sales@fuelcellstore.com
USA: 1 (855) 251-0016
International: +1 (979) 703-1925

Solar USB 2.0 Kit Instructions

Product Code: 1221502
Brand: Brown Dog Gadgets

Intro: Solar USB Charger 2.0

Everyone has USB gadgets. It's pretty much a fact of life. Another fact of life is that these USB gadgets also continually run out of power when you most need them. No need to fear, solar power is here Ditch those crazy wall adapters, throw out the laptop, and start making your own solar charger

This guide will show you step by step instructions on how to assemble the Solar USB 2.0 Kit. This kit will charge most small USB devices such as cell phones, mp3 players, iPods, and iPhones.

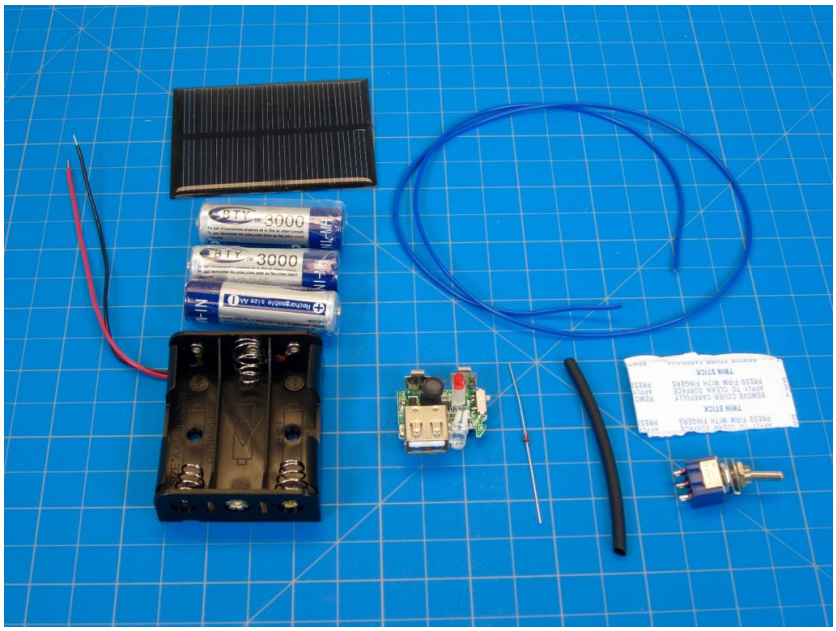
This project was designed for beginner makers and students. It re uires a base knowledge of soldering. While you can charge small gadgets, this project is not appropriate for camping or to be relied on for extreme emergencies.

Difficulty: Easy
Grade Level: 8th and up (age 12+)
Time: 30 to 60 minutes

Step 1: Parts and Tools

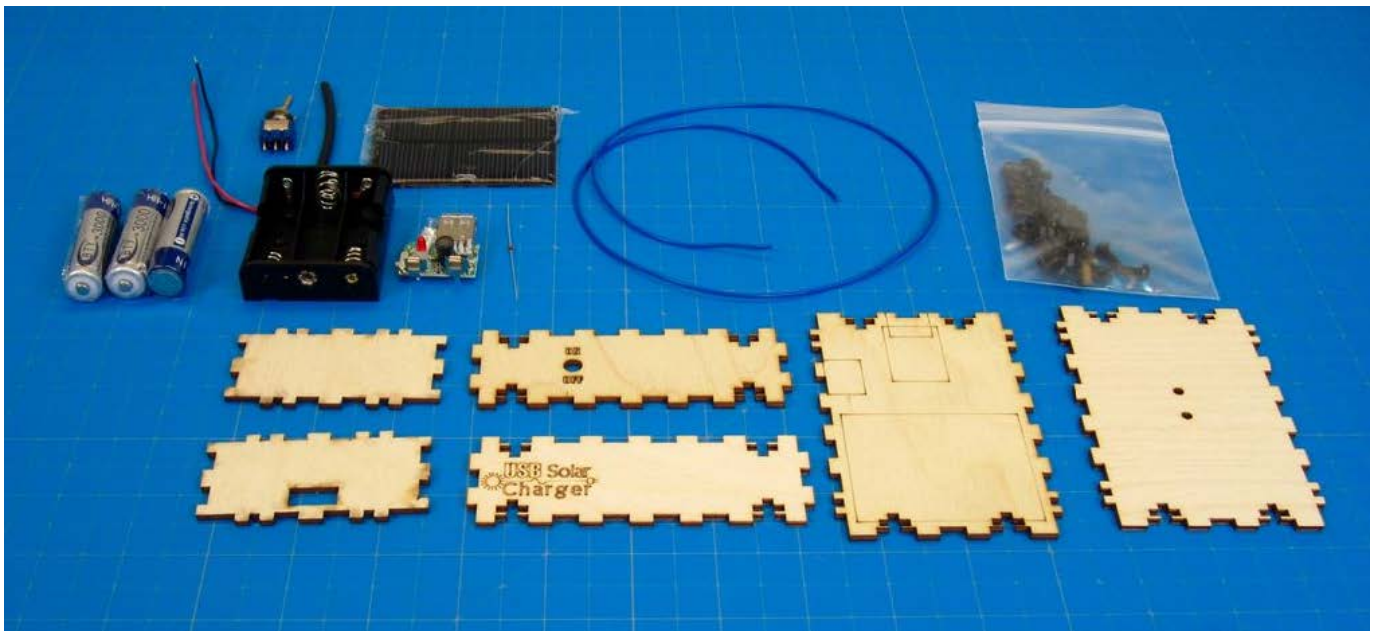
Included Parts:

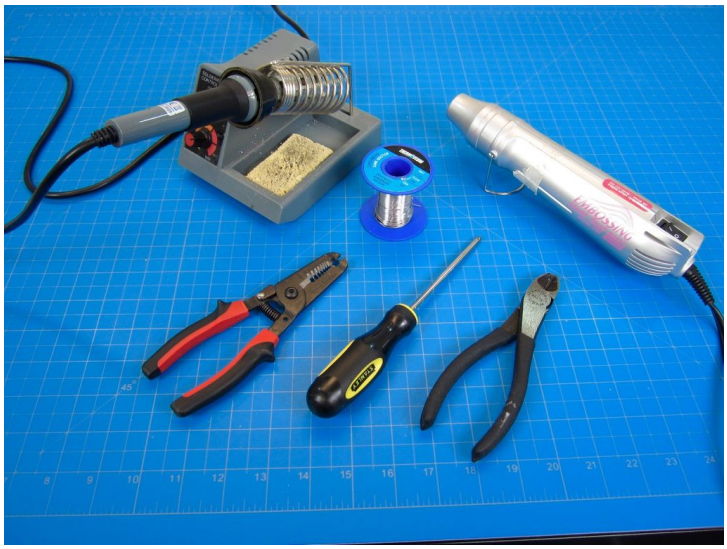
- USB Charging Circuit
- 6V 80mA Solar Cell
- 3 AA Holder
- 3 Rechargeable AA Batteries @ 2600mAh
- Toggle Switch
- Wire
- Shrink Tubing
- Laser Cut Enclosure w/ Screws

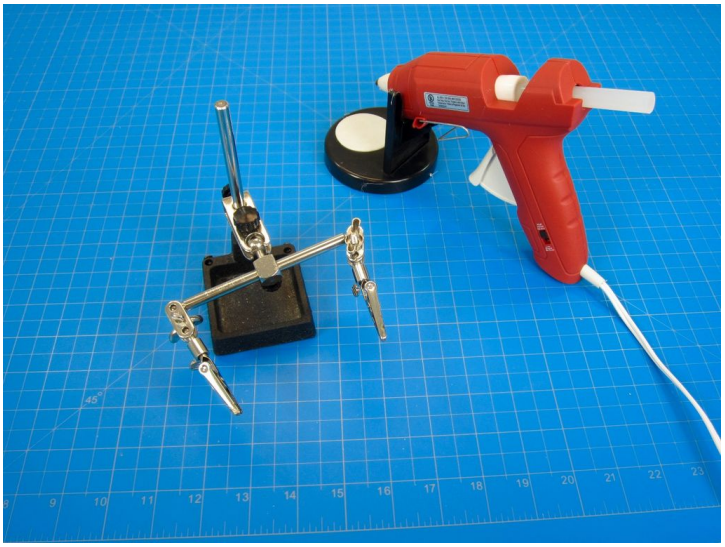


Tools Needed:

- Soldering Iron and Solder
- Double-sided Foam Mounting Tape
- Screwdriver
- Wire Stripper or Cutter
- Hot Glue Gun
- USB Cable to plug in your device of choice







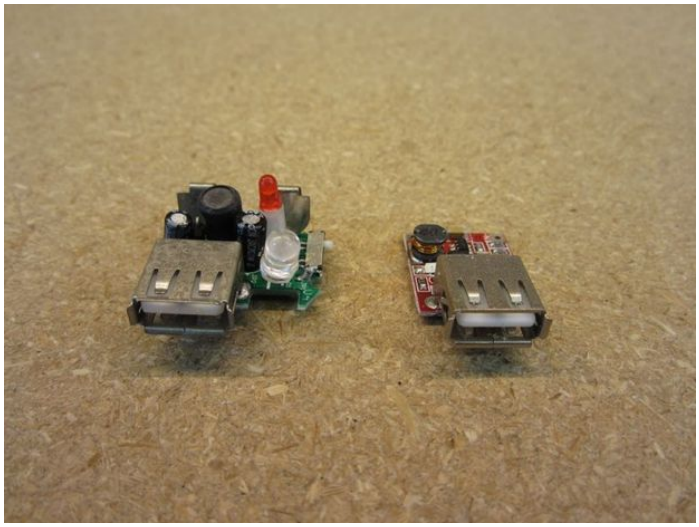
Step 1: Parts and Tools (cont..)

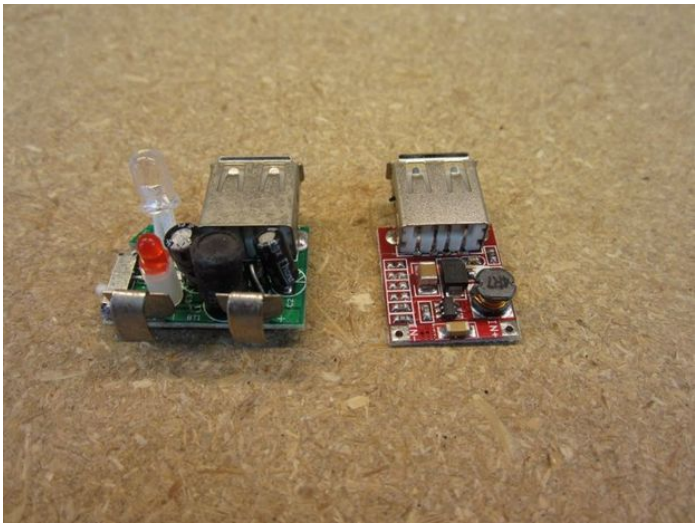
USB Charging Circuit

USB charging requires 5V at around 500mA of power to charge most gadgets. In order to meet these criteria in a small package we use a USB Charging Circuit, which boosts low voltage (2V) DC up to 5V DC. Nothing comes free though; we trade our increased volts for fewer amps. To avoid this tradeoff, we could use larger solar panels and larger batteries, but this would result in a larger, heavier, and more expensive charger.

If you're using an older Apple product, make sure your USB Charging Circuit is compatible. Typically a USB gadget requires just power from a USB port to charge. Most iPhone models, however, require a tweak to USB to work. iPhones will check the USB data ports in order to identify what kind of device it's plugged into and change charging speeds if it thinks the port can support it. Unfortunately if it doesn't see anything on the data tabs it will refuse to charge. This is a problem that plagues many generic USB chargers, especially older ones.

Our USB Charging Circuit needs a minimum of 2V to operate, so we need to choose power sources with this in mind.





Battery Power

We always advise the use of power storage when doing a solar project. Solar is inconsistent due to the inconsistent nature of the sun. Using batteries helps stabilize the flow of power, and also lets us hold onto that energy for later use.

In this project we use three rechargeable AA batteries. Rechargeable batteries put out 1.2V of power and using three in series gives us 3.6V. Using two batteries will cause our voltage to drop below 2V too quickly, and our USB Charging Circuit won't be able to operate. Four batteries would require a much larger solar cell to charge.

Solar Power

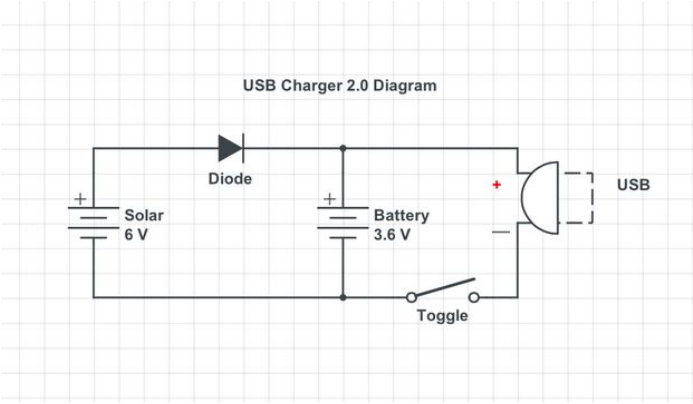
Batteries require a minimum voltage in order to charge, but raising the voltage will not cause the batteries to charge faster. The general rule is to provide 1.5 times as much voltage as your battery needs (for us 3.6V x 1.5V = 5.4V), but with solar we want some wiggle room. We want our solar panel to meet the minimum voltage, even on days with a few clouds, so a 6V panel does well.

When charging AAs using a wall adapter, we're able to charge them at high speed due to smart chips that constantly monitor the battery. Since our circuit is "dumb," with nothing to monitor the batteries, we trickle charge the batteries using the 10% rule. AAs can be safely charged as long as they don't have more than 10% of their capacity thrown at them at any one time. This means our 2,000mAh batteries should only get 200mA of current.

Our solar cell is rated for only 80mA, so we're completely safe! Different panels and batteries vary, so make sure yours work well together. One good aspect of the trickle charge method is that it will never over-charge the batteries. Once they're full they just stay topped off.

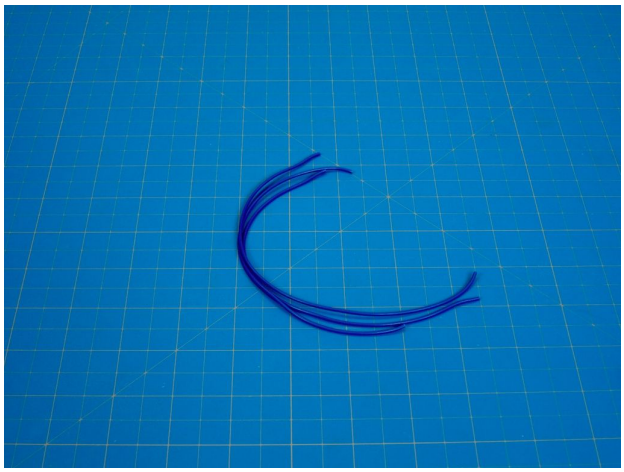
Circuit Diagram

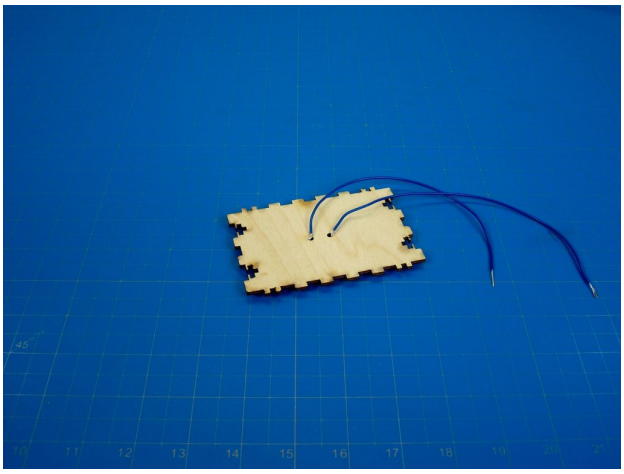
Below is a circuit diagram for this project. It's designed so that the solar cell is always charging the batteries and the toggle switch turns the USB circuit on/off. A diode has been put in place to prevent power from flowing the wrong direction into the solar cell. This is a very common diagram for solar. This basic setup can easily be scaled up or down depending on the project.

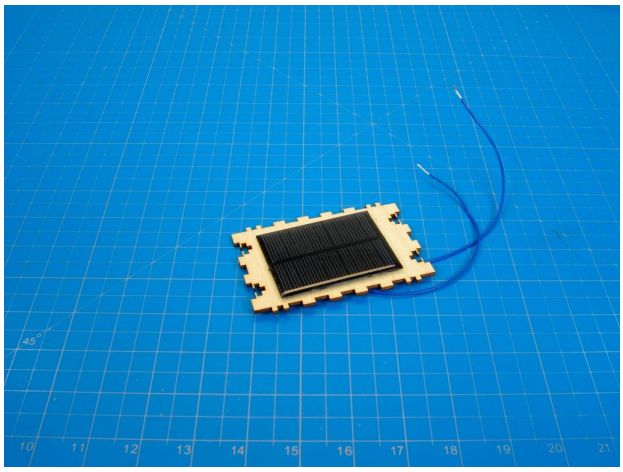


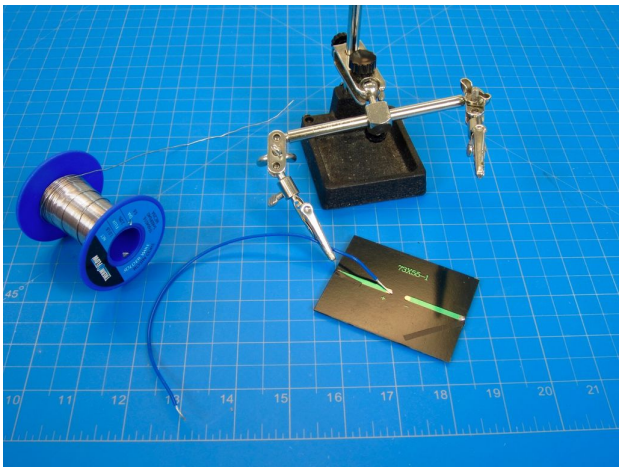
Step 2: Solder The Solar Cell

1) Cut three six inch lengths of wire.
2) Using a wire stripper, expose about ¼ inch of wire on each end of all three wires. If you have our kit, this may already be done. You can also strip the battery pack wires at this time.
3) Solder one wire to the positive (+) tab on the solar cell and another wire to the negative (-) tab on the solar cell. You should have two wires attached with two loose ends when you are done.
4) If you are using a laser cut case, apply foam tape to the bottom of the solar cell. Leave the protective film on the tape. We won't secure it until the end. Now thread the wires through the holes in the lid of the case.







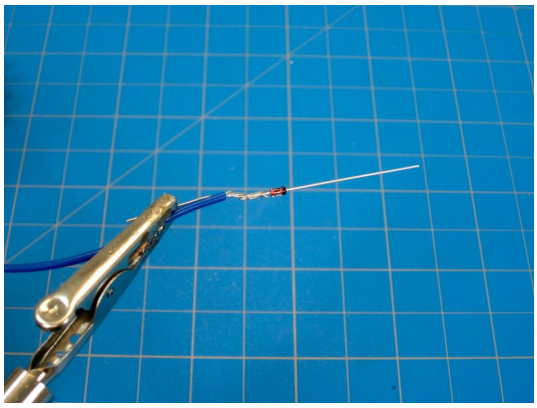


Step 3: Attach the Battery and Diode

Please read all steps before continuing.

1) Strip the ends of the battery pack. It may be necessary to snip off their exposed ends first.
2) Take the negative (black) wire from the battery pack and twist it together with the negative wire coming off the solar cell. Do not solder this yet.
3) Grab the diode. One side of the diode has a black line (negative) and the other side does not (positive). You'll want to take the positive (+) wire coming off your solar cell and twist it together with the positive side of your diode. Push the wrapped wire all the way up next to the head of the diode. Solder it in place and snip off the extra wire from that side only.
4) Wrap the positive (red) wire from battery pack and wrap it around the negative side of the diode. Push it up into place and solder. DO NOT cut that end of the diode.

Optional: It is helpful to use shrink tubing or electrical tape on this setup for protection. Align all the wires together, then slip the shrink tubing up past the diode. At the end of the project we'll use a heat source to shrink it into place.

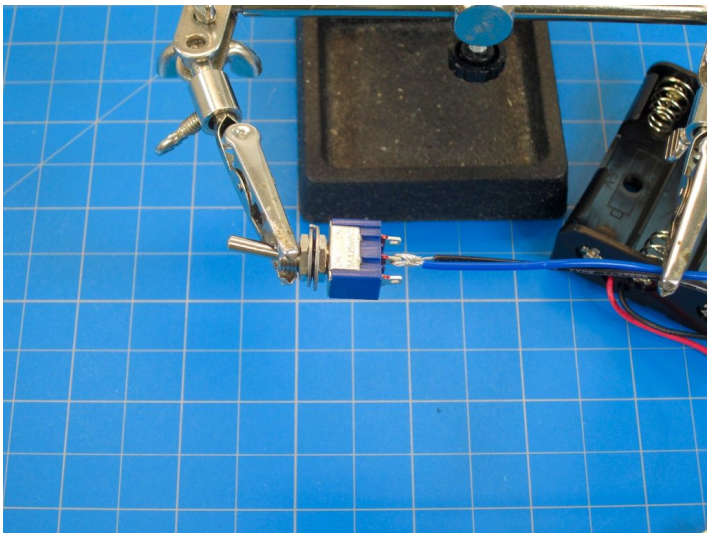


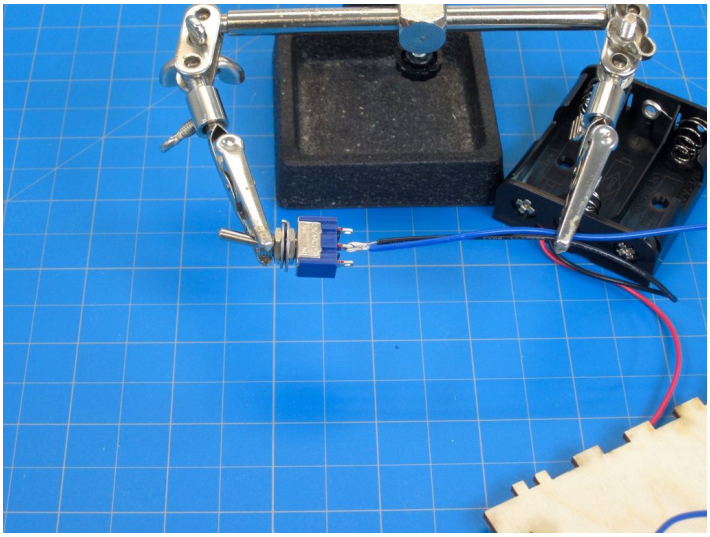
Step 4: Connect the Toggle Switch

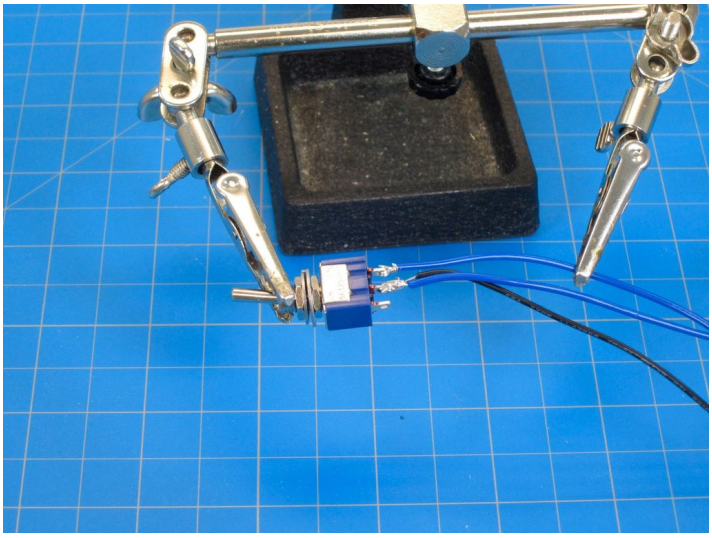
1) Grab the twisted together negative (-) wires from the battery pack/ solar cell. Solder this to the middle pin on your toggle switch.
2) Take the last 6 inch piece of wire and solder it to either one of the remaining outside pins. It doesn't matter which one.

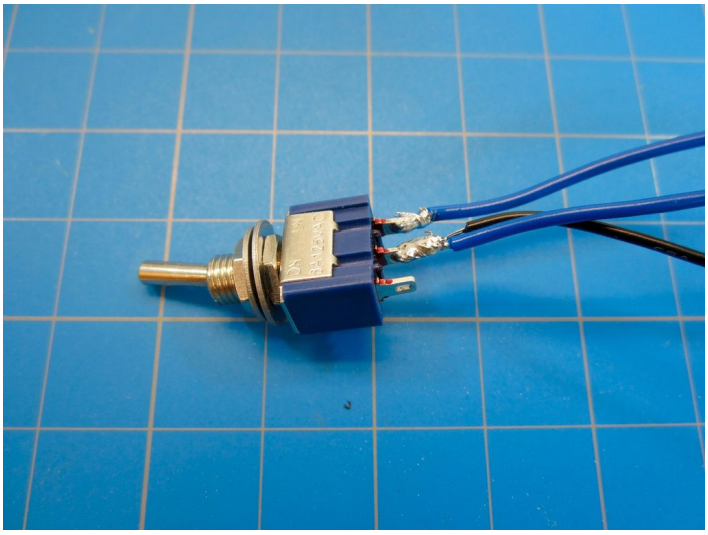
Tip: If you can't thread the wire through the little holes on the Toggle Pins don't worry. Using a Helping Hand you can easily solder to the side of the pins.

Keep in mind that the toggle switch is made of metal and plastic. It is possible to melt it if you hold your soldering iron in place too long.







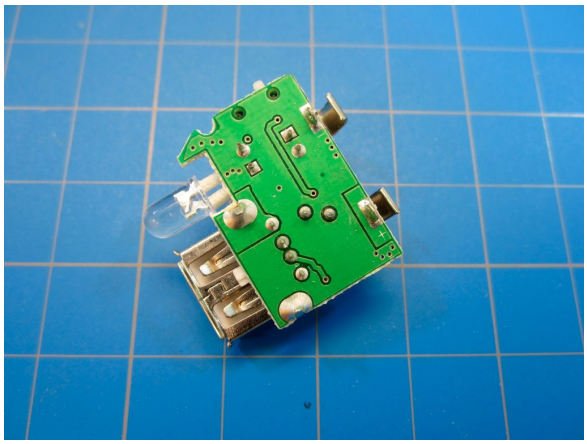


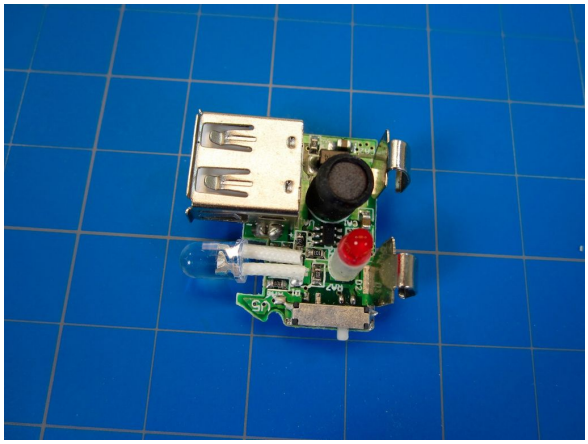
Step 5: Connect the USB Charging Circuit

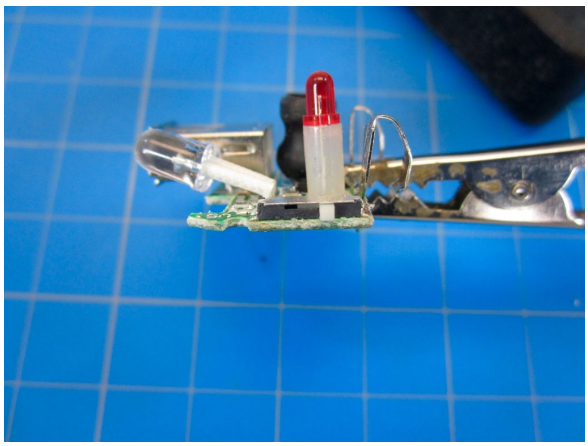
The circuit in our kit has metal tabs coming off of the board which you will solder wires on to. If you found your own USB Charging Circuit it may have through hole connectors.

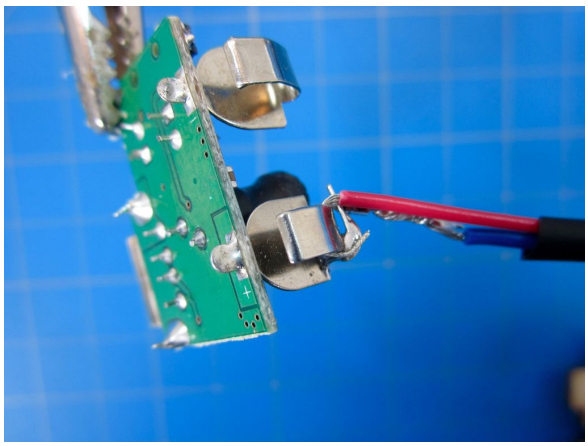
1) On the under side of the board locate the positive (+) and negative (-) symbols.
2) Wrap the left over side of the diode around the positive (+) tab from the circuit board. Solder into place.
3) Wrap the wire coming off the toggle switch around the negative (-) tab coming off the circuit board. Solder into place.
4) When you finish soldering, clean up by clipping off any bits of wire that stick out.
5) Our USB Circuit has a small three-position switch on the side. Move the switch so that its positioned back towards the soldering tabs. (If you have batteries in place the Red LED will be on.)

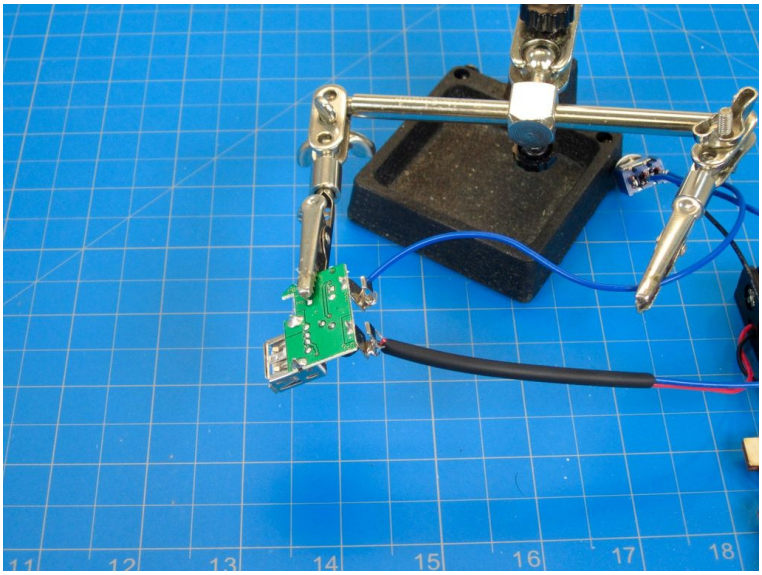
The white LED is not used in this project. You can cut it off, or position it straight up and out of the way.











Step 6: Testing and Trouble Shooting

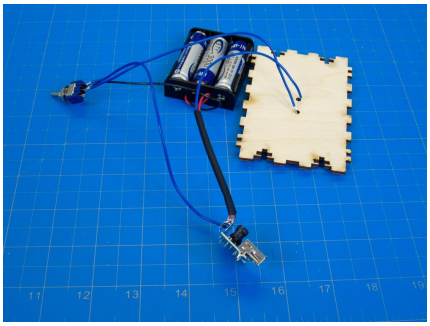
At this point your project should work. Grab a small USB gadget and plug it in. We like to test ours with a USB LED Light, but a phone or MP3 player will work as well.

If everything works, use a lighter, hair dryer, or heat gun to close up your shrink tubing over the diode.

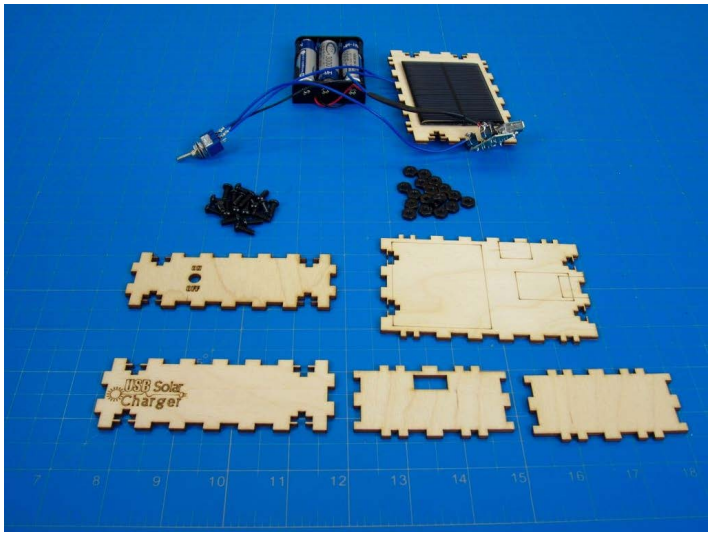
If it isn't working try these steps.

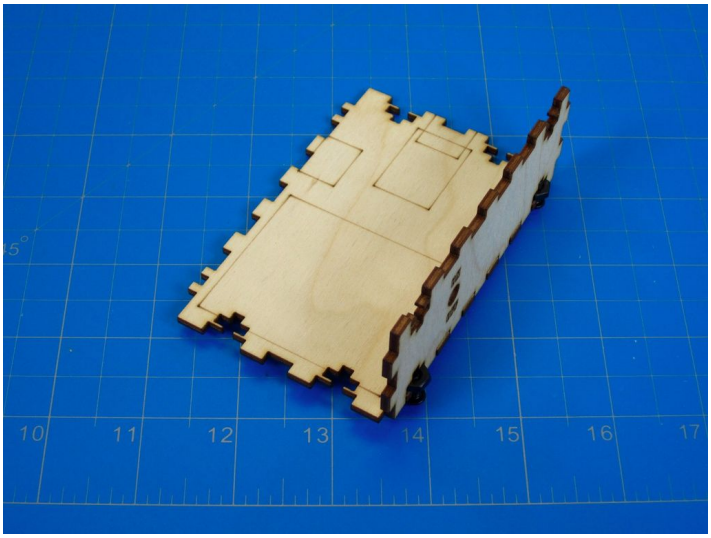
> Are your batteries dead? Try some different AAs, even regular ones, to see if that does the trick.
>
> Is your toggle switch in the right position? Toggle back and forth just to be sure.
>
> Is it your gadget? Some large phones and most all tablets won't charge off either circuit. Grab a small mp3 player or different phone to try it out. I use a simple USB LED light to test mine.
>
> Does your iPhone to say "Charging Accessory Not Supported"? This probably means your AAs are low or the switch on your Apple Circuit Board is in the wrong spot.

If none of these fixes work for you, check your wiring to make sure you have good solder connections, and that everything is connected correctly.



Step 7: Putting the Case Together





Step 8: The End

Your Solar USB 2.0 Kit charger is now complete!

Once again, please keep in mind that this charger will not charge larger gadgets such a big phones and tablets. It's also not suitable for camping or emergencies due to the fact that it takes several days to charge up.

If you're looking for something pre-made check out the Solar Gear over at fuelcellstore.com.

I hope you learned a thing or two about solar power from this guide. It's easy to scale up this project to do bigger and better things.