THE SCIENCE & SAFETY of LITHIUM-ION BATTERIES

Grade Level: 6–8

Subject: Physical Science / Engineering / Health & Safety

Time Needed: 1 hour

Standards Alignment:

- **NGSS MS-PS1-1, MS-PS3-3, MS-ETS1-1** (Structure and Properties of Matter, Energy Transfer, Engineering Solutions)
- **Health & Safety Integration:** Evaluating risk and safe technology use

Learning Objectives

By the end of this lesson, students will:

- Understand how lithium-ion batteries work.
- Analyze the risks of battery misuse and how **thermal runaway** occurs.
- Apply battery-safety practices in real life.

Materials Needed

- **Video:** *The Power (and Danger) of Lithium-Ion Batteries*
- Whiteboard or smartboard
- Printed handouts:
  - Lithium-Ion Battery chart
  - What Happens in Thermal Runaway chart
  - Battery fire articles—print or share links
- Access to internet (optional, for group research)
- Sticky notes or index cards

NFPA Kids

Sparky.org • **SparkySchoolHouse.org**

Sparky® is a registered trademark of NFPA. ©2025 NFPA

Warm-Up: Tech Check-In

(5 minutes)

Ask students:

"How many rechargeable devices did you use today before coming to school?"

Write tallies on the board (e.g., phones, earbuds, electric scooters, etc.).

Lead into: "All of those rely on one innovation: the lithium-ion battery."

Watch the Video and Pair-Share

(10 minutes)

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

AFTER WATCHING THE VIDEO, LET STUDENTS PAIR-SHARE:

- 2 facts that surprised them
- 1 safety tip they will remember
- 1 "what if" question they still have

 ©2025 NFPA

Investigate Battery Breakdown Stations

(20–25 minutes)

Set up two rotating stations for hands-on or observational learning. Students spend about 15 minutes at each station and record observations on a shared chart.

Station 1: Article Review: When Batteries Go Wrong

Materials: Printed articles or story links

Task: Work in pairs to identify and record:

- What started the fire?
- What could have prevented it?
- What pattern do students notice across cases?

Station 2: Pressure Buildup Simulation

Materials:

- 1 sealable ziplock bag (quart-size)
- 2–3 tablespoons baking soda
- 1/4 cup vinegar
- 1 paper towel
- Safety goggles for each student
- Optional: Tray or container to catch spills

Task:

1. Students pour vinegar into the ziplock bag.
2. Wrap the baking soda in a folded paper towel (to delay reaction).
3. Carefully drop the baking soda bundle into the vinegar and quickly seal the bag.
4. Place it on a tray and step back. Watch as the bag fills with gas and swells up. (It may even pop!)

Task:

Document what happened during the experiment.

Ask: How is this like a lithium-ion battery when it is damaged and overheats?

 ©2025 NFPA

Charge Into Fire Safety™ Tip Clip

(10–12 minutes)

Prompt:

You're a fire safety influencer! Your job is to help people stay safe when using phones, tablets, and other devices that use lithium-ion batteries.

Your friend accidentally left their phone in the car on a hot day, and now it is really hot. What should they do?

Task: In small groups, create a 60-second **"Charge Into Fire Safety™ Tip Clip."**

Your video should:

- Focus on **one main tip**: Never leave phones or other devices out in the sun or in a hot car. Really hot or cold temperatures can damage the battery and even start a fire.
- Include:
  - A short script (what you'll say)
  - Visuals like drawings, props, or signs
  - A catchy slogan or jingle

Safety Steps to Know:

If a device feels hot:

- Move it out of the sun.
- Turn it off.
- Let it cool in a cool, dry place.
- Tell a grown-up right away!

Presentation Options:

- Perform your Tip Clip live.
- OR record it and submit it digitally.

Exit Activity: Safety Statement & Sticky Challenge

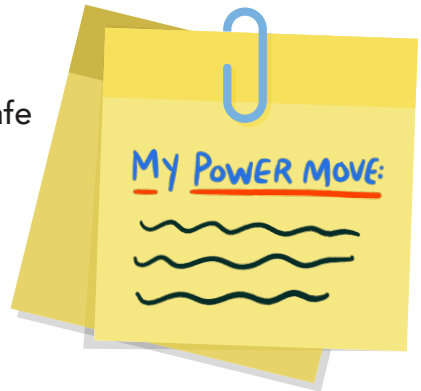
(10 minutes)

Prompt:

"With great power comes great responsibility."

On a sticky note, each student names ONE "power move" to stay safe with devices (e.g., unplugging at 100% or using the correct charger).

Stick them on a class board or poster labeled **Charge Into Fire Safety™ Power Moves.**



 ©2025 NFPA

Articles for Station 1

Use these example articles with students for group discussions.

"Cell phone charging in Topsfield home explodes, sparks bedroom fire, official says"

Location: Topsfield, Massachusetts, USA

Summary: A cell phone left charging overnight in a Topsfield bedroom exploded, sparking a fire that damaged the second floor of the home. Fire crews responded quickly and were able to contain the flames, preventing further spread. No injuries were reported. Officials emphasized the importance of charging devices on hard, flat surfaces and avoiding overnight charging. The incident serves as a reminder of the potential fire risk posed by lithium-ion batteries when improperly charged.

Link to original article: Boston 25 News

"Brixton fire: Families 'extraordinary' escape"

Location: Brixton, London, United Kingdom

Summary: A family in Brixton narrowly escaped a nighttime house fire caused by the explosion of a converted e-bike's lithium-ion batteries. A woman and her three children managed to evacuate their split-level house before firefighters arrived. The children suffered smoke inhalation, and the woman was hospitalized. The second floor was severely damaged by fire, and the third floor sustained heat and smoke damage. The fire is believed to be accidental. London Fire Brigade highlighted the risks associated with DIY battery conversions and improper charging practices.

Link to original article: South London News

"Lithium-ion battery sparks house fire in Ellendale"

Location: Ellendale, Delaware, USA

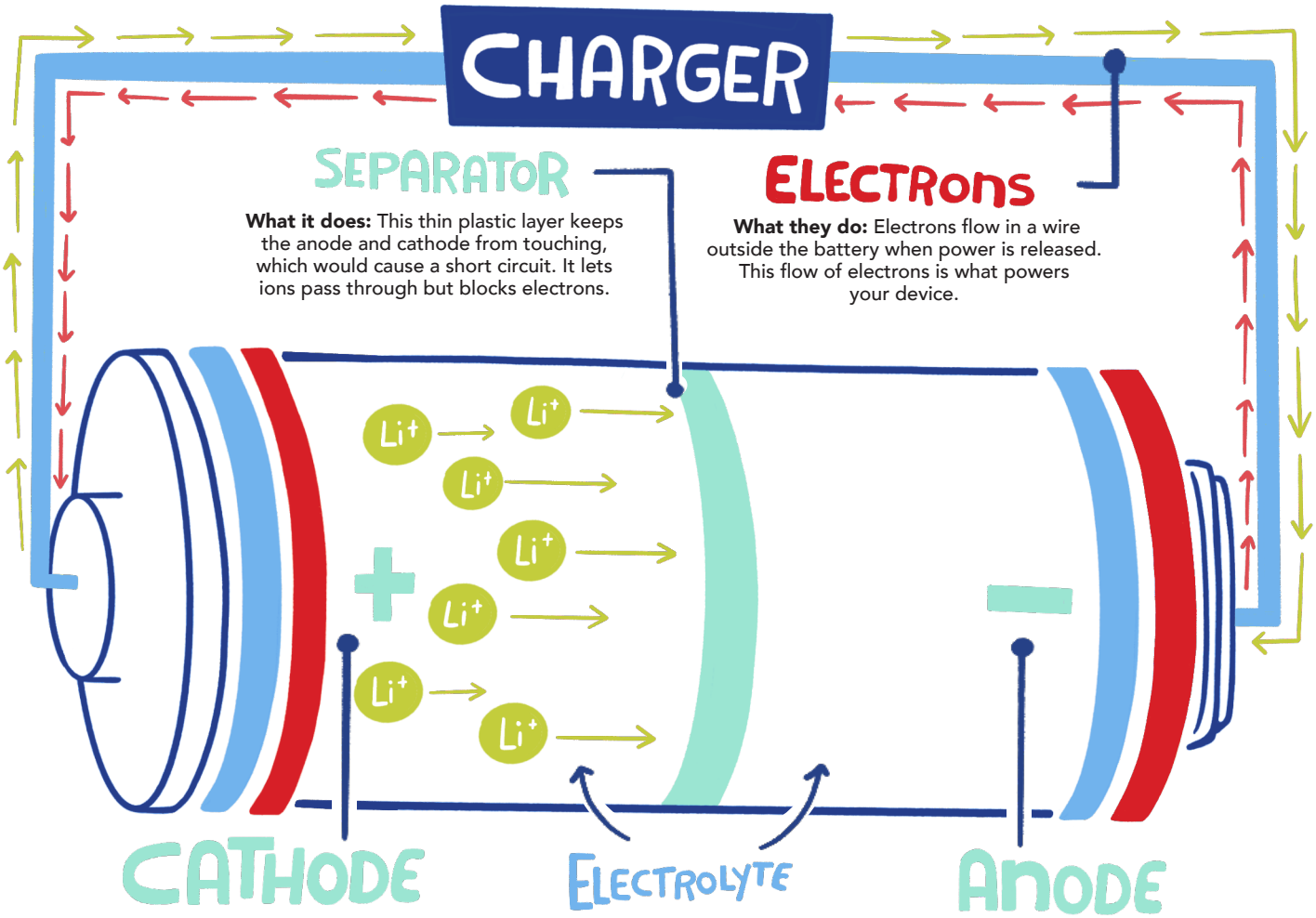
Summary: A lithium-ion battery in a charging iPad ignited a fire in an unoccupied two-story home on Willow Street in Ellendale. The fire, discovered after a neighbor heard a smoke alarm and saw smoke, was confirmed in the living room. Firefighters from Ellendale and Milton extinguished the blaze. The Fire Marshal's Office emphasized the importance of working smoke alarms.

Link to original article: CoastTV

 ©2025 NFPA

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):

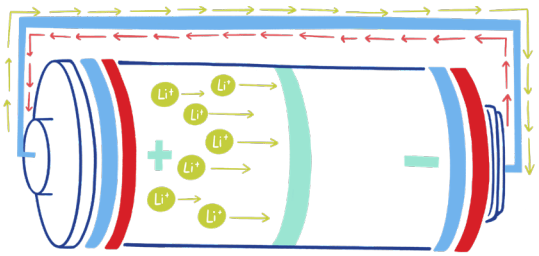
Lithium ions move from the anode → to the cathode.

NFPA Kids

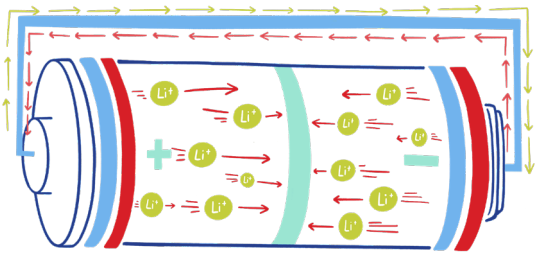
 ©2025 NFPA

WHAT HAPPENS IN THERMAL RUNAWAY

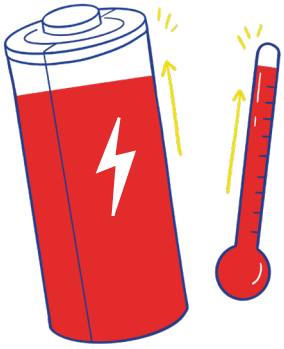
1. The battery goes into a self-heating state.



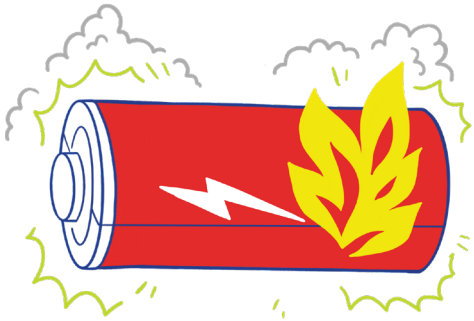
2. It generates heat faster than it can cool down.



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!

 ©2025 NFPA