



# Solar Cars

## Lesson 3: Build Solar Cars

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**DESCRIPTION:** Students will build their solar vehicles. There are many options for them to do this, depending on the specific variables hoping to be tested following the construction and material-selection process. Students will be given the opportunity to try out multiple sizes of gears or pulley systems in order to determine which type they hope to be racing in the following lesson plan and make verbal predictions about what exactly will take place when comparing the different iterations of vehicles.

**GRADE LEVEL(S):** 4, 5, 6

**SUBJECT AREA(S):** Science, investigation, fair tests, Laws of Motion, forces, energy, energy transformation, variables, mass, engineering

**ACTIVITY LENGTH:** 45 minutes

### **LEARNING GOAL(S):**

Students will construct a geared solar car, a pulley-system solar car, or both. Students will make verbal predictions about the outcomes and viabilities of different types of solar cars. Students will pinpoint the independent, dependent, and control variables in their solar car testing process.

### **NEXT GENERATION SCIENCE STANDARDS:**

- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved
- PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- PS2- 2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

## STUDENT BACKGROUND:

Students have a basic understanding of:

- Types of energy and energy transfer and transformation
  - Isaac Newton's Laws of Motion
  - Forces acting on an object
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## Materials List (30-person class)

- Solar car kits for each science group:
  - Depending on how you would like for students to compare results, this could be done in a number of ways:
    - You could have some groups only test pulley systems and some only test geared vehicles
    - You could have each group test both, comparing results and selecting their optimal car.
    - You could have the whole class test one type at a time.
  - It is useful to give students some options in terms of gear and pulley sizing in order for them to determine which would be the most effective with their vehicle.
- Sunlight or other (powerful) light source(s)

## Vocabulary

- **Fair Test:** refers to an experiment that is carefully controlled to ensure that the information gathered is reliable.
  - **Variable:** any factor that can be controlled, changed, or measured in an experiment.
  - **Controlled Variable:** Remains as is, constant or does not change during an experiment.
  - **Responding (Dependent) Variable:** Reacts to the change, able to be measured or observed.
  - **Manipulated (Independent) Variable:** a condition that you change in an experiment.
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## Lesson Details

### Activity – Building Solar Cars

- Build Solar Cars following the Basic Solar Car Construction instructions. It may be useful for students to start with this iteration of the car, then modify it to add different sizes of gears and then move into the pulley system.
- Additionally, you could modify these instructions to include pulley car construction or take away instructions entirely, having students use the pieces how they envision. However, having certain pieces in place such as the wood blocks screwed in could be useful especially for young students to give them a starting point.

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- Teach students to troubleshoot on their own as best as possible.
- Have an artificial light source if you are not going in the sun.
- Discuss with your students how different types of variables will come into play when testing these cars. What will the dependent variable be? What will the independent variable be? How can we design a control?

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