

Building a Junior Solar Sprint Car

In this activity you are going to use engineering design principles to build a solar powered car. The Junior Solar Sprint Kit from Solar Made® provides you with most of the necessary components to build your car. A chassis (the frame of the car) must be built using balsa wood or another lightweight and strong material. The chassis should be designed to be stable and it should not break when the motor, panel, and wheels are connected to it. When designing the chassis, the placement and alignment of the wheels need to be planned carefully.

Junior Solar Sprint Kit Includes:

- Official JSS Solar Panel (Specs: 3V, 3W, 4.5"x13", 4" Flat Wire Leads)
- Official JSS Solar Motor (6" Stripped Wire Leads)
- Motor Mounting Bracket w/ Screws
- (3) Motor Shaft Gears
- (2) Alligator Clips

Junior Solar Sprint Deluxe Kit ALSO Includes:

- (2) Axle Shafts
- (4) 1" Wheels w/ Tires
- 48 Tooth Spur Gear
- 56 Tooth Spur Gear
- 64 Tooth Spur Gear

WARNING: The included solar panel is fragile and can easily be cracked or broken. Care must be taken not to drop, bend, or twist the panel. The solar panel can still be used if there are cracks, but its efficiency is reduced. You should verify that your panel is clean (dirt on the panel will block sun absorption and reduce efficiency). If the panel needs to be cleaned, use a soft rag and rub the panel gently. Do not remove, pull, or twist the conductor tabs (the two silver tabs on the solar panel).

When designing your solar car, you should think about:

- **How should I install my gears?** Utilize a small gear for the motor and a large gear for the axle. Going from a small gear to a large gear increases the torque from the motor to the axle. This provides good acceleration like when you use a low gear on a bicycle.
- **What affects the solar panel efficiency?** We have already discussed cracks and dirt on the panel surface, but the angle of the solar panel to the sun and amount of sunlight are other factors that you should consider.
- **What aspects of the chassis design will affect the performance of the solar car?** You should consider how the weight of the vehicle, friction, the stability of the chassis, and the wheel placement/alignment affects performance.

Instructions

- 1) Think about the design of your solar car chassis. You will be using balsa wood (or another strong & lightweight material) to construct the chassis so think about the overall dimensions of the car as well as the weight that the chassis must support (the motor and solar panel), and the overall weight of the car. You want the car to be light in order to make the car go as fast as possible. When engineers are solving problems and designing devices they often start by drawing a diagram. On a separate piece of paper, sketch your solar car design making sure to label each component (i.e. the motor, the wheels, etc).

- 2) Start to build your solar car chassis. Use glue to connect your chassis pieces if necessary.
- 3) Add the axles, gear, and wheels. Axles can be mounted in any way you can think of. One way to do this is to use eye hooks to connect the axles to the chassis (see Figure I). The eyelets can be pushed into the chassis so that only part of the eye sticks out of the wood (nuts and washers can be used to secure the eyelets if this is done). The wheels can be pushed onto the axles. Be careful not to break the wheel or bend the axle. If the wheel hole or gear is too small to fit the axle through, push a drill bit or nail through the wheel hole or gear to make the hole larger (see Figure II). Be careful not to drill into it too much or the gear won't grip on the axle. You can cut a piece of straw to slip over the axle in order to keep the wheels from slipping back and forth.

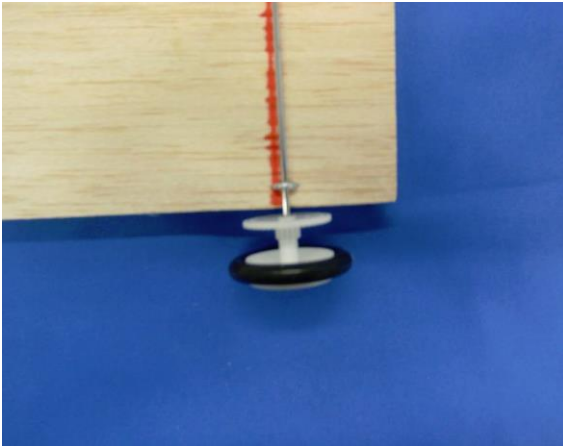


Figure I

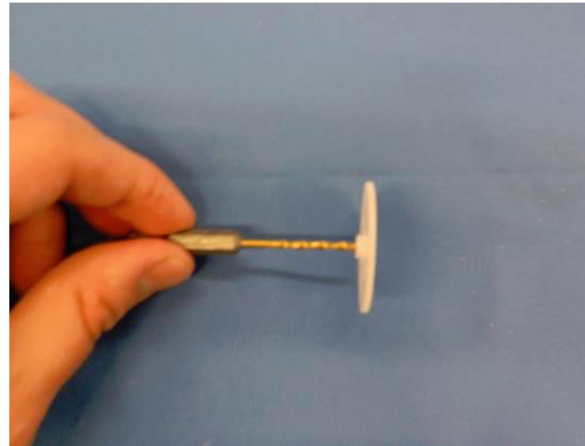


Figure II

- 4) Add the motor. Use the metal motor holder and four screws to mount the motor to the chassis (see Figure III). Think carefully about motor placement before securing the motor. Remember that the gear teeth on the motor must touch and mesh with the gear on the axle. You may need to utilize a straw on the axle or some other method to keep the gears from slipping away from each other.

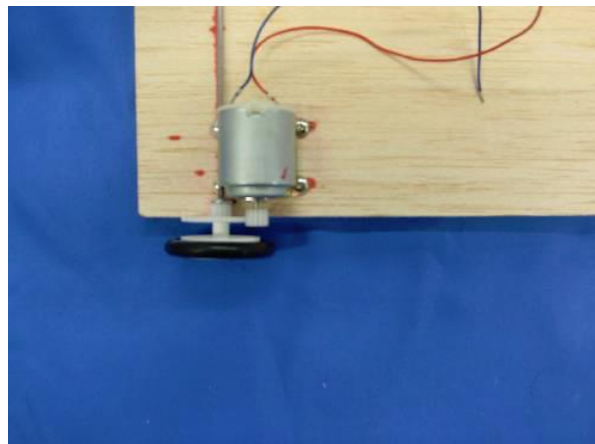


Figure III

- 5) Mount the solar panel to your chassis (see Figure IV). Make sure your panel will point towards the sun and that it is secured (rubber bands work well, glue should not be used). Before attaching the solar panel make sure you have carefully considered how the cell

should be positioned to maximize the power created by it. Connect the motor and solar panel using the included alligator clips (see Figure V).

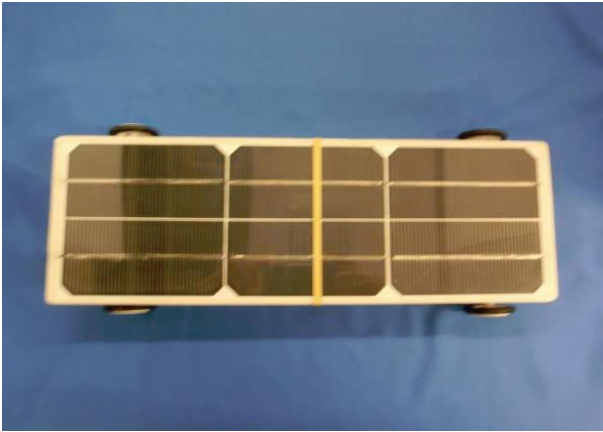


Figure IV

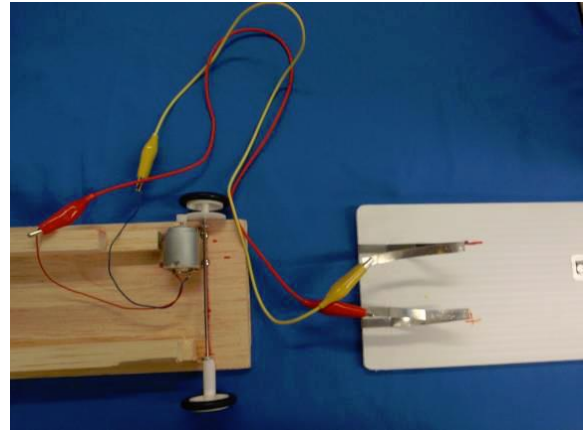


Figure V

- 6) Once the car is completed, verify that it works. If your solar car is not working properly, try the following:
 - a) If the motor is running backward, try reversing the wires.
 - b) If the wheels are sliding from side to side, try using pieces of a straw as a spacer.
 - c) If the car turns significantly rather than going straight, check the axles to make sure they are parallel to each.
 - d) If the acceleration seems to be very slow or the motor is not producing enough torque to get it started from rest, try changing the gear ratio.
- 7) Decorate your chassis as you like using markers, stickers, etc.
- 8) You are now ready to race your solar car!

Additional resources can be found at:

<https://www.solarmade.com/collections/junior-solar-sprint>

<https://www.solarmade.com/blogs/resources/junior-solar-sprint-information>

<https://www.nrel.gov/docs/gen/fy01/30828.pdf>

<http://www.fsec.ucf.edu/>