# Solar Racing (Teacher Notes)

*(The Design, Construction, and Evaluation of a Solar-Powered Car)*

*Notes on Part 1: The Design Process*

- In this activity, your students will experience first-hand the process of design. When they design their car, they will conceptualize and then turn their ideas into real-life models that work. Remind them that design is different than normal problem-solving because:
  - You don't know what problems are going to arise. (You discover and solve problems as you go along. Everyone's challenges will be different.)
  - There is never one right answer.

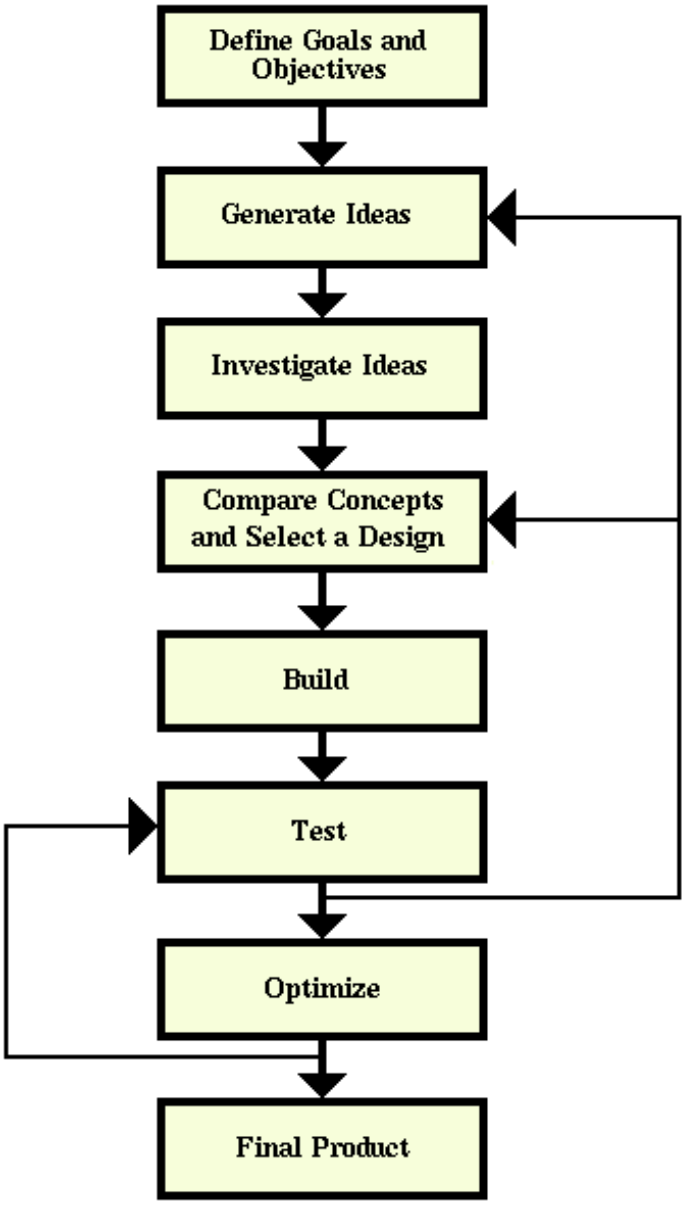


Figure 1. The Design Process

- It is important to note that the process presented here may be used at any and all levels of model car design, from the design of individual components to the complete car as a system. The key principle in the process is to start all designs with many ideas, then investigate and evaluate several of them before locking into a design.
- Part of the challenge is learning to combine good ideas from several people into a winning design. Students should be encouraged or required to use a notebook to record their ideas and sketches. Ideas not written down or sketched are quickly forgotten. In addition to providing a means to store and communicate ideas, putting thoughts down on paper often aids in idea generation and clarity.[2]

*Notes on Part 2: Experiment with Principles and Prototypes*

- Another important point to make to students is that designers have to deal with tradeoffs. For example, when a car designer uses a larger engine for greater performance, it usually sacrifices fuel efficiency. In a sports car, performance and speed are very important. But in a city car, fuel efficiency is more important. The students are the designers and it is up to them to decide which goals are the most important and that is their first step.
- Even though there is no one right answer, some answers may be better than others for a particular application. Obviously, in Junior Solar Sprint, the faster cars will win. But remember strategy can be a big factor - there are variables like the amount of sunshine that may influence your decisions.

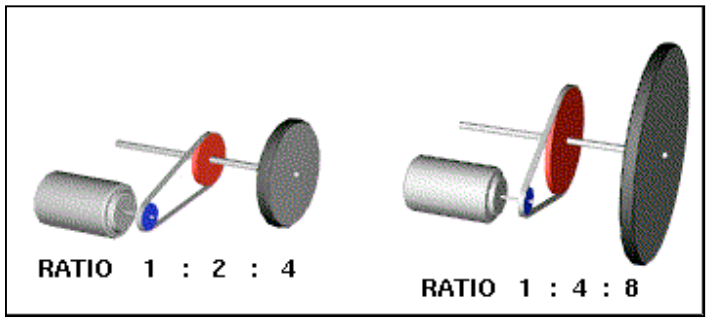


**Figure 1:** Transmission wheel combinations

- The source site for the figure above is also the source for the gear ratio exercise included in the Student Handout. Reviewing the materials available at this site and sharing the PowerPoint presentation are suggested for preparing students to calculate the gear ratios for their own cars.

- ***Notes on how a solar panel operates.*** When you look at the diagram above, you might ask, "How does the solar panel turn the sun's energy into electric energy?" The solar panel is made of a sandwich of two materials called *semiconductors*. Each material is made of millions of atoms. As you might already know, atoms have a positively charged *nucleus*, and negatively charged *electrons* which spin around the nucleus. When these two materials are put together in a sandwich, an interesting thing happens: electrons become pulled from the bottom half. But there's a problem. The electrons are all attached to atoms, and the atoms won't let go very easily. This is where the sun's energy helps out. If we shine sunlight on these materials, the sunlight has enough energy to knock the electrons off of the atoms. The electrons will then be free to be pulled to the top of the sandwich.

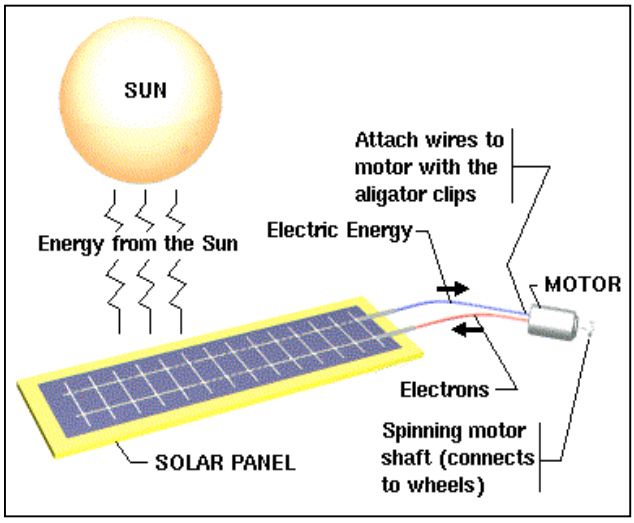


**Figure 2**: Solar Panel Motor Configuration

Now if we connect wires to a motor, electrons will flow through the wire into the motor (making it spin) and back through another wire to the solar panel where they can fill the "holes" left in the atoms that lost their electrons.

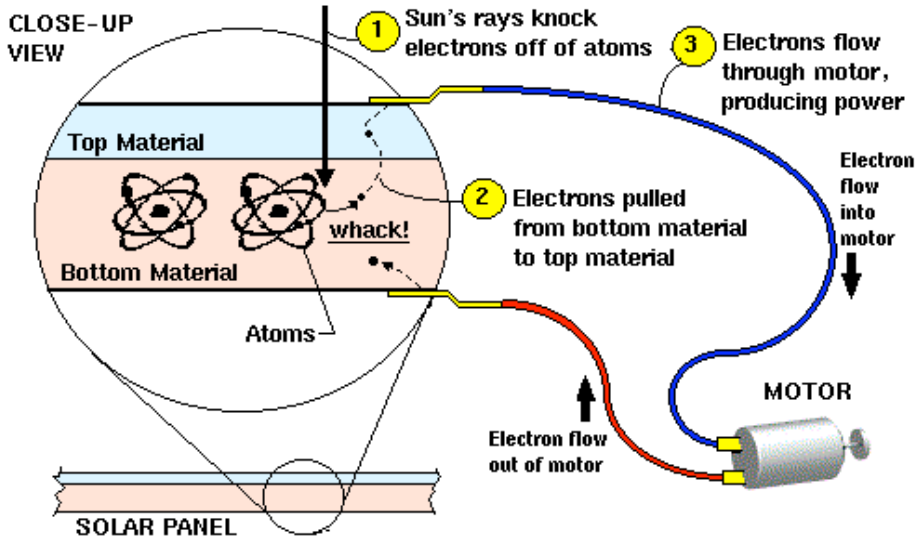


**Figure 3:** How a Solar Panel Works

For additional information and great visuals to use in a lecture on how the solar cell produces power from a molecular level, please visit: