GRADE 5 ENERGY TRANSFORMATIONS: ELASTIC POWERED CARS

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Elastic Powered Race Cars

Possible Technology focus: Sensor timer: Maki Maki, light sensors, micro bit, scratch

In this activity, students learn about engineering design by constructing elastic powered cars from everyday materials that can travel in a straight line for a distance of at least 3 meters within a 1 meter wide track. They test their elastic powered racers, evaluate their results, and present to the class.

Grade Levels: 5

Time: three or four 50-minute classes for design, construction, testing, modifying and evaluating

Prior knowledge of renewable, non-renewable energy sources and energy transformations is necessary before this task. Students must also have prior knowledge in Data Management calculating mean and Patterning and Algebra use of variables.

Inquiry Focus: To use recyclable materials and a renewable energy source while explaining the energy transformations that takes place in designing, building, testing and modifying a racecar.

Learning Outcomes

As a result of this activity, students will have:

- Designed and constructed an elastic powered car
- Measured distance and calculated speed
- Tested and refined their designs
- Communicated their design process and results

Curriculum Expectations:

Language (Writing)

Publishing

3.7 use a range of appropriate elements of effective presentation in the finished product, including print, script, different fonts, graphics, and layout (e.g., use legible printing and cursive writing; include a labelled diagram)

Producing Finished Works

3.8 produce pieces of published work to meet identified criteria based on the expectations related to content, organization, style, use of conventions, and use of presentation strategies

Science (Understanding Earth and Space Systems- Conservation of Energy and resources)

1.2 evaluate the effects of various technologies on energy consumption (e.g., improving our home's insulation allows us to conserve heat and reduce energy consumption; aerodynamic design can improve the energy efficiency of cars and buses; household appliances designed to make our lives easier use large amounts of energy; some cars and recreational vehicles use energy less efficiently than others), and propose ways in which individuals can improve energy conservation.

2.3 use technological problem-solving skills (see page 16) to design, build, and test a device that transforms one form of energy into another (e.g., create a child's toy that uses the electrical energy from a battery or solar cell to move across the floor [kinetic energy] and make a noise [sound energy]), and examine ways in which energy is being "lost" in the device.

3.1 identify a variety of forms of energy (e.g., electrical, chemical, mechanical, heat, light, kinetic) and give examples from everyday life of how that energy is used (e.g., electrical energy for cooking; chemical/electrical energy to run our cars; mechanical energy to hit a baseball; light energy for managing traffic on the roads; heat energy to warm homes and schools)

3.3 describe how energy is stored and transformed in a given device or system (e.g., in a portable electric device, chemical energy stored in a battery is transformed into electrical energy and then into other forms of energy such as mechanical, sound, and/or light energy

3.5 explain that energy that is apparently "lost" from a system has been transformed into other energy forms (usually heat or sound) that are not useful to the system (e.g., sound from a car's engine does not help the car move)

Math – (Patterning and Algebra)(Data Management)

– Demonstrate, through investigation, an understanding of variables as unknown quantities represented by a letter or other symbol

– calculate the mean for a small set of data and use it to describe the shape of the data.

Lesson Activities

In "Elastic Powered Racers," students explore elastic powered car design. They work in as "engineers" to design and build their own rubber-band car out of everyday items. They test their rubber band cars, evaluate their results, and present to the class.

Resources/Materials

For each student:

- 16 in. x 16 in. sheet of corrugated cardboard (cereal box or smaller piece of cardboard can be used)
- Four wheels (wooden wheels, plastic bottle tops, CD's)
- 8-10 rubber bands

- 2 dowel pieces
- 4-6 paper clips
- 2 water bottles
- Scissors
- duct tape/ tuct tape
- hot glue
- 1-60 cm piece of wood
- 1 Paper cup
- 4 popsicle sticks
- 2 straws
- 4 Gusset pieces (Paper)
- 1 -8x10 cardstock
- Stop watch

Instructional Planning and Delivery

1. Show students the various Student Reference Sheets. These may be read in class or provided as reading material for the prior night’s homework.

2. Hand out planning and design outlines explaining that each student must complete a model and material list.

3. Explain that students must develop a car powered by elastic bands from everyday items, and that the elastic band car must be able to travel a distance of at least 3 meters within a 1 meter wide track. Elastic bands cannot be used to slingshot the cars. The car that can travel within the track for the greatest distance is the winner.

4. Students develop a plan for their elastic powered car. They decide on materials they will need, write or draw their plan, and then present their plan to the teacher.

5. Have students write the amount of materials available on material list. Limited materials are available for each student. Students may trade unlimited materials with other students to develop their ideal parts list.

6. Next, students execute their plans. They may need to rethink their plan, request other materials, trade with other students, or start over.

7. Finally….students will test their elastic powered car. Students can create the 1-meter wide “track” using masking tape on the floor. Statistics will be measured and recorded included time, distance and averages.

8. Students will then be given 20 minutes to make modification to their original racecars.

9. Statistics will be measured again to see if any improvements were made.

10. Students then complete an evaluation/reflection worksheet, and present their findings to the class.

Additional teacher and student resources:

Different examples of elastic powered vehicles:

How to build a rubber-band car   from cardboard and old CDs, from PBS Design Squad.

How to build a rubber-band car courtesy of malasiaminilover.com. Step-by-step instructions with illustrations.

https://www.youtube.com/watch?v=YSqj1c8fBns (https://www.youtube.com/watch?v=YSqj1c8fBns) Step-by-step instructions with using a propeller

https://www.youtube.com/watch?v=g-wZj1z5qbU (https://www.youtube.com/watch?v=g-wZj1z5qbU) Step by step chariot type racer

Possible Extension:

Students could plan, design and build timing devices for the racetrack. Using background knowledge of coding.

Examples:

1. Using 2 Microbits (one with speaker and the other connected to the light sensor) can be used to time if you embed the light sensor below your racetrack. The Racetrack will need to be the specified dimensions. The light sensor will sense a shadow and then alert the other. The first Microbit times the start and will stop the timer when it receives the message from the other. I would disconnect the battery packs from the microbits to conserve the battery life until used.

2. Using a long sheet of folded paper is what's called a pressure sensor. Place copper tape or tinfoil on the inside of the spine. When the race cars run over at the circuit will be connected as a two pieces of tape will complete the circuit. Using the Makey Makey kit and scratch you can program the pressure sensor to stop timing when the ___ (up,down,right,left arrow) is pressed. This will work using construction paper 1m in length at the start and finish line and know how heavy the cars would be.

3. Make two square pieces of cardboard and 2 strips of tinfoil with the Microbit is called a timing gate. Each car would need a piece of tinfoil on its underside which when the car runs over the gap in the tinfoil will complete the circuit. You can use the Microbit that I left or alternatively you could use a Makey Makey kit and connect it the same way you would the pressure sensor.

RESOURCES

- Student Resource (https://connex.stao.ca/sites/default/files/elastic_powered_racersdesign.docx)
- student page - design (https://connex.stao.ca/sites/default/files/elastic_powered_racersdesign.docx)
- student page -construction testing and evaluating (https://connex.stao.ca/sites/default/files/elastic_powered_cars_construction_testing_evaluation.docx)
- construction 4.jpg (https://connex.stao.ca/sites/default/files/construction_4.jpg?width=4032px&height=3024px&iframe=true)
- construction 1.jpg (https://connex.stao.ca/sites/default/files/construction_1.jpg?width=4032px&height=3024px&iframe=true)
- construction 2.jpg (https://connex.stao.ca/sites/default/files/construction_2.jpg?width=4032px&height=3024px&iframe=true)
- construction 3.jpg (https://connex.stao.ca/sites/default/files/construction_3.jpg?width=4032px&height=3024px&iframe=true)
- design 1.jpg (https://connex.stao.ca/sites/default/files/design_1.jpg?width=4032px&height=3024px&iframe=true)
- design 2.jpg (https://connex.stao.ca/sites/default/files/design_2.jpg?width=4032px&height=3024px&iframe=true)
- design 4.jpg (https://connex.stao.ca/sites/default/files/design_4.jpg?width=3913px&height=2569px&iframe=true)
- design 3.jpg (https://connex.stao.ca/sites/default/files/design_3.jpg?width=3826px&height=2616px&iframe=true)
- testing 1.jpg (https://connex.stao.ca/sites/default/files/testing_1.jpg?width=4032px&height=3024px&iframe=true)
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ELEMENT

- Critical Thinking (/expert-elements/critical-thinking)

(/classroom-catalysts) **RETURN TO CATALYSTS (/classroom-catalysts)**