

Brake That Car!

Background

The structure of something affects how it functions. You learned in 3rd Grade that some structures of animals affect how they function. One of the best examples of this is how different birds have adapted beaks, enabling them to hunt for food in different ways. In this science unit, you have found that the structure of plants also affects their function. One example are the sharp thorns on a cactus, which help them defend themselves.



Likewise, humans design and construct all sorts of things, including machines, houses, buildings, and toys. The structure of these things affects their function. Engineers always think carefully how the structure of what they are working on will solve the problem (the function).



The Challenges

Using your science knowledge and your engineering skills, your team will design and construct a wooden car from the materials provided. Keep in mind that the structure of the car will affect its function. Your car needs to be adjustable so that it can successfully function in two different contests:

➤ **Need For Speed**

→ After rolling down a ramp, your car should travel as far as possible

➤ **On The Spot**

→ After rolling down a ramp, your car should stop at a designated spot on the floor

Rules and Information

1. Your teacher will tell you how much time your team has to design, construct, and test your wooden car. The contests will occur after that.

2. When it is your team's turn to compete on Brake That Car Contest Day, your team will:
 - a. explain to the class how your car is intended to work.
 - b. have three tries at the "Need For Speed" contest. The teacher will measure the distance each time, and you will record the distances.
 - c. have only **90 seconds** after your teacher tells you the result of the third trial of the "Need For Speed" contest, to place your car on the ramp for the "On The Spot" contest (during the 90 seconds, you will make adjustments to the car)
 - d. have three tries at the "On The Spot" contest. The teacher will measure the distance each time, and you will record the distances.
3. All molecules of the car and cargo must be behind the ramp's red starting line when the car is released (**not pushed**).
4. The teammate who releases the car may only use one hand.
5. Three or four of the car's wheels must be touching the ramp when released --- nothing else may be touching the ramp when the car is released. All cargo must be touching the car prior to the release. After it is released, it is permissible for cargo to fall off the car.
6. Nothing can "hook" onto the ramp.
7. The designated spot for the car to stop is 30 cm from the bottom edge of the ramp.
8. All distance measurements will be made to the middle of the front of your team's car.
9. The materials provided to your team are:
 - One block of wood (approximately $\frac{3}{4}$ " x $2\frac{1}{2}$ " x 6", with a hole)
 - 4 wooden wheels
 - 2 wooden dowels (each about 4" long)
 - One piece of string (about 48" long)
 - One piece of felt (about 6" x 6")
 - 2 straws
 - One 200 g hooked mass
 - One push pin
 - Other supplies that can be used: Paper, glue, masking tape, up to 6 paper clips, up to 6 rubber bands
10. Other materials commonly found in your classroom may be included on your car, but prior approval must be obtained from your teacher.

The Engineering Design Process


Step 1: Identify the Problem - In your own words, write a sentence describing each problem you need to solve.

Need For Speed: _____

On The Spot: _____

Step 2: Brainstorm – Brainstorm design ideas with your teammates. Share your thoughts, but don't discuss details.

Step 3: Design – After brainstorming, each team member should take a few minutes to think individually about the best way to meet the challenges. Each team member should then sketch his/her design ideas. It is helpful if the materials are labeled.



Step 4: Select a Design – Share your design with your team. Discuss the advantages and disadvantages of the designs. Agree on the team’s design, and sketch it. Label the materials.



Step 5: Construct – Gather the materials and build the car. New ideas or suggestions may emerge from you or your teammates. Include them while building if your team agrees on them.

Step 6: Test and Evaluate – When your team is ready, ask your teacher for permission to test your car using the ramp. You may have to take turns with other teams. Your team should observe your car carefully, and evaluate how well it performs. Your team should discuss ways to modify the car, make the modifications, and re-test it if you have time.

IT IS NOW TIME FOR THE CONTESTS!

Brake That Car Contest Day

Contest #1: *Need For Speed*

	Distance the Car Travels from the Edge of the Ramp (in cm)
Trial #1	
Trial #2	
Trial #3	

Observations about your car's performance in "Need For Speed":

Contest #2: On The Spot

	Distance the Car Stops from the Designated Spot (in cm)
Trial #1	
Trial #2	
Trial #3	

Observations about your car's performance in "Need For Speed":

Brake That Car Evaluative Feedback

Student Name: _____

Check the statement that best describes the quality of the student's teamwork for Brake That Car.

- C** = Consistently
- U** = Usually
- I** = Inconsistently
- R** = Rarely

	C	U	I	R
Team Work – Worked collaboratively with teammates				
Building – Successfully contributed to the building of the team's car with no assistance from the teacher				
Participation – Actively participated in all aspects of the task				
Sportsmanship – Demonstrated good sportsmanship during the Brake That Car Contest Day				
Overall Contribution Rating:				

Other teacher comments about your performance and achievement:

Date: _____