# Solar Cars

## Lesson 1: Gears vs. Pulleys on Solar Cars

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**DESCRIPTION:** Students will design an investigation to test differences between solar vehicles. This is an excellent follow-up lesson to the solar boat activity or any other activity in which students have already experimented with other types of solar vehicles. However, it can additionally be implemented without having a previous vehicle-design activity as long as students have discussed energy fundamentals, forces, engineering design, and photovoltaics. In this specific lesson, they will make predictions based on their own understanding of engineering design and apply what they have learned previously to a challenge involving gears and pulleys on solar vehicles.

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

**SUBJECT AREA(S):** Science, engineering, gears, pulleys, Laws of Motion, force, energy, energy transformation

**ACTIVITY LENGTH:** 30 minutes

**LEARNING GOAL(S):**
Students will design an investigation to test differences between solar vehicles. They will make claims based on backing evidence, without having directly tested their vehicles before this point. They will use background knowledge regarding pulleys and gears in order to begin the design process. Students will determine which specific design they will be moving forward with for the next lesson.

**NEXT GENERATION SCIENCE STANDARDS:**

- 5- PS2-1. Support an argument with evidence, data, or a model.
- 5-PS2-1. Cause and effect relationships are routinely identified and used to explain change.

**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

## Materials List (30-person class)

- SolRun Solar Machines Classroom Set from SunWind Solar (http://sunwindsolar.com) Specifically, you will need a subset of materials from this kit:
  - Gears
  - Pulleys
  - *Note: you can scale this activity up or down for time or student understanding by providing only one set of gears and one set of pulleys, or include them all and let students decide if/how they will limit options during testing.*

## Vocabulary

- **Gear:** one of a set of toothed wheels that work together to alter the relation between the speed of a driving mechanism (such as the engine of a vehicle or the crank of a bicycle) and the speed of the driven parts (the wheels).
- **Pulley:** a wheel with a grooved rim around which a cord or rubber band passes. It acts to change the direction of a force applied to the cord/rubber band and is chiefly used (typically in combination) to raise heavy weights.

# Lesson Details

## Activity – Gears vs. Pulleys for Cars

- Ask students to quick write in science journals: **Focus question**: Would a car travel faster with a gear or pulley system? Explain.
- Show images of gears and pulleys: Easy to find many great pictures on Google Images.
- Have classroom discussion on which would be better to drive solar cars.
- Additional discussion should take place on what might result with different size gears (Large versus small gears). If you can, you may want to go to the school bike rack or display your own bike.
- Determine science partners for solar car investigation (note/decide upon size of gears/pulleys to be used with each group):
  - some with pulleys
  - some with gears



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