

Solar Car Lesson

Lesson Overview

This lesson gives the students a chance to build their own Lego[®] solar car and discover how solar power can produce enough energy to move an object. In Part 1, students construct and race a solar car. In Part 2, students investigate how various parameters, such as the angle of the solar panel, the distance between the motor and the axel, and the weight of the car, can affect the efficiency of the solar car. This activity can be both fun and a learning experience. Hopefully it is a sunny day so you can go outside and do this; otherwise light bulbs (50W or greater) should work, but they have to be very close to the solar panel to produce enough energy to power the car.

Grade-Level

This lesson is appropriate for 7-12 grade levels. Discussion questions can be developed/modified for the appropriate age group and course content.

PA Academic Standards

This lesson relates to several academic standards for *Science and Technology and Engineering Education*, including:

3.2. Physics

1. Force & Motion of Particles and Rigid Bodies
2. Energy Storage and Transformations: Conservation Laws
5. Nature of Waves
7. Science as Inquiry

3.3. Earth and Space Sciences

4. Sciences and Transfer of Energy
8. Science as Inquiry

3.4. Technology and Engineering Education

2. Technology and Environment
3. Energy and Power Technologies

Lesson Time

Part 1 will take the students approximately 45 minutes to build and race the cars. Part 2 will take the students another 45 minutes to do the modifications and to race the cars again. This lab would have to take place in a 90 minute lab period or over a period of 2 days (one day to build and race then another day to modify and race)

Student Activities

In Part 1, students work in pairs or small groups to build and race a solar car. For Part 2, students will be split up into three groups. One group ("Panel Angle") will explore different angles of the solar panel and how that affects the car's speed and efficiency. Another group



("Axel Distance") will tinker with the placement of the motor away from the axel it's attached to and see how that affects the car. A third group ("Car Weight") will experiment with how the weight of the car affects its performance.

Provided Materials: *(Each solar car kit contains the listed materials.)*

1. Solar Panel (1.0V)	2. 4 Wheels
3. 6 X 14 rectangular Lego [®] piece for the body of the car	4. Velcro or something to hold solar panel onto the car with
5. Motor	6. 2 flat 2 X 6 Lego [®] pieces that the solar panel rests on, one with the Velcro attached to it*
7. 1 Rubber Band/String	8. 4 small rectangular Lego [®] pieces with holes that the axels will go into
9. 4 pieces of rubber tubing	10. 1 flat 4 X 4 Lego [®] piece that the motor is mounted on
11. 4 Wheels	12. 3 Lego [®] 2 X 6 block pieces used to change the angle of the solar panel or the weight of the car. ^a
13. 2 Wooden axels	14. Red pulley
15. Red motor axel cover	16. Velcro or something to hold solar panel onto the car with

^aUse the pieces to alter either the angle or weight without changing both at the same time

Additional Materials: *(These can also be provided.)*

Stop watches

Balance to weigh cars

Teaching the Lesson:

Part 1:

1. The teacher introduces the topic of solar energy by explaining how photons from the sun are converted into energy using a photovoltaic (solar) cell.
2. The students are divided into pairs or small groups.
3. The students build the Lego[®] solar car according to the provided procedure.
4. The students race/time the unmodified solar cars and record their results. (Start and finish lines of tape at a distance of 5-10 ft apart is recommended.)
5. The students complete a worksheet related to the experiment and/or discuss the results. (See suggested discussion questions.)



Part 2:

6. The students are split into three groups: "Panel Angle," "Axel Distance," and "Car Weight."
7. Each group modifies their cars using the recommended procedures.
8. The students race/time each modification to their solar cars and record their results.
9. Each group will select their optimal modification (fastest solar car). There will be a final race among the three groups.
10. Have the students complete a worksheet related to the experiment and/or discuss the results. (See suggested discussion questions.)

Suggested Discussion Questions:

1. Explain how energy from the sun is converted into a form of energy which powers a solar car.
2. Which types of energy are involved in this process? Is energy created or lost in the process? Explain.
3. What are the benefits of a solar car in comparison to a traditional gasoline-powered car?
4. What are the drawbacks of a solar car in comparison to a traditional gasoline-powered car?
5. Do you think a life-size solar car is feasible? Explain.
6. How does the panel angle (axel distance, car weight) affect the solar car's speed? Explain.
7. Which panel angle (axel distance, car weight) is optimal? Explain.

Potential Modifications/Extensions of the Lesson:

- Construct a battery powered car using the same materials (and same mass). Race the battery powered car and solar car on a sunny day. Discuss the pros and cons of battery power versus solar power.
- Encourage creativity by having the students design their own solar cars (using Legos[®] or other materials). Make it a contest. Who can design the fastest car? The biggest car? The smallest car? The most unique "car"?

