

# Basics of Designing & Building Your Model Car

Grade(s): 6-8

## Learning & Activity Goals/Objectives

- What are the basic design strategies
- What are the best materials for strength vs. weight
- How does the structure of my vehicle impact its durability

## Overview

Using a continuous feedback loop of: Ask -> Imagine -> Plan -> Build -> Test and Evaluate, students will learn the steps necessary to successfully build a working model solar vehicle. This information will be extremely important as they move through the stages of building their Solar Sprint cars and developing not only a working vehicle but one that might win the races.

Following the informative lesson, students will participate in a building exercise that will engage them in the building and design of shapes that could help them improve the overall strength of their vehicles without sacrificing added weight.

## Curriculum Standards

### Health & Physical Education

- 2.1.8.A.3
- 2.2.8.A.2
- 2.2.8.B.2
- 2.2.8.C.1

### Mathematics

- CCSS.Math.Practice.MP4
- CCSS.Math.Practice.MP7
- CCSS.Math.Content.6.NS.B.3
- CCSS.Math.Content.6.G.A.4
  
- CCSS.Math.Content.7.G.B.[1&6]
- CCSS.Math.Content.8.G.B.7

### Science

- 5.2.6.E.3
- 5.1.8.A.2
- 5.1.8.B.[1&2]
- 5.1.8.D.[1-3]

### Technology

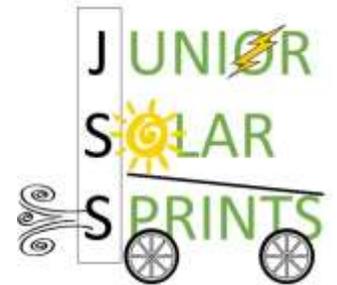
- 8.2.8.B.[1-3]
- 8.2.8.E.1
- 8.2.8.F.1

### Life & Career Skills

- 9.1.8.A.1
- 9.1.8.A.4
- 9.1.8.B.1
- 9.1.8.C.[1-3]

### Visual Arts

- 1.3.8.D.1



## Design and Build Lesson Plan: 2020

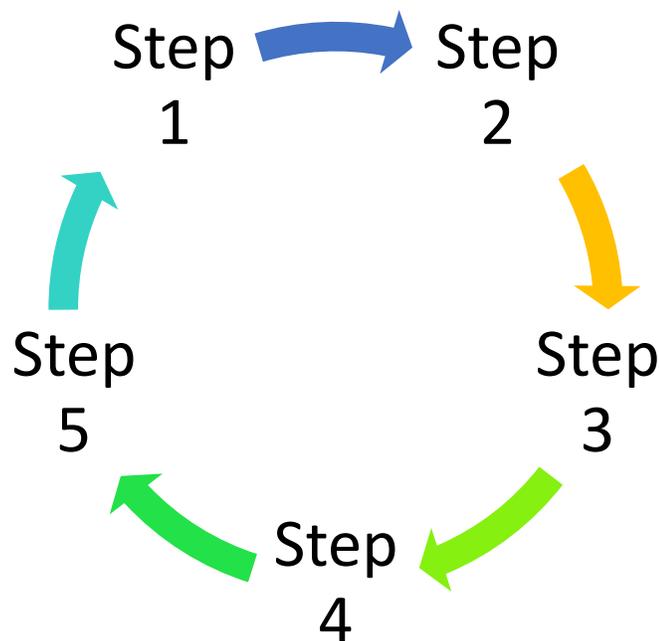
**Objective:** Students will understand the engineering design process, know more about requirements for their vehicles, and build a simple structure.

**Time:** 40 Minutes

**Materials:** Design and Build PowerPoint, materials for students to build a simple structure

### **Procedure:**

1. Ask students to identify the stages of the engineering design and build process. Write their answers on the board in a circular flow chart. Like this:



Have the students try and organize which steps go where. The actual steps are: ASK, IMAGINE, PLAN, BUILD, TEST. Talk about what they should do in each section and why it is an important step.

2. Utilizing the PowerPoint, provide them with the actual design and build process emphasizing the testing portion of the process. Also emphasize that it is a cycle so once they test something if it doesn't work the way they want it to they can go right back into the loop and try again.
3. Next, utilize the PowerPoint to show the students the different parts of a JSS race car.
4. Ask the students to describe to you what a chassis is. Once you get a definition make sure to emphasize that it is the part of the vehicle that everything else is connected to. So if the chassis isn't the right material, size, etc. the rest of the car will suffer.

5. Talk about two different scenarios that students normally have with their chassis. Utilizing the PowerPoint talk about strength vs. stiffness. As them some possible things that could go wrong if they have a chassis that is strong but not stiff. Talk about how this may affect their car. Now ask them some possible things that could go wrong if they had a material that is stiff but not strong. Talk about how this may affect their car.
6. Finally, you will discuss the two extra design challenges, the passenger and the race line, in addition to building a functioning car.
  - a. The first challenge is to carry a standard 12 oz. soda can down the track. Emphasize that it **MUST** be a soda can and not any other type of can. Anything carbonated has a thicker wall and this is heavier than a can that isn't. They must also have the tab that is used to open the can, if it falls off they can put it into the can, but they may be asked to prove they have it on race day. Instruct the students to think of the can as their passenger so they should not do anything to the can that they wouldn't do to a person (i.e., cutting up the can, squashing it, gluing it down, etc.). The can cannot support any other part of the car. If the compartment the can is in is holding up the solar panel they may be asked to prove that the structure won't collapse when they remove the can.
  - b. The second challenge is attaching their car to the race-line. This is 60# fishing line and stretches the entire length of the 66 foot track. The wire cannot come undone. They must design a way for their vehicle to attach easily to the line, stay on the line throughout the race, and easily be removed following the race.

### **Activity:**

To help the students demonstrate the design process and show the importance of having a strong chassis have the students build a simple structure that can support weight.

Use any building materials you would like and have a competition between students to see who can build the strongest structure. Magnet rods and metal balls work really well if you have access to them.

Test the structures by adding weight, science or social studies text books work great. The picture to the right is demonstrating the testing process.

