

Solar Racing

Adapted by Duc Tran, Environmental Science Institute: 11/2010

Source: "Solar Racing" http://www.pspb.org/e21/media/Solar%20Racing_v105_LP.pdf

Grade Level: 11 – 12; may be adjusted for other grades

Length: Depending upon the depth of the investigation, the suggested time frame for this lesson is four to ten 50 minute class periods.

Sample TEKS:

§130.329. Manufacturing Engineering: 1A – I, 3B, 5A

§112.39. Physics: 1A, 2A, 4B

Objectives

Students will know that:

1. Solar energy is a renewable energy source, and its utilization has numerous benefits for our environment.
2. The angle at which a solar cell is positioned in relation to the sun affects its power output.
3. The amount of current produced by a photovoltaic cell is proportional to the amount of the light hitting the cell; therefore, increasing light intensity or increasing the size of the cell itself will increase the power output of the cell.

Students will be able to:

1. Describe 3 factors influencing a solar car's power needs: friction, air drag, and acceleration.
2. Discuss the motion of their solar car based upon its position, direction, and speed.

Overview

Students will harness solar energy to power a car that they will design and construct. Students will utilize the design process and undergo review by their peers to select an optimal gear ratio and components for their car. After completing construction, students will participate in a "Solar Race."

Teacher Tools

- Soldering iron
- Utility Knife or coping saw
- Glue gun
- Needle-nose pliers
- 1/8" drill bit or electric drill with bit
- 2 C-Clamps

- Rulers
- Pencils
- Wire strippers and cutters

Materials (per group)

- Solar Sprint kit (from <http://www.solarmade.com/JuniorSprint.htm>)
 - Solar panel
 - Motor with lead wires and clips
 - Motor mounting bracket with screws
 - Gears for motor shaft
 - Solar Sprint accessories kit (from <http://www.solarmade.com/JuniorSprint.htm>)
 - 2 shafts
 - 4 wheels with tires
 - 2 spur gears
- NOTE: Many of these accessories can be extracted from old toys, VCRs, tape recorder, old “Spirograph” gears and reused as shafts, wheels, and gears
- Foam core, Blue board, wood, corrugated cardboard – various reused materials can be utilized to construct the body for the car
 - Stopwatch

Procedure

Part 1: The Design Process

1. Allow students to divide into teams of 3 or 4.
2. Briefly describe components of the solar car – solar panels, chassis, wheels, axles & bearings, transmissions, body shells.
3. Allow teams to work together to brainstorm initial car concepts and record their discussions on paper. Prompt students to generate a list of questions before they can selecting a design.

Part 2: Design Review

1. Allow each team to present their design to their classmates. The presentations will address each team’s decisions and rationale regarding the major car components: transmission, chassis, wheels & bearings, body and photovoltaic array.

Part 3: Construction

1. Construct the cars.
2. Allow time for test runs. If sunlight is scarce, halogen lamps work well to power cars for short distances.

Part 4: Solar Racing

1. For more information concerning the rules of the contest, please check the following website: http://eagle.chimacum.wednet.edu/middle/jss/Course_Rules.htm.
2. Let the race begin!

Data Collection

Teacher should provide student with worksheets for students to record their data and observations. Students should have a description of their design, accompanied with an illustration. During the test runs, students should record the some quantitative data such as speed, distance traveled, average speed, acceleration, and more.

Sample Assessment Questions

1. What are 2 ways to increase the power output of a solar cell? [Increasing light intensity or increasing the size of the cell]
2. What are some limitations of a car powered by solar energy? [Ex: weather – cloudy days]
3. What are some merits of a car powered by solar energy? [Ex: benefits the environment, reduce air pollution]
4. What effect(s) does friction and air drag have on the cars?
5. What is speed?
6. What is the average speed of your car?
7. What is the difference between acceleration, velocity and speed?