

Start Engineering



Grade Level: Elementary School

Student Objectives

- Understand the different phases of the engineering process (ask, imagine, plan, create, test and improve)
- Utilize the engineering process to create a solution to a problem (NASCAR Hall of Fame or your own)
- Understand the role of engineers in NASCAR
- Demonstrate STEM skills

Materials List

- Engineering Process PDF
- Engineering process videos: <https://www.youtube.com/watch?v=fxJWin195kU> or https://www.youtube.com/watch?v=MAhpfFt_mWM
- Paper (plain and/or grid)
- Pencils
- Scissors
- Tape (masking or duct)
- Markers, crayons or colored pencils
- Materials to build a car:
 - You can either build your own car (see materials below) or use a diecast, plastic car or wooden toy cars.
 - For the car body, any sturdy material that can be cut or sized will work such as cardboard or plastic board. Cardboard tubes (paper towel, toilet paper, etc.) can be used as well.
 - For the wheels, anything round will work, such as soda/pop bottle caps, cut-out wheels (thick paper, cardboard, etc.), jar lids, wooden wheels, cut-out plastic wheels (plastic plates, plastic cups, plastic card), tea light candles (remove the candle and use the metal holder), etc.
 - For the axels, any sturdy, straight object can be used, such as straws, pencils, straightened out paper-clips, straightened out wire clothes hanger, cut-out (cardboard, plastic plate, etc.), stick or twig, nails, plastic construction building toys (LEGO, K'nex), etc.





- Materials to build racetrack:
 - o For the track, you can use cardboard box(es), Hot Wheels track or other racetracks, train tracks, books, newspaper, magazines, cookie sheets, etc. Racetracks can be built out of a variety of materials.
 - o For the track curves, you can use cardboard boxes, Hot Wheels track curves, train track curves or plastic/cardboard tubes.
- View races at Charlotte Motor Speedway – spring and fall races (two different tracks):
<https://www.youtube.com/watch?v=qMW6XQhaEKM> May Race: <https://www.youtube.com/watch?v=GwDmQxaX18w>

Lesson Plan and Procedures for Adults

1. Introduce the student(s) to the engineering design process. View engineering process videos or read each step from Engineering Process PDF (download). Talk about what each step means and any applications that you have experience with.
2. Try the engineering process by baking chocolate chip cookies.
 - Ask – Can you create a better cookie?
 - Imagine – Try making a cookie that is softer with more chocolate chips or add in potato chips.
 - Plan – How do you make cookies and what are the ingredients/measurements?
 - Create – Make the recipe.
 - Test – Eat the cookies and ask questions. What was good, what might be better and what is missing? Did your recipe work?
 - Improve– Switch out ingredients or quantity and try again. Discuss with the student(s) what each step in the engineering design process means.
3. Explore the engineering process with a different household item or by even creating a car physically or in a racing game. Have the student(s) write down each step and either write or draw the elements to create a plan. Create and test the plan.
4. Discuss how we utilize the process each day without realizing it – from deciding what we are going to do, clothes we'll wear or where to go.





5. Talk about engineering process and its application in NASCAR. Discuss each step and what ideas they may have for making improvements and how they would test their improvements.
 - NASCAR holds races in different locations each weekend where everything can be different, from the track surface, the angle or banking of the track and even the rules themselves.
 - Teams, track staff and officials use the engineering process to answer a problem. An official may use the process to improve the inspection process where cars need to be measured to meet specific requirements, but it can take a long time. Track operation staff may think about how to improve the flow of fans into the stands or change the track by add new corners or changing angles. And a race team could use different parts to improve their race car (within the rules), creating a different shape of the car, add/remove weight or make improvements to communication with the driver.
6. Conclusion: Review the steps of the engineering process. Explain it is the student's turn to use the engineering process to solve a problem. Discuss the problem options below and let them work through the engineering process. When they test their solution, remember to measure the outcome so they can make changes and compare results from the first trial to the second. (HINT: You can modify as many times as you wish and re-test, gathering new data that you can use for math problems and graphing.)

PROBLEM 1:

The engineers on a race team have a problem. The racecar need to go further than their competitors. Think about how to make a car move (whether through gravity, air power or rubber band power.) Test the car and record your data for how far the car moved.

Added Challenge:

- The racecar must move under its own source of power.
- You can release the car, but you cannot push, pull or touch the car to get it to move forward.
- You cannot attach the car to a piece of string and pull it around.
- The axles which the tires are attached to on the racecar must spin. Axles generally are a straight piece that spins inside a bushing (or tube) so the tube can attach to the car chassis (body).





PROBLEM 2:

The engineers on a race team have a problem. They need to build a race car that can turn left on a racetrack versus traveling in a straight line on a racetrack. Think about how you can get a car to turn left or right. You can use the same car you built before or start from scratch. (HINT: Think about the axles that turn the wheel and how you mount (tape) them on the base. You may need to add an angle versus going straight across.)

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PROBLEM 3:

Track engineers want to add more challenges to races by re-envisioning an oval racetrack. Engineers are looking to add an extra turn or include a road element to the track. You need to think about how you can add a twist (left and right turns) to an oval track that normal has four turns. (HINT: Charlotte Motor Speedway is a good reference. The spring race is on the oval track but the fall race is now on the ROVAL™. Check out Charlotte racing footage at www.nascar.com.)

