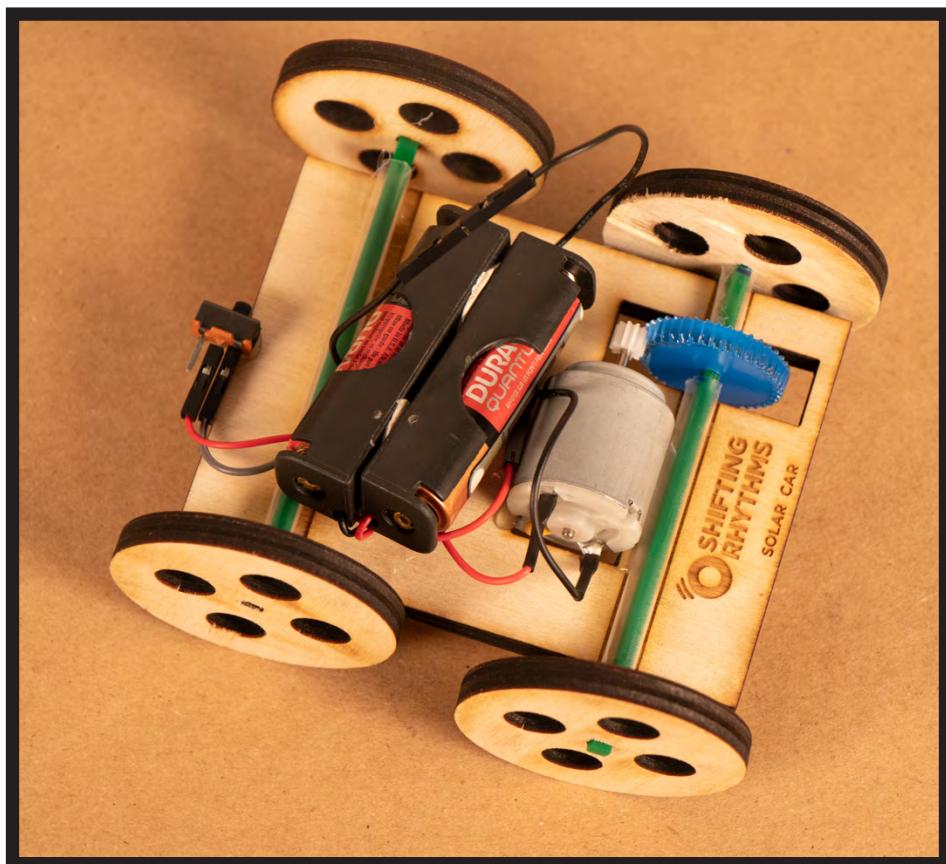




SHIFTING RHYTHMS

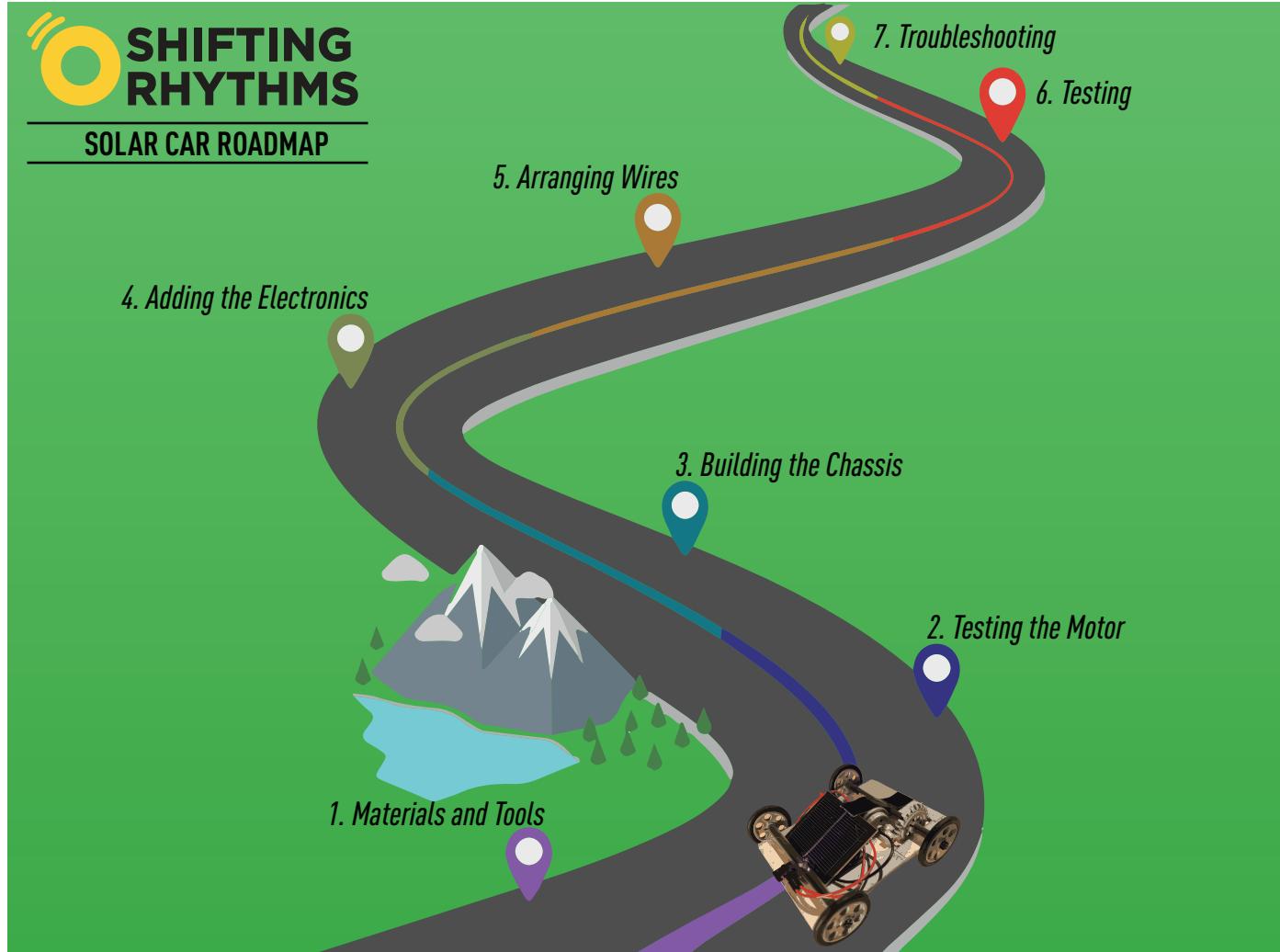
Solar Powered Car

Time Estimate: 60-90 min



Tags: Electrical, Mechanical

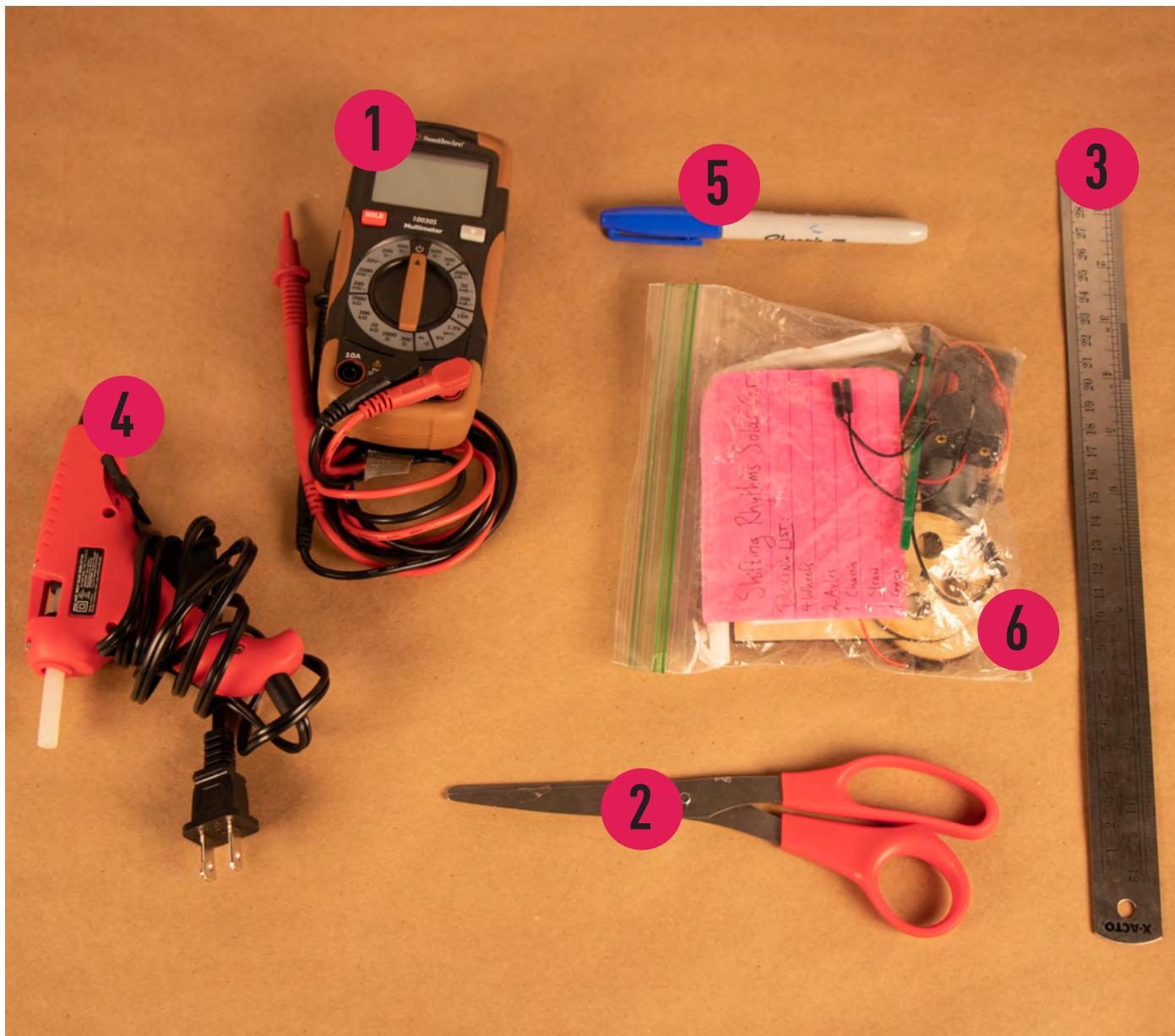
Roadmap



This is a roadmap. It shows where you will be going and the big steps to build a solar powered car. It might seem long, but don't worry! You'll get there.

Part 1: Materials and Tools

Tools



Tools you will need:

- 1. Multimeter 2. Scissors 3. Ruler
- 4. Hot glue gun 5. Sharpie 6. Solar Car Kit

You can find all of these on the tool table. Grab one of each for your group.

Part 1: Materials and Tools

What are these things? What do they do? Lets find out:

The multimeter measures electricity safely

The tools will cut the cardboard and straw

The ruler measures the straw. Make sure you measure in inches!

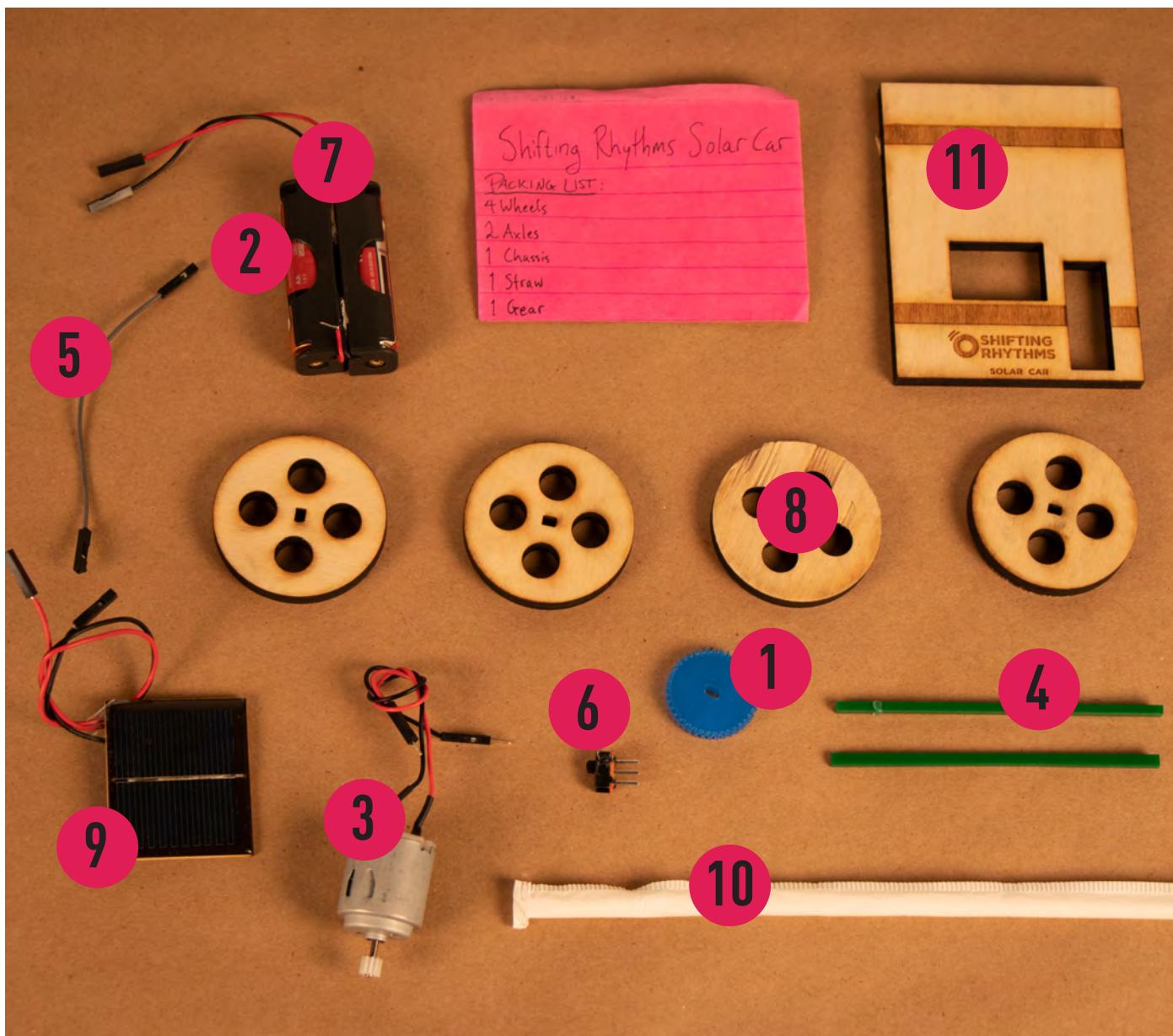
The hot glue melts strong glue and you push it out by pulling the trigger.

The Sharpie will be used to mark important pieces.

The kit holds the pieces used to make the car. We'll explore this on the next page.

Part 1: Materials and Tools

Parts



Make sure you have all the kit pieces:

1. Big Gear
2. 2 AA Batteries
3. Motor
4. 2 Axels
5. Connector Wire
6. Switch
7. Battery Pack
8. 4 Wheels
9. Solar Panel
10. Straw
11. Chassis (pronounced chassey)

Part 1: Materials and Tools

What are these things? What do they do? Lets find out:

The big gear allows the motor to spin the wheels.

The batteries power the car if the sun isn't out.

The motor uses electricity from the solar panel or batteries and spins to make the car go forward.

The axels make sure the wheels spin together.

The connector wire allows you to connect two wires that have pointy ends. The pointy ends go into the holes of the connector wire. Electricity flows through the wires.

The switch allows you to break the flow of electricity and put it back together.

The battery pack holds the batteries and makes the electricity in them go through the wires.

The wheels allow the car to spin.

The solar panel takes energy from the sun, electrons, and turns it into electricity the motor can use.

The straw gives a place for the axel to spin on the car.

The chassis is the base of the car that everything sits on.

Part 2: Testing the Motor

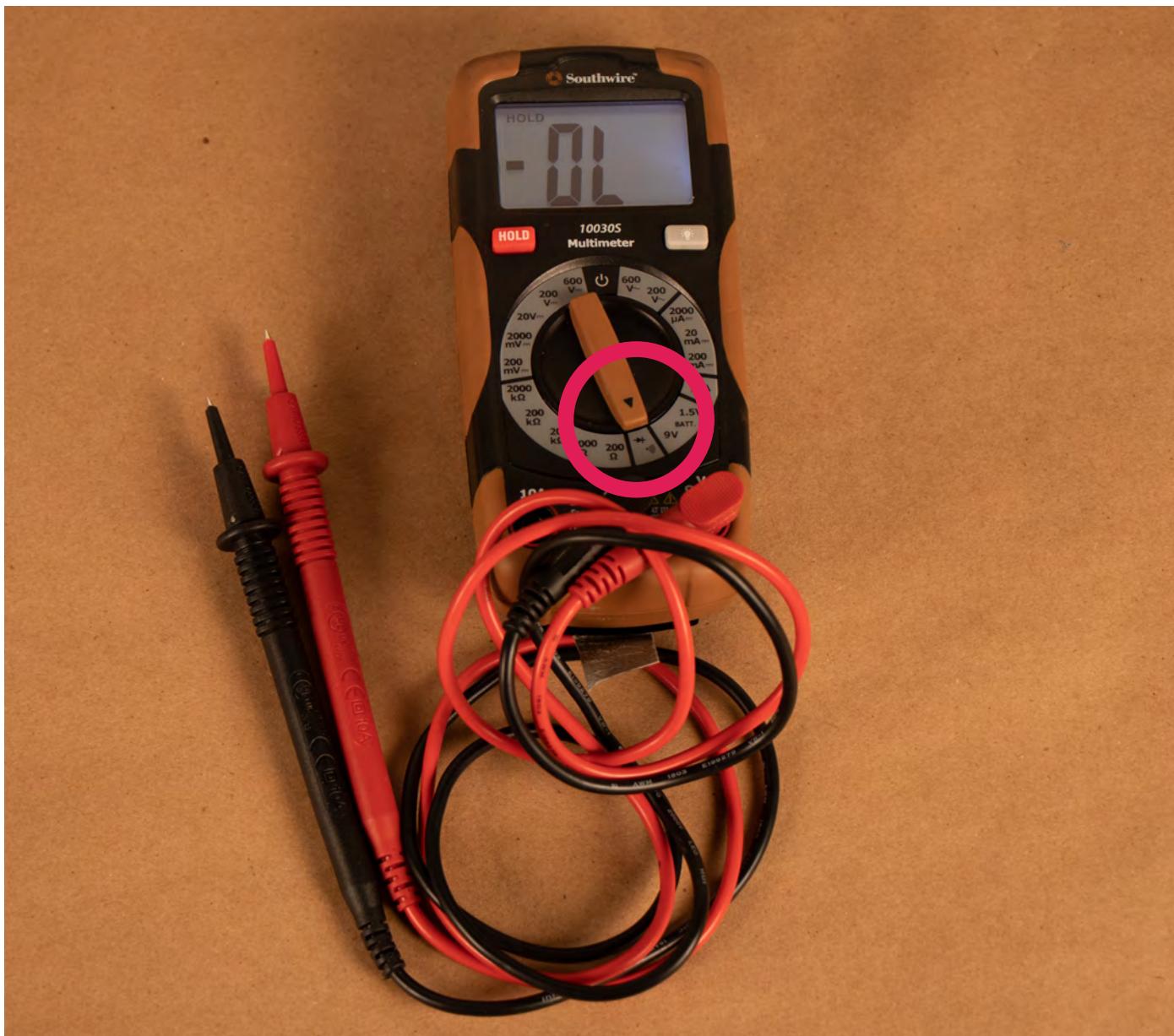
Step 1: Gather Supplies



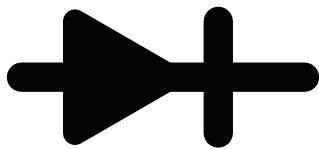
Grab the multimeter, the switch and the Sharpie.

Part 2: Testing the Motor

Step 2: Turn on Multimeter



Turn the multimeter dial to the label that looks like:



If you touch the black and red tip together, they should make a noise.

Part 2: Testing the Motor

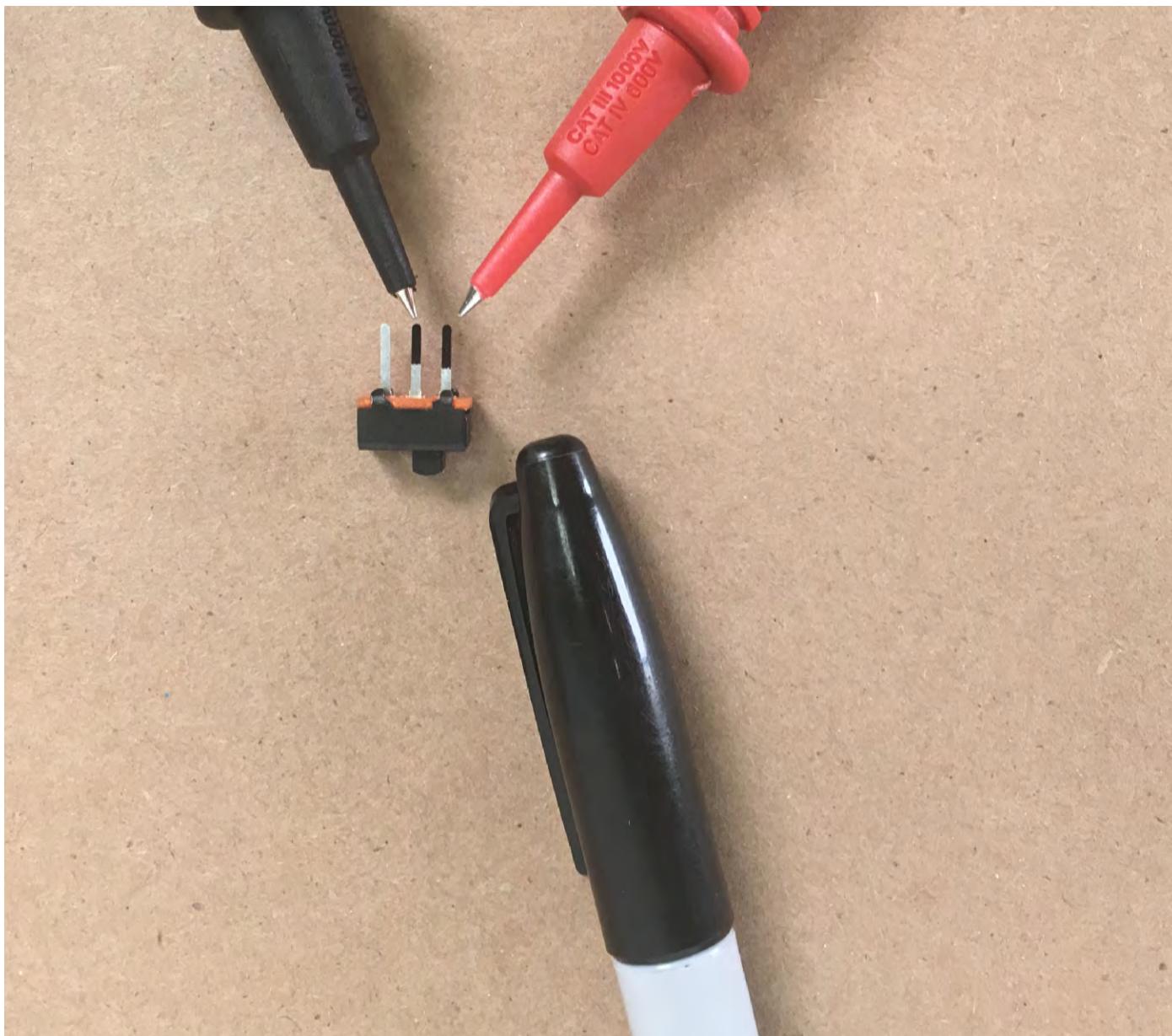
Step 3: Find Switch Pins



Touch one tip of the multimeter to the middle pin, and one tip to the right pin. The multimeter should make a noise. If not, touch the left pin and the middle pin.

Part 2: Testing the Motor

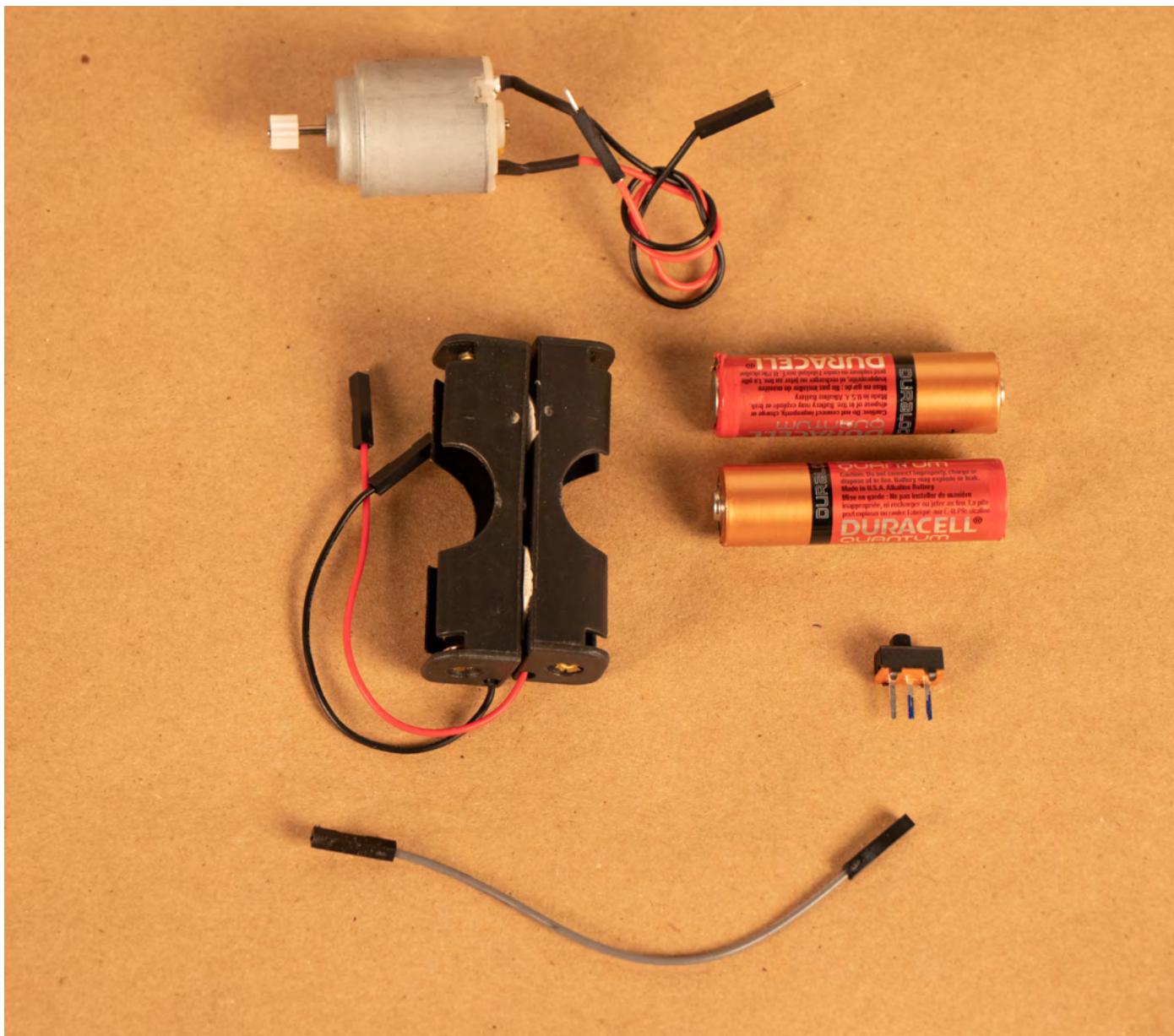
Step 4: Mark Switch Pins



Once you have found the two pins that make the multimeter beep, mark them with a Sharpie. Put the switch somewhere safe and turn the multimeter off.

Part 2: Testing the Motor

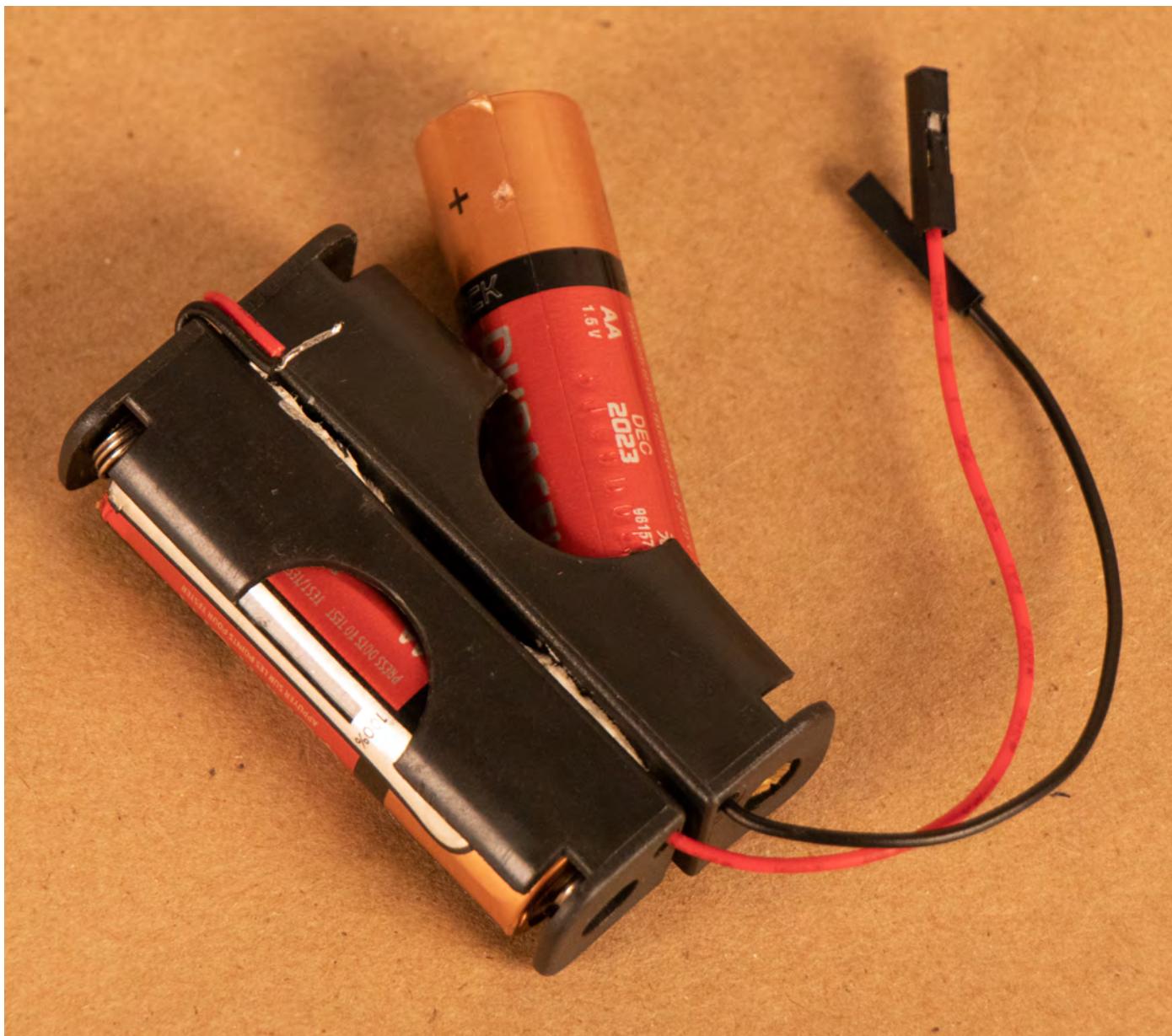
Step 5: Gather Parts



Next, gather two AA batteries, the motor and the battery holder, the switch and the connector wire.

Part 2: Testing the Motor

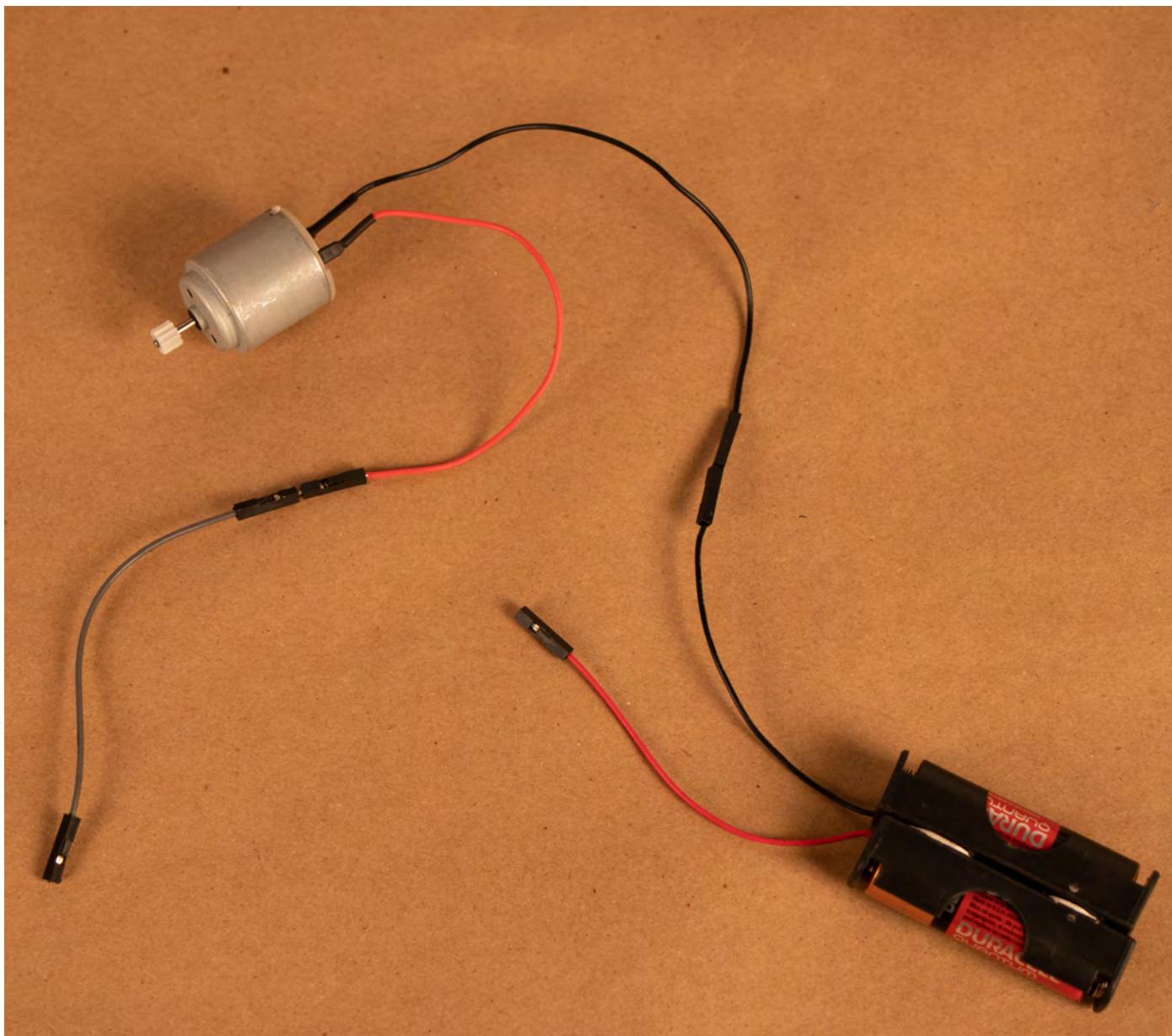
Step 6: Insert Batteries



Insert the two AA batteries into the battery holder. The battey holder has a + and - sign on each sign. The flat end of the battery is the - side, and stick it on the - part of the battery holder and then slide in the + side.

Part 2: Testing the Motor

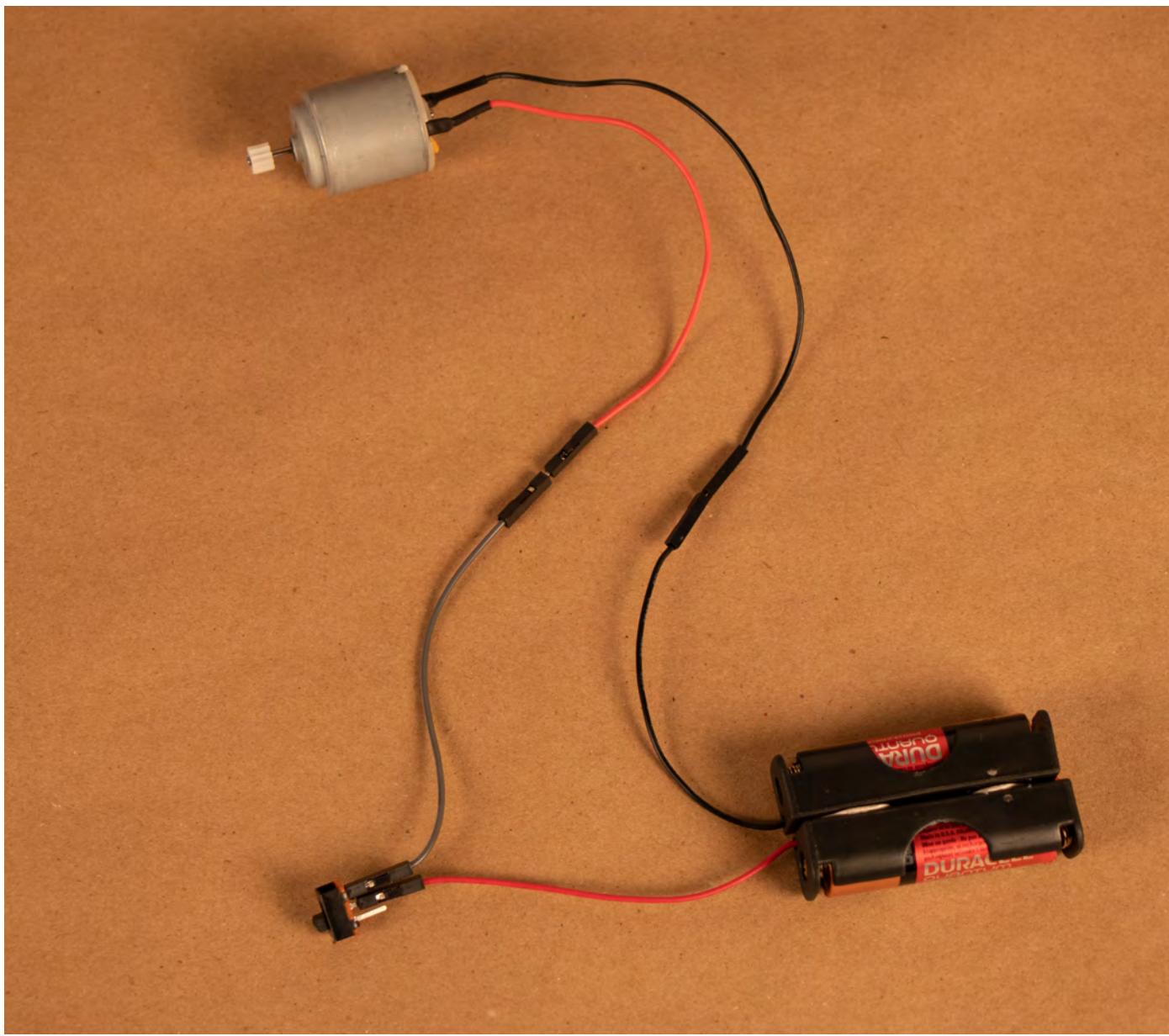
Step 7: Connect the Motor



Plug the pointy black wire from the motor into the black wire from the battery pack. Plug the pointy red wire from the motor into the connector cable.

Part 2: Testing the Motor

Step 8: Connect the Switch



Add in the switch following the image above. Make sure to only connect wires to the pins that you Sharpied! When you flip the switch, the little white gear on the motor should spin. Then turn your switch off.

Part 2: Testing the Motor

Is something not working? Let's find out why...

If your motor isn't spinning, make sure all of your wire connections are good.

If your motor isn't spinning, make sure your batteries are in the right way.

If you are still unsure, ask a friend for help! Two brains is sometimes better than one.

Finally, if your motor still isn't spinning, ask your instructor for guidance.

Part 3: Building the Chassis

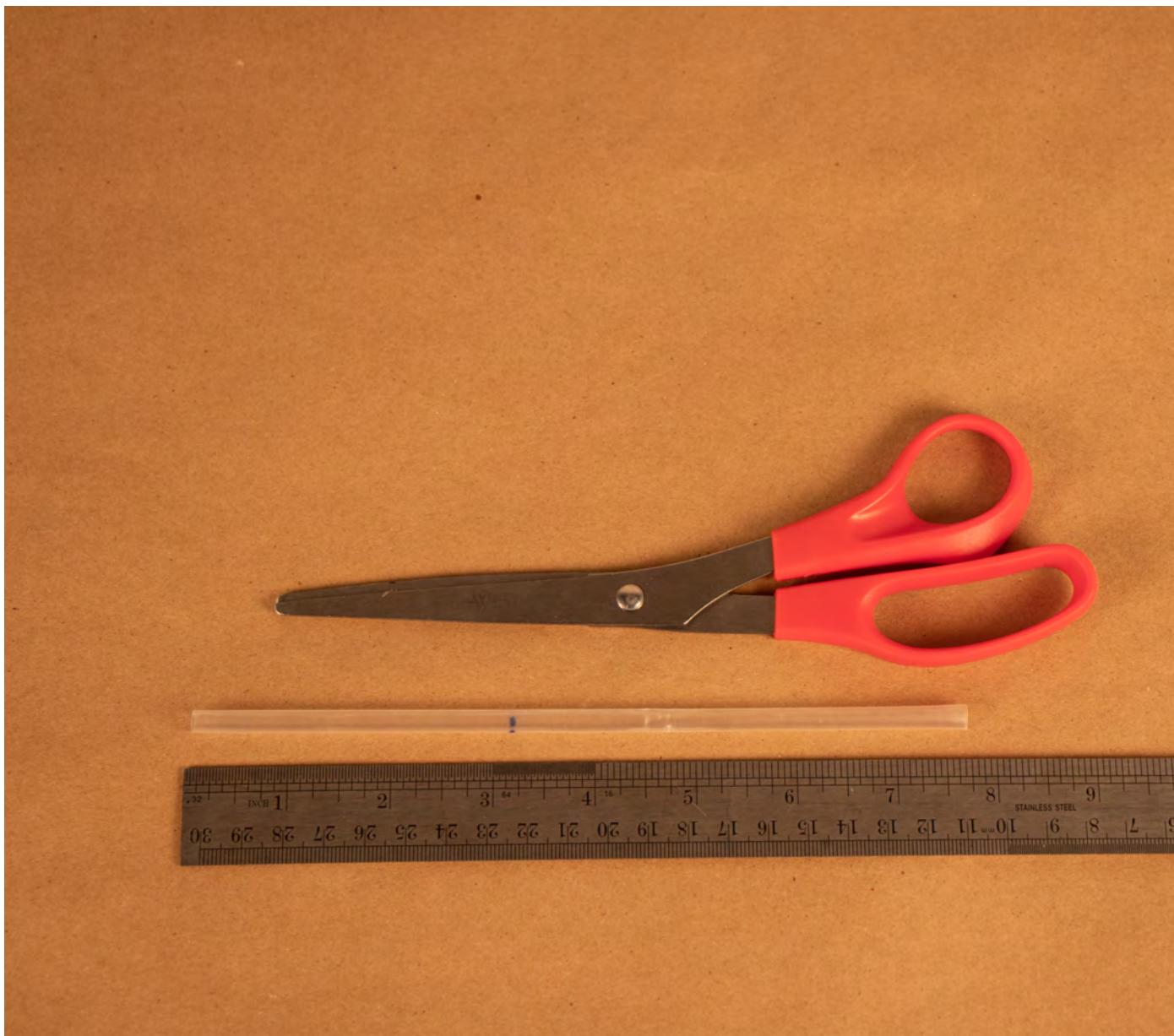
Step 9: Gather Supplies and Plug in Hot Glue Gun



Put some hot glue in the back of the hot glue gun and plug it in. Make sure to put it somewhere safe so it can't get bumped or accidentally touched (it's hot!). Grab your straw, ruler, Sharpie and scissors.

Part 3: Building the Chassis

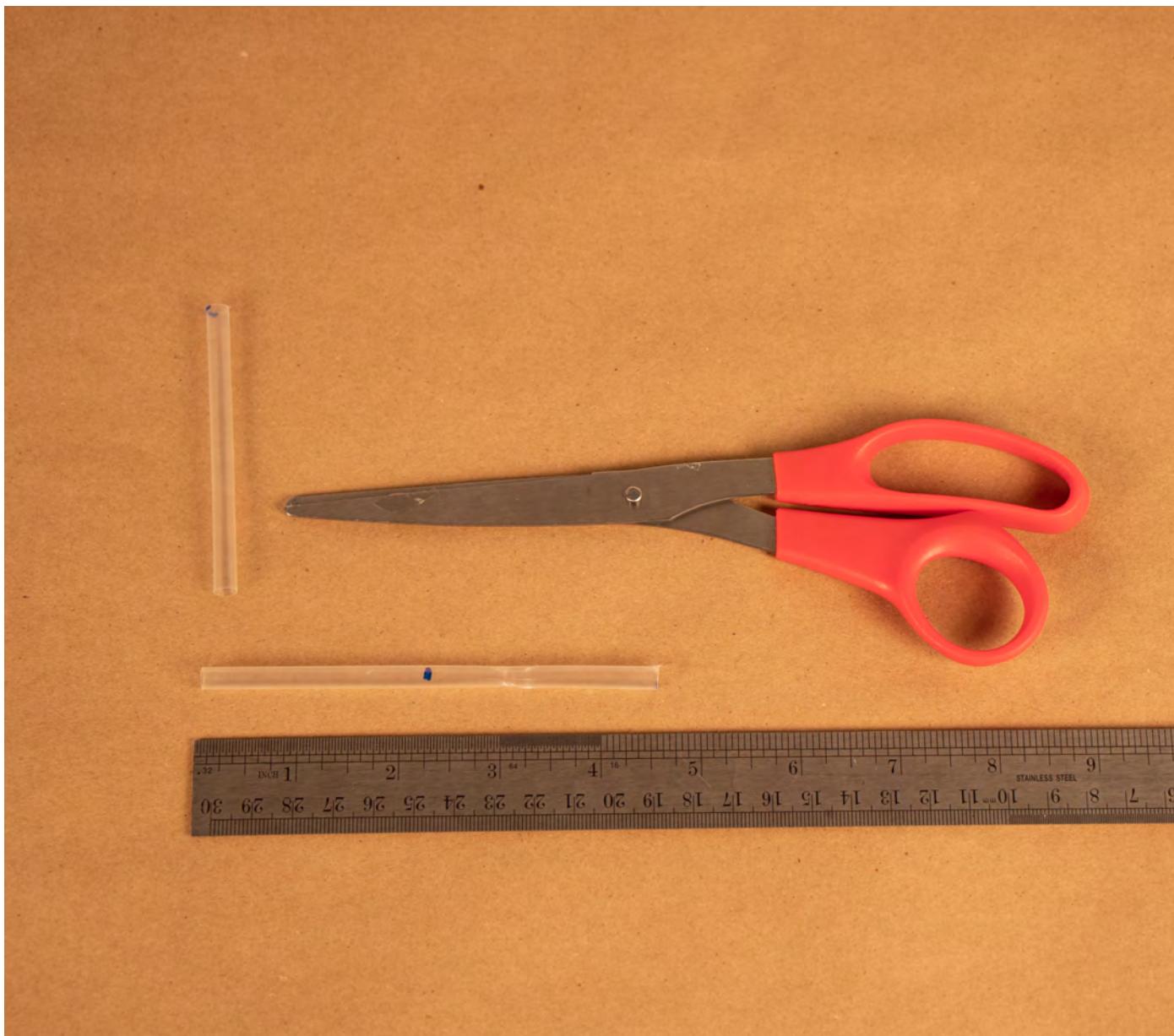
Step 10: Cut Straw 1



Using the ruler, measure $3\frac{1}{8}$ inches ($3\frac{1}{8}''$) out on the straw, mark it with your Sharpie and cut it.

Part 3: Building the Chassis

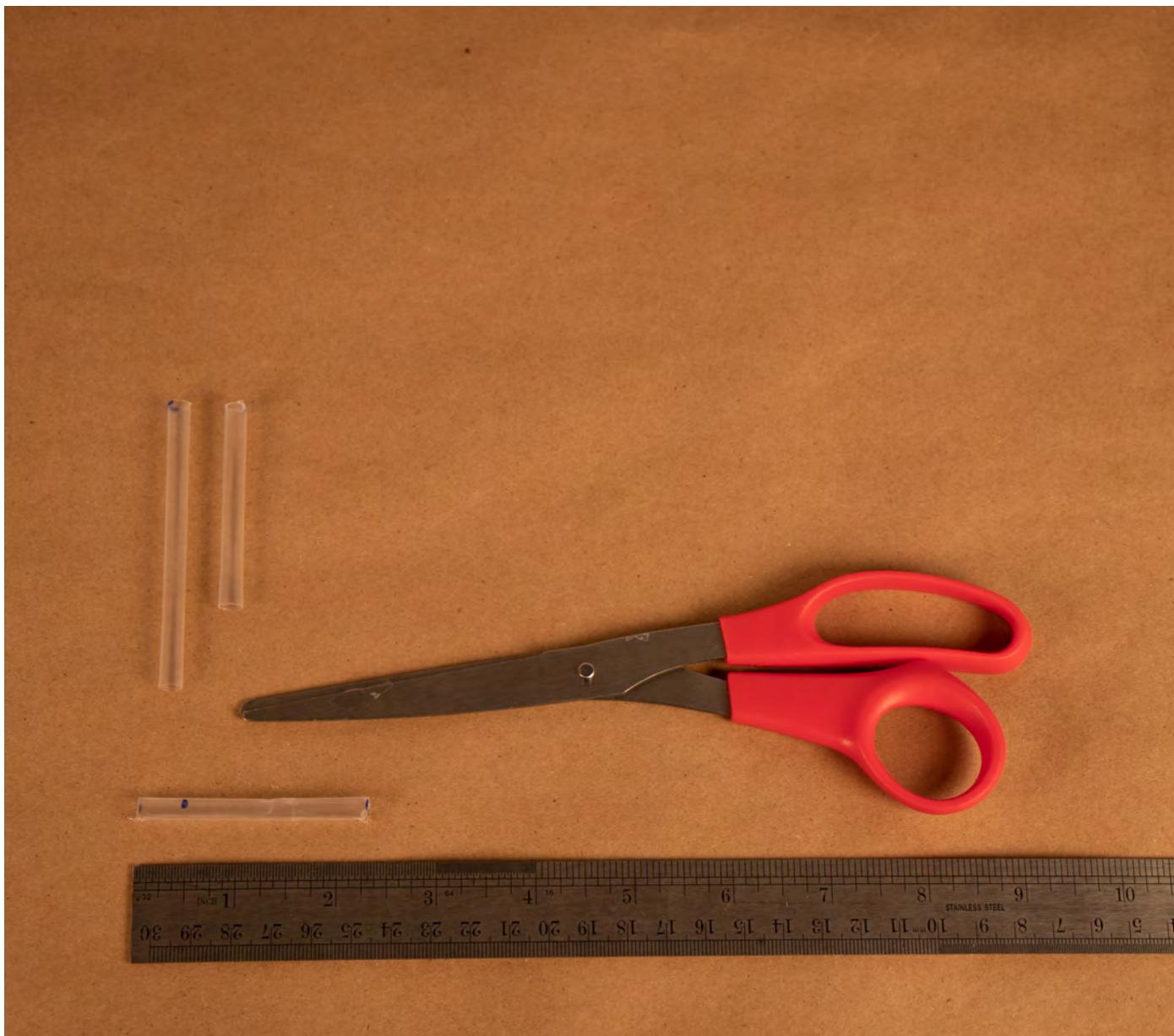
Step 11: Cut Straw 2



Using the ruler, measure $2\frac{1}{4}$ inches ($2\frac{1}{4}"$) out on the straw, mark it with your Sharpie and cut it.

Part 3: Building the Chassis

Step 12: Cut Straw 3



Using the ruler, measure 1/2" out on the straw, mark it with your Sharpie and cut it.

Part 3: Building the Chassis

Step 13: Align the Straws



Place the straws on their pre-marked spots on the chassis. They should all hang over the outer edge of the chassis a little.

Part 3: Building the Chassis

Step 14: Glue the Straws



Glue the straws in place by taking the straw off the chassis, putting down some drops of glue and putting the straw back how you aligned it in Step 13. Make sure to glue the straws straight across!

Part 3: Building the Chassis

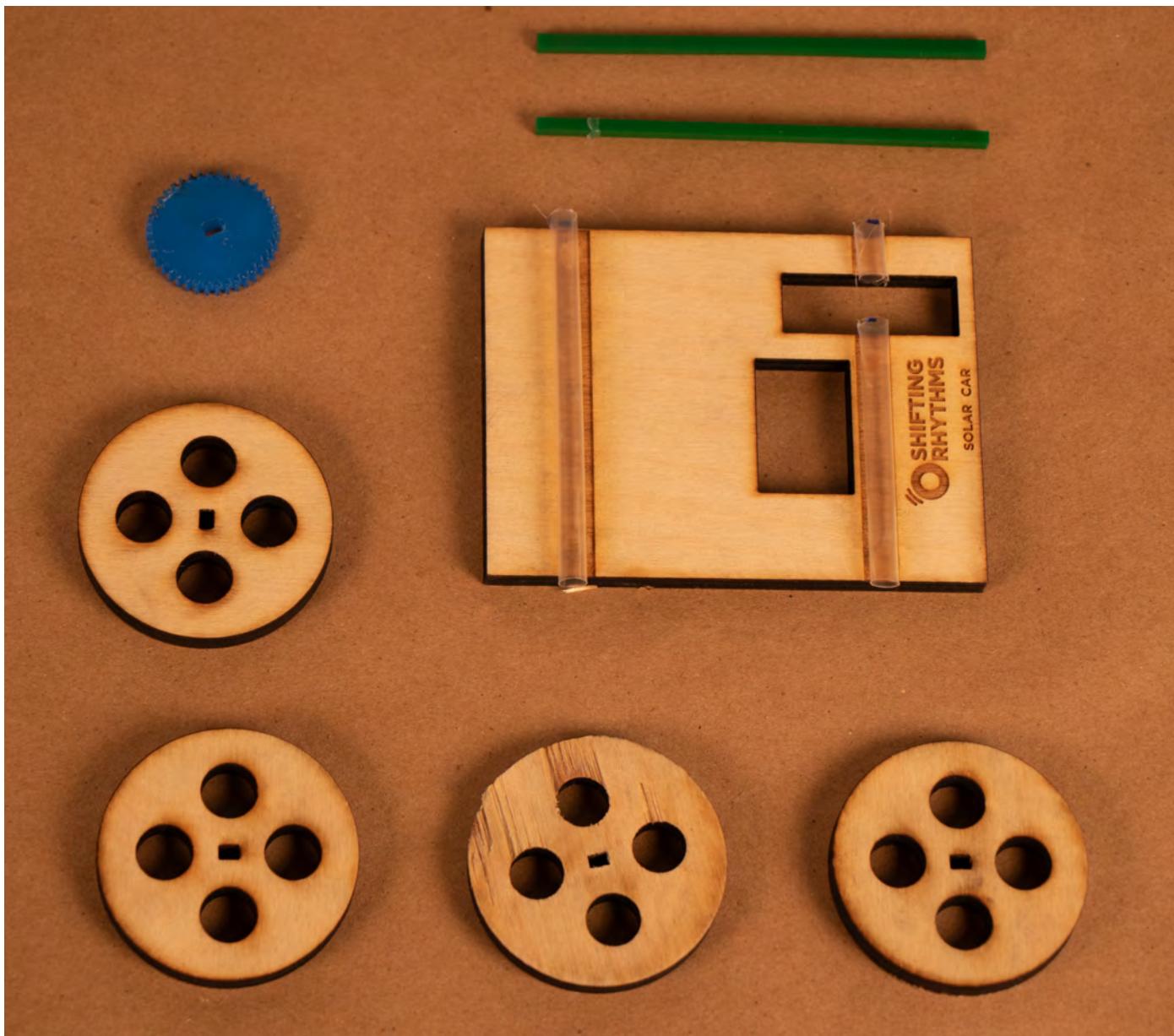
Step 15: Checkpoint



All of the straws should be glued to your chassis at this point. Make sure your chassis looks like this one. Grab a friend if you have any questions or if something doesn't look right.

Part 3: Building the Chassis

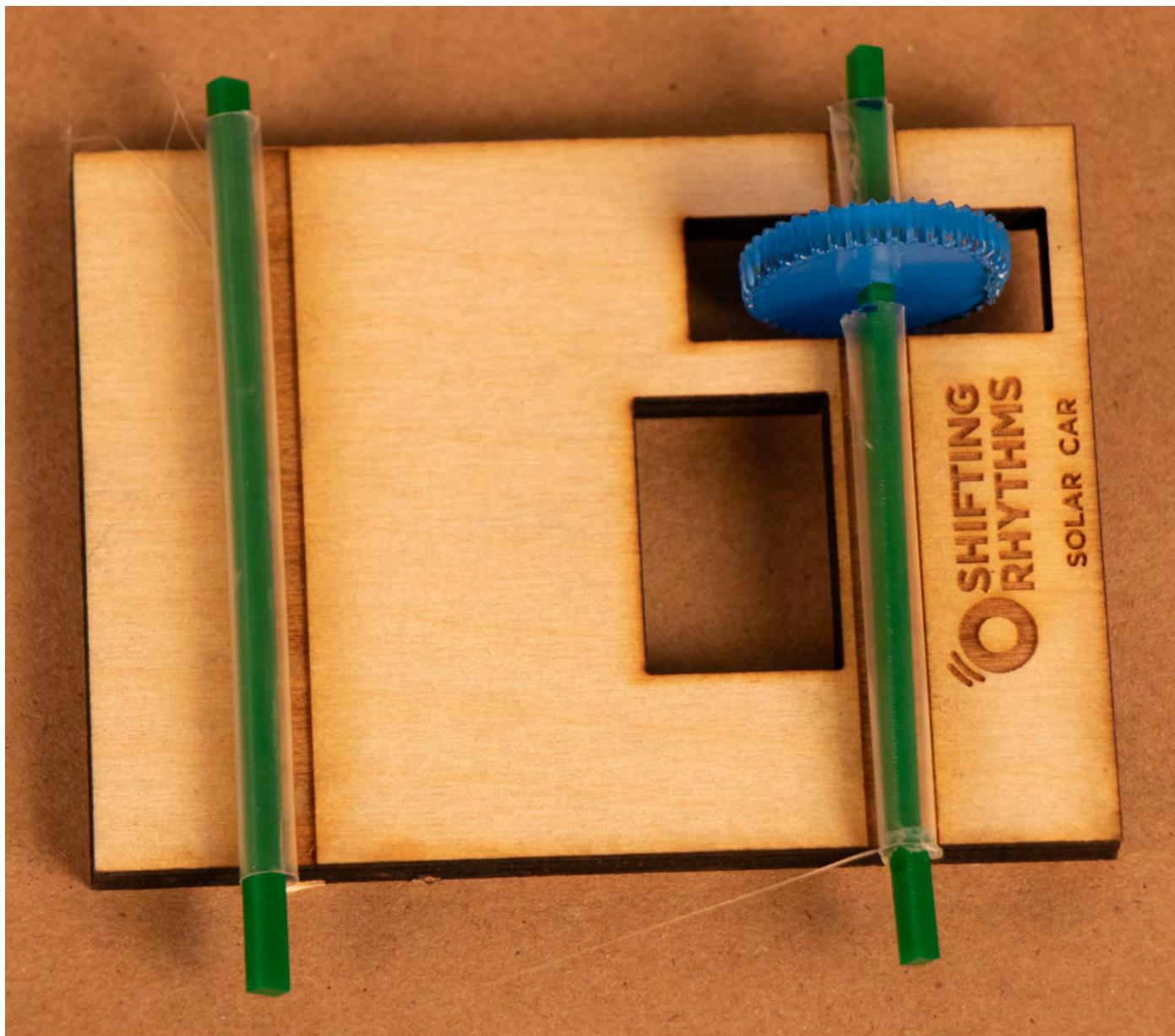
Step 16: Gather Wheels, Gear and Axles



Get your 4 wheels, 1 big gear and 2 axles ready.

Part 3: Building the Chassis

Step 17: Insert Axles



Stick one axle through the 3 1/8" straw. Stick another only through the 2 1/4" straw, then stick it through the hole in the big gear, and finally through the 1/2" straw. It should look like the one in the picture.

Part 3: Building the Chassis

Step 18: Put on the Wheels



Stick on your 4 wheels so they barely touch the straws.

Part 3: Building the Chassis

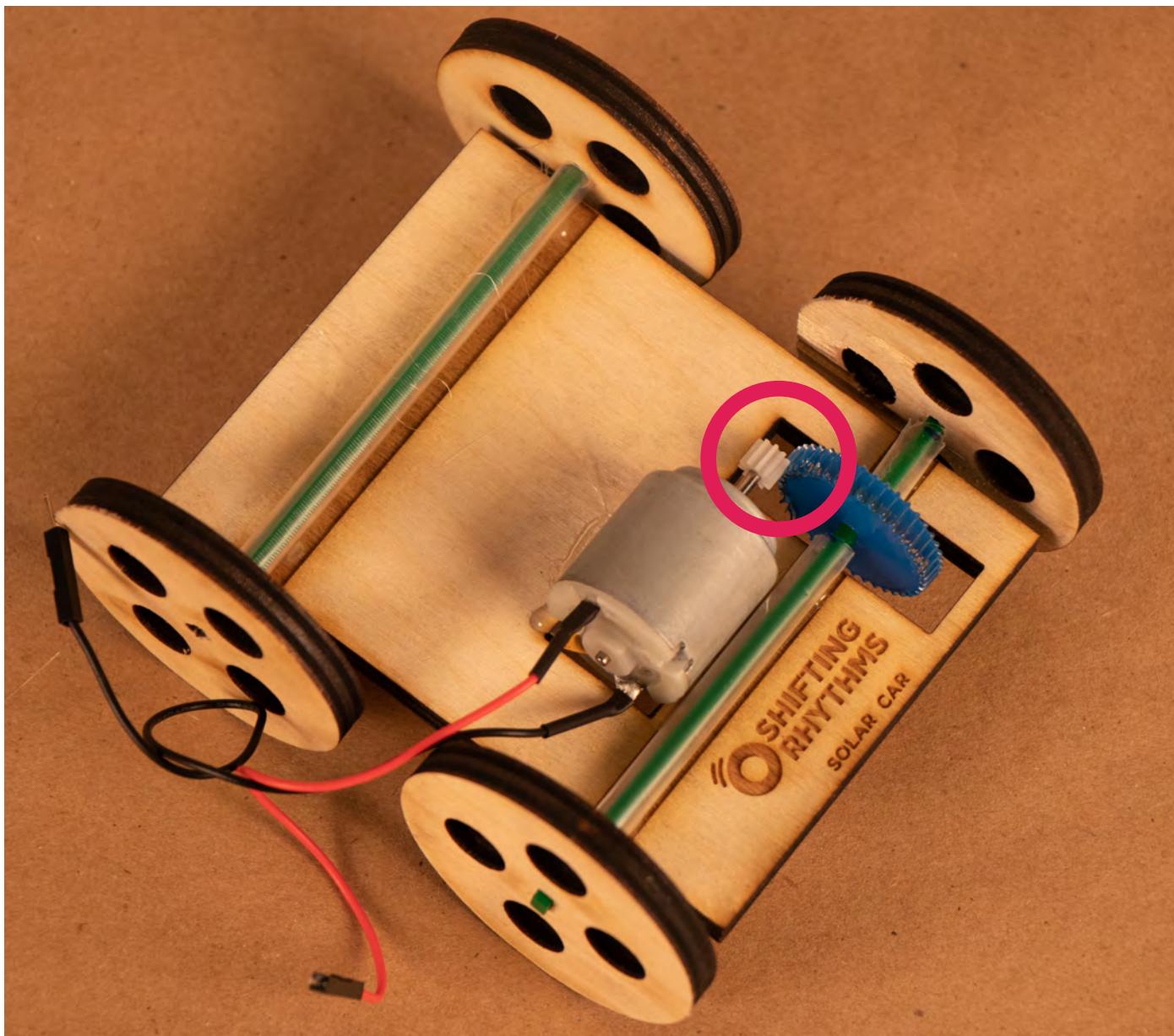
Step 19: Glue on the Motor



Lay down glue on the long edges of the motor hole, shown above as red lines, and then gently press in the motor after unplugging it from the battery pack and connector wire.

Part 3: Building the Chassis

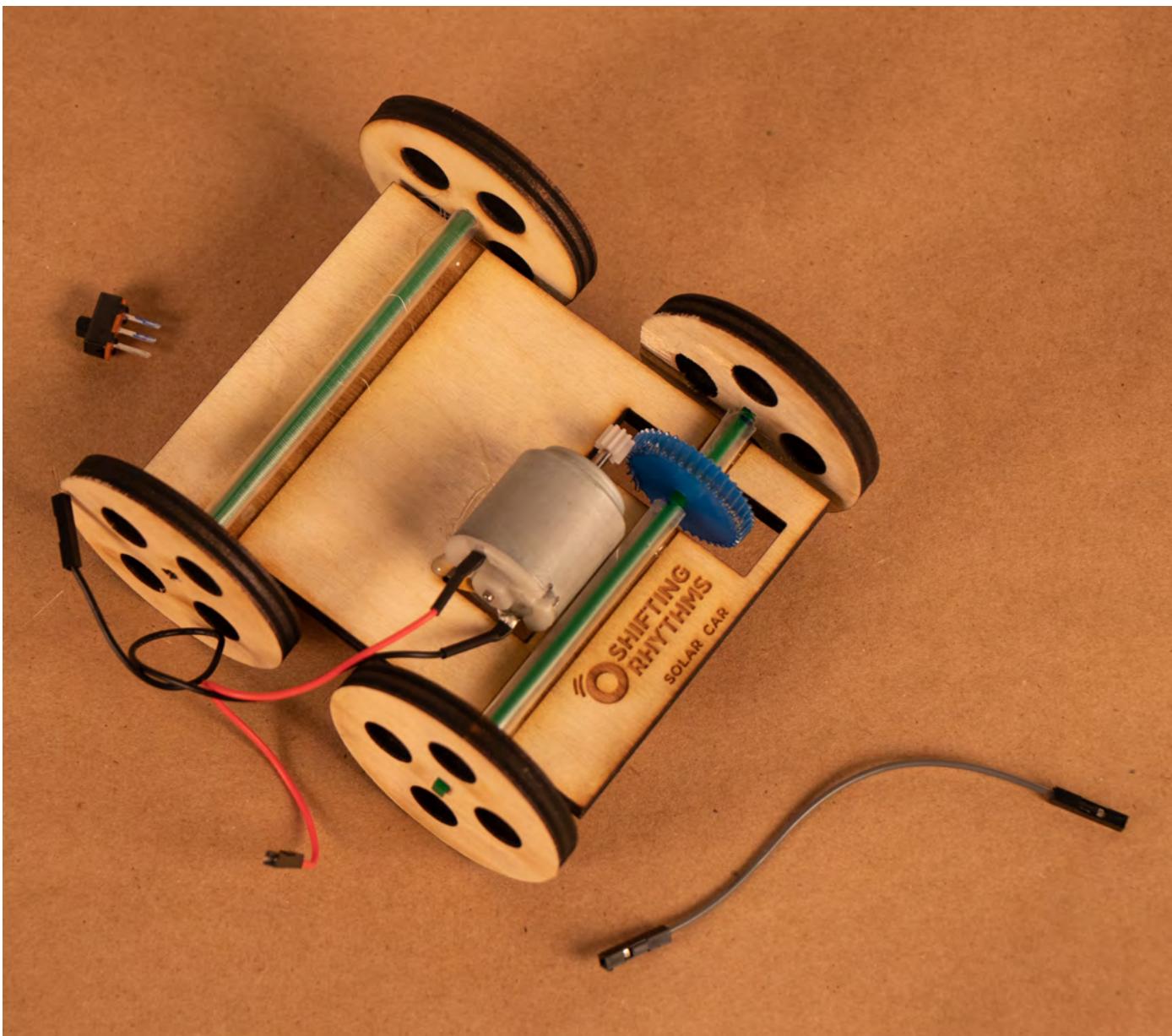
Step 20: Checkpoint



This is what your car should look like. Make sure the big gear is touching the little gear on the motor. This is shown in the highlighted area in the picture. If you are unsure, ask a friend for help!

Part 4: Adding the Electronics

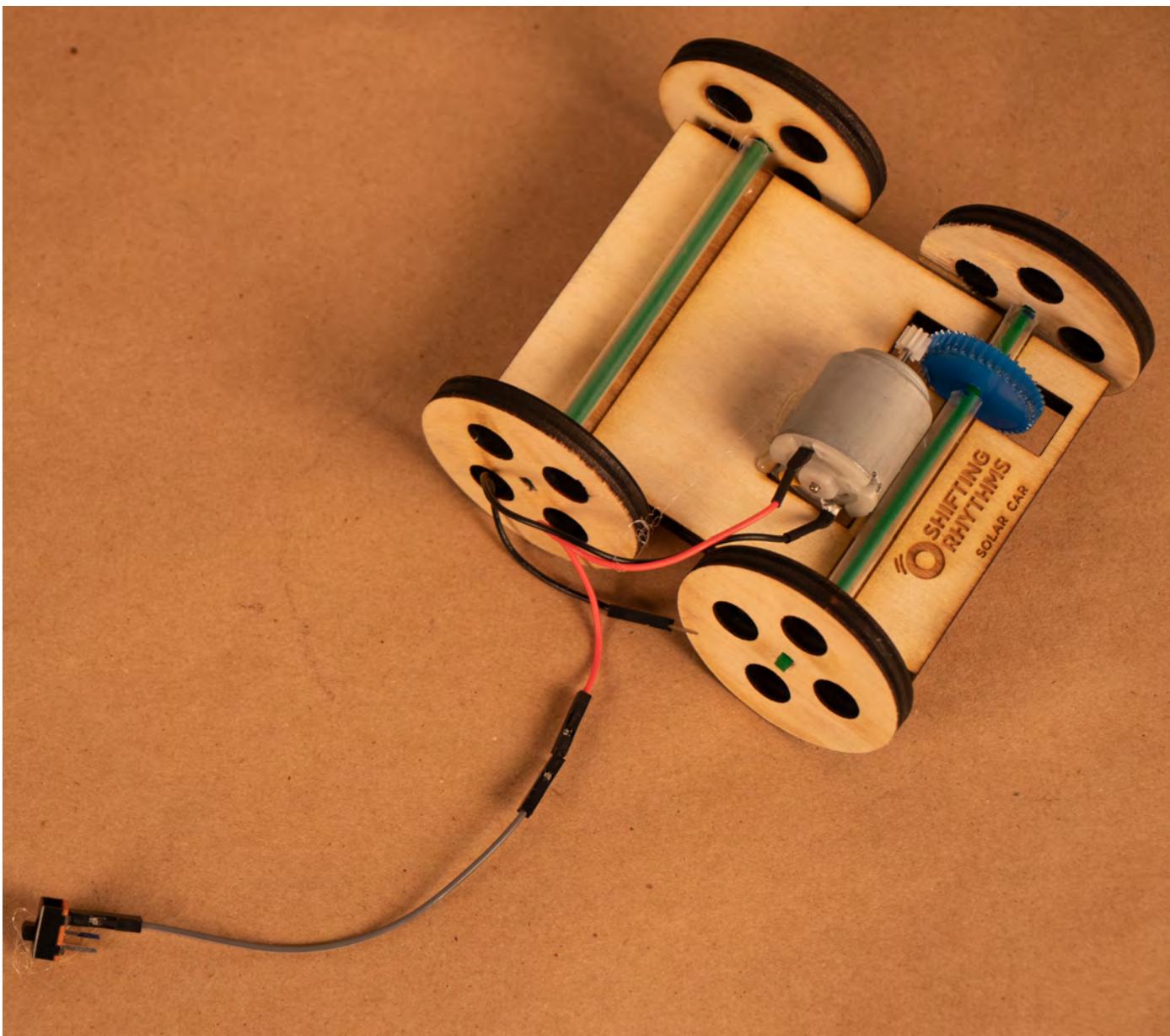
Step 21: Gather Parts



Grab your switch and connector wire.

Part 4: Adding Electronics

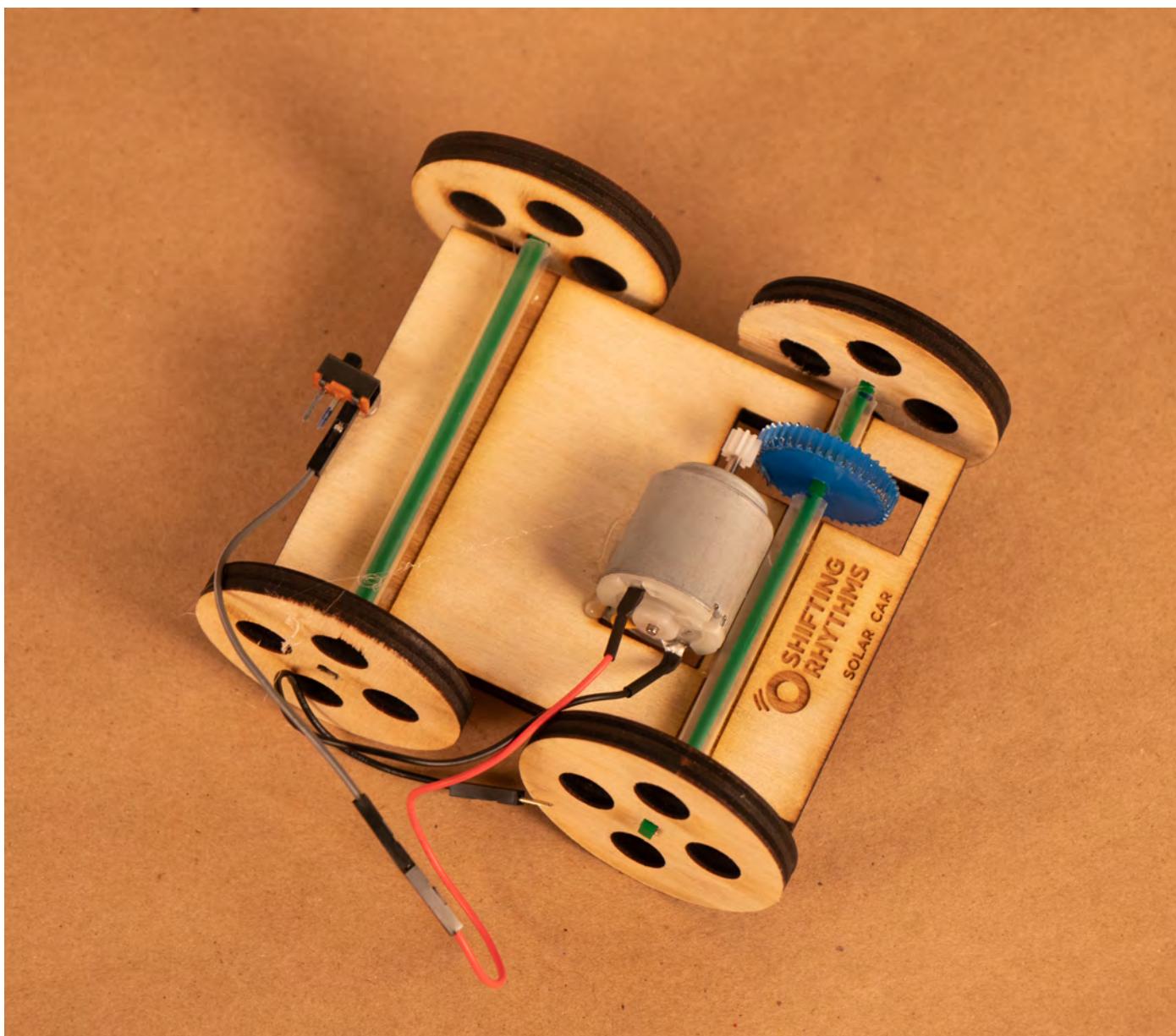
Step 22: Wiring the Switch



Plug the pointy end of the red wire into one end of the connector wire, and attach one end of the connector wire to one of the pins you marked in Step 4.

Part 4: Adding Electronics

Step 23: Glue Your Switch



With your switch plugged attached to the connector wire, place a tiny drop of glue at the front of the car and glue down your switch. Make sure not to cover the pins with glue!

Part 4: Adding Electronics

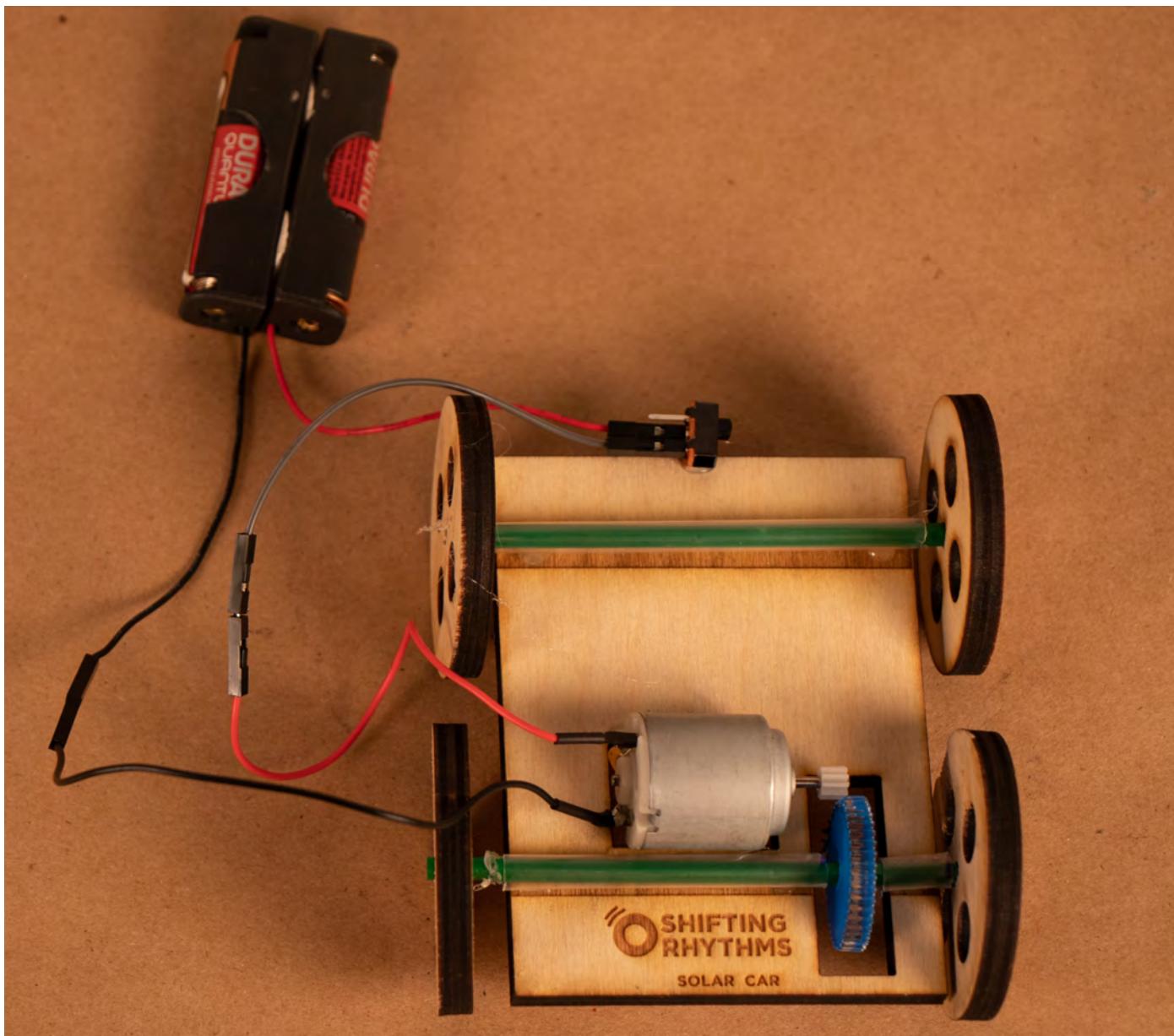
Step 24: Unplug Hot Glue Gun



Unplug the hot glue gun and carefully put it somewhere safe. It is still very hot and could burn someone!

Part 4: Adding Electronics

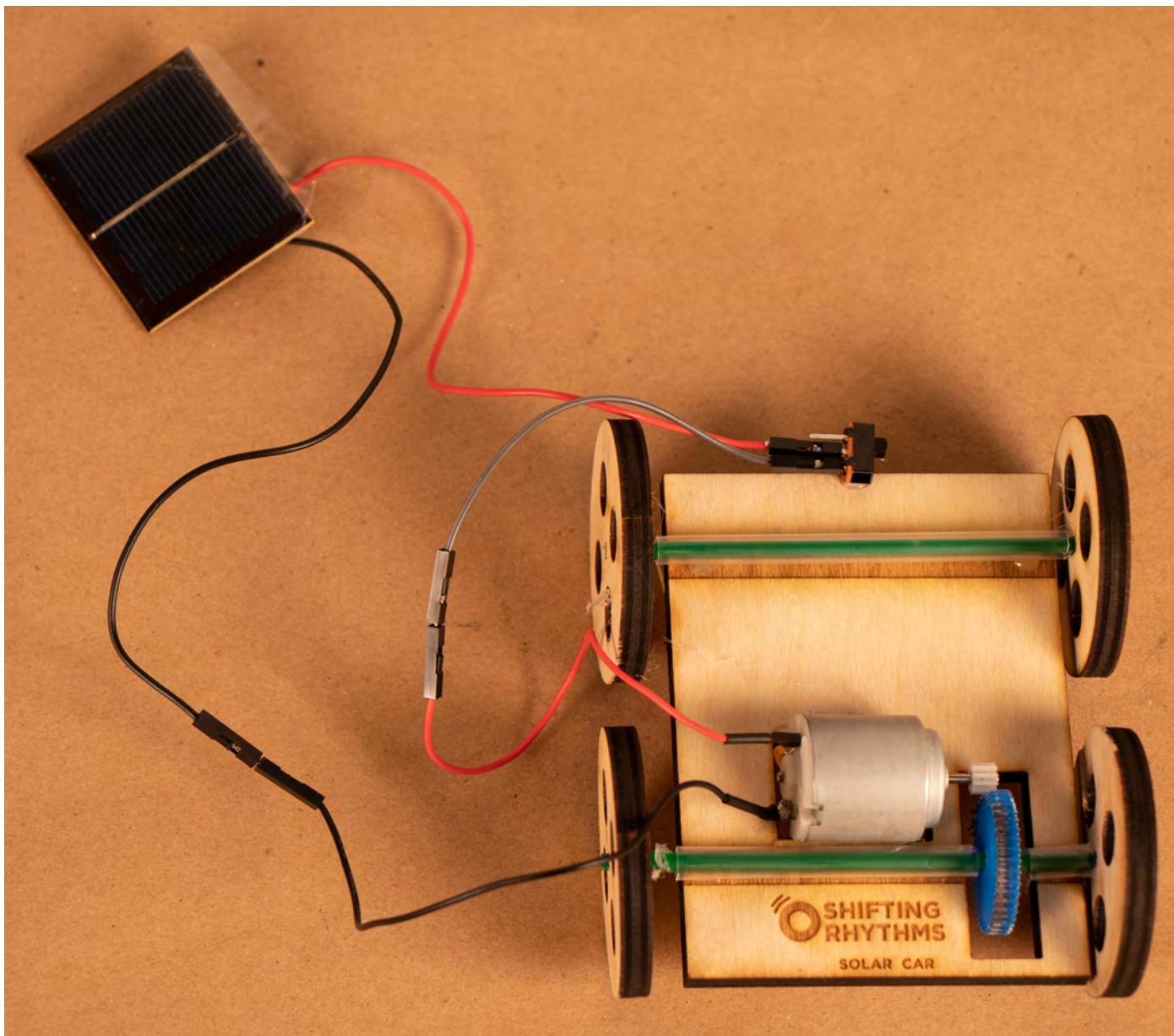
Step 25: Test with the Battery Pack



Plug the red battery pack wire into the other switch pin you marked and connect the black battery pack wire to the black motor wire. Turn your switch on! The motor should spin the big gear and as a result, the wheels should spin too!

Part 4: Adding Electronics

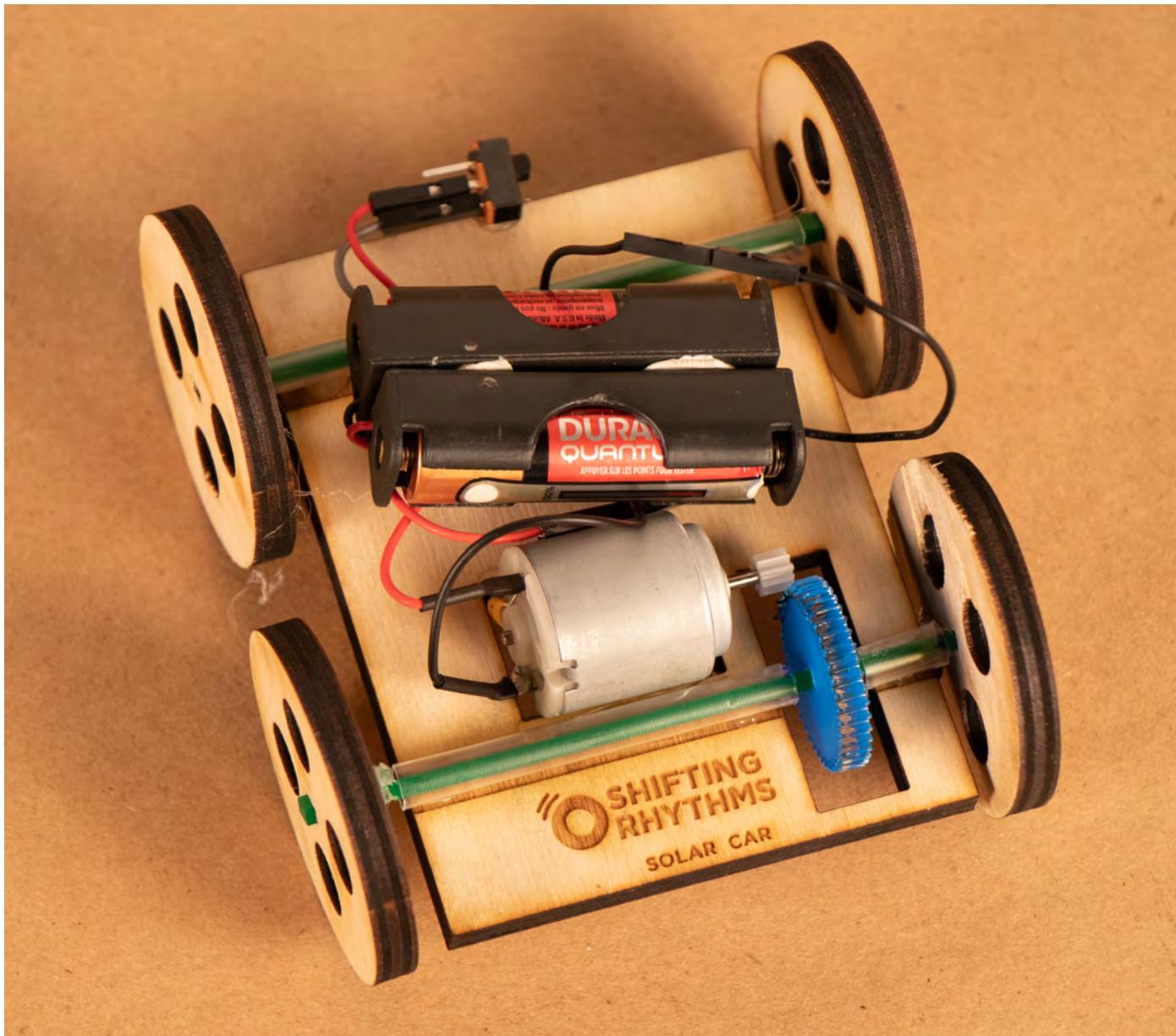
Step 26: (OPTIONAL) Swap in Solar Panel



Unplug your battery pack and wire the solar panel the same way: attach the red wire to the marked switch pin and connect the black solar panel wire to the black motor wire.

Part 5: Arranging Wires

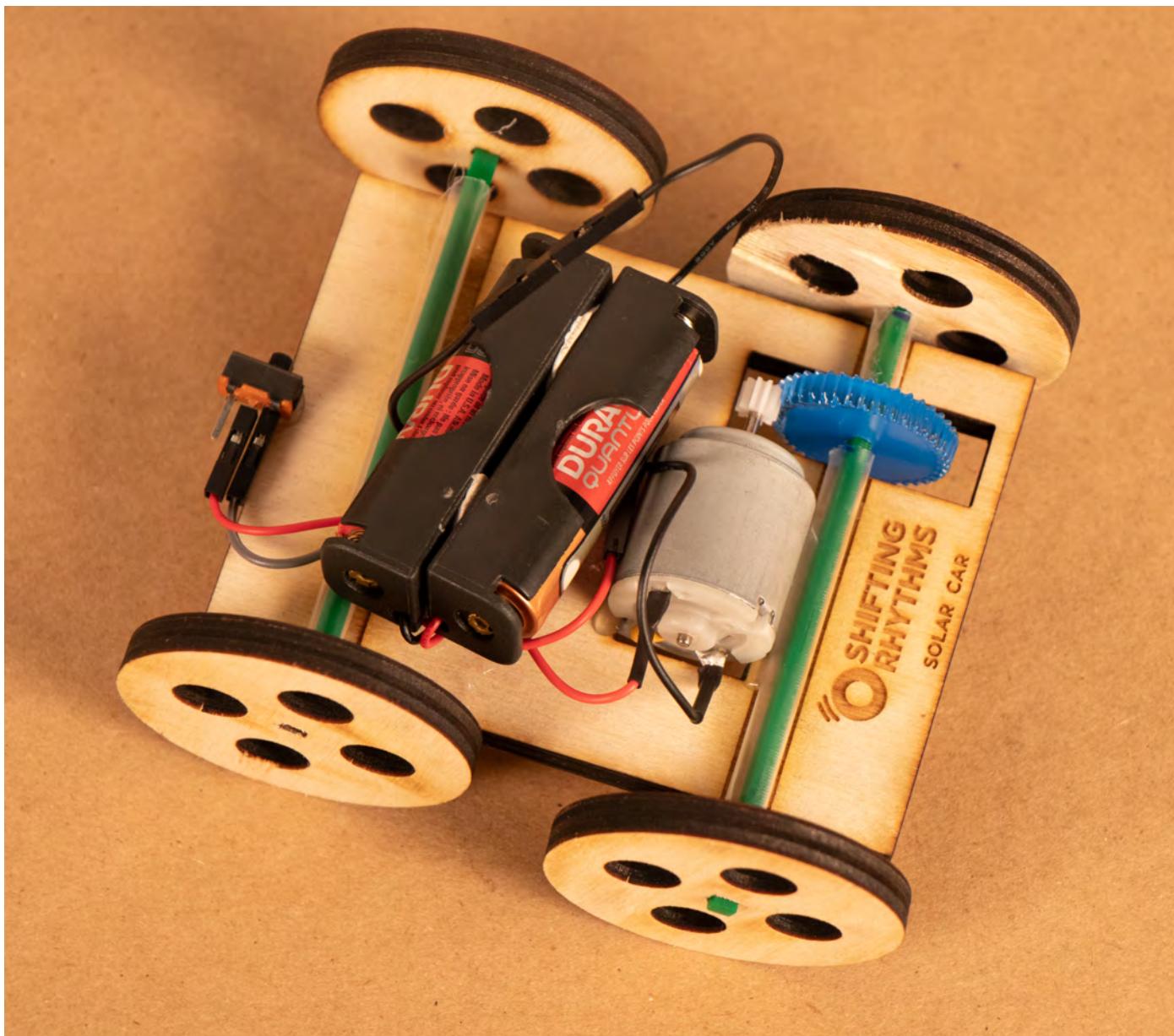
Step 27: Fold Wires and Place Panel/Pack



Fold all of the wires together and secure them with a clip. Then, put the battery pack or solar panel on top and secure it with a small strip of tape.

Part 6: Testing

Step 28: Watch it Roll!



If your car has a solar panel, you need to put it in direct sunlight. Flip the switch, put it down and watch it go! With a battery pack, you can do it inside or on a cloudy day. Find a partner and see whose car drives straighter.

Part 7: Troubleshooting

Is something not working? Let's find out why...

If your car isn't working right, try some of the following steps:

Make sure all your wires are connected tightly. If you find a loose connection, you might need to push the wires together more.

Make sure your red wires are plugged into the right pins on the switch. Remember, you can test this with your multimeter.

If you're using the solar panel and the car won't drive, try spinning the gear a little bit. Sometimes this helps jumpstart the motor and get it running when it's in the sunlight.

Make sure nothing is covering up your solar panel. If the solar panel can't see the sun, it won't get any power to make your car drive.