



BUILDING A WORKING JACOB'S LADDER TOY (WITH BATTERIES)

A Jacob's Ladder is a fun toy that uses electricity to make a "ladder" of flame climb upward.



QUESTION

How does a Jacob's Ladder work, and what makes the flame climb from the bottom to the top?



HYPOTHESIS

I think the flame climbs because _____

MATERIALS

- ☐ 2 x AA batteries (1.5V each)
- ☐ Battery holder with switch
- ☐ 2 carbon rods or graphite electrodes (about 6–8 inches long)
- ☐ Thin copper wire (24–26 gauge)
- ☐ 1–2 small alligator clip leads (optional)
- ☐ Denatured alcohol (methanol) or isopropyl alcohol (70% or higher)
- ☐ Small shallow dish or cup (for alcohol)
- ☐ Safety goggles
- ☐ Lighter or long match
- ☐ Heat-resistant surface (tile or metal tray)



Tip: Graphite rods from old batteries or carbon arc rods work well!



SAFETY FIRST!

- Work in a well-ventilated area away from anything that can burn.
- Use denatured alcohol or isopropyl alcohol only.
- Keep a small container of water or a fire extinguisher nearby.
- Wear safety goggles.
- Do not leave the Jacob's Ladder unattended while lit.
- The rods and wires can get hot—do not touch them when in use.
- Ask an adult for help if you are unsure about any step.

SAFETY IS YOUR RESPONSIBILITY!



PROCEDURE

1. Put on your safety goggles.
2. Set the two carbon rods upright and parallel, about 1–2 inches apart. Secure them so they stand straight.
3. Cut 6–10 short pieces of copper wire (about 1–1.5 inches each). These will be the "rungs."
4. Wrap each wire rung around both rods. Make sure the rung touches both rods tightly.
5. Connect the positive (+) side of the battery holder to the bottom of one rod. Connect the negative (–) side to the bottom of the other rod.
6. Pour a small amount of alcohol into the shallow dish. Place it under the ladder.
7. Turn on the switch.
8. Light the alcohol at the bottom between the rods.
9. Watch and observe the flame as it climbs the ladder!



OBSERVATIONS

What I Observed	Yes / No	Notes
The flame starts at the bottom.		
The flame moves upward.		
The flame jumps from one rung level to the next.		
The flame goes all the way to the top.		
The wires or rods get hot.		
Any other observations:		



CONCLUSION

1. Did your results support your hypothesis? ☐ Yes ☐ No

Why or why not? _____

2. In your own words, explain how a Jacob's Ladder works.



CHALLENGE (Optional)

Try changing the distance between the rods or the number of rungs.

What happens? Write your results here: _____



EXTEND YOUR LEARNING

Research real-world uses of electricity jumping gaps or arcs.

Write one example: _____



HOW IT WORKS

Electricity flows up one side, jumps across a small gap at a higher rung (through the flame), then continues up the other side. This makes the flame appear to climb the ladder!