

## The Science Behind the Chromebook Challenge

The Science of Thermal Runaway

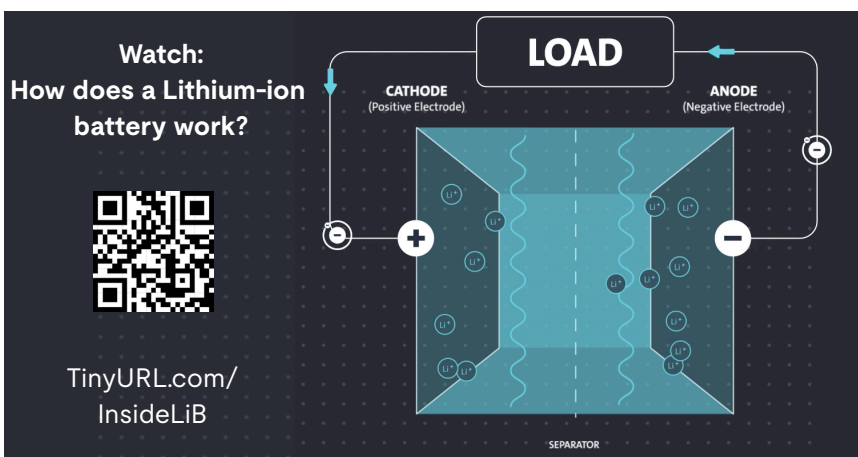
### STUDENT READING

An extremely dangerous TikTok challenge where students short-circuit their laptops has caused fires and toxic smoke. **Let's explore the science behind this challenge!**



#### Lithium-ion batteries

Lithium-ion batteries power the devices we use every day. Headphones, phones, laptops, and electric vehicles all use these batteries. They are popular because they are compact, long lasting, and a powerful source of energy. Lithium-ion batteries can also experience a phenomenon called thermal runaway.



**Thermal runaway** is an uncontrollable, self-heating, chemical reaction that releases heat very quickly. It can result in battery swelling and venting, smoke, fire, or a combination of these that results in toxic off-gassing. Physical damage, overheating, or puncturing a lithium-ion battery can cause thermal runaway.

#### Circuits

A **circuit** is a closed path for electricity to flow. It has a load, conductors, and energy source.

A **short-circuit** happens when electricity flows along an unintended low-resistance path, generating heat.

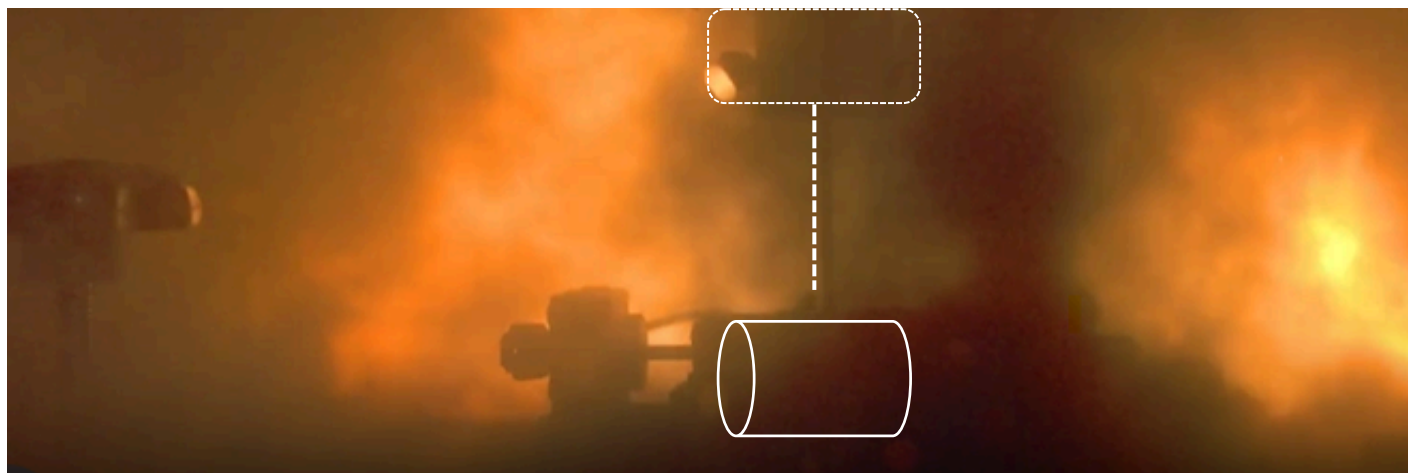


Watch:  
Understanding a  
circuit

TinyURL.com  
/LiBCircuit



1. What component of a laptop's circuit is the LiB?
2. Draw a model of a laptop's circuit and identify the three components.
3. How might a paperclip disrupt the laptop's circuit?



### Why paperclips?

Paperclips are good **conductors** of electrical energy. If a paperclip is put into the USB port of a laptop, it can create a short-circuit. This can overheat the lithium-ion battery in a laptop and cause it to enter thermal runaway.

Sharp metal objects can puncture the battery. Puncturing the battery can cause an internal short-circuit. Internal short-circuits occur when there is damage to the battery's separator that physically separates the battery's anode and cathode. The image above shows the results of the "blunted nail test:" sparks, fire, and toxic gases. In this test, safety scientists intentionally puncture a battery to create an internal short-circuit. This allows them to understand the battery's limits.

**Watch:**  
**Blunted nail test**



TinyURL.com/  
LiBDamageDangers



**4. How could you revise your model in number 2 to demonstrate a short-circuit? How about an internal short-circuit?**

### Toxic smoke

The substances released as smoke during thermal runaway are concerning to human health. Toxic gases, hazardous metals, and particulate matter are all part of the gas mixture in this smoke. They can also settle on surfaces leading to exposure even after the fire is extinguished.



### SENSEMAKING

Safety science helps us better understand real-world challenges to safety, like this viral challenge.

**5. In your own words, summarize the risks of the Chromebook Challenge.**

**6. Now that you know the science behind lithium-ion battery damage, what does it make you think about this viral challenge?**