety Power Move:



My Fire Safety Power Move:



My Fire Safety Power Move:

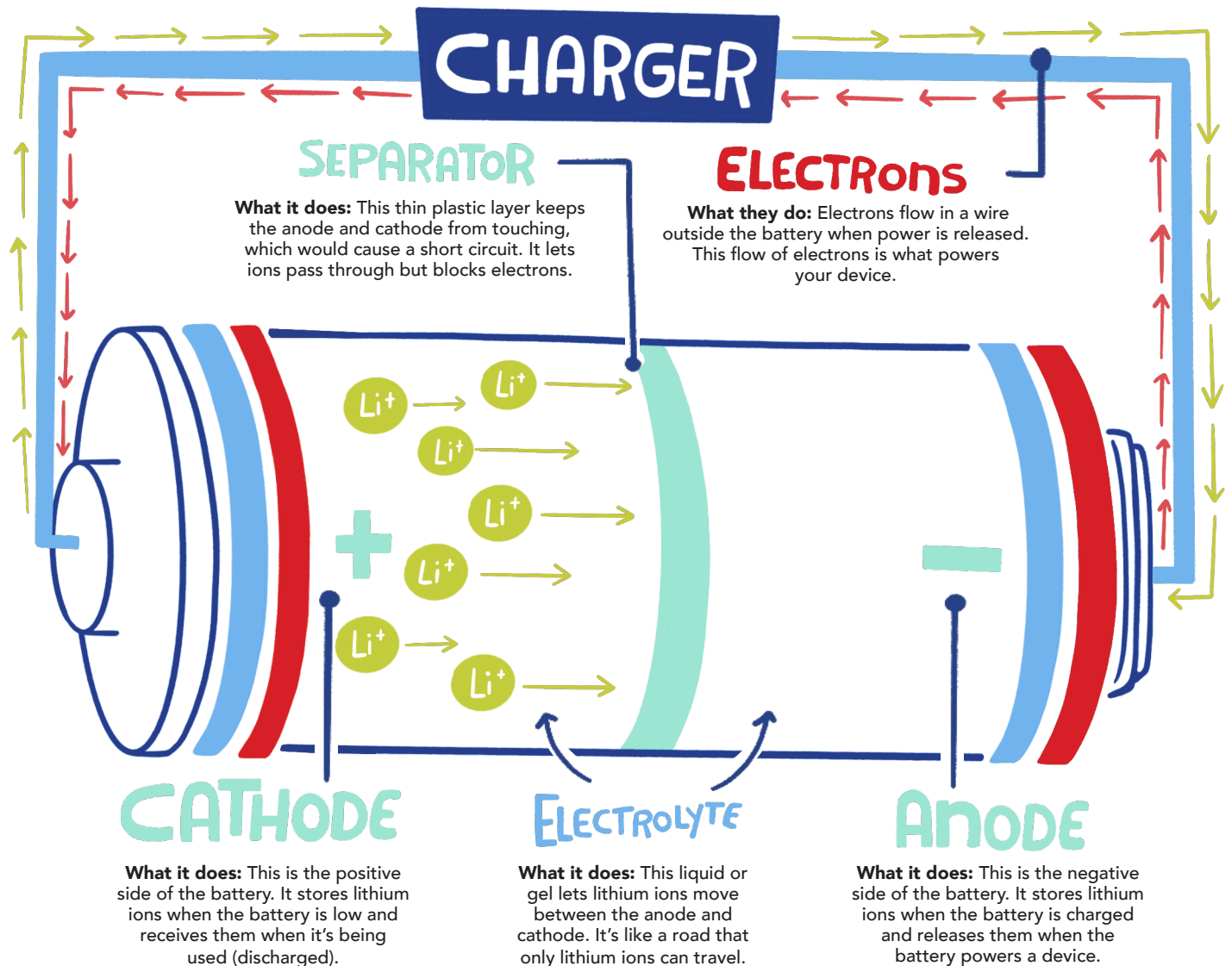


My Fire Safety Power Move:



LITHIUM-ION BATTERY

Here's how a lithium-ion battery works.



Li^+ LITHIUM IONS

What they do: These tiny particles move between the anode and cathode to store and release energy. They're the real "power movers" inside the battery.

When the battery is charging:

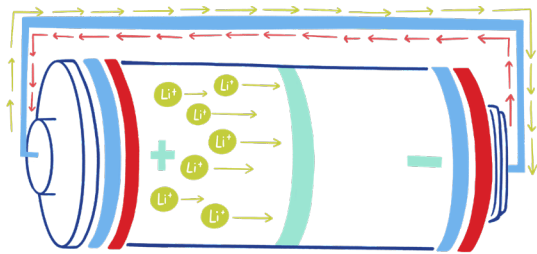
Lithium ions move from the cathode → to the anode.

When the battery is discharging (in use):

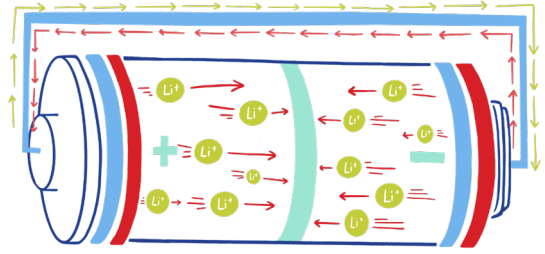
Lithium ions move from the anode → to the cathode.

WHAT HAPPENS IN THERMAL RUNAWAY

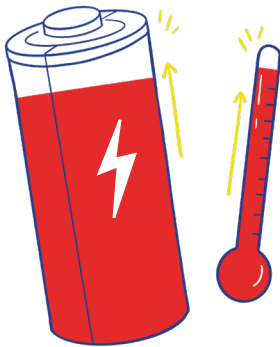
1. The battery goes into a self-heating state.



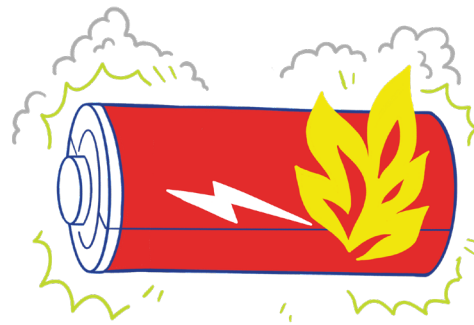
2. It generates heat faster than it can cool down.



3. Once it gets too hot, it reaches a state called **THERMAL RUNAWAY**.



4. This can lead to very high temperatures, smoke, or even fire.



What It Might Look Like

The battery feels hot.
It starts to change shape, color, and smell.
You see or smell smoke.



What You Can Do

Unplug the charger.
Turn it off.
Let it cool in a cool, dry place.
Tell a grown-up right away!