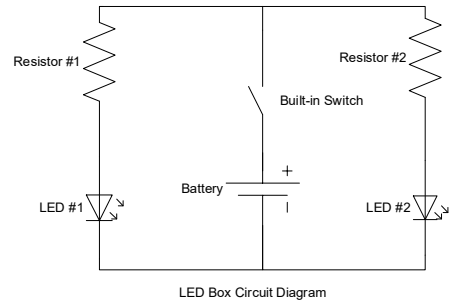


Handout - LED Box Instructions



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

Materials:

- 1) LED Box handout
 - 2) One AA-battery holder with built-in switch (batteries already inserted)
 - 3) One breadboard (small board with holes on one side)
 - 4) Two black wires
 - 5) Two resistors
 - 6) Three slow color changing LEDs (two for project, one spare)
 - 7) One small box (lid and base)
 - 8) One piece pre-folded vellum
 - 9) One Velcro circle
 - 10) One roll of tape
- A pair of scissors (not included) is helpful to cut the 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!

Check your supplies—scissors will be helpful if you have them.

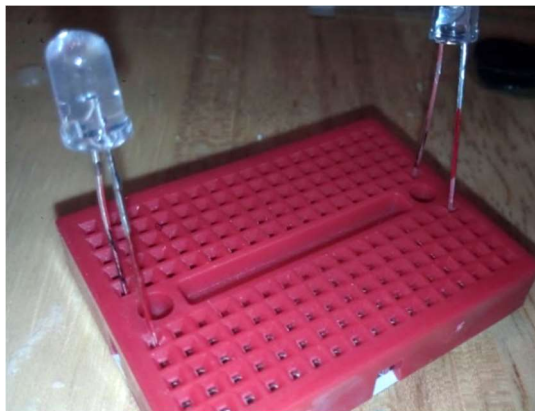


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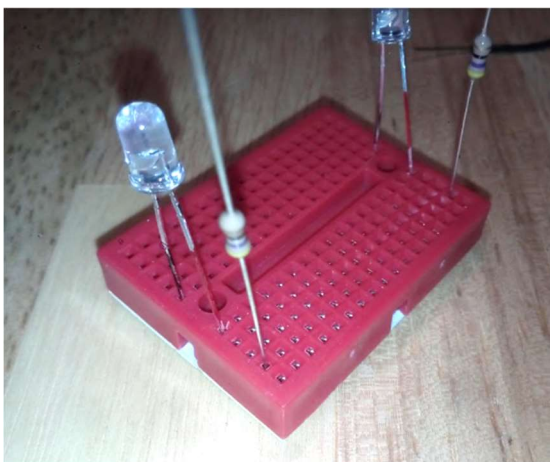
1. We'll build the circuit first, so put the box/battery case/vellum aside.

2. Start with the LEDs. Put the **RED** leg of the first LED in one of the holes in a row at one end of the breadboard, and the **BLACK** leg into a hole on the opposite side of the center line. Remember, crossing the center line means that the two legs of the LED will be part of different rows/connections.



3. Take the second LED and put the **RED** leg in a hole at the other end of the breadboard but on the same side of the center line as the first **RED** LED leg. Then put the **BLACK** leg into a hole on the opposite side of the center line. The two **RED** legs should now be on one side of the center line and the two **BLACK** legs on the other with the LEDs at opposite ends of the board.

4. 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.



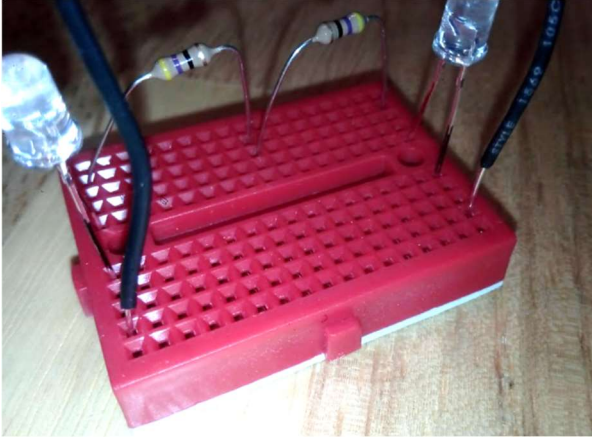
5. Then take one resistor and insert one leg into a hole in the same row as one of the **RED** LED legs. Remember, being in the same row means these two components will be electrically connected. Take the other resistor and put one leg in a hole in the same row as the second **RED** LED leg.

Remember, resistors don't have a positive or negative leg so they can go in any orientation.

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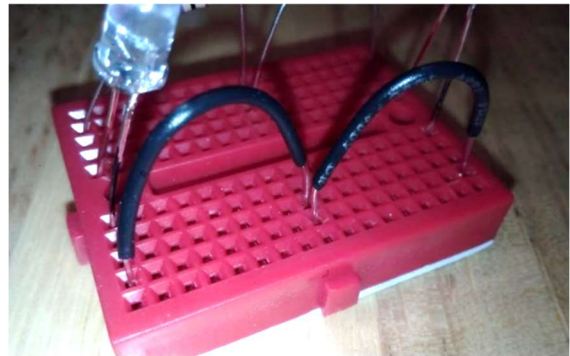


6. Bend the resistors, taking the two free ends and putting them in holes the same row towards the center of the board.



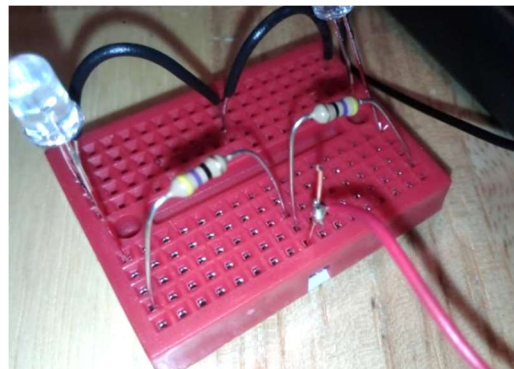
7. Turn the breadboard around and take one black wire. Put one leg in a hole in the same row as one of the **BLACK** legs of the LED. Take the other black wire and put it in a hole in the same row as the other LED's **BLACK** leg.

8. Bend the black wire, taking the free legs of and utting them in holes in the same row towards the center of the board

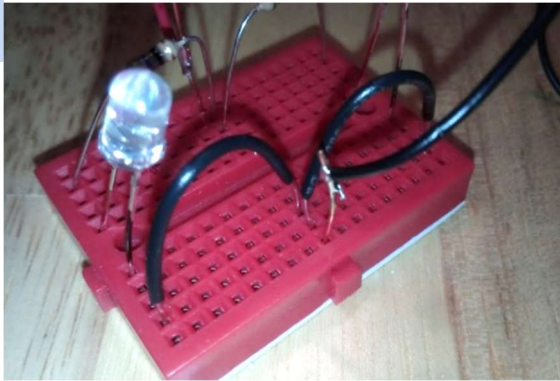


9. Now untape the wires from the battery case. There should be one **RED** and one **BLACK** wire. Batteries are already inserted, so make sure that the switch is in the 'OFF' position before doing the next step

10. Put the **RED** wire from the battery case into a hole in the same row as the two resistor legs (the actual wire from the battery case has a 'post' wire soldered to the end—that post is what should be inserted into your breadboard)



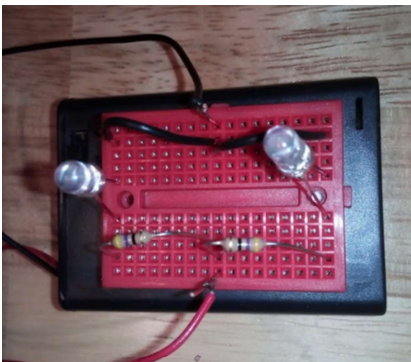
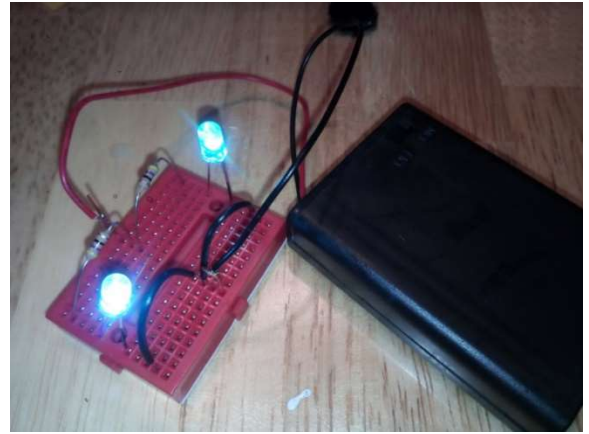
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11. Put the **BLACK** wire from the battery case into the same row as the two black wire legs.

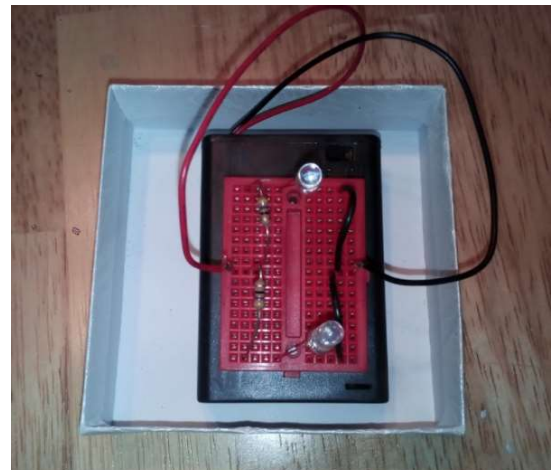
12. Before we finish the project, test the circuit. Flip the switch on the battery case to 'ON' and make sure the LEDs come on.

If the LEDs do not come on, check all of your connections and make sure that everything is in the right place and all legs are pressed firmly into the correct holes on the breadboard. Also make sure that wires aren't touching outside of the breadboard



13. Peel the layer of plastic (the thin yellow part, not the white foam) off the back of the breadboard and use it to stick the breadboard to the top of the battery case, right under the on/off switch. Remember, don't cover the on/off switch!

14. Take the Velcro and put it on the opposite side of the battery case as your breadboard, and use that to Velcro your battery case into the bottom of the white box. This way you can take it back out if you need to change the batteries.



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



16. 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!

