

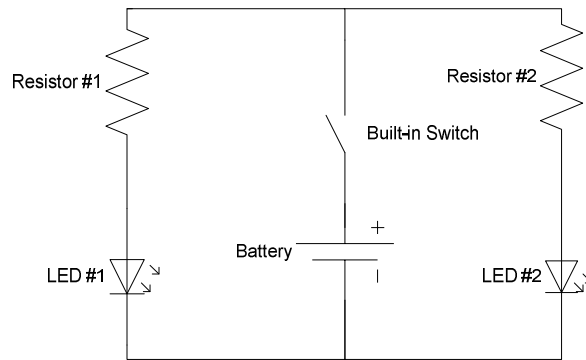
Handout - LED Box Instructions



Introduction: In this activity, you'll create a circuit using two LEDs, two resistors, and a battery case with a built-in switch. You'll then put the completed circuit into a box, and the final product will be a "lantern" that turns on and off with the use of the switch on the battery case.

Objective: After this, you'll be able to:

- Explain how a switch, LED, resistor, and power source work.
- Have your own LED box to keep.




LED Circuit Box Diagram

Materials:

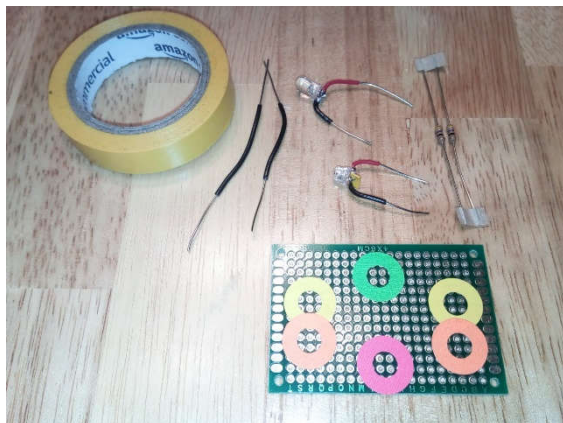
- 1) LED Box handout
 - 2) One AA-battery holder with built-in switch (batteries included)
 - 3) One circuit board with colored circles on it (board may be brown or green)
 - 4) Two black wires
 - 5) Two slow color changing LEDs
 - 6) Two resistors
 - 7) One small box (lid and base)
 - 8) One piece pre-folded vellum
 - 9) Two sets of Velcro
 - 10) One roll of electrical tape
- A pair of scissors (not included) is helpful to cut the electrical tape.

Things to remember:

- 1) In a circuit, **red wires** mean **positive** and **black wires** mean **negative**
- 2)  LEDs (or Light Emitting Diodes) have a **positive** leg and **negative** leg. Make sure you don't mix them up!
- 3) If wires are touching, it creates an electrical connection. Only allow wires in your circuit to touch if they're supposed to!

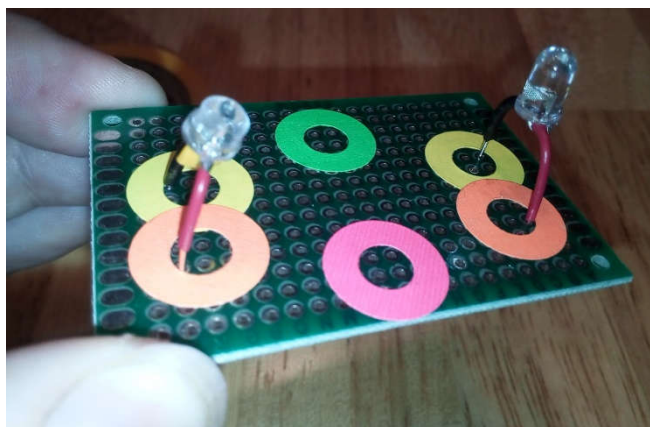
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1. Check for your supplies—scissors will be helpful if you have them. We'll start with the circuit, so put the box/battery case/vellum aside for the moment.

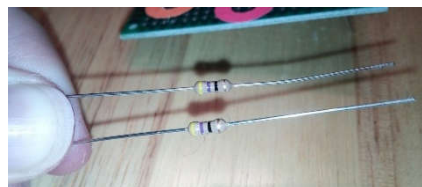


2. Start with the LEDs. Put the **RED** leg of the LED through one of the holes in the orange circle in the circuit board, and the **BLACK** leg of the LED through one of the holes in the yellow circle on the circuit board.

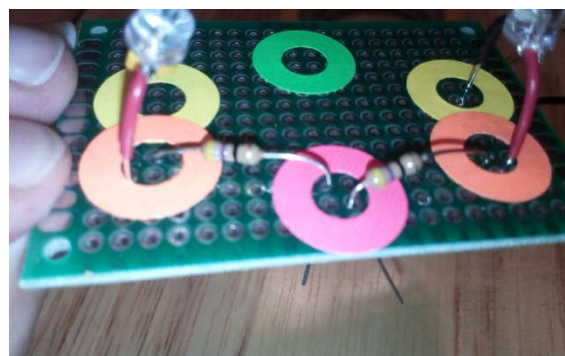
Try not to bend the LED legs close to the bulb if you can avoid it—bend the wire from the insulation down.



3. Get the resistors ready. They're held together by two little pieces of paper, so hold the resistors in the middle and pull on the paper at the ends and it should pop off.

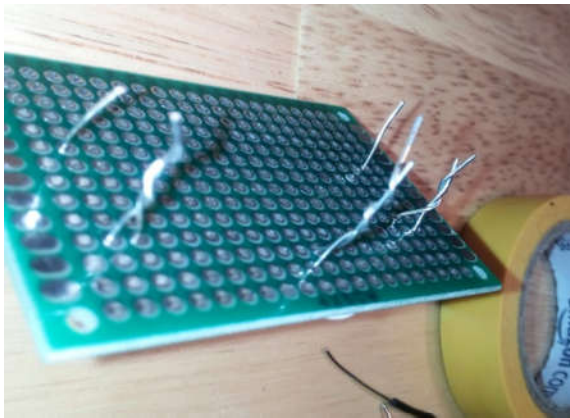
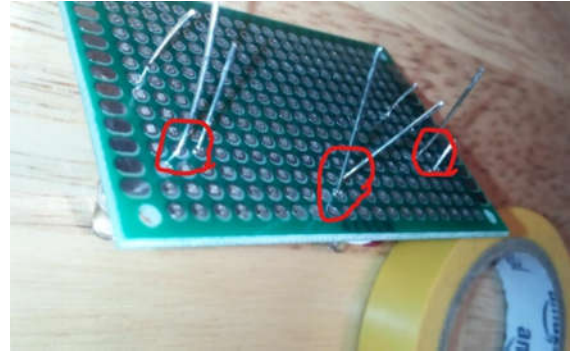


4. Then take one resistor and insert one end into a hole in the orange circle next to the LED leg and the other leg into a hole in the pink circle. Do the same with the other resistor except starting next to the other LED leg.



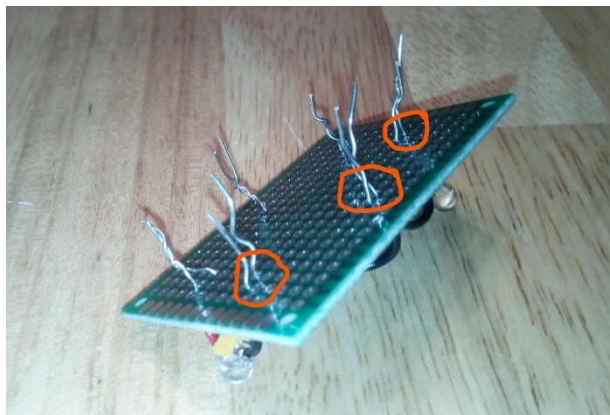
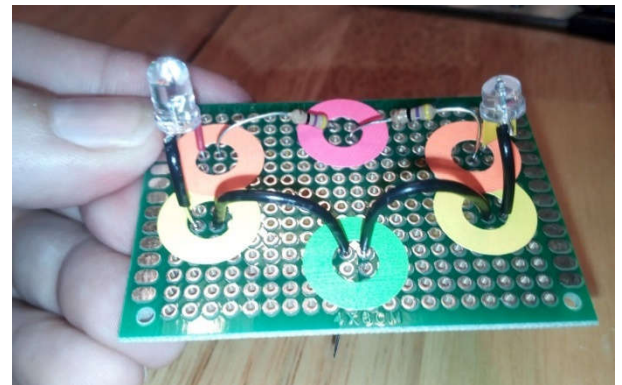
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5. Turn the circuit board over and find your groups. A group is any pair of legs that have gone through the *same* circle on the front of the circuit board, so you should have three—two that have a resistor leg and a **RED** LED leg in them, and one that has two resistor legs in it. There are also two **BLACK** LED legs that don't connect to anything yet.



6. Twist the legs in each group together. Remember that you're trying to make an electrical connection, so the wires need to stay together when you're done twisting.

7. Turn the board back over and add the black wires. Put one leg through a hole in the yellow circle next to the **BLACK** leg of the LED and the other through a hole in the green circle. Do the same with the other black wire and the other LED.

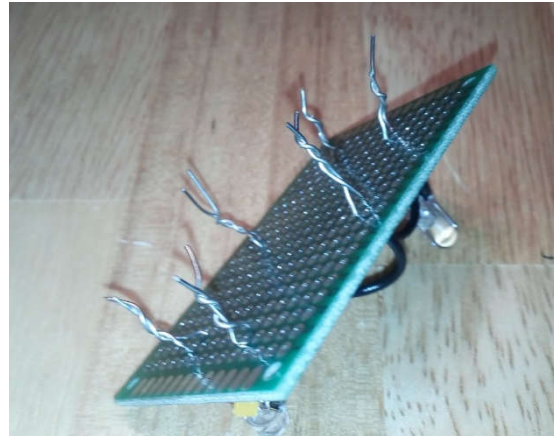


8. Turn the board back over and find the three new groups—two that have one wire and one **BLACK** LED leg in it, and one that has two wire legs.

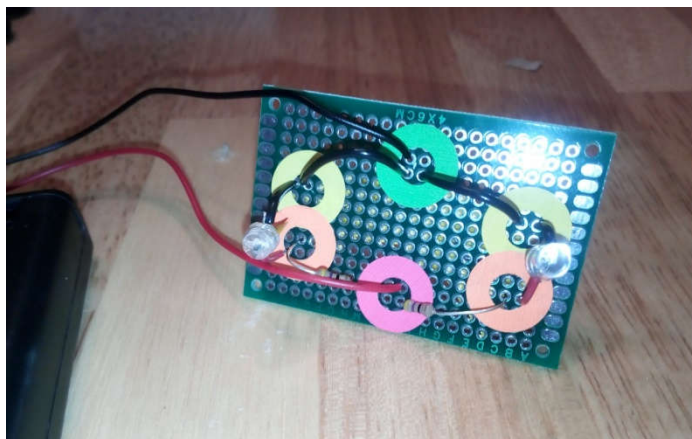
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9. Twist the new groups together. Like before, the wires need to stay touching after you're done twisting so it will make an electrical connection

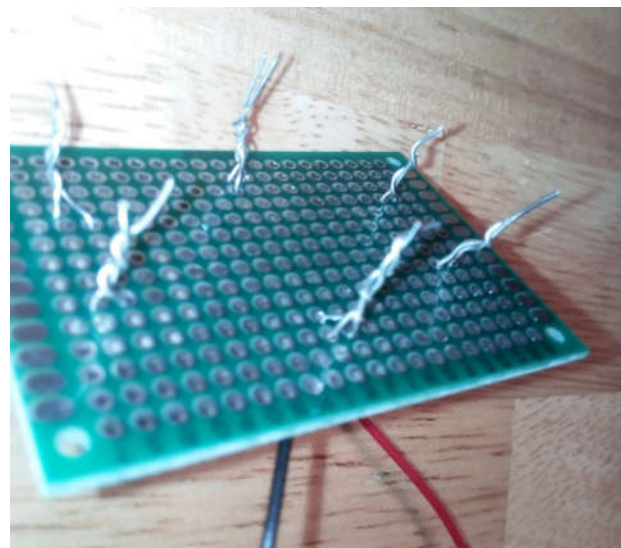


10. Turn the board back over and untape the wires from the battery case. There should be one **RED** and one **BLACK** wire. Batteries are already inserted, so make sure that the switch is in the 'OFF' position before doing the next step



11. Put the **RED** wire from the battery case into a hole in the pink circle near the resistor legs. Put the **BLACK** wire from the battery case into a hole in the green circle near the wire legs.

12. Turn the board back over and find the two new free wires. Twist them in with the rest of their group—the two resistor legs go with the **RED** wire, and the two black wire legs go with the **BLACK** wire.



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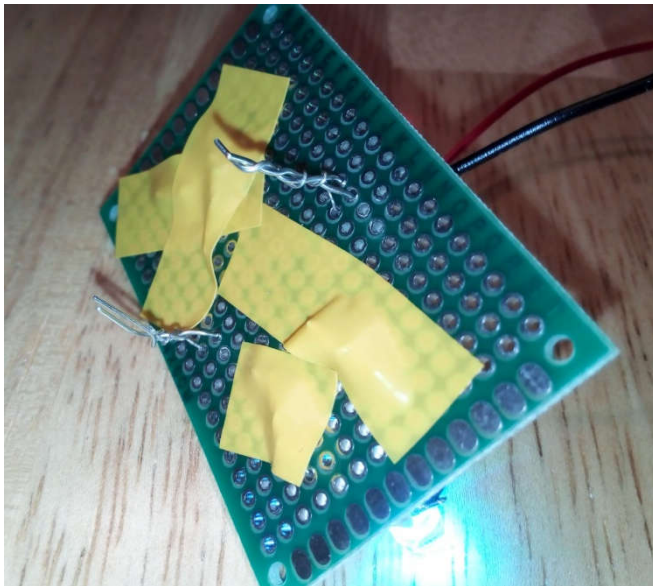
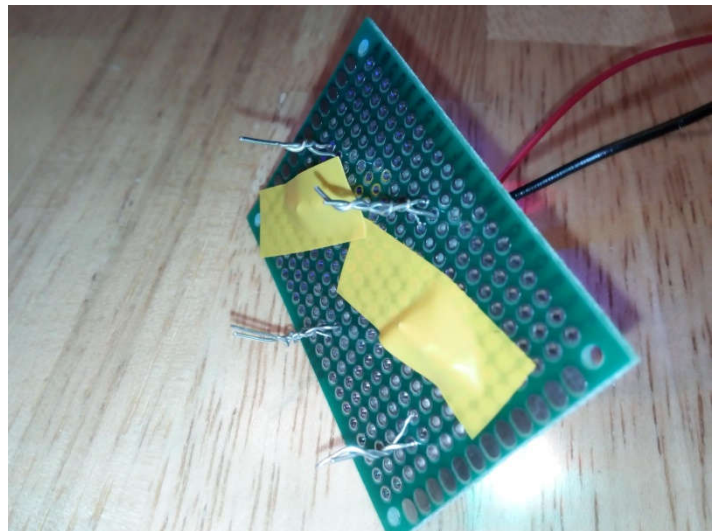
13. Before we finish the circuit, turn the board back over and flip the switch on the battery case to 'ON' and make sure the LEDs come on.

If the LEDs do not come on, check all of your twists and make sure that the circuit connections are tight.

14. Leave the LEDs turned on, and flip the board back over. Cut two pieces of electrical tape and select two twists on the diagonal. Push each down and tape it to the board, covering the wires.

Remember, the only wires that are allowed to touch are the ones in their own group!—even the diagonal ones shouldn't touch each other.

If either LED turns off, check that side of the circuit again and make sure the LED stays lit once the wires are taped down.

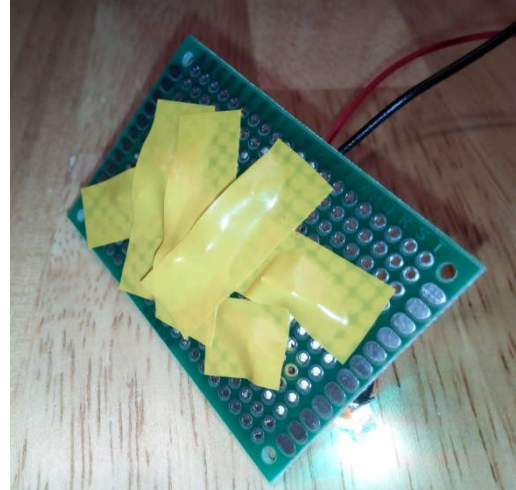


15. Push down the next set of diagonal twists and tape to the board with two more pieces of electrical tape. The wires can overlap the electrical tape (electrical tape is an insulator), but they still aren't allowed to touch any wires outside their own group.

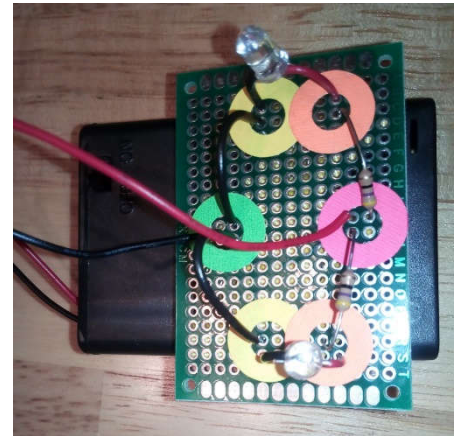
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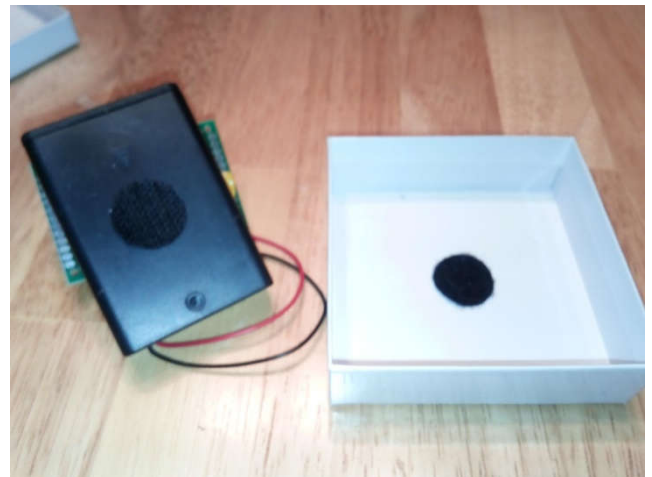
16. Push down the last two wire twists, making sure that they don't touch each other, and tape them in place with two more pieces of electrical tape.



17. Find one of the Velcro pieces. Put one side in the center of the tape on the circuit board, and the other in the center of the battery case under the ON/OFF switch. Then attach the circuit board to the battery case.



18. Put one side of the other piece of Velcro on the bottom of the battery case, and the other on the inside of the bottom of the white box. Then attach the battery case and circuit board to the white box.



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19. Take the folded vellum and wrap it around the *outside* of the bottom of the white box and tape it in place.



20. The top of the white box should fit on top of the vellum, and when you take the top off you can reach the ON/OFF switch.

Congratulations! You have completed an LED box!

