



## Solar Car Challenge: Introduction of the Problem

### Activity Summary:

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**DESCRIPTION:** Students will play around with the solar car kits to familiarize themselves with the materials in preparation for the solar car engineering challenge.

**GRADE LEVEL(S):** 6, 7, 8

**SUBJECT AREA(S):** Physics, energy, electricity, solar, motion, engineering

**ACTIVITY LENGTH:** 2 hours

**LEARNING GOAL(S):** To introduce students to the problem that this project will attempt to solve: building a solar car that will go straight, far, and fast to win a race.

### STANDARDS MET:

#### Oregon:

- AST 11.1 Student can design a solution for a defined problem, identifying the design constraints.
- AST 9.4 Student can evaluate possible solutions to global climate change.
- AST 7.1 Student can compare and contrast renewable and non-renewable energy resources.

### Next Generation Science Standards:

- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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- MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

### SCIENCE KIT MATERIALS LIST:

- (1) Sol Run Solar Inventions Classroom Kit (see Teacher Preparation below to divide kit into student materials)

### OTHER MATERIALS LIST:

- Shop lights with 500-Watt bulbs and extension cords (if there isn't enough sun)
  - "Student Instructions for Axle Installation" handout
  - "Student Instructions for Wheel Installation" handout
  - "Student Instructions for Motor and Solar Panel Installation" handout
  - "Playing Around With Solar Cars" student worksheet
  - Videos online: Solar Car Challenge video <http://www.solarcarchallenge.org/challenge/>
  - "Solar Car Challenge Engineering Packet"
- .....

### Vocabulary:

- Chassis
- Friction
- Solar panel

### Student Background:

- Students should have a basic understanding of electricity and how photovoltaic modules work

### Educator Background:

- It is helpful if teachers have a basic understanding of how photovoltaic modules work, the energy transformations at work:
  - Electromagnetic radiation (from the sun) to electrical energy (occurs in the photovoltaic module)
  - Electrical energy to motion (in the DC motor)

### Lesson Details:

#### Teaching Guide:

1. Introduce the challenge by showing the Solar Car Challenge videos.
2. Pass out "Solar Car Engineering Outline," included in the "Solar Car Challenge Engineering Packet."

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3. Have students come up with a problem statement (such as: How can we use the sun's energy to power a car that will go straight, far, and fast?).
  4. Pass out solar car kits with the car bodies that have been prepped with wooden bars and eye hooks.
  5. Walk students through wheel, motor and solar panel installation.
  6. Take students outside to test their vehicles. If there isn't enough sun, use shop lights indoors.
  7. Have students remove all the parts of their cars except for the prepared chassis for the other classes to build.
  8. Discuss with students problems with their cars. Make a list on the overhead. Discuss the problems caused by too much friction (wheels rubbing against chassis, axles not moving freely, car tires against the road), the position of the sun relative to the position of the solar panel (it won't move if there is not enough light directly hitting the solar panel), or gearing sizes and positions.
  9. Have students complete the "Playing Around with Solar Cars" worksheet.
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## Teacher Preparation for Student Kits:

**Divide Sol Run Solar Invention Classroom Kit materials into the following parts for each Student Kit:**

- 1 Solar panel
- 1 Motor clip
- 1 Coroplast (serves as the chassis)
- 1 Motor shaft bushing
- 2 Large red plastic wheels with 2 black rubber o-rings as tires
- 2 Small red plastic wheels with 2 black rubber o-rings as tires
- 2 Ten-cm wooden dowels
- 2 Fifteen-cm wooden dowels
- 4 Screw eye hooks
- 2 Wooden blocks
- 1 Small gear
- 1 Large gear
- 8 Pieces of tubing cut into 5-mm sections
- Push pin
- Sand paper
- Velcro tape

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