

# Materials for Experiments

**This Unit is a bit different from the rest.** While we usually try to keep the materials simple for you, some of these materials are *not* your everyday items. The experiments for Lesson 1 (Basic Alternative Energy) are mostly everyday items, however Lesson 2 experiments (Advanced Alternative Energy) require specialized equipment, so you'll want to pick which experiments you want to do before buying the materials.

*NOTE: This material list is for the entire Experiment section online.*

## Lesson 1 Experiments:

Bags (zipper-close and plastic)	oven
balloon	black paint with paintbrush or
batteries, AA-size	black spray paint
bottle, plastic two-liter	paper clips
bowl, plastic	white copy paper
clay, modeling	peanut (shelled)
corn syrup	penny
measuring cups and spoons	aluminum pie pan
cups (paper, plastic, and Styrofoam)	pinwheel
earphone or headset	plate
Epsom salt	pliers
Small electric fan	shoebox
Flowerpot with saucer (unglazed ceramic)	silicon solar cell
Aluminum foil	sink
funnel	aluminum
grass clippings, freshly cut	soft drink can
hole punch	spoons
ice chest or cooler or freezer	straw
glass jars or water glass	string
lamp with incandescent bulb	tape
Lysol spray	tea bags
magnifying lens	thermometer
match or lighter	tomato juice
mitt, insulated	watch or clock
newspaper	water
	wires with alligator clips

## Lesson 2 Experiments:

We've broken the materials down in this list by project, so you'll find overlap between the different projects. Most projects take a bit of time to do – they're not like the quick 5-minute activities you have seen so far.

We'll be re-using items from Units 10 and 11 here, like motors, lights, battery packs, wires, and electrical components. If you already have these parts, simply scratch them off this list (below).

### Solar Battery

- ½ sq. foot of copper flashing sheet (check the scrap bin at a hardware store)
- Alligator clip leads ([RS#278-1156](#))
- Digital multi-meter
- Electric stove (*not* gas)
- Large plastic 2L soda bottle
- ¼ cup salt
- Sandpaper & sheet metal shears

### Solar Oven

- Two large sheets of poster board (black is best)
- Aluminum foil
- Plastic wrap
- Black construction paper
- Cardboard box
- Pizza box (clean!)
- Tape & scissors
- Reusable plastic baggies
- Cookie dough (your favorite)

### Marshmallow Roaster

- 7x10" [page magnifier](#) (Fresnel lens)
- Cardboard box, about a 10" cube
- Aluminum foil

- Hot glue, razor, scissors, tape
- Wooden skewers (BBQ-style)
- Chocolate, marshmallows, & graham crackers

### BristleBot

- Old toothbrush
- Tiny vibrator motor from [Radio Shack](#) or [Solorbotics](#) (you can also rip one out of an old cell phone) or use a [disk motor](#)
- Small watch battery

### Solar Vehicles

- Multi-meter
- Solar Project Kit ([Radio Shack #22-1201](#)) or other solar cell with motor (usually sold in hobby stores) with gear set
- Foam block (about 6" long)
- 2 straws (optional)
- 2 wooden skewers (optional)
- 4 milk jug lids or film can tops

**Wind Turbine**

- A digital Multi-meter
- Alligator clip leads ([RS#278-1156](#))
- 1.5-3V DC Motor ([RS #273-223](#))
- 9-18VDC Motor ([RS #273-256](#))
- Bi-polar LED ([RS #276-012](#))
- Foam block (about 6" long)
- Propeller from old toy or cheap fan

**Fruit Batteries**

- Apple, lemon, grapefruit, lime, potato, or other fruit/vegetable
- Digital multi-meter
- Alligator wires ([RS #278-1156](#))
- Zinc plate, galvanized nail
- Copper plate (1/2" x 2") or shiny copper penny (you can scrub a tarnished penny with ketchup to shine it up)

**Steamboats**

- Copper tubing (1/8"-1/4" dia x 12" long)
- Votive candle
- Foam block
- Scissors or razor (with adult help)
- Bathtub

**For Grades 9-12:****Stirling Engine**

- Three diet shake tin cans (Slim Fast, Adkins, etc.)
- Three soft drink aluminum cans (one of which is a taller 12 oz beer can if available)

- [JB Weld Epoxy](#)
- [Red High-Temp RTV Silicon Gasket Maker](#)
- 2" or longer straight pin (e.g. yarn darning)
- 3/4" to 1/2" PVC elbow (outer diameters are 1-1/4" and 1" respectively)
- Small balloon
- Flat washer and nut
- Metal coat hanger
- Old CD
- Wire nut to connect coat hanger to CD (optional)
- Wooden base and wood screws (optional)
- Tools: tin snips or stainless steel scissors, pliers, can opener, hammer

**Crystal Radio**

- Toilet paper tube
- Magnet wire (Radio Shack part # [278-1345](#))
- Germanium diode (1N34A) (Radio Shack part #276-1123)
- Alligator clip test leads ([Radio Shack part #278-1157](#))
- 100' stranded [insulated wire](#) (for the antenna)
- Scrap of cardboard
- Brass fasteners (3-4)
- Telephone handset or get a crystal earphone from [C. Crane](#) (part #EKI) – they also carry the germanium diode if Radio Shack doesn't have it.

## Fuel Cells

[Fuel Cell Car Kit](#) (Item# KT-FUELCCK from [www.hometrainingtools.com](http://www.hometrainingtools.com)). This kit is a bit expensive, but if you want to build a car that runs entirely from sunlight and water, this is the one you want to get. The company that makes this particular model also sells the conversion kits for (real!) cars. Great starter kit for kids interested in fuel cell technology - after kids get the hang of how it works, they can up the power and perhaps use it on a go-cart?

## Beam Robots

- Tiny eccentric motor from [Radio Shack](#) or [Solarbotics](#) (you can also rip one out of an old cell phone)
- Vibrating disk motor from Radio Shack or [Solarbotics](#) (you can also rip one out of an old cell phone)
- Two 2.2k-Ohm resistors from [Radio Shack](#) or [Solarbotics](#)
- Six 4700  $\mu$ f [electrolytic capacitors](#)
- Two PNP 3906 transistors from [Radio Shack](#) or

[Solarbotics](#) (get a few extras, as these are the first things to burn out)

- Two NPN 3904 transistors from [Radio Shack](#) or [Solarbotics](#) (get a few extras, as these are the first things to burn out)
- Two voltage triggers from [Solarbotics](#) (get the 1380-G or J or N)
- Two [37x33mm solar cells](#) from Solarbotics (we won't be using the circuit on the back - just the solar cell)
- Paper clips (a few of each: small and large)
- Hot glue gun, soldering iron with solder, electrical tape
- Pliers, wire cutters, diagonal cutters (if you have them)

**Optional Beam Robots:** After you've built the BEAM robots above, you can move onto more advanced designs. Here's the parts you'll need for them:

- [Solar Roller](#)
- [Trimet](#)
- [Miniball](#)