Western Engineering

Outreach

Rubber Band Car Bowling

Grade 6-8

Meet Today's ENG HERO!

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Bruce completed his Bachelor of Mechanical Engineering at the University of Waterloo, followed by his Masters and PhD at Queen's University. His research interests include vehicle dynamics and control, multibody dynamics and numerical modeling and simulation.

To learn more about Dr. Minaker visit:
https://www.eng.uwo.ca/mechanical/people/adjunct_faculty.html

Learning Goal:

- Students will develop their problem solving skills as they build a test a rubber band car
- Curriculum Connections: Grade 7 - Form and Function; Grade 8 - Systems in Action

Materials Needed:

- Plastic bottles
- Cardboard
- Straw
- 2 Skewers
- Rubber band
- Scissors
- Hot glue
- 4 Wheels (can be made out of cardboard or bottle caps)

Engineering and Science Connections:

What kind of engineer do you think designs cars?

Automotive engineers design vehicles that we use for life, work and play. They are involved in the design all the way to the production of the vehicle. Some automotive engineers work on the basic systems of a car such as brakes and engines, or some can be involved in the safety, comfort, practicality, or handling aspects. However, a car cannot move without some sort of energy input / output.

You have probably heard of the Law of the Conservation of Energy. This principle states that energy can neither be created nor destroyed. It can only be changed from one form to another. There are many different forms of energy that can be used to do work, for example, heat, light, and electricity. There are two more kinds of energy that we will discuss today: kinetic energy and potential energy.

Kinetic Energy - the energy of motion, when an object is moving. Objects that are moving have the ability to do work.

Potential Energy - the energy associated with an object because of its position or structure. For example, a car at the top of a hill has potential energy because of gravity. If you were to push it, that potential energy would be transformed into kinetic energy when the car rolls down the hill.

Another kind of potential energy is elastic potential energy. This is the energy stored as a result of applying a force to deform an elastic object, like when you twist an elastic band. Examples of object designed to store elastic potential energy include the coil spring of a wind-up clock, a bent diving board right before a diver jumps, and an archer stretching the string of a bow. We will use elastic potential energy to power our rubber band cars. That potential energy when the elastic is released will be transformed into kinetic energy as the car starts moving!

Video Recommendation: *Elastic Potential Energy - GCSE Physics*

https://www.youtube.com/watch?v=vUminOz9EVo

Activity:

Before you start, think about the following questions:

- What kind of energy will power our car?
- What kind of energy will the car have while it is in motion?
- What are other things that have elastic potential energy?

You and your team of engineers have been hired by Tesla to create a car that runs on a different kind of energy. In continuing their mission to accelerate the world's transition to sustainable energy. They have electric cars figured out, but want to expand the market to include cars powered by potential energy! You must make sure your vehicle is accurate as well. After it is built, it must drive straight enough to knock over other bottles set up like bowling pins.

Part 1 – Build Your Car Design Challenge

First, you must plan out what you want your car to look like. Draw out your design. You can use any of the materials listed in the materials section. You can use a pop bottle or cardboard as the body of the car. Use skewers as the axels and design some wheels as well. Use small pieces of straw for the axels to sit in.

There are many ways you can add the elastic to make the car function. Use your problem solving skills to come up with a solution.

- Think about how we must stretch the elastic in some way to create the potential energy.
- The elastic should not go flying off when the car is released, so it must hook onto something on the car.

Try several solutions. If your first solution does not work, think about why. Think about how you might fix the problem that is occurring, then try your next solution. Repeat this until something works. This problem solving process is something engineers call the Engineering Design Process. They try to understand the problem, build a solution, test it, then repeat! All professional engineers have to go through trial and error.
See the next page for a possible solution.

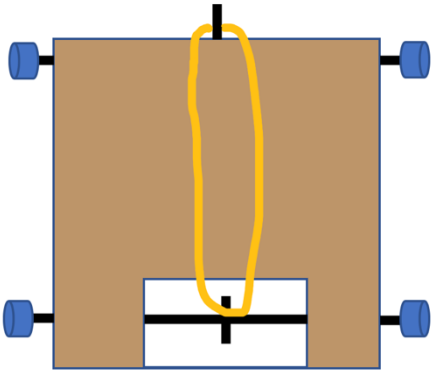
Part 2 – Bowling

Now it is time to test your car! Set up empty bottles or other recycles about 6 feet away. Wind up your car and release. See how many bottles you can knock down. Make adjustment if your car does not move straight enough or far enough. Can you knock down everything for a rubber band car strike?

Possible Solution

Here is one possible solution for adding the elastic:

1. On the front of your car, add a small piece of skewer that the elastic can be looped onto.
2. On the back axel of your car, add a small piece of skewer in the middle that is perpendicular to the axel.
3. Place the elastic onto the front piece of skewer. Loop the elastic around the perpendicular piece on the back axel. Twist the back wheels. The elastic should twist around the axel, adding the potential energy necessary. Release and watch as the potential energy is converted to kinetic movement.



What Did You Learn?

- What are the two forms of energy discussed? Can you name any more?
- Why does the elastic work to power the car?
- What is the Law of Conservation of Energy?

Future Learning

- Put your Engineering Design Process to the test by using problem solving to build a balloon rocket car. Rather than being powered by an elastic, a balloon car is powered by the air in the balloon. Remember that trial and error is okay!

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!