# Solar Rover

by REchargeLabs

Build a Solar Rover that uses power from the sun, then design wheels to explore imaginary planets (or your backyard)!

When scientists and engineers send out a rover to Mars, which is more than 33 million miles away from earth, they make sure it has power so it can move around. Power allows them to control and navigate the rover. The rover collects and sends data back to scientists and engineers here on earth.

Power and wheels are two of the many important components on a rover. In this activity, the goal is to make a Solar Rover that can travel from point A to point B over obstacles and terrains.

**Through this designing and engineering process, you will learn;**

- How to harness the cleanest and most abundant renewable energy, solar energy.
- Learn about basic circuitry with a solar panel as a power source, spring connectors as input, and motor as an output.
- With the material provided in our Recharge Labs' kit, it include a super capacitor as an energy storage options. You will learn about the importance of storing energy and why it's needed when it comes to Solar energy.
- You will learn about traction by experimenting with different materials and wheels designed to overcome the rough and unforeseen terrains a Rover must face.

You are highly encouraged to manipulate and change the shape and design of the non electronic parts.

If you choose not to get the kit from REcharge Labs, you can easily find the materials used in this activity with a couple searches.

## Step 1: Here Are the Materials You Will Need

**Rover's main parts:**

(1) 2” by 6” Cork base

(1) Gear motor

(1) Solar panel

(1) Solar panel stand (optional for Charging station)

(1) 2.7V-10F super capacitor

(1) Straw for front axle holder

(1) Candy melts treat stick, or paper stick ( axle)

(1) Roll of masking tape

(2) Spring connectors

(4) Axle adapters (here is a link to 3D print the axle adapters

or you can get them from rechargelabs.org).

(4) Pool noodle foam wheels

**Optional wheels exploration parts:**

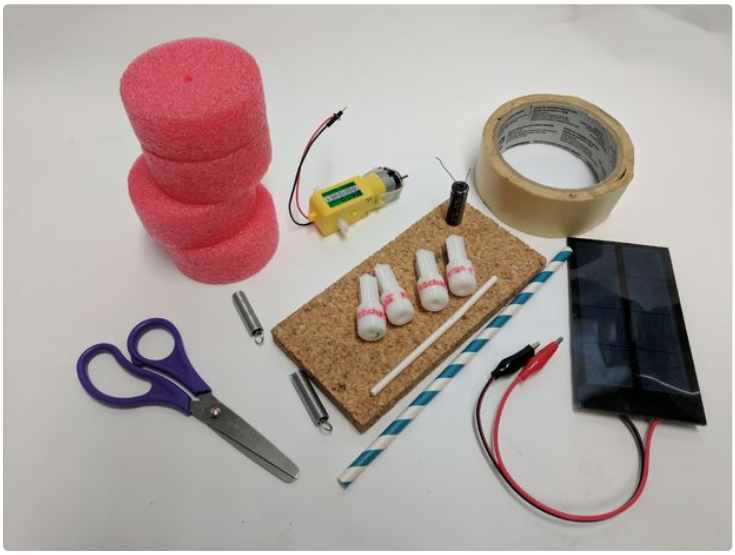
Thick rubber bands (size of the rubber band must fit with the foam wheels)

Different grit of sandpaper

Screws to make studded wheels

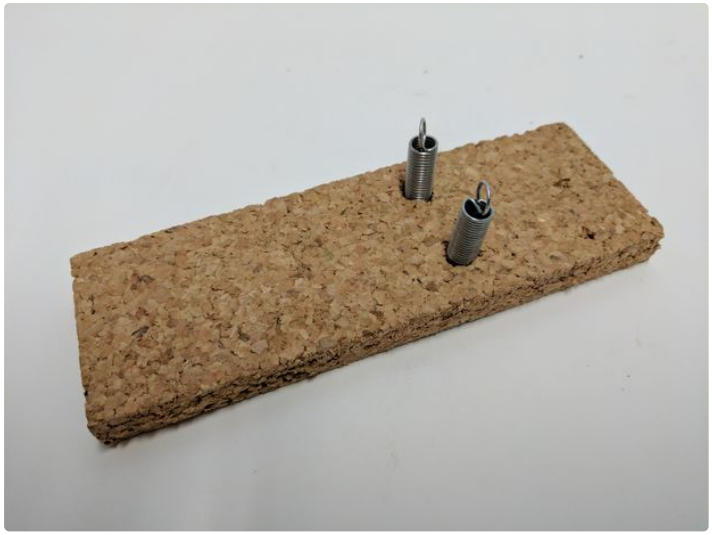
Scissors to trim or change wheels.

Other materials around the house or classroom to experiment with traction.



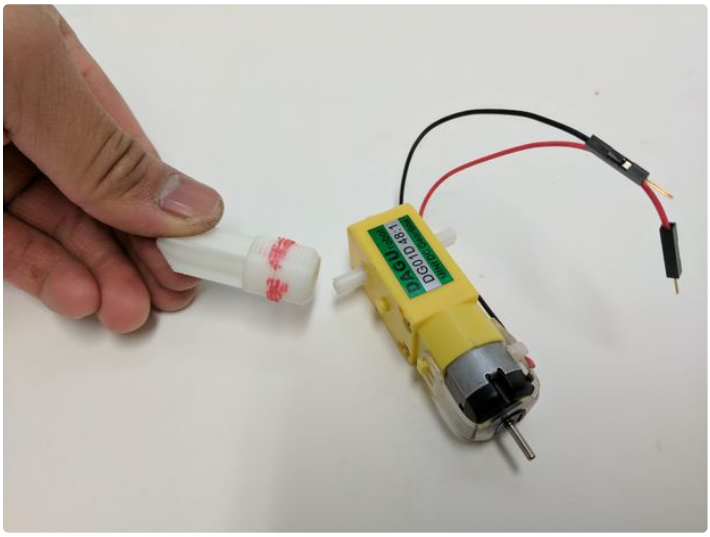
## Step 2: Rover's Frame

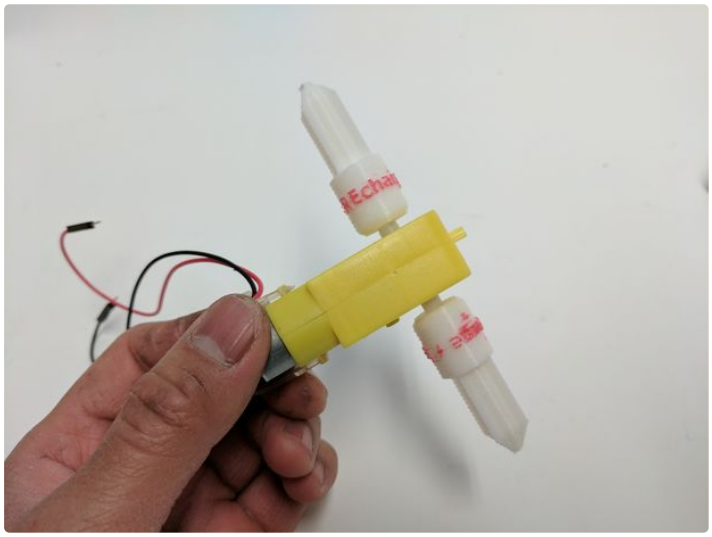
Use a cork sheet as the frame of the rover. Put each spring in the hole on the cork. These springs will act as connectors.



## Step 3: Motor With Axle Adapters

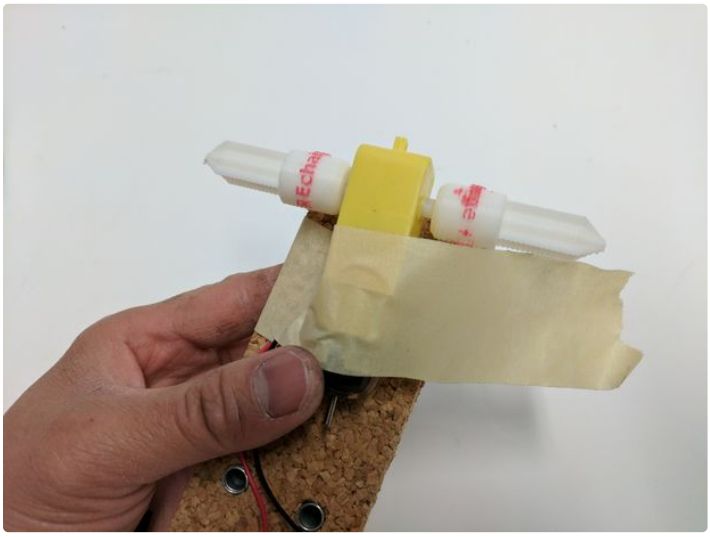
Take two axle adapters and the motor. Force fit the two axles onto the motor. Try to push them both on at the same time with pressure from each side.

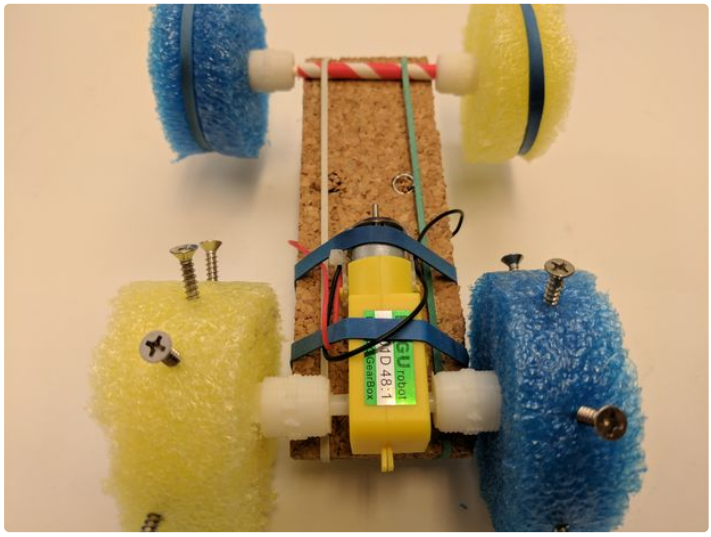




## Step 4: Motor on the Frame.

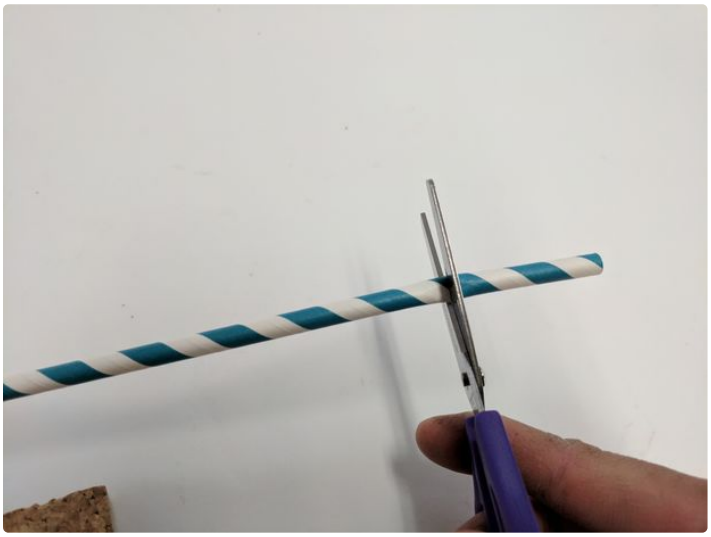
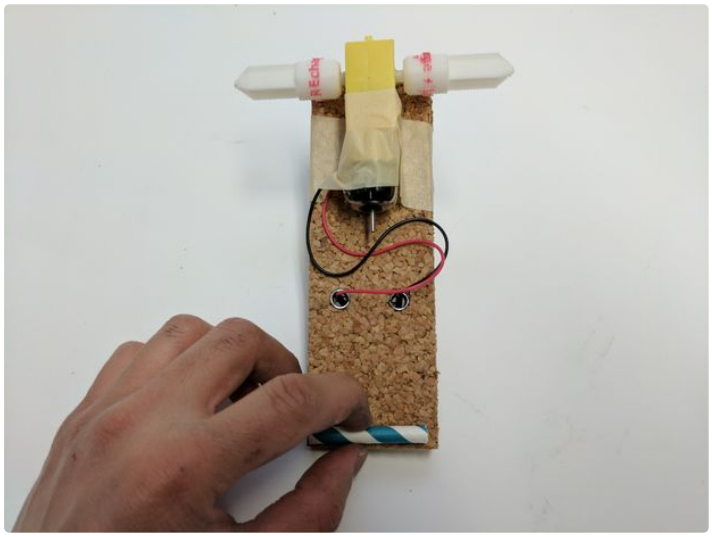
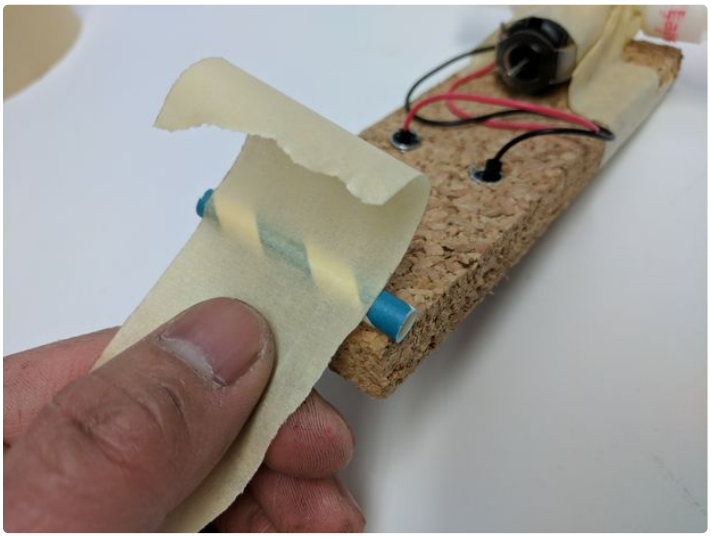
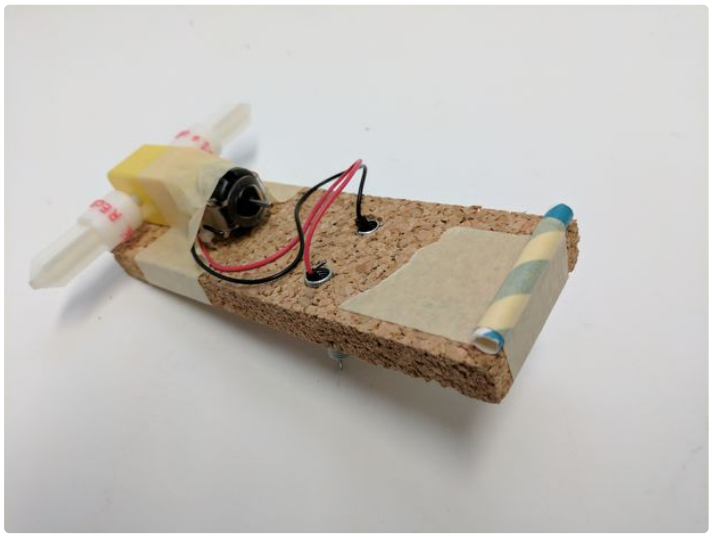
Now, tape your motor to the cork frame. Or use rubber bands to hold the motor to the cork frame.





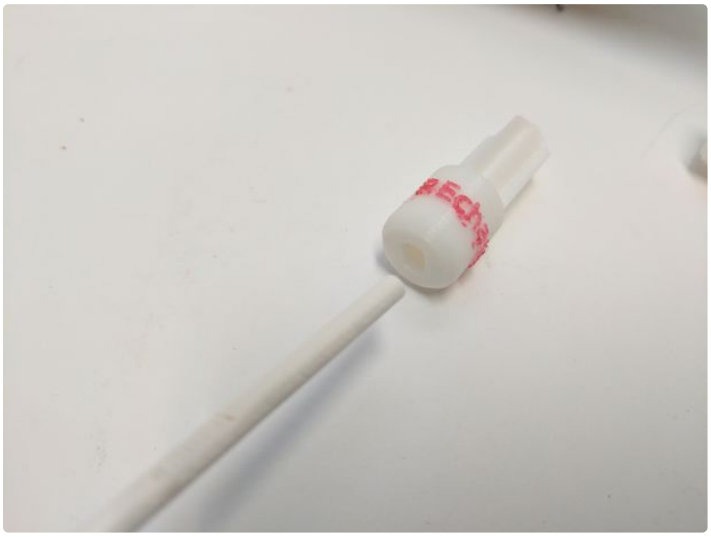
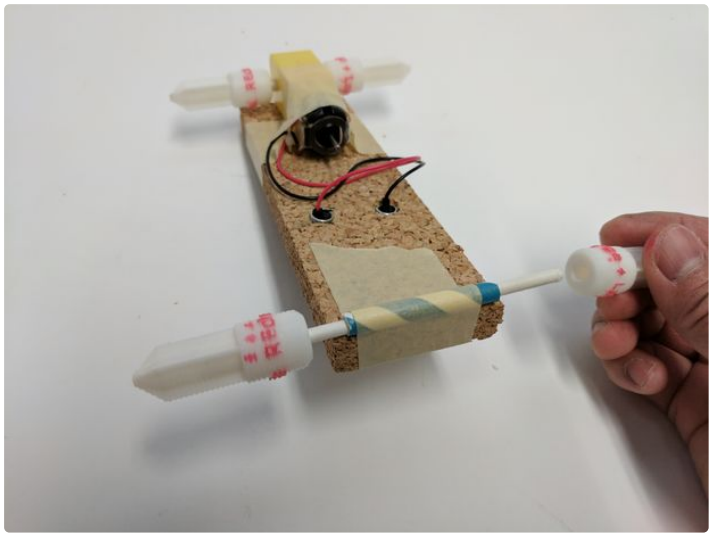
## Step 5: Front Axle Holder

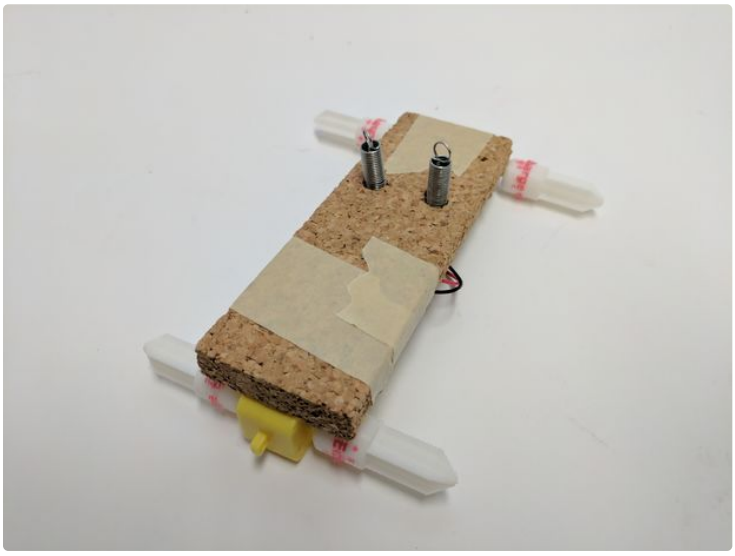
Cut the straw to the width of the cork frame. Place it in the front end of the cork frame. This straw will hold the front axle in place.

## Step 6: Front Axle

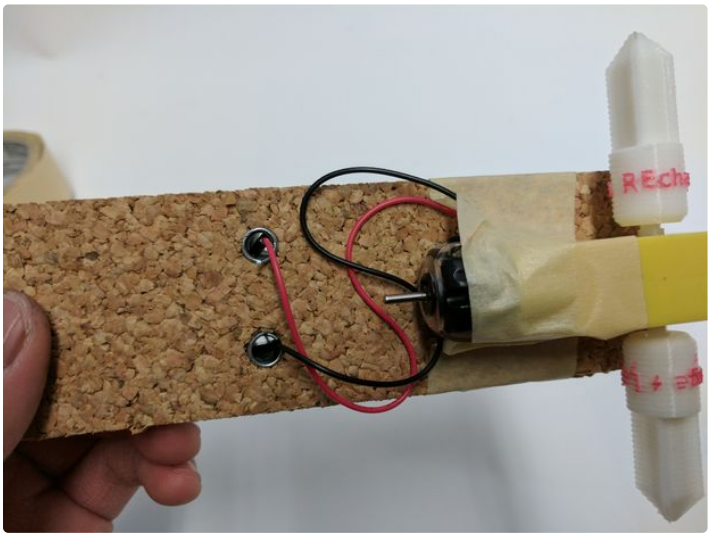
With the paper stick, put in one of the axle adapters. Then put the other end through the straw/axle holder on the rover. Finish the front axle with another axle adapter.

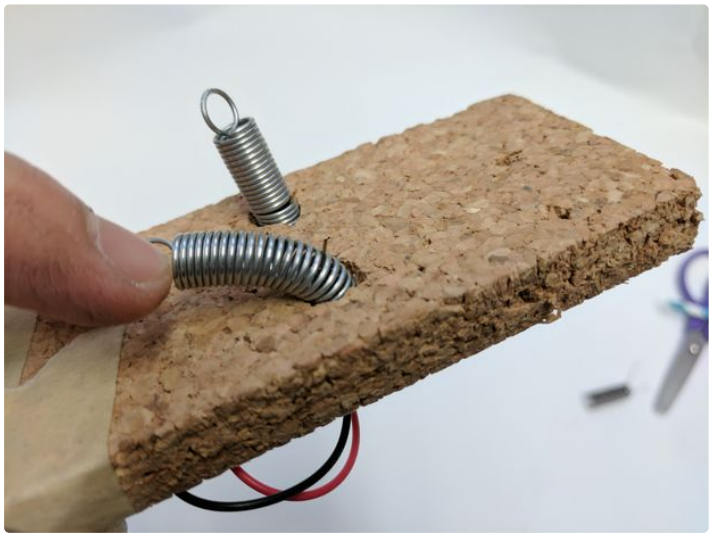



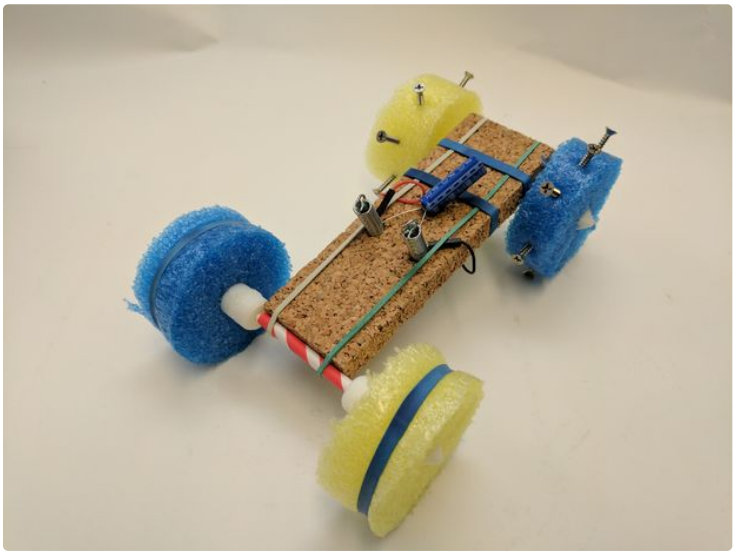


## Step 7: Spring Connectors

Connect the motor wires to each spring. Put each wire through a spring hole from the bottom up. On the top side, bend each spring to clamp down each wire. Make a note on which color wire is connected to which spring. Red is positive (+) and Black is negative (-). The wires from the motor can also go on the side of the rover. It does not has to go through the hole of the springs.

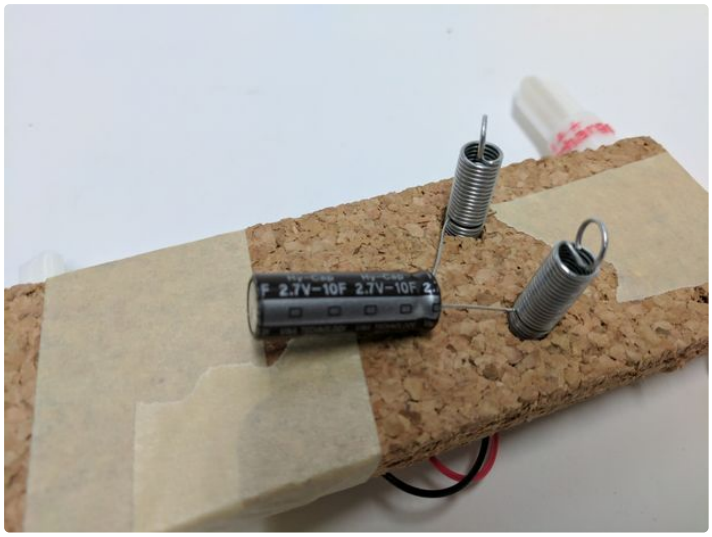






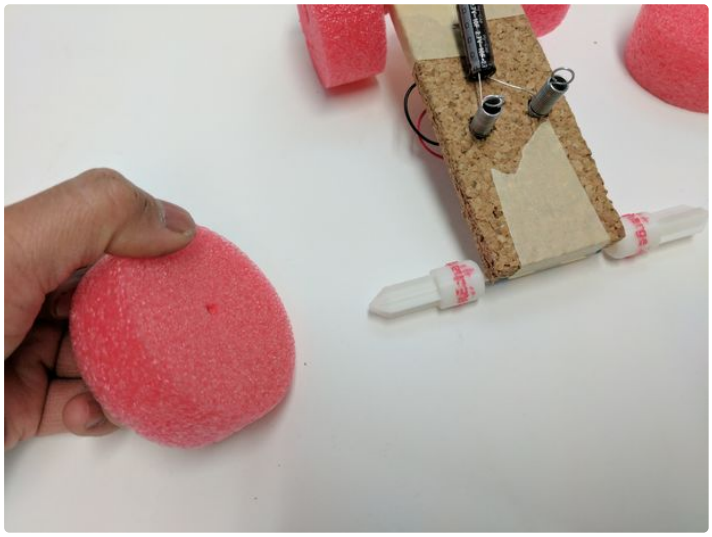
## Step 8: Storing Energy

Use a supercapacitor as energy storage. Connect the supercapacitor to the motor by putting the longer leg to the spring where the red (+) wire connected to. Then connect the shorter leg on the supercapacitor to the spring where the black (-) wire connected to.




## Step 9: Adding Wheels

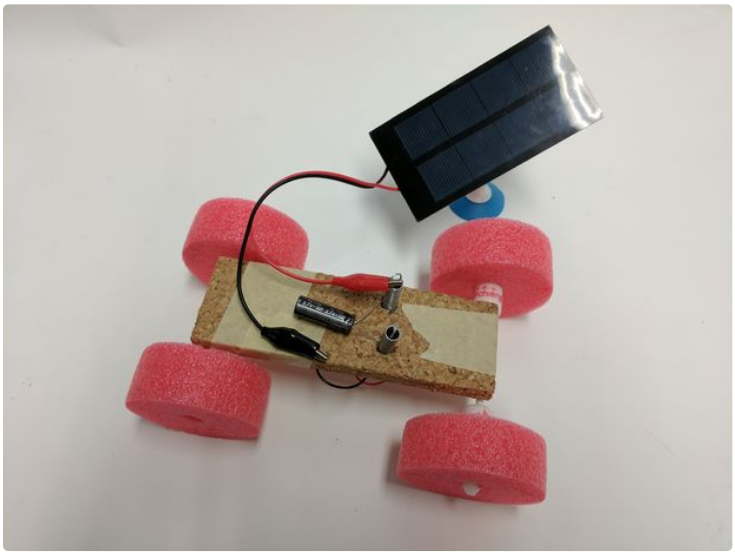
Adding wheels to each axle. At this point, try not to add anything or make change to the wheels just yet. Make changes to the wheels after testing to see if the Solar Rover works.



## Step 10: 3 Ways to Make the Solar Rover Move. Method 1: Charging Station

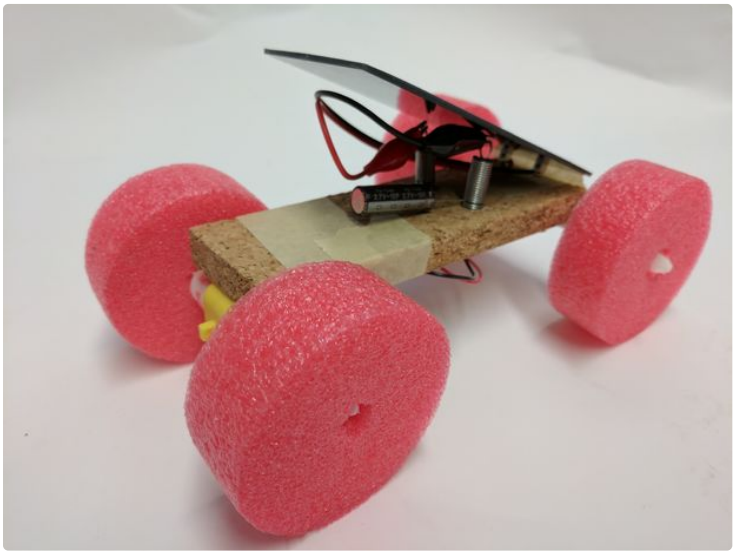
To make the charging station, create a stand for the solar panel. Or you can use a suction cup phone stand to hold the solar panel.

To charge the Rover, connect the red (+) wire from the solar panel to the positive spring and the black wire to the negative spring. Put it out in the sunlight for about 30 seconds or until the Rover starts to move. When the Rover is ready and starts to move, disconnect the rover from the solar panel. Try to time the rover to see how far it can go depending on how long it's charged.



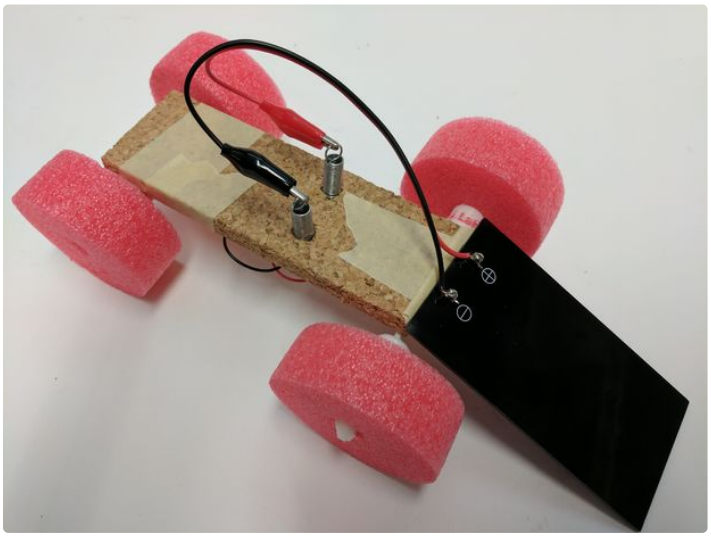
## Step 11: Method 2 ...Solar Panel and Supercapacitor On-board

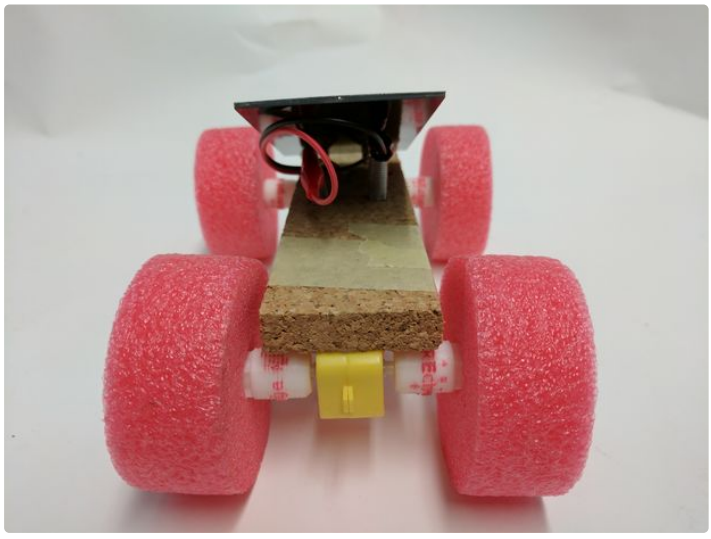
Have the supercapacitor and the solar panel on board. To do so, follow the same connection as the previous step but put the solar panel on the rover instead of a stand.



## Step 12: Method 3: Direct Connection to the Solar Panel

You can experiment with connecting the solar panel directly to the motor without a super capacitor.





## Step 13: Observation and Data Collection

- What are the advantages and disadvantages of:
    - Having a charging station?
    - Having a solar panel on the rover with direct connection?
    - Having a solar panel on the rover and super capacitor as power storage?
- What materials have more traction on what surface?

For a complete kit and more experiments with Solar and Wind energy? Please, visit our website at rechargelabs.org