# Solar Car Challenge 2024

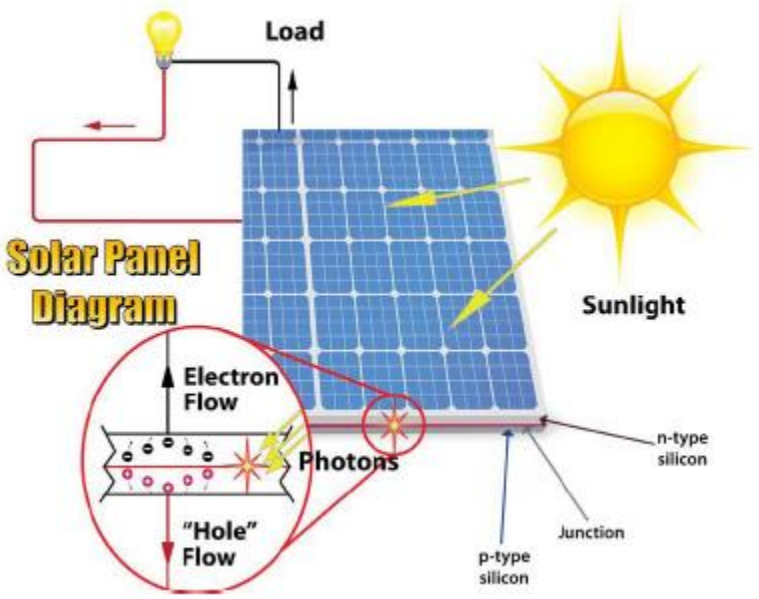
Team Name _____

Team Members _____

Class _____

## Background

Solar energy, the conversion of sunlight to electricity, has enormous potential as a clean source of renewable energy to replace fossil fuels. Although solar energy has powered satellites and spacecraft for over 50 years, it accounts for less than 1% of electricity generated in the United States today.




A solar cell, also called a *photovoltaic cell* (PV cell), is a light-sensitive semiconductor device that uses the *photoelectric effect* to convert sunlight into electricity. Conventional solar cells contain a silicon diode as the semiconductor. The diode is created by layering n-type silicon (silicon doped with an impurity that has one more valence electron than silicon) to p-type silicon (silicon doped with an impurity that has one fewer valence electron than silicon). The different properties of the materials at the p-n junction give rise to a potential difference at the interface. Photons of light striking the silicon surface excite electrons to different energy states and create "electron-hole pairs." Electrons move toward the positive side of the junction, "electron holes" toward the negative side, and the resulting flow of electrons generates an electric current. The amount of current produced by a PV cell is proportional to the amount of light striking the cell. Wires attached to the "p" and "n" silicon layers allow the electricity to power calculators, watches, recharge batteries, electric motors, and many more electrical devices. Panels of solar cells connected together generate enough electricity to power satellites.

An important factor limiting the use of solar energy is the trade-off between cost and efficiency. Photovoltaic cells convert only 15–20% of the Sun's radiant energy to electric energy, much less than the chemical energy of fossil fuels (about 35% is converted to electric energy). Scientists and engineers are continually researching ways to improve solar cell efficiency and bring down the cost. Each year teams of scientists, engineers, and even students participate in

solar car challenges where they design and build solar-powered vehicles capable of carrying one or more passengers on a cross-country trip. Finding ways to economically harness the Sun's energy is an important goal toward more clean energy alternatives. (Flynn, 2020).

**Pre-activity Questions**

1) What are the advantages and disadvantages of using solar energy to generate electricity?

2) Your solar car travels 20.5 m in 3.4 seconds. What is the speed of your car?

3) If you were designing a car to run on solar energy what are some design elements that should be included to make sure that it can travel faster?

4) What could solar energy be used for?

## Overview

In this activity your group will use the materials presented to design and build a solar powered car. The goal is to produce the car that fastest over a set distance.

## Materials

| | | |
|---|---|---|
| Cardboard base | Solar Mini Panel (1V, 400mA) | Tape |
| DC motor | Scissors | Stopwatch |
| Solar Accessory Bag of wheels, axels, and gears | Drinking Straw | Wire Strippers |

* Include any extra materials or that you intend to use

## Design & Build

In this section you will experiment with different types of designs using the materials presented. Use your research skills and prior knowledge to inform your design to build the fastest solar car!

**1)** In the space below draw your idea for the design given the materials presented.

**2)** Explain why you think your design will work the best?

**3)** Test your initial design.

| Trial | Distance (m) | Time (s) | Speed (m/s) | Observations |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| Average | | | | |

**4)** After having tested your initial design, use the following space to draw or explain any design changes that will improve your results.

**5)** After your design modifications test your design again and enter the results below

| Trial | Distance (m) | Time (s) | Speed (m/s) | Observations |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

| | | | | |
|---|---|---|---|---|
| Average | | | | |

**Solar Car Challenge**

You are now ready to test your final design in a race against your classmates! Use the following table to record your results of your group:

| Trial | Distance (m) | Time (s) | Speed (m/s) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| Average | | | |

**Post Activity Questions**

1) Describe your final design of your group's solar car and give a reason for each modification and the result you obtained. Was this a good modification? Why or why not?

2) Show the calculation for the speed of your car during the challenge.

3) If more materials were available what other things may improve the cars overall performance?

4) Describe the types of energy involved and that energy is transferred to make the solar car move.

*References: The Solar Car Challenge was developed using instructional materials and documentation from Flynn Scientific (2020*