



Learn to light up colorful LEDs in basic circuits with solar energy. Your solar powered LEDs will then light up the creatures or containers you craft from repurposed plastic packaging. Inspiration will come from biology, the lifecycle of plastics and our own imaginations. The newly invented glowing creatures may even turn into characters for stories!



## Workshop Objectives

During the course of this workshop, participants will:

- Learn about circuits that run on solar power.
- Create a creature made of recycled plastics.
- Add a solar powered circuit to the creature that lights up LEDs.

## Suggested Ages

9-16 is optimal. There is fine handwork that needs to be done which can be too difficult for younger participants.

## Next Generation Science Standards Addressed

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS-ETS1-4. Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.



## Materials

For each participant:

- solar cell
- 2-4 LEDs
- resistors
- hookup wire
- copper foil

Group materials:

- short scissors
- hole punch
- drill
- rivet gun
- cool hot glue
- zip ties,
- fishing line
- string
- tape
- knives
- saw
- drill
- shears
- sharpies
- tape
- wire stripper

Recycled plastics:

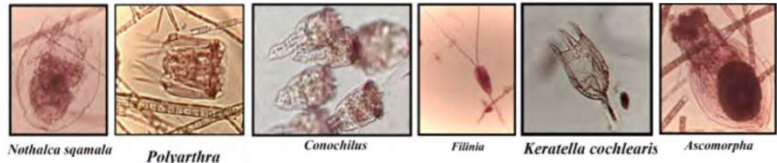
milk jugs, soda bottles, bottle caps, trays from crackers etc., yogurt containers, soap and detergent bottles, bubble wrap, plastic wrap, plastic bags, mesh bags (frequently used for onions) Styrofoam packaging such as 'to go' clam shells, or larger packaging, toys, anything else plastic!  
Toothbrushes, CDs, DVDs, k cups, the rings from bottle caps...

## Preparation

- Gather plastics.
- Make sure your work area is near windows that will let in bright sunlight. You will want to test your creations in the sun.
- Set up the work area—you may want to make one table “adult supervision only” and place all the sharp tools there.

## Safety

- Power tools and knives used by skilled users only, unless under direct supervision of a skilled teacher.
- Wire breaks when bent too many times – beware of delicate spots: LEDs, wires, solder points...
- Enjoy your creation at night by placing it near incandescent bulbs, but not too close to a bulb! This will generate too much energy for the design of the circuit and can blow out your LEDs.



## Creatures and Recycled Plastic

Solar energy powers your creation.

The more sun or light, the more colorful and quickly your creation's lights will change colors

Plankton makes nutrients and oxygen from the power of the sun, from photosynthesis.

Half of the world's oxygen is produced by ocean phytoplankton (plant plankton.)

Plastics come from chemically processing oil, coal, natural gas and more (but are mostly made from oil.)

Marine creatures are downstream of our waste streams. As plastics break into smaller pieces, marine life mistake the plastic bits for plankton.

Plastics are persistent. As they disintegrate, they cycle through us and our ecologies – never biodegrading – just breaking into smaller pieces. As plastics go through us, they can cause a variety of health problems.

Plastics cannot be recycled, only down-cycled.

Plastics are wonderfully useful and beautiful.

Right now there are no independent standards for 'biodegradable' plastics, if properly designed, they will be much better. Many are not biodegradable.

## Running a Creative Creatures Session

Talk about plastics and recycling.

Explain that using the materials gathered, participants will be making glowing solar powered creatures or simply creations using a solar cell for power and LEDs to light up the creations.

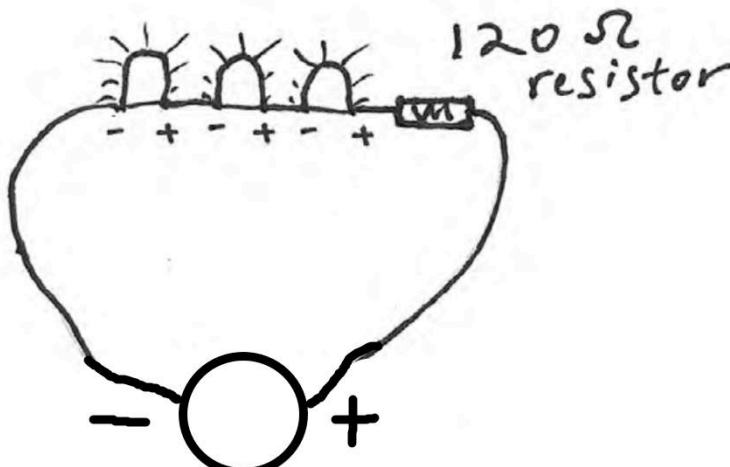
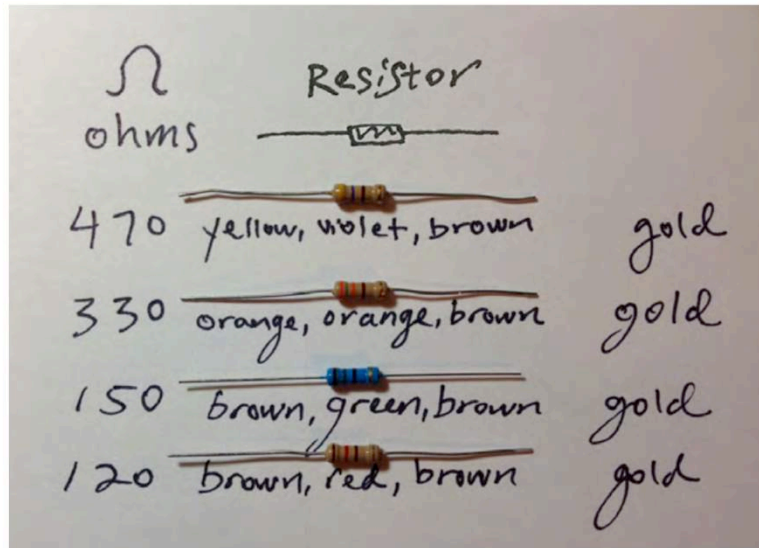
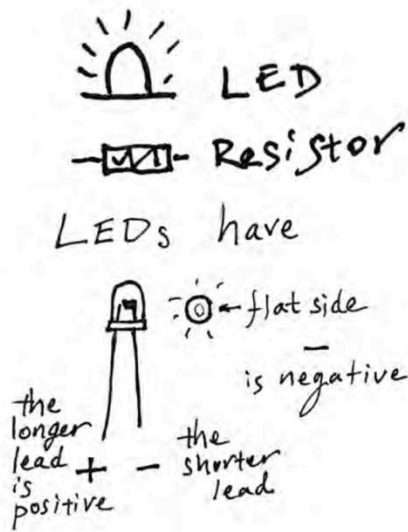
### Creature Creation

Your creature can be anything. Maybe it's:

- an enclosure or other shape
- a mobile
- not even alive (psst - everything is alive)
- a character in mythic stories, your own or of cultural invention, with journeys, conflicts and resolutions
- planned out first (sketch, write, describe) or
- done without a plan – see what happens if you start exploring materials

Start playing with materials and connectors to make a creature that pleases you.

As you design, consider the following schematics to set up your circuits:

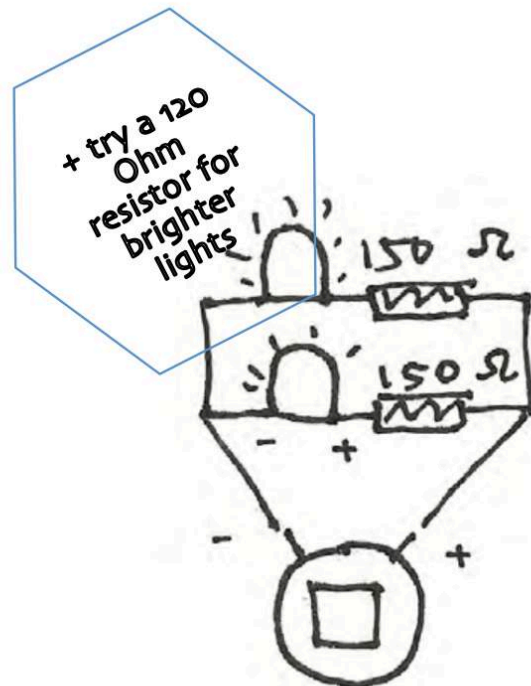
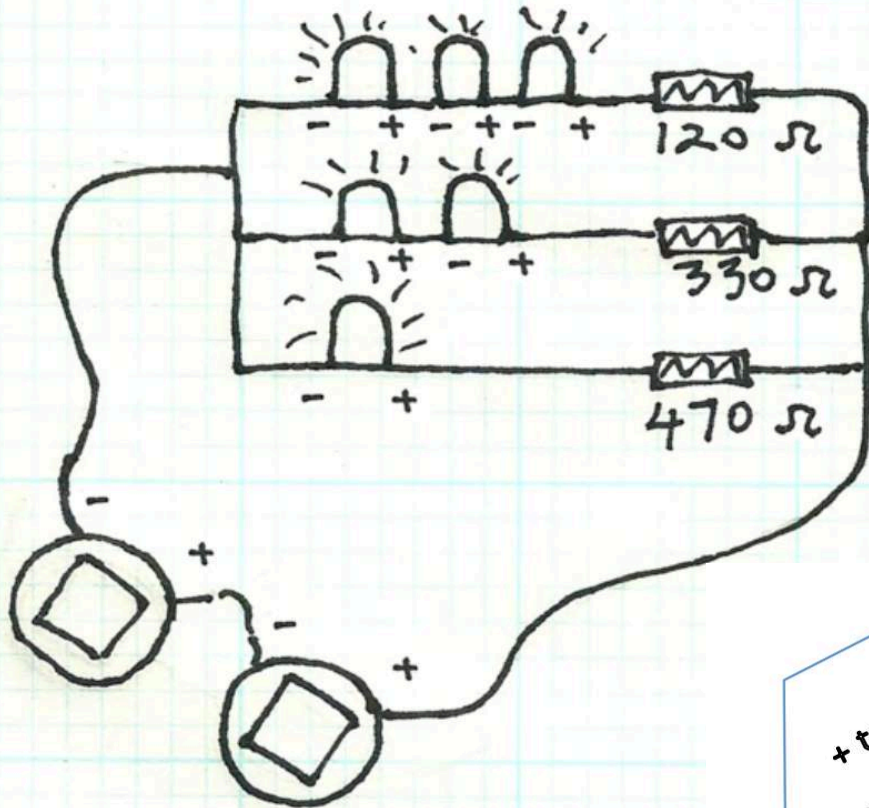


You will be wrapping the wires on the LEDs and solar cell together to make the circuit. Realize that your wraps need to be tight so that the power can flow. Use the wire strippers to peel back the plastic on the wire so that you can wrap it around the legs of the LEDs, resistor and solar cell.

Test your circuit in the sunlight.

There are other circuits that you can try:

Add additional LEDs and resistors. Add another solar cell.



When all creatures have been created, have a parade through the sunlight to show them off.

## Concepts/Vocabulary

**Sunlight is a power source.**

**Solar cells do not store power; they just convert sunlight to power.**

**Solar cell:** a device that converts solar radiation into electricity

**LED:** light-emitting diode, a low power light source

**Resistor:** a device having a designed resistance to the passage of an electric current

**Why do we need resistors?**

The power generated by the solar cell is too powerful for the needs of the LED. Using a resistor restricts the flow of the power, helping the LED to burn longer and not be over powered. Different components in a circuit run on different amounts of power, so there are many types of resistors that are used in circuits.

**Why doesn't my creature stay lit up when I move it out of the sun?**

There is no battery—no storage place for potential power—in your circuit. Your circuit can only run when it is receiving power directly from light.

## For more information

Solar Circuit activity sheet from Sunny Schools

[http://old.solar-aid.org/sunnyschools/blog/Activity sheet 5.pdf](http://old.solar-aid.org/sunnyschools/blog/Activity%20sheet%205.pdf)

Solar LED Circuit Experiment

<http://sciencewithkids.com/Experiments/Energy-Electricity-Experiments/LED-solar-circuit.html>

Simple Solar Experiments (including how to add a battery to a circuit)

<http://www.evilmadscientist.com/2008/simple-solar-circuits/>

How Solar Cells Work (and some really interesting LED jewelry)

<http://www.lumenelectronicjewelry.com/2014/05/solar-cells-a-powerful-sandwich/>

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