



## Minor Challenge Set #3

**STEM Field:** Mechanical Engineering

**Level:** Senior

**Challenge Name:** Design Your Car Suspension

### Materials required:

- Materials to build a simple car with the following parts:
  - Wheels
  - Axles
  - Car frames
- A small cardboard box that fits on the car
- Some peanuts / marbles / sweets as 'cargos'
- Rubber bands
- Pencils / pens as speed bumps
- Other office materials such as scissors, tape, glue as you see fit to assemble your car!

## Introduction:

Have you ever wondered how parts in the car work together to maintain a smoother ride and keep the wheels on the road? The road handling, steering stability and passenger comfort are provided by the car's suspension - a system consisting of tyres, springs, shock absorbers and linkages. A combination of springs and dampers work to absorb and decrease road vibrations.

In this project, you will build your model car and suspension system to keep the cargos safe as the car drives over speed bumps! This is an

engineering design project, and so, while there are some requirements you need to meet, the design, materials and engineering process are up to you!

## Specifications:

- Make a small cardboard box and fill it with peanuts / marbles / sweets. Carefully cut the flaps of the cardboard to keep the top face open. Our goal is to design a suspension system to keep the peanuts / marbles / sweets safe when travelling over speed bumps.
- You can use tape to attach this cardboard box to the top of your car.
- You cannot use a toy car for this project. You can make your own simple car model using any craft materials you can find. There are no restrictions on the size or model of your car.
- Set up speed bumps for your car to drive over. You can tape several pencils or pens to a flat surface, parallel to one another and 10 -12 cm apart.

## Instructions:

- Assemble your car (without suspension system). Tie a string to the front of your car so you can pull it over the speed bump. Fit the cardboard box with 'cargos' on top of the car. Pull the car quickly across the speed bump.
- Assemble the suspension system and fit this to your car. Fit the cardboard box with 'cargos' and pull the car quickly across the speed bump.

## Tips:

- When attaching the wheels and axles to the car frame, ensure the axles can rotate freely and without too much resistance.
- The engineering design process is iterative - meaning that we repeat the steps and make improvements to our design as we go. So don't get discouraged if your design doesn't work in the first try!
- If you use rubber bands for the suspension system, consider changing the type of rubber bands as you design the suspension system. *Do length and thickness of the rubber bands affect your design?*
- Consider changing the weight and how you fit the cargo box on top of the car. *What happens if we attach more weights to the car, such as taping coins to one corner, or taping coins directly to the cargo box?*
- Consider changing the speed at which your car drives over speed bumps. *What did you notice?*
- Refer to the Learn More! Resources section for some further readings on car design tips.

## Reflection Questions:

- Are there any improvements you would make to this challenge?
- What are the key concepts of science and engineering that relate to this challenge?
- How did the ride quality of the car differ with the suspension system?
- Did you vary the length or thickness of the rubber bands, speed at which the car was travelling and weight distribution? What did you find?

- What is the effectiveness of your final design? If you were to do this challenge again, what would you have done differently next time?
- What are some of the challenges you faced while working on this challenge? How did you overcome them?
- When you were building the car, which pieces of information / data / observation influenced your brainstorming ideas and final design?

## Submission Guidelines:

- Submit photos of your car and experimental setup. Include a short summary that addresses the Reflection Questions. One of the photos should include a diagram of your car model with labelled parts.

**Note:** When submitting this Minor Challenge, please upload pictures of your project or experimental setup. Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your mentor first.

- There is a submission form directly on the Minor Challenge page here: [https://sciencechallenge.org.au/index.php/minor - challenges/](https://sciencechallenge.org.au/index.php/minor-challenges/). Fill out the details and make sure you upload your submission.

## Learn More! Resources:

- Build Your Own Race Car! | Car Suspension Basics, How-To & Design Tips - <https://www.buildyourownracecar.com/race-car-suspension-basics-and-design/>
- Toyota | How Are Cars Made - <https://www.toyota.co.jp/en/kids/car/index.html>

If you enjoyed this activity, you may want to explore this career resource:

- Science Buddies | Automotive Engineer - <https://www.sciencebuddies.org/science-engineering-careers/engineering/automotive-engineer>
- Science Buddies | Mechanical Engineer - <https://www.sciencebuddies.org/science-engineering-careers/engineering/mechanical-engineer>

## Sources:

- Finio, B., 2017. Absorb the Shock!. [online] Scientific American. Available at: <<https://www.scientificamerican.com/article/absorb-the-shock/>> [Accessed 30 May 2021].