$1 Solar Light Hack

Subject: Electronics and solar power

Suggested Grade(s): 4th-8th grades

Lesson length: 60 min

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Guest activity from the StemAZing Project

Dollar Tree stores sell a variety of solar-powered items, like garden lamps or desk lamps. In this document, we detail how to hack two different $1 solar lights for use in science experiments and invention projects. The following instructions can be modified to other similar items. From these solar lamp/lights, the students will be able to hack for solar panels, high intensity LEDs, switches, rechargable AAA batteries, and parts.

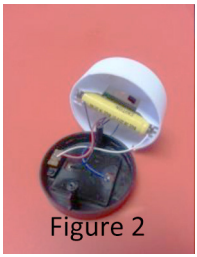
Materials

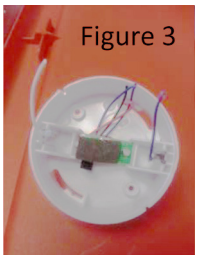
- Solar-powered white desk lamp (SKU#: 1751177)
- Stainless-steel solar-powered garden lights with stakes, 10" (SKU#: 175127)
- Philips head screwdriver
- Flat screwdriver
- Wire cutters (or scissors)
- Multimeter
- Test leads

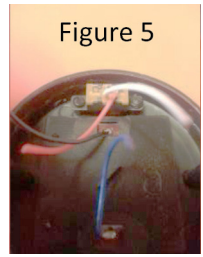
Instructions

Solar-Powered White Desk Lamp

1) Take apart the lamp, as shown in Figure 1. The plastic cover for the LEDs is removed by twisting first. Everything else is simply press fit together so pull the pieces apart.
2) Unscrew two screws holding the solar assembly together to reveal the wires and rechargeable battery, as shown in Figure 2.
3) Cut all five wires right in the middle of their length, including the one tucked in the white plastic housing, as shown in Figure 3. This can be done either with scissors or wire cutters. The solar panel (in the black plastic housing) will now be separated from the white plastic housing. Note that the colors of insulation around the wires in each light might vary.
4) Remove the rechargeable battery from the white plastic housing, as shown in Figure 3. Remove the screw from the green circuit board to free the high intensity LEDs as shown in Figure 4. Important: do NOT remove the LEDs from the circuit board.
5) Using a flathead screwdriver, pry the switch off the back plastic housing shown in Figure 5. It is simply held on with some melted plastic and should come free with a little pressure as shown in Figure 6.







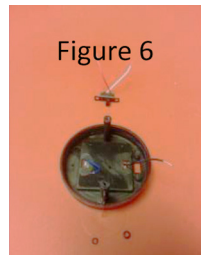
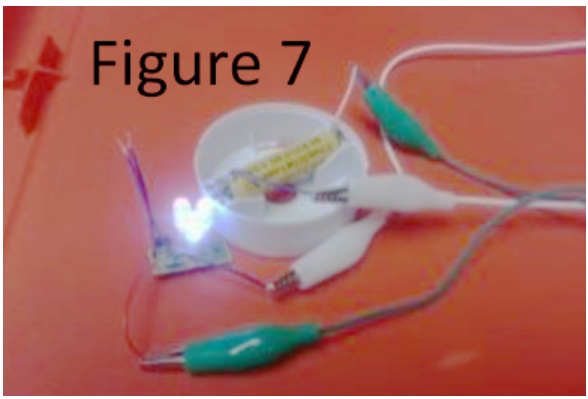


Figure 7 shows the high intensity LEDs connected to the battery using test leads to light them up. Figure 8 shows the solar panel connected to a multimeter using test leads to measure the voltage output of the solar panel.



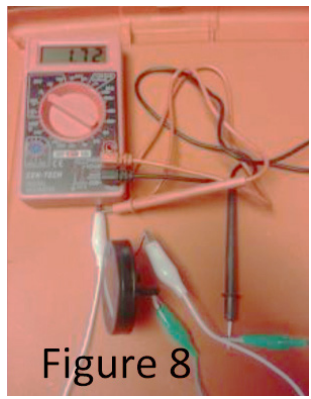



Figure 1

1) Unscrew two screws holding the solar assembly together as shown in Figure 1. This will allow the solar assembly to come apart as shown in Figure 2.
2) Cut all four wires in the middle of their length as shown in Figure 3. This will free the solar housing from the battery housing.
3) Unscrew the screw holding the green circuit board to the battery housing to free the high intensity LED. As shown in Figure 4, all the components should now be separate—the circuit board with LED, the solar housing, and the battery housing. Important: Do NOT remove the high intensity LED from the circuit board.


Figure 2

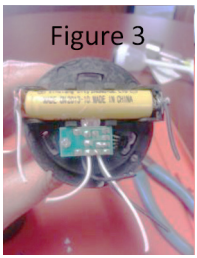


Figure 3


Figure 4

Figure 5 shows the extraneous parts of the garden light which can be used for all manner of invention at the will of the creativity of your students.

To connect the test leads, you will need to use the scissors to score (gently cut) the insulation a quarter of an inch from the end of each wire and pull the insulation off to reveal the bare copper wire.

Figure 6 shows the high intenstiy LED connected to the rechargeable battery using test leads. Please note that LEDs are directional, so if the LED does not light up, switch the test leads coming from the battery.

Figure 7 shows the solar panel connected to a multimeter measuring the voltage output. If the voltage is negative, simply switch the test leads connected to the multimeter. It should not change the magnitude of the measured voltage, only get rid of the negative sign.


Figure 5

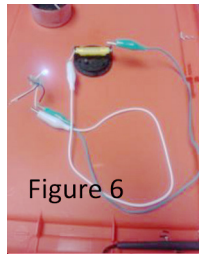


Figure 6

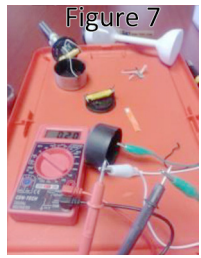


Figure 7


Figure 8

Figure 8 shows the components all reconnected as they were originally using test leads where the wires were cut. The circuit board knows if the solar panel is in light charging the battery. For the LED to work, the solar panel must be covered.