Here Comes the Sun – Solar-powered Car Design Guide and Worksheet

Introduction: For this class project you will work with a partner to design and build a solar-powered car. You will learn how solar cells generate electricity from sun light and how to connect the solar panels to achieve maximum current output. You and your partner will build a car using the solar panels to power an electric motor which will drive the wheels. You will need to solve some of the same kinds of engineering problems and make trade-offs that real automotive engineers face.

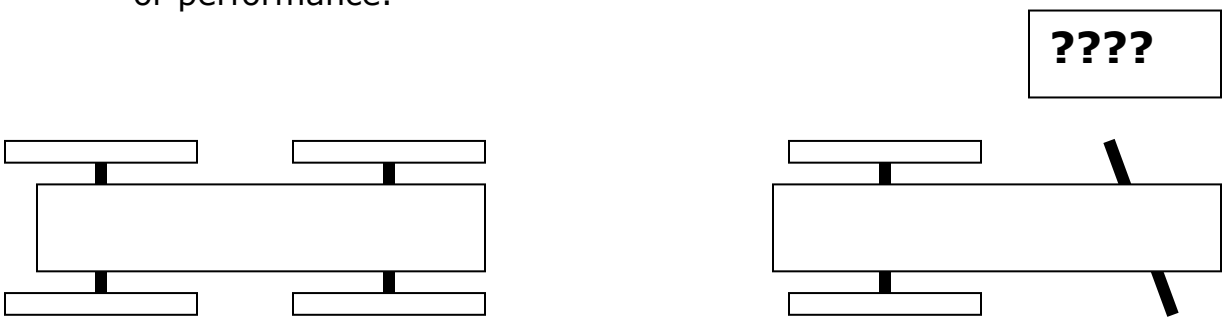
We will measure the performance of your car with the following tests:

- **Cargo carrying capability** – can you car pull a trailer loaded with 10g steel washers?
- **Direction** – does your car run straight?
- **Speed** – the ultimate test – we will see which cars are fastest!

Some Helpful Hints: Because all of your cars will use the same basic power systems – solar panels and electric motors – careful attention to construction is critical. The best performance will usually be achieved by the teams that do the most careful work.

Pay close attention to the following critical areas:

- Alignment of front and rear axles – these must be parallel to each other if you want the car to go straight;
- Quality of attachment of the axles to the chassis platform – are they well-fastened to the chassis? Do they wiggle?
- "Just right" meshing of the gears – not too loose, not too tight
- Weight – think about ways to minimize weight without sacrificing reliability or performance.

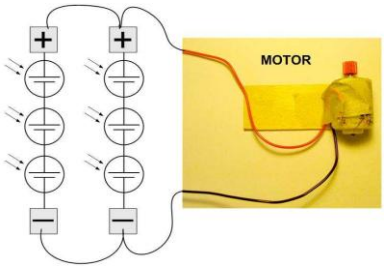


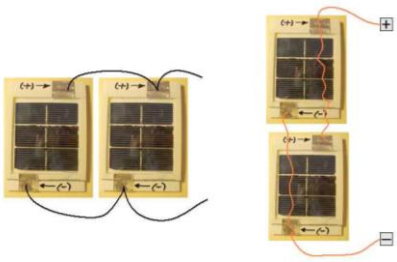
Here is an interesting design challenge – can you design a three-wheeled solar car??

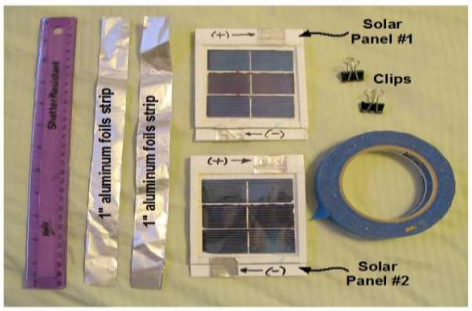
Assembling and wiring the solar panels: This is a bit tricky involving some clever use of aluminum foil and metal clips. We will work on this together and then attach the panels to your motor and test it using a high powered lamp. The photos below show the key steps that we will go through.

Assembling the Solar Panels

- The electric motor you will be using for the solar cars requires 1.5 – 3.0V and 2.1 – 2.2A in order to start to run from stop
- If you connected two panels in series you would generate 3.0V and 1.5A
- If you connected them in parallel you would generate 1.5V and 3.0A
- Electric motors require current rather than voltage to start from stop so the parallel connection is recommended in this case





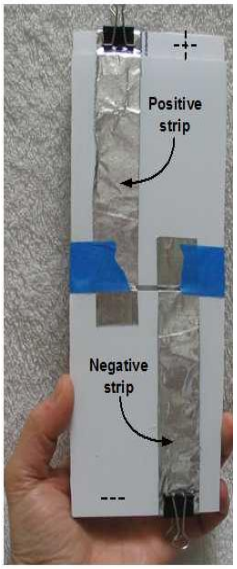


Step 1

Step 2

Step 2

Step 3



Testing Your Design: We will test the panels and motors before final assembly to make sure the panels are wired correctly. After the car is assembled we will help you run the following tests to see how well your design performs. During these tests you should observe how your car behaves and determine what improvements could be made. Use the space at the bottom of the page for recording your test results.

Starting test: This test checks to see that the motor will start and that the gears are meshing smoothly. It is also a good test of the overall assembly accuracy and quality. Does the motor start? Does the car run when placed on the floor?

Directional Test: Does the car run straight or does it curve either left or right? What would cause the car to curve? How can that be corrected?

Cargo hauling test: We will hook the car to small "trailer" filled with some steel washers. Each washer weighs about 10 gr. Is the car able to pull the trailer? How does the car react to the additional weight? What if you add more weight?

Speed Test – where the rubber (plastic in our case) meets the road! How does your car perform against all the other cars. Notice what other teams have done to improve their cars. What can you do to make yours faster?

Test Results

Starting	**Wheels off the ground**	**Wheels on the ground**

Direction	**Really straight**	**Curves a Little**	**Curves a Lot**

Cargo Capacity	**0g**	**Trailer only**	**10g**	**20g**	**30g**	**40g**	**50g**	**>50g**

Design Notes: Changes you made, things you learned and some feedback for us!

1. What design decisions did you make that worked out well?

   What decisions did not work out so well?

2. What specific changes did you make to improve performance?

   Direction related:

   Speed related:

3. What was the biggest surprise?

4. What did you like best about the project?

5. How could we improve the overall project?

Many Thanks to all of you and best of luck/success for the future!