

Instructional Teacher Guide - Car Activity

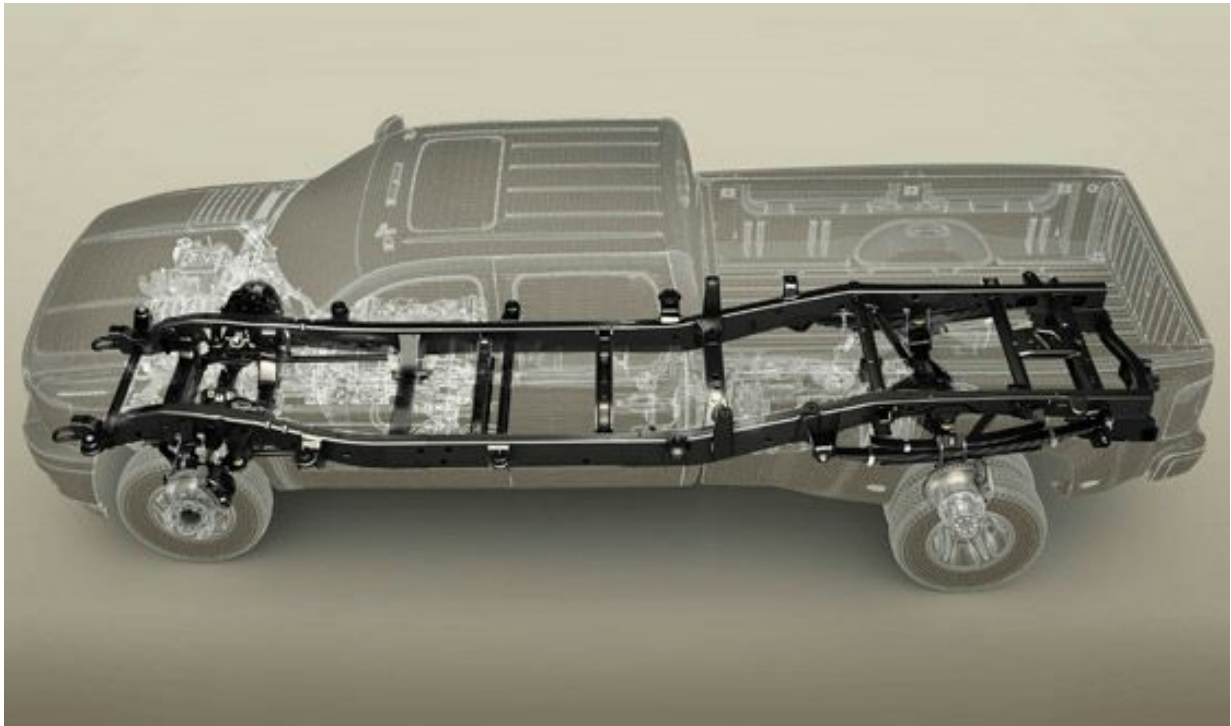


Figure 1: 2011 Chevrolet silverado frame.

Disclaimer

This activity guide is a general guideline of the engineering design process, intended to serve as a reference for teachers. The teacher is responsible to incorporate and comply with the New Generation Science Standards of design for 3rd to 8th grade students in their lesson plans.

Teacher preparation

For additional information about engineering concepts to aid the understanding of this activity visit the link below. In addition, It is recommended to watch the instructional teacher guide videos provided in the same link:

<http://research.engr.oregonstate.edu/pigroup/engineering-design-toolkit>

Materials

- One Engineering Design Toolkit contains all materials needed for this activity.



Figure 2: Engineering Design Toolkit

Constraints

The students are expected to finish activity within a 45-50 minute time frame. (Note: Every engineering design step has a recommended time limit shown in the engineering design process section of this document.)

Learning outcomes - The student must...

1. Show an understanding of the problem.
2. Show an understanding of the solution and the purpose of the solution.
3. Be able to plan/design the solution.
4. Be able to implement their plan to the solution with the materials provided.
5. Be able to test the solution.
6. Be able to understand why the solution does not work.

7. Show an understanding of the engineering design process steps.

Note: The learning outcomes are general guidelines of the engineering design process, intended to serve as a reference for teachers. The teacher is responsible to incorporate and comply with the New Generation Science Standards of design for 3rd to 8th grade students in their lesson plans.

Source: <http://www.nextgenscience.org/sites/ngss/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf>

Introducing the activity

To introduce the activity follow the following procedure:

Note: This procedure was only created with the intent to serve as a reference on how to structure and teach this activity. Teachers have the full flexibility of teaching this activity based on their teaching style.

1. Setup the materials for students before session starts as shown in Figure 3.



Figure 2: Engineering Design Toolkit materials setup for the Car activity

2. Introduce the Engineering design process to students.

- ***Definition - Engineering design process:***

The engineering design process is a series of steps that engineering teams use to guide them as they solve problems. The design process requires that

engineers repeat the steps as many times as needed, making improvements along the way.

Sources: <https://www.teachengineering.org/engrdesignprocess.php>



Figure 4: Engineering Design Process

Source: <http://shop.dowlingmagnets.com/p/engineering-design-process-magnets>

3. Introduce the activity's problem description to the students.

Problem Description

Abraham lives in Corvallis. He wants to visit his grandmother in Portland. He can not get to Portland on time without a car. It's key that Abraham stays on the highway the whole time to ensure that he gets there on time. Use the provided materials to build a car that can drive straight and roll far enough to get to Portland. The car can be pushed, but can

not be touched after release. The car must be able to roll at least 10 ft. The highway is only 3 ft wide and the car must stay within those limits.

4. Instruct the students to follow the Engineering design process steps.

- **Step 1: Ask** (Duration = 5 minutes)
 - What is the problem that Scott is facing? (**Learning outcome 1**)

- **Step 2: Imagine and plan** (Duration = 10 minutes)
 - Questions to aid the car design.
 - Why does Scott need a car? (**Learning outcome 2**)
 - How can Scott make/build a car? (**Learning outcome 3**)
 - Mission
 - Have the students draw out their designs of the car on the whiteboard provided.

- **Step 3: Create** (Duration = 20 minutes)
 - Question to aid the car creation.
 - Using the materials provided at hand, how will you make the car? (**Learning outcome 4**)
 - Mission
 - Show the students the possible designs diagram then let them design one of their own.

- **Step 4: Test** (Duration = 5 minutes)
 - Question to aid testing of the car.
 - To check if the car works, we should test it, How can we test if the car works? (**Learning outcome 5**)
 - Mission
 - Have the students test their car designs in the hallway. Measure a 10ft distance, if the car rolls up to the 10 ft distance then it is a success.

- **Step 5: Improve** (Duration = 5 minutes)
 - Questions to aid improving the car
 - For the cars that did not reach the 10 ft distance, Why did the car not work? How can we re-make the car to improve it? (**Learning outcome 6**)
 - Mission
 - What have you learned ? (**Learning outcome 7**)

Adjusting difficulty (Optional)

New problem descriptions

Re-define problem statement so that the students try to build the car with the least amount of materials possible as well as adding a bucket on the top to make the car travel the 10 ft distance in a straight line as shown in figure 5..

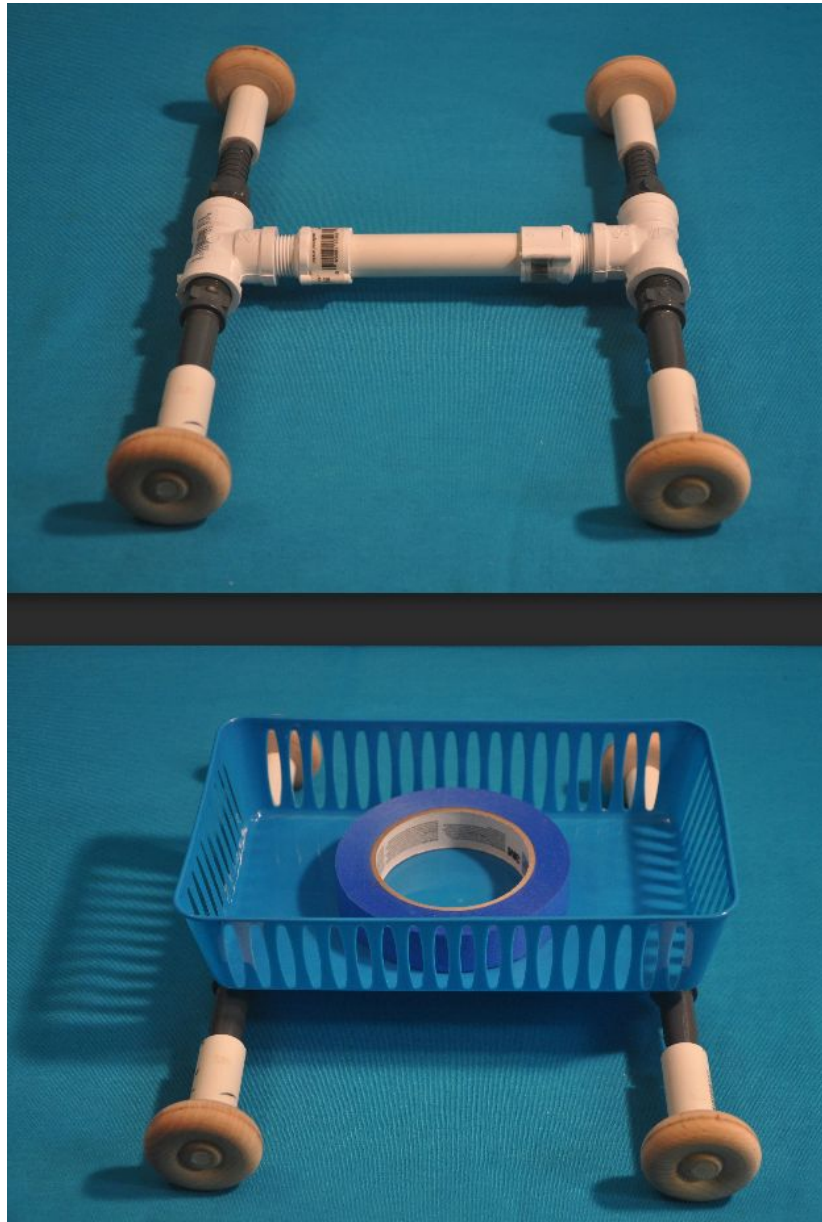


Figure 5: Car design with least amount of materials.