

Solar Fan STEM Kit Challenge

A solar cell can convert energy from the sun into electricity. This kit has some basic parts to build a solar circuit. Put on your experimenter's hat. Remember to make a complete circuit (a circle). Also remember to connect the bare metal ends of the wires. The insulation around the wires will stop the electricity.

How do solar cells work?

Solar energy is a type of electricity created from the light rays of the sun. Current technology harvests these rays using a panel of **solar cell** wafers containing two different layers of silicon. One layer (called n-type, high in *negative* charge) contains an excess of electrons, while the other layer (called p-type, high in *positive* charge) has room to accommodate electrons. These two faces create a charge difference across the solar panel (i.e., from top to bottom)—producing an electric field that can drive electrons to travel from one side to the other if a wire connects them to complete a **circuit**.

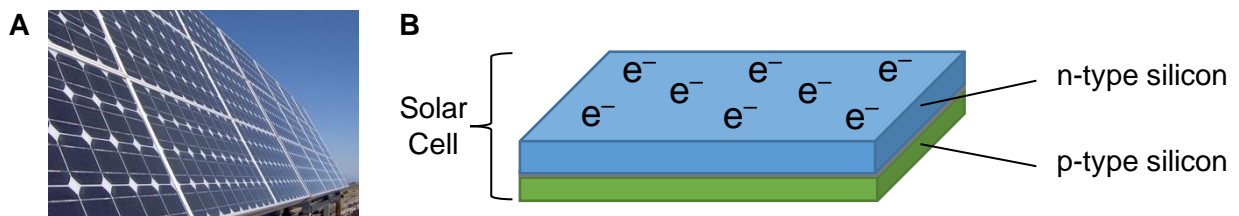


Figure 1. (A) Panel of solar cells. Source Wikipedia. (B) Diagram showing n- and p-type layers of a solar cell.

When the sun's rays strike the n-type side, the sunlight's high energy is transferred to the electrons which causes them to be excited. These excited electrons can then break away from their atoms and travel along a connected wire to reach the p-type side. During the electron's journey, it can give power to electronics. This process is the source of electricity originating from solar panels harvesting high-energy sunlight.

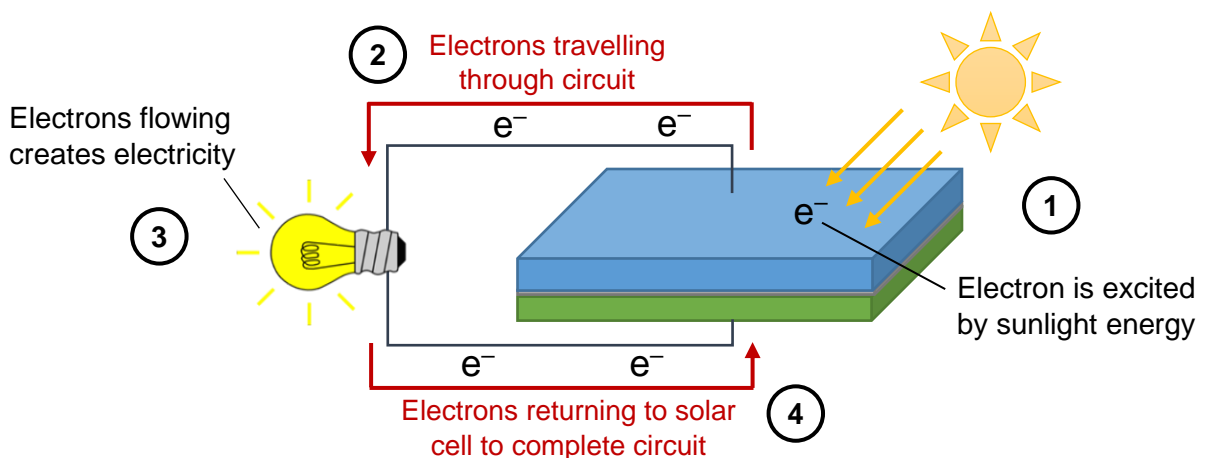


Figure 2. Schematic showing flow of electricity through circuit after solar cell captures sunlight.

Solar power provides a clean, renewable option to meet our energy needs. Unlike petroleum-based fuels (e.g., oil, gas) or other carbon-based energy sources (e.g., coal), solar energy does not produce greenhouse gases like carbon dioxide which contribute to global warming. Therefore, there is a societal benefit to using this energy alternative. Currently, research is focused on creating new materials that can harvest sunlight better while producing more power. Scientists are also finding ways to store the produced electricity, as well as creating the infrastructure needed to distribute it through the power grid.

Order your kit

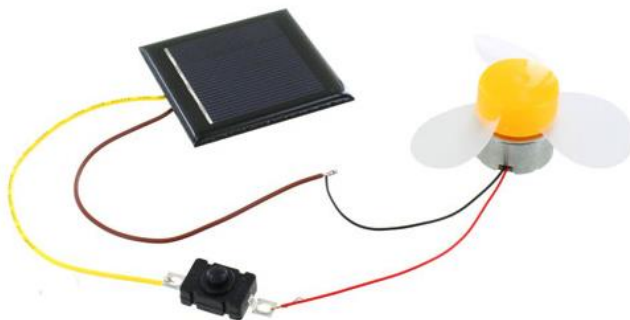
Order a Solar Battery STEM kit from either of the two vendors below:

xump.com for \$4.95

<https://www.xump.com/science/Solar-Fan-Mini-STEM-Kit.cfm>

Amazon.com for \$8.95

https://www.amazon.com/Solar-Fan-Mini-xUmp-STEM/dp/B07TFB8QT1/ref=sr_1_20?dchild=1&keywords=xump&qid=1587492957&sr=8-20



Note: Please refer to the manufacturer's product manual for instructions.

Tips

- The exposed copper on the wire leads of the solar panel and fan might be too short. In order to create better contact, the insulator (plastic) covering can be removed using a wire stripper tool or a knife. Be careful not to cut through the copper when removing the insulation wrap.
Warning: When using cutting tools, always have adult supervision and assistance.

Try these challenges

- 1) Can you make a complete circuit with solar cell, motor /fan, and switch?
- 2) What happens to the fan if you reverse the wires coming from the solar cell?
- 3) What happens if you shade the solar cell with your hand?
- 4) What happens if you tilt the solar cell so that it not facing the sun directly?
- 5) Can you make a solar spinner with just the solar cell and motor?
- 6) Can you design a solar fan powered boat?
- 7) Can you make a solar fan hat to keep you cool on sunny days?
- 8) Make a circuit using the 1.5V AA battery holder. How is a battery different from the solar cell?

Answers

- 1) Can you make a complete circuit with solar cell, motor /fan, and switch?
Yes.
- 2) What happens to the fan if you reverse the wires coming from the solar cell?
The flow of electrons in the circuit will change direction. As a result, the motor will also turn in a different direction.
- 3) What happens if you shade the solar cell with your hand?
Shading a portion of the solar cell affects how much sunlight strikes the solar panel. This will affect how strongly electrons can be excited and how many will travel through the circuit.
- 4) What happens if you tilt the solar cell so that it not facing the sun directly?
The amount of sunlight shining onto the solar panel will be different. This will also affect how strongly electrons can be excited and how many will travel through the circuit.
- 5) Can you make a solar spinner with just the solar cell and motor?
Yes, as long as you connect the wires in a complete circuit.
- 6) Can you design a solar fan-powered boat?
Yes, as long as the motor is protected from water.
- 7) Can you make a solar fan hat to keep you cool on sunny days?
Yes, make sure the fan is spinning the correct way so that the windflow direction is suitable for cooling.
- 8) Make a circuit using the 1.5V AA battery holder. How is a battery different from the solar cell?
A battery uses chemical reactions to produce electrons, while a solar cell uses energy from sunlight to excite and free electrons for flow. A battery works when there is no sun but eventually it runs out of power.

Project ideas



Figure 3. Inspirational projects. (A) Solar-powered fan hat. *Warning: Avoid moving parts near face.* (B) Solar-powered boat. (C) Solar pinwheel for garden. Source Google Images.