



# A Crash Course in Lithium Batteries

## Why can I take my LiPo Battery on a plane but not the storage below?

- The storage part of a plane is not regulated in temperature and pressure
  - This causes serious danger of a LiPo battery catching on fire
    - If there is a fire, the plane has no system in place to stop it
- The temperature and pressure difference would only happen once at cruising altitude
- Inside of the plane, where people sit, the temperature and pressure is regulated
  - This means LiPo batteries are much safer
- Due to the nature of LiPo batteries many airlines also restrict how many and what type are allowed on the flight

## Can I run my iPhone off of AA batteries?

- Yes!
  - Many people commonly charge their phones off of AA batteries
  - There are two different ways:
    - 1) Your phone can be connected to AA batteries
    - 2) You can buy a charger that converts the power from AA batteries into something your phone can use
  - The exhibit below is a DIY method of the second option
- Below image gathered from:  
<https://marco.org/2010/08/20/charging-an-iphone-with-aa-batteries>

Battery Used	Number of full charges
Energizer Ultimate Lithium, 4 AAs	2.20
AccuEvolution NiMH, 4 AAs	1.21
Monoprice iPhone battery, lithium-ion	0.96
Energizer alkaline, 4 AAs	0.70

## Fast Facts on Batteries

- A phone battery powers your device by the flow of electrons from the positive electrode to the negative electrode and charges by the electrons going the other way.
- Whatever you are powering is “between” these two electrodes, so the flow of power starts at the positive electrode and flows through your phone and ends up back in the battery at the negative electrode.

Should I let my phone go to 0% before recharging?

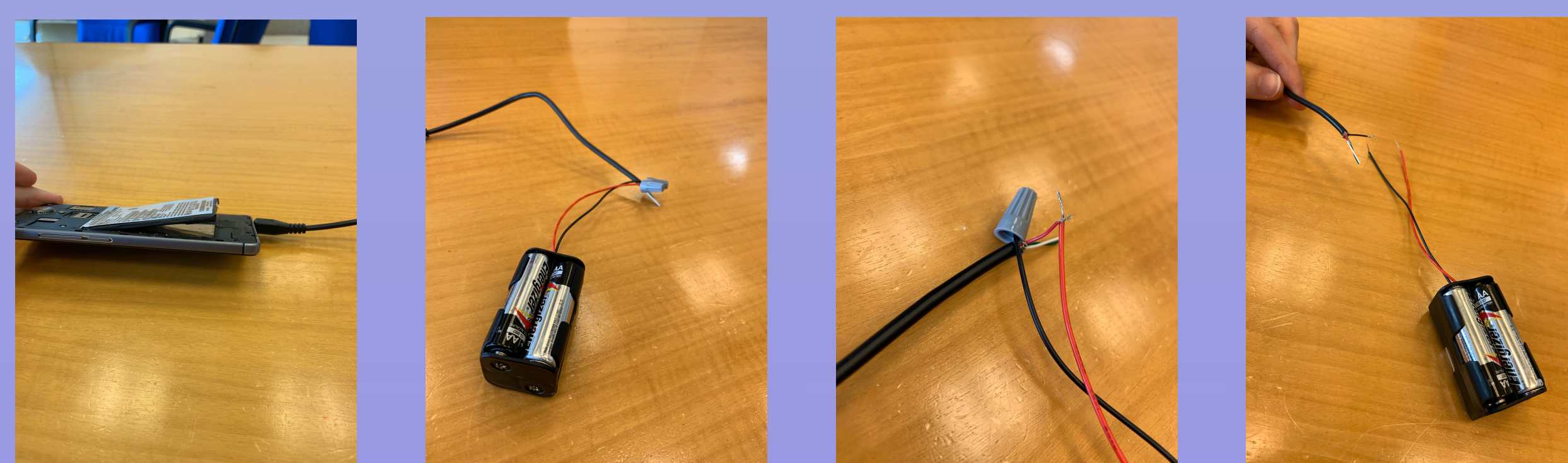
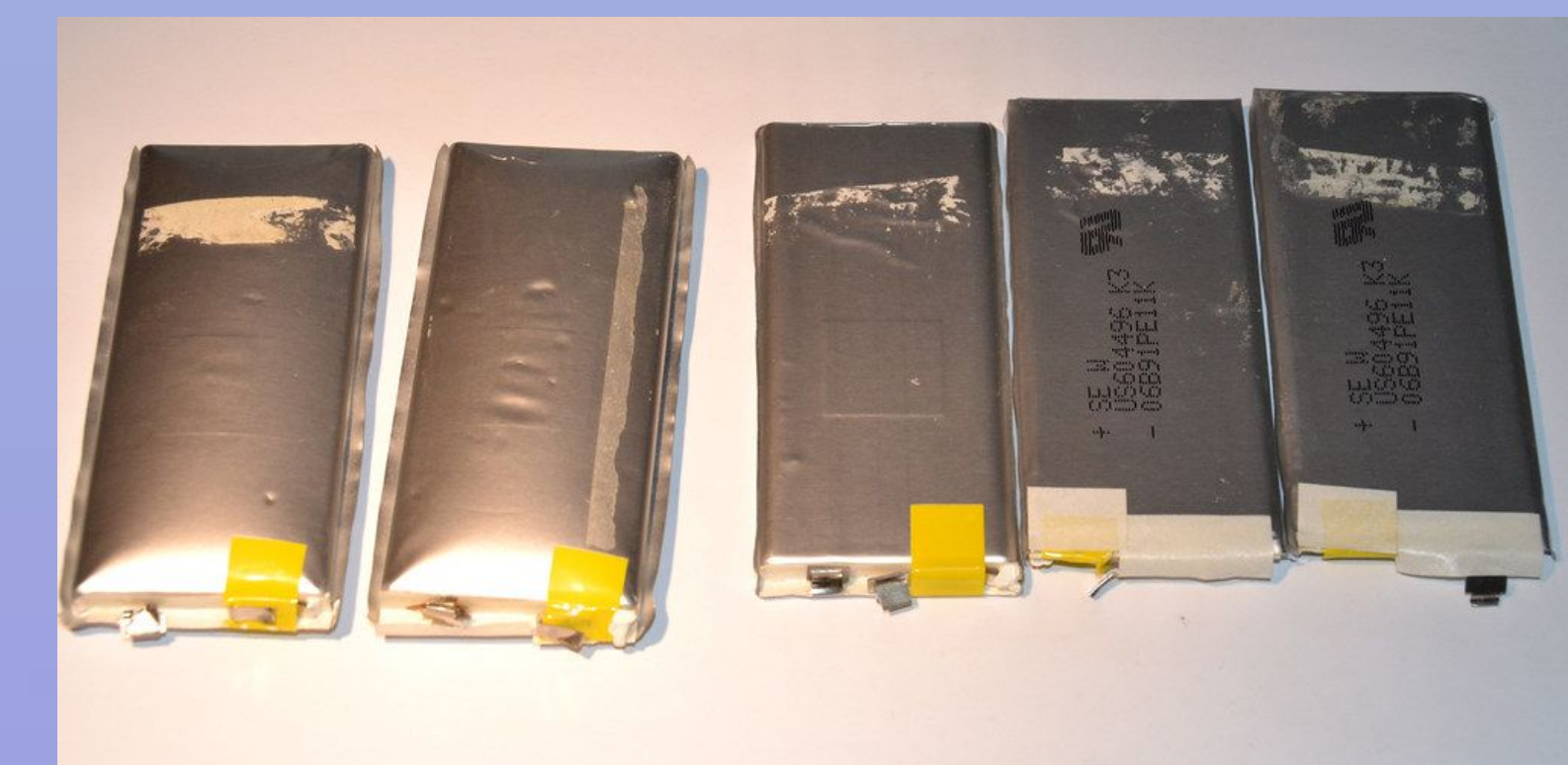
Can I overcharge my phone?

## Why did the Samsung Galaxy Note 7 explode?

- The reason the Samsung Galaxy Note 7 exploded was due to faulty batteries. Corners of the batteries were pushed in and caused the positive and negative electrodes to touch within the casing of the battery.
  - This is an example of what is commonly known as “short circuiting” where all the electricity within the battery is flowing at once instead of being slowly drained by proper usage. This is what is usually happening when you see electronics sparking and smoking up because it's getting very hot.
- Heat can be catastrophic in a phone battery because if it gets too hot it'll form air pockets will which begin an irreversible reaction where more and more heat is generated, and more and more air is formed.
  - This process is called a “Thermal Runaway.”
- This entire event happens almost instantaneously, and the battery will go from fine to exploding in no longer than a couple seconds, which is why nobody ever had time to react when their phone started exploding in their pocket or bag.

## Why do you need to replace your phone battery?

- When a Lithium-Ion battery discharges, the Lithium Ions move from the positive electrode to the negative electrode. In a perfect world, this process would occur 100% every time, but this is not the case.
- While several factors contribute to the degradation of your battery one of these is the wearing out of your anode. The anode is worn out by the build-up of Lithium atoms on your anode which weakens the effectiveness of your anode.
  - This occurrence is called Solid electrolyte interface (SEI).
    - This process can be slowed, but it cannot be stopped.
- Ways of slowing the degradation of your battery
  - Not leaving your phone in overly hot or cold areas for long periods of times.
    - Dont leave your phone in your car during a hot day
    - Dont expose your phone to the cold for long durations of time.



Stephen Bader - College of Arts and Sciences  
Nate Barone - School of Computer Science and Engineering  
Tolga Kaya - Program Director and Associate Professor  
School of Computer Science and Engineering  
Michael Altis - Makerspace Technician