# Type of battery in modern device

The batteries in your modern-day gadgets—from iPhones to laptops to Bluetooth headphones to tablets—are a different beast entirely. These are lithium-ion (aka li-ion) batteries, and they have some pretty significant advantages over NiMH and other rechargeable batteries that came before.

# Memory Effect of Nickel Cadmium

Memory Effect describes the situation in which [NiCd](https://en.wikipedia.org/wiki/NiCd) batteries gradually lose their maximum energy capacity if they are repeatedly recharged after being only partially discharged. The battery appears to "remember" the smaller capacity.

# Memory effect on modern device

Memory effect, as it's called, affects NiMH batteries but it doesn't apply to your modern smartphone. In fact, your phone's battery hates when you do that. Similarly, lithium-ion batteries don't need to be "calibrated" with a full charge and a full discharge when they're new. Li-ions can pack a lot of power into a small size, and they don't lose too much of that energy to leakage when they're not in use.

# HOW DOES A LITHIUM-ION BATTERY WORK?

All batteries work by having two electrodes—an anode and a cathode—with a bunch of a material called electrolyte between. When you plug a battery into a completed circuit, a chemical reaction starts taking place at the anode and electrons start building up over there. Those electrons want to travel to the cathode, where it's less crowded, but the electrolyte between these two parts keeps the electrons from taking the short way there. The only way through is the circuit that the battery is crammed into, and those electrons power your device in the process. Meanwhile, the positively charged lithium ions the electrons leave behind travel through the electrolyte to meet the electrons on the cathode side.

Once all the electrons have made the trip, your battery is dead. Except! If you're using a rechargeable battery like a lithium-ion, you can reverse the process. If you dump energy into a circuit using a charger, you can force the reaction to go in the other direction and get that electron party at the anode all crowded again. Once your battery is recharged, it'll mostly stay that way until there's something for it to power again, though all batteries leak some charge over time.

# Battery Capacity

What determines the capacity of the battery is the number of lithium ions that can nestle themselves into the tiny, porous craters of the anode or the cathode. Over time, with repeated charge the anode and the cathode degrade, and can't fit as many ions as they used to. As that happens, the battery stops holding a charge as well as it once did.

# HOW DOES A LITHIUM-ION BATTERY RECHARGE?

It's easy to think of charging a battery as though you're filling a tub with "power." Just hook up the hose until it's full! From the outside, that's exactly how it works, but on the inside it's a little more nuanced.

A lithium-ion battery typically charges in two stages. First comes the process called constant current charging. This is the part that really is pretty simple. The charger for your phone or tablet will apply a steady current of electricity to the battery to get all those electrons back to the anode. During this stage, the charger just decides how much power is coming out of the firehose and starts spraying. The higher that constant current, the faster the battery can charge. High-voltage quick chargers—like the ones that are starting to come with a lot of new phones—take advantage of this first stage to cram in the juice as quickly as possible (at the cost of a bit of extra stress on the battery).

When the battery is 70 percent recharged, the procedure changes and flips over to constant voltage charging. During this second stage, the charger makes sure that the voltage—that is, the difference in current between the battery and the charger—stays the same rather than keeping the current constant. Practically, this means that as the battery gets closer to full, the current the charger sends into it decreases. As the battery gets full, the rate at which it charges slows down. Once you reach 100 percent, the charge simply trickles in, just enough to account for the tiny, tiny bit of charge your battery loses naturally over time.

# Over-charging

All modern Li-Ion rechargeable devices have some sort of power management IC, designed to prevent overcharging the battery. They'll keep your phone battery topped off and ready to go throughout the night with a trickle charge at most.

# Battery death

No matter how many times you bring it back to life, your battery will die someday, or at least degrade into a shadow of its former self. That's unavoidable. Most lithium-ion batteries have a rated lifetime of somewhere between 500 and 1,500 charge cycles.

One cycle is just one bout of discharging, but how much energy you discharge in one go—a measure referred to as depth of discharge (DoD)—matters bigtime. Lithium-ions really hate a deep depth of discharge.

According to Battery University, a staggeringly exhaustive resource on the topic, a li-ion that goes through 100 percent DoD (the user runs it down all the way to zero before recharging) can degrade to 70 percent of its original capacity in 300-500 cycles. With a DoD of 25 percent, where the user plugs it in as soon as it gets to 75 percent remain, that same battery could be charged up to 2,500 times before it starts to seriously degrade.

# What is dangerous for battery?

Lithium-ion batteries despise heat. A li-ion battery that's been exposed to temperatures of around 100 degrees Fahrenheit for a year will lose about 40 percent of its overall charge capacity. At 75 degrees, it'll lose only about 20 percent.

When your battery stops powering your phone, it doesn't mean it's actually empty. It's not! Lithium-ion batteries only discharge most of the way, mainly because when they discharge all the way they can get wildly unstable. If a battery comes close to that danger zone, a protection circuit in the battery will trip and kill the battery forever and for real, functionally destroying the battery before it can discharge to a level where it's in danger of exploding.

# Leaving device plugged

Contrary to what you might think (or have been told), leaving your phone or laptop plugged in all the time is not bad for its battery. That's because your gadgets, the batteries in them, and the chargers you attach them to are actually pretty smart about the way they do business. Trickle charge—what your battery gets when it's connected and full—is way less detrimental to the battery's health than a larger discharge would be.

At least make sure you've got good airflow. Don't block cooling vents. Maybe even pick up a fan with a stand.

# Charging pattern

Lithium-ion batteries don't respond well to being charged all the way up and then run all the way down. They take much better to little bits of charge here and there.

Also, beware of quick chargers. While your phone and charger are generally smart enough to minimize damage from high-voltage chargers, a lot of power super fast can generate extra heat.

# Environment

make sure you don't leave your phone in a hot car all day. Or place it on top of your gaming PC. Or use it in a sauna. Try to avoid wireless charging if you can, because the waste-heat those chargers generate will also bake your battery.

# Storing device

If you're storing batteries, you give them about a half a charge first. They'll slowly lose their charge over time, and if it drops into the true-zero danger zone, your battery will automatically trip its safety circuit and kill itself for real before it can become unstable.