BOTTLE CARS

OVERVIEW

In this activity, campers will learn about the conservation of energy, kinetic and potential energy. Newtons laws of motion will also be explored. Campers will be able to make their very own bottle cars made from common household materials.

TOPIC AREA(S)	**GRADE LEVEL**
Physics Engineering	Grades 5 and 6

QUESTIONS PRIOR TO THE LESSON/GETTING EXCITED

- Who here has ever blown up a balloon and let it go?
- What happens when a balloon full of air is released?
- What can you do to make your balloon go crazier after its released? (blow it bigger)
- Why does a full balloon move like that after being released? What is the physics?
- Why does a ball roll after it has been thrown? (kinetic energy)

BACKGROUND INFORMATION FOR INSTRUCTORS (INCLUDE QUESTIONS W/ ANSWERS)

It might not seem like it at first, but a simple balloon car is loaded with physics and engineering concepts! When you inflate a balloon, it stores **potential energy** in the form of stretched rubber and the compressed air inside. When you release the balloon, this energy is converted to **kinetic energy**—the energy of motion—as the balloon zooms around the room. Some of the energy is also converted to heat due to friction. **According to the law of conservation of energy**, the total amount of energy is conserved. Energy never "disappears"—it just changes to another form.

Another way to think about the balloon's movement is to use **Newton's third law of motion**: For every action there is an equal and opposite reaction. When you inflate a balloon and then release the nozzle, the rubber contracts and pushes the air out the nozzle. This means that there must be an equal and opposite reaction—the air pushes back on the rubber, propelling the balloon forward. This principle is used in real rockets and jets that shoot a high-speed stream of gases out the back of their engines, propelling the vehicle forward

The car also contains a **simple machine**: the **wheel and axle**. This invention has been around so long, we take it for granted—and many of us ride in wheeled vehicles every day.

BOTTLE CARS

RELEVANCE TO THE CURRICULUM

Grade 1 and 2	Grade 3 and 4	Grade 5 and 6	Grade 7 and 8
Needs & Characteristics of Living Things Growth and Changes in Animals Materials, Objects and Everyday Structures Movement Energy in Our Lives Properties of Liquids and Solids Daily and Seasonal Changes Air and Water in the Environment	Growth and Changes in Plants Habitats and Communities Strong and Stable Structures Pulleys and Gears ▪ Forces Causing Movement Light and Sound Soils in the Environment Rocks and Minerals	Human Organ Systems Biodiversity ▪ Forces Acting on Structures and Mechanisms Flight Properties of and Changes in Matter Electricity and Electrical Devices ▪ Conservation of Energy and Resources Space	Interactions in the Environment Cells Form and Function Systems in Action Pure Substances and Mixtures Fluids Heat in the Environment Water Systems

MATERIALS (SPECIFY WHETHER PER CAMPER, GROUP OR CLASS)

Per camper:
-Plastic bottle
-Four plastic bottle caps
-Wooden skewer
-Two straws
-Balloon
-Tape
-Scissors

SAFETY CONSIDERATIONS

-use extreme caution when cutting holes in bottle caps (adult assistance/ supervision required)

PROCEDURE

1.Cut one of the straws in half and tape both pieces to one side of the water bottle going widthwise (**parallel**)

2.Cut the wooden skewer in half and push each piece through one of the straws. This will form the axles

3. Use scissors to poke a “+” shaped hole directly in the center of each plastic bottle cap (adult help/supervision)

4. Press each bottle cap onto the ends of the wooden skewers to form wheels.

5.Put your car down on a flat surface and give it a good push. Make sure the car rolls easily and coasts for a bit before stopping. If your car gets stuck or does not roll smoothly make sure: your axles are parallel to each other; the hole in each bottle cap is centered; and the straws are securely taped to the water bottle and do not wobble. You can add some glue if tape is not sufficient.

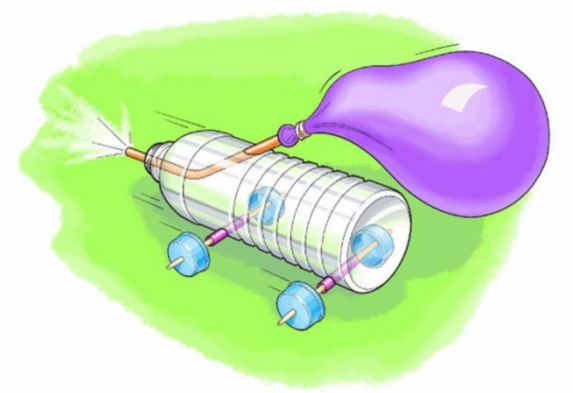
6.Tape the neck of the balloon around one end of the other straw. Wrap the tape very tightly so the connection is airtight.

7.Cut a small hole in the top of the water bottle, just big enough to push the straw through.

8.Push the free end of the straw through the hole and out the mouth of the bottle.

9.Use tape to secure the straw to the bottle.

- 10.Blow through the straw to inflate the balloon, then put your finger over the tip of the straw to trap the air. *What do you think will happen when you put the car down and release your finger?*



REFERENCES

https://www.scientificamerican.com/article/build-a-balloon-powered-car/