

Tech Time - “Light it UP”

Design Challenge: How can you, as an electrical engineer, build a lamp or light?

Constraints:

- **Design and laser cut the body of the lamp**
- **Use a non-addressable LED light strip, 3V battery pack, and a switch in your lamp.**
- **Solder connections within the circuit.**







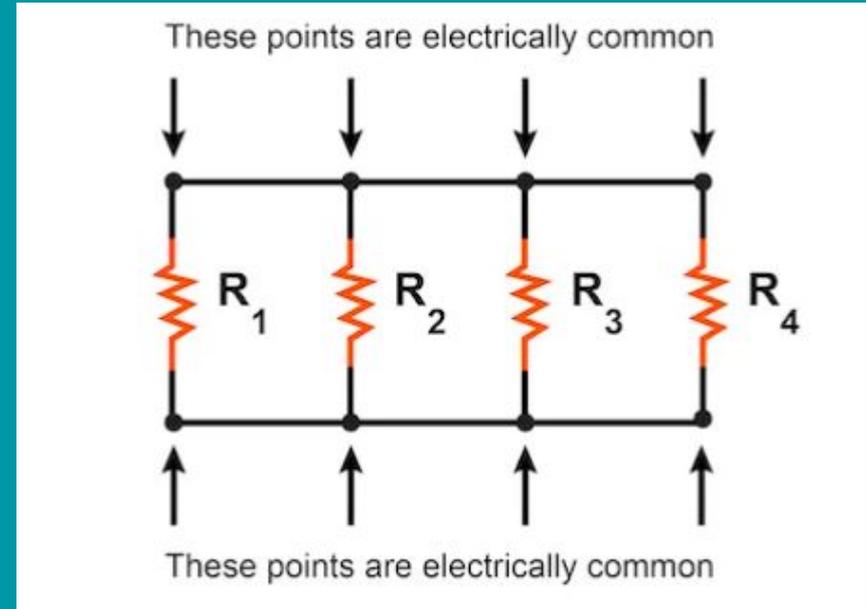
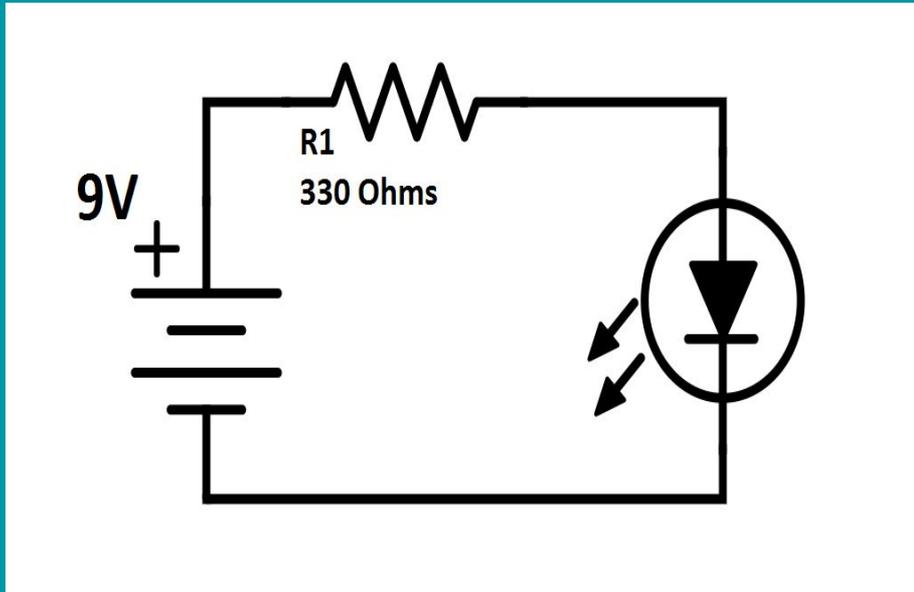
9th Grade Learning Targets:

- Review series circuits
- Learn to solder safely
- Design in CorelDraw and MakerCase
- Operate laser cutters correctly

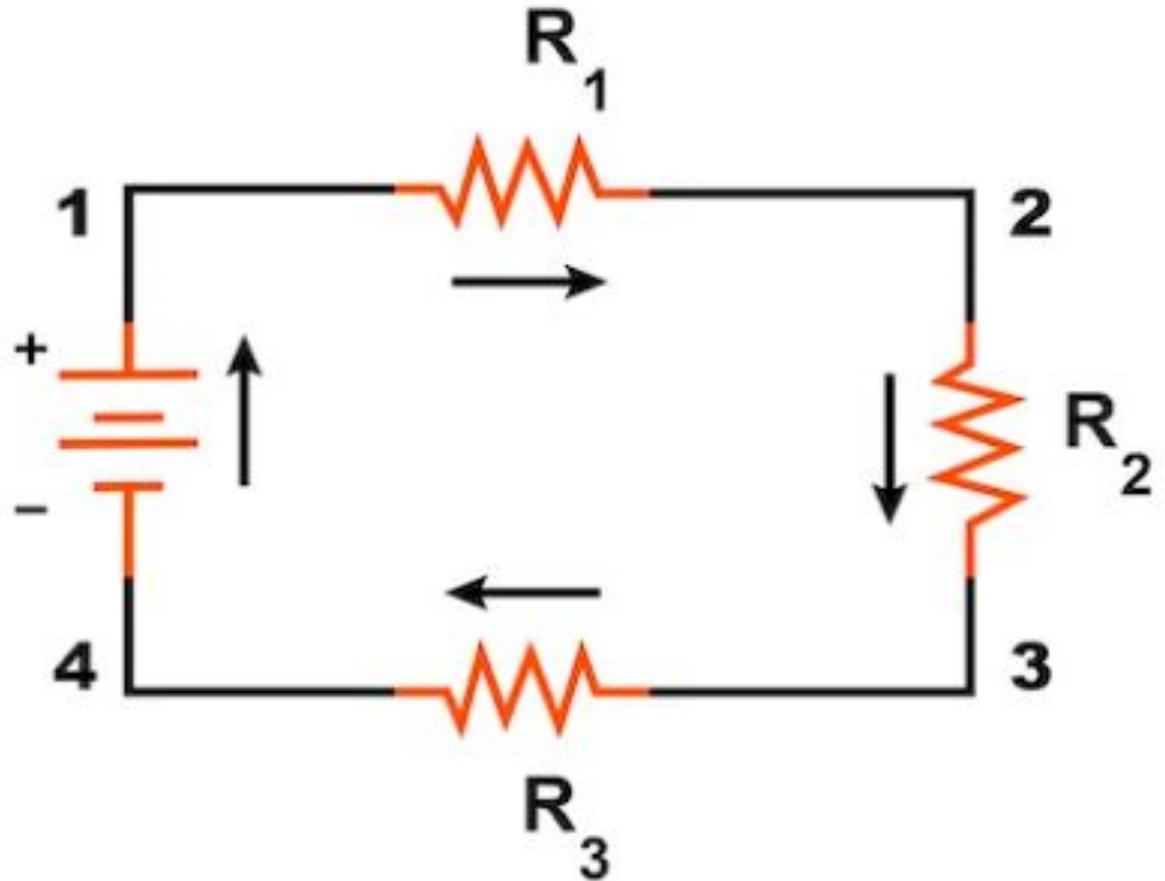


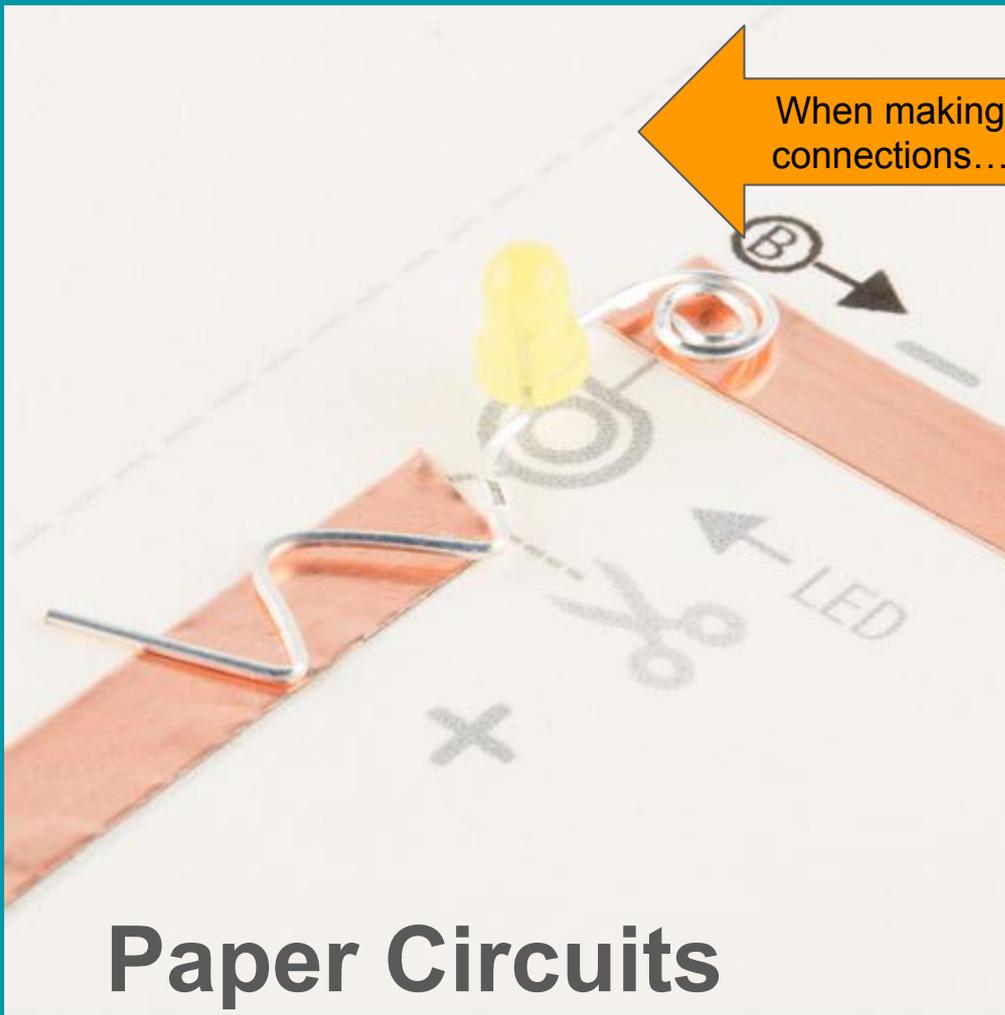
Earn the following MCs: Multimeter Basics, Soldering, Laser Cutter Operator, Laser 3D Designer

Simple circuit has 3 things: a source of voltage (power source), a conductive path, and an electrical device that uses the power (load) of some kind.

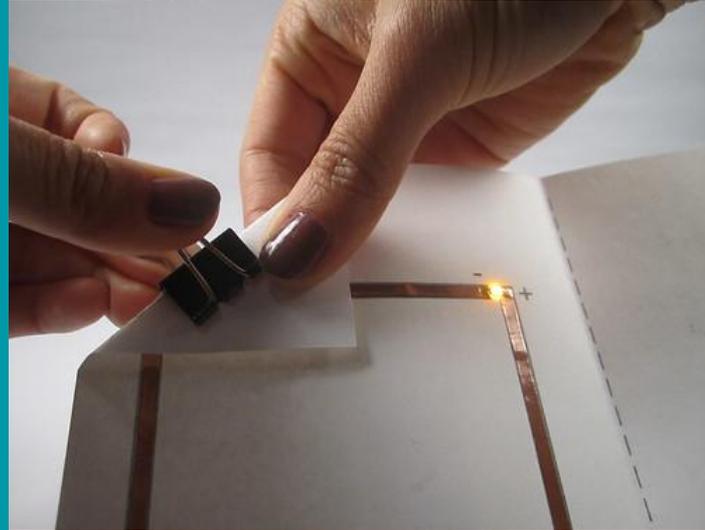
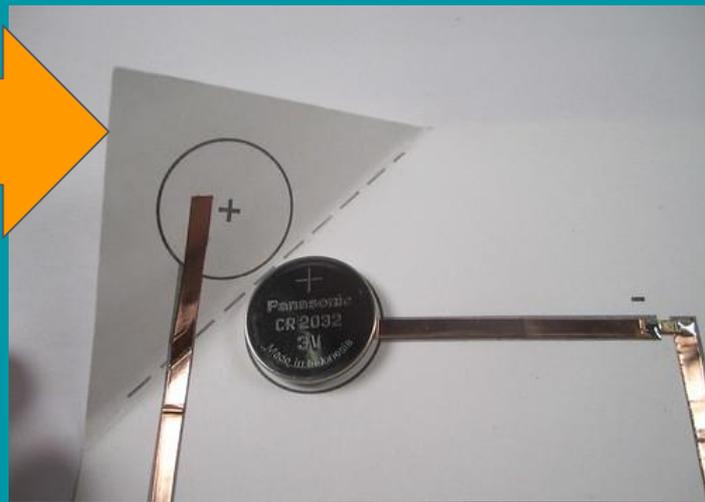


Simple Series Circuit is a circuit where the components are connected end-to-end.

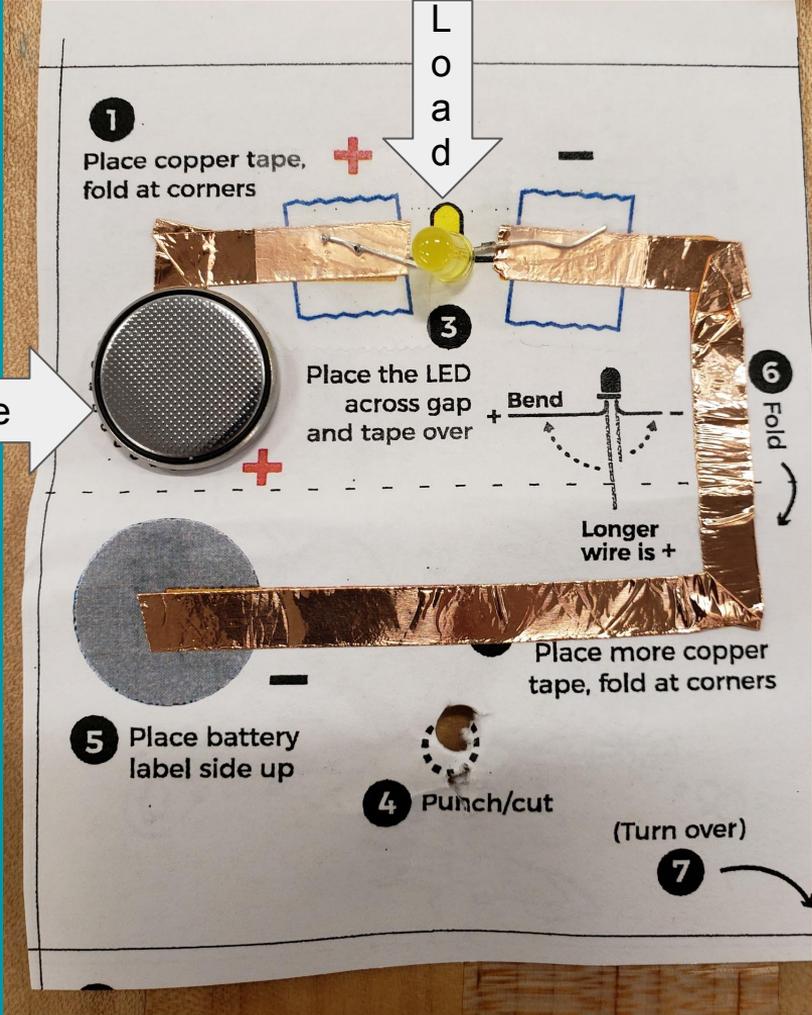




When making connections...



Paper Circuits



Power Source

Simple Series Circuit

1

Place copper tape, fold at corners

Load

3

Place the LED across gap and tape over

6

Fold

Bend

Longer wire is +

5

Place battery label side up

4

Punch/cut

(Turn over)

7

Place more copper tape, fold at corners

What is a multi-meter and how do you use it?

<https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-multimeter?from=YouTube>

If a conductive path is formed, the multimeter will beep.

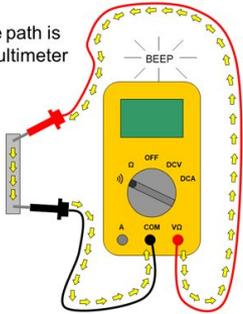
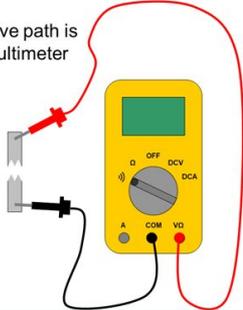
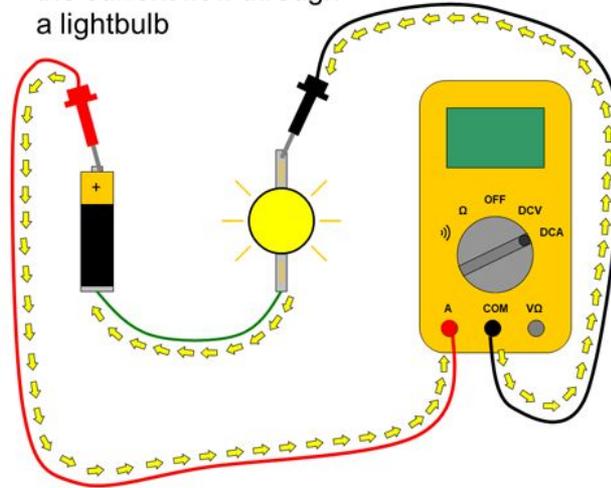


Image Credit: Ben Finio, Science Buddies / Science Buddies

If the conductive path is broken, the multimeter will not beep.



Connect a multimeter **in series** to measure the current flow through a lightbulb



What you can document while practicing.

Use the multimeter on your series circuit to practice.

Multimeter Basics

Use a multimeter to check for continuity and voltage drop

- Connect terminals to proper pins on the multimeter
- Set the multimeter to Ohms continuity setting
- Use the ammeter feature of a multimeter to measure current through a circuit
- Measure voltage across your battery or as voltage drop across a component.

Related Pathways



How to Solder



Resources

Soldering

Prepare the wires and components before soldering

1. Strip the wires



Image from: <https://www.yic-electronics.com/blog/How-to-Property-Strip-a-Wire.html>
Go here for more information: <https://www.wikihow.com/Strip-Wire>

2. Splice the wires by twisting the wires a. Stranded to Stranded Wire

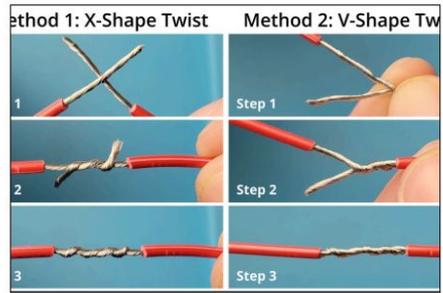


Image from and more information can be found here:
<https://www.instructables.com/A-Comprehensive-Guide-to-Soldering-Techniques-Tool/>

Soldering

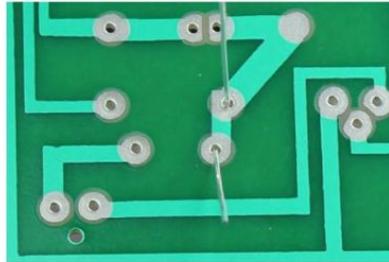
Solder at least two components together (i.e. one wire to another) with a clean connection

From: <https://www.makerspaces.com/how-to-solder/>

How To Solder

To better explain how to solder, we're going to demonstrate it with a real world application. In this example, we're going to solder an LED to a circuit board.

Step 1: Mount The Component – Begin by inserting the leads of the LED into the holes of the circuit board. Flip the board over and bend the leads outward at a 45° angle. This will help the component make a better connection with the copper pad and prevent it from falling out while soldering.



Document
your
progress!

What you need to document while practicing.

Get two wires and heat shrink to practice these skills.

Soldering

Use soldering irons/guns with proper techniques

- Prepare the wires and components before soldering
- Solder at least two components together (i.e. one wire to another) with a clean connection
- Use heat shrink to protect the soldering joint.
- Demonstrate how you solder the two components (heat up the components with the iron/gun and then apply solder from the other side)
- Show your final product and a clean workstation.

Related Pathways

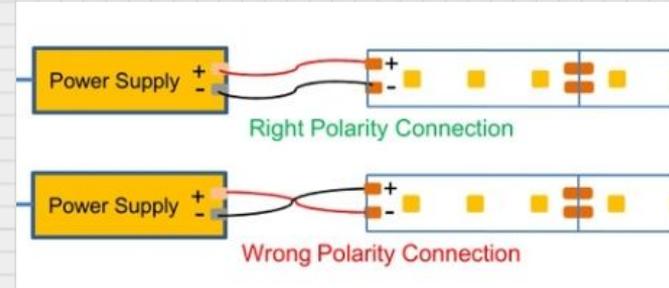
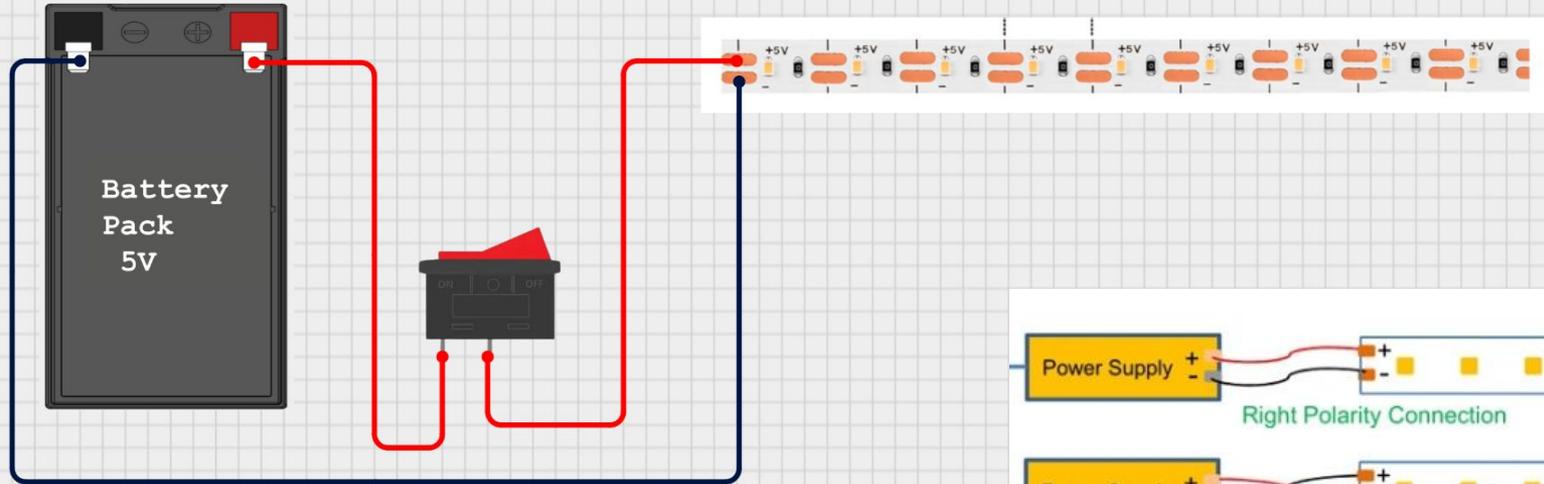




1. After submitting the soldering MC (this has to be done), get two wires and a non-addressable LED strip. This will be the beginning of your custom lamp design.
2. Solder the power supply wires to the non-addressable LED strip.
3. Go to the next slide.

Wiring Diagram of LED, Switch, & Battery

Circuit Designer

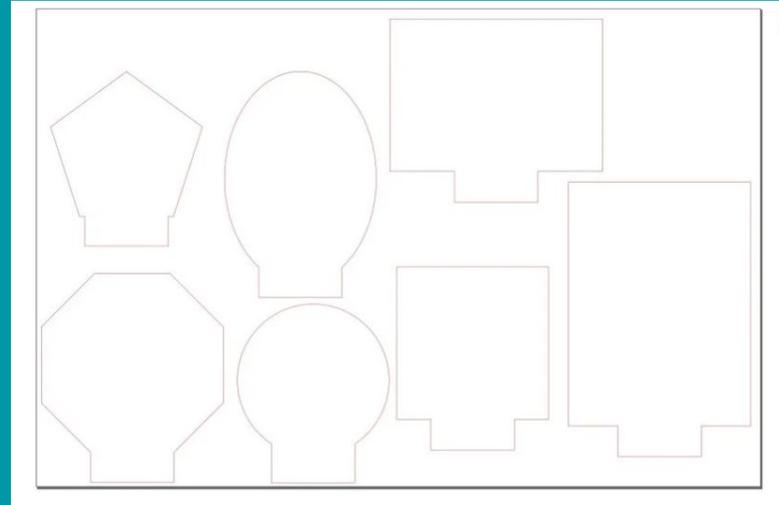


You can use [makercase.com](https://www.makercase.com) to make your box. 2"x4"x6" (or less)

Be sure to make a slit in the top of the box for your acrylic. Approx. 2.75" x 0.125"

Materials:

- Translucent Acrylic
- Foam, cardboard, plywood for box



Document
your
progress!

What you need to document while practicing.

Laser Cutter 3D Designer

Laser Cutter 3D Designer

Use design software to create 3D objects from laser cut designs

- Use at least one 3rd party tool (i.e. makercase, luban, etc) to create a laser cut 3D model
- Import the files from the 3rd party tool into vector software
- Customize the imported design by adding at least two components to the design (i.e. a logo, hole for a button, etc)
- Set the dimensions of the design space for your laser cutter material, and optimize the layout to reduce waste
- Use appropriate outline and fill settings to achieve the desired outcome with the laser cutter
- Export file(s) in the correct format for your laser cutter's interface/software/app
- Show your final product

Related Pathways



What you need to document.

Laser Cutter Operator

Laser Cutter Operator

Effectively use a laser cutter to engrave and cut designs

- Use calipers to acquire precise thickness measurements for your material
- Use laser cutter interface/software/app to select appropriate material attributes and ensure correct speed and power settings are used
- Send a design to the laser that includes elements to be engraved and cut out and input the proper settings for each
- Maximize salvageable material when developing a product.
- Show the final product that includes the evidence for this micro-credential

Related Pathways





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How It Works

Make a lamp - any kind of lamp - and show everyone how you made it!