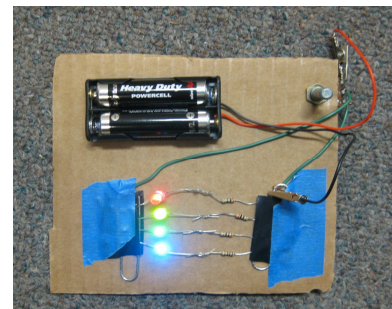


## Energy of Color

Simple tips to make an illuminating device

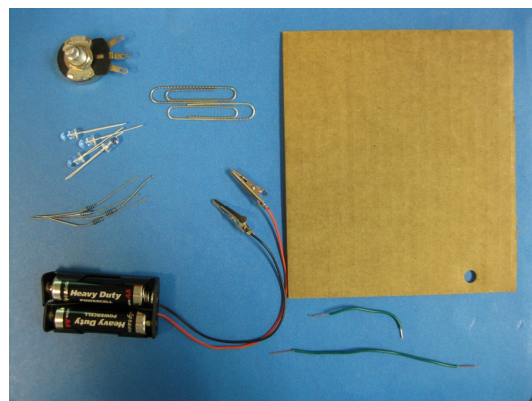
This is an easy, solderless way to explore the Light Energy and Color activity by Paul Doherty, which can be found here:

[http://www.exo.net/~pauld/summer\\_institute/summer\\_day4+5light/light\\_energy\\_vs\\_color.html](http://www.exo.net/~pauld/summer_institute/summer_day4+5light/light_energy_vs_color.html)



### Materials

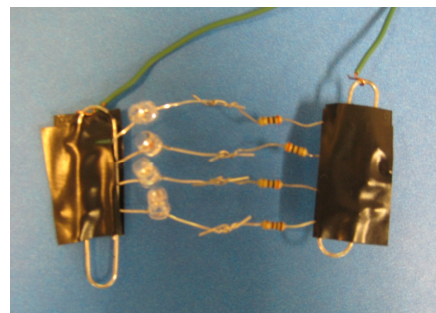
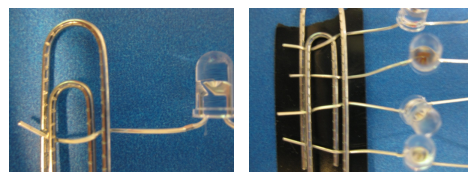
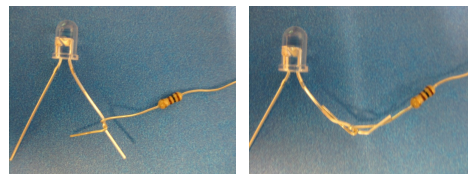
red, green, and blue LED (other colors optional)  
a 200 ohm resistor for each LED  
2 AA batteries and battery holder  
(optional) alligator clip attachments  
1kohm potentiometer  
2 jumbo paper clips  
cardboard big enough to hold everything  
insulated wire for connections  
wire strippers, hole punch



There are several ways to make this circuit. Here is just one.

### To do and notice

1. Connect each LED to a resistor by twisting the **short** end of the LED to either end of the resistor. To connect, make an “X” with the two wires, twist twice, fold the ends up into a “V”, and twist again on both sides.
2. To connect these LEDs in parallel, connect them to a paper clip on either side. To ensure a secure connection, weave the wire through the paper clip back and forth between all 4 legs of the paper clip. The paper clip will deform as you do this, but forcing it back into shape will help crimp the wires into place. Attach the free end of all the LEDs to one clip, and do the same with the free resistor ends to another clip. When all the LEDs and resistors are in place, secure them to the paper clip with some tape. Leave enough of the paper clip exposed to attach a wire.
3. The potentiometer should have a nut that screws onto the dial. Punch a hole into the piece of cardboard and push the dial through the bottom. Secure it into place with the nut.
4. Arrange the battery holder and LED unit onto the cardboard, and tape them into place. Use the insulated wire to make a permanent connection between the **middle** terminal of the potentiometer and the paper clip attached to the LED half of the parallel unit (+ end). Use



another piece of wire to make a permanent connection between the **first** terminal of the potentiometer and the paper clip attached to the resistor end of the unit (- end).

5. To use the pot as a voltage divider, attach the positive lead from the battery to the **third** terminal of the potentiometer. Finally, attach the negative lead of the battery holder to the resistor-side paper clip (- end).
6. Turn the dial of the potentiometer to adjust the voltage between 0 and 3 volts. Observe when each LED illuminates.

\*note: make sure you disconnect the battery when not in use. Even if the LEDs are off, the battery is still draining!

### **What's going on?**

Check out Paul's write-up at:

[http://www.exo.net/~pauld/summer\\_institute/summer\\_day4+5light/light\\_energy\\_vs\\_color.html](http://www.exo.net/~pauld/summer_institute/summer_day4+5light/light_energy_vs_color.html)  
for a detailed explanation of the science and math behind your new device. Why are so many LED indicators red?