



## Solar Car Challenge: Criteria, Constraints and Background

### 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:** 50 minutes

**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.

**OTHER MATERIALS LIST:**

- “Solar Car Challenge Engineering Outline” student handout included in the “Solar Car Engineering Challenge Packet”
  - “Solar Car Challenge Background Research” student handout included in the “Solar Car Engineering Challenge Packet”
  - “Playing Around with Solar Cars” worksheet
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**Vocabulary:**

- Chassis
- Friction
- Solar panel

**Student Background:**

- Students should have a basic understanding of electricity and how photovoltaic modules work
- Students should have had experience playing around with the solar cars (see the activity: “Solar Car Challenge: Introduction of the Problem”)

**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)

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## Lesson Details:

### Teaching Guide

1. Begin with a review of the previous day's lesson. Go over the "Playing Around with Solar Cars" worksheet.
2. Have students determine the criteria for this challenge. Example: To build a solar car that will go far, straight and fast. Brainstorm and agree on specific, quantitative definitions for the criteria.
3. Discuss the constraints that students must deal with in this challenge. Examples: Time, money, limited materials, no bigger than 2 feet by 2 feet, only one solar panel and one motor used, must be lightweight, etc.
4. Discuss different types of materials that could be used.
5. Have students complete the "Solar Car Challenge Background Research" student handout.

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