

Soda Can Engine

AT A GLANCE:

Students investigate Newton's Third Law of Motion using thrust produced by falling water.

STUDENTS WILL BE ABLE TO:

Practice the process of scientific inquiry by designing and testing their own 'Hero Engine'.

BACKGROUND INFORMATION:

This activity simulates the operation of the classic aeolipile engine invented by Hero of Alexandria more than 2,000 years ago. Hero's engine was a spinning copper sphere that was propelled by a thrust produced by a jet of steam. The engine was an early demonstration of the action-reaction principle (third law of motion) stated by Sir Isaac Newton 1,700 years later. Steam, shooting out through two L-shaped holes, creates an action force that is accompanied by an equal reaction force in the opposite direction.

PRINCIPLES:

Newton's Third Law of Motion states that for every action there is an opposite and equal reaction.

DETAILED EXPLANATION:

As the water pushes through the angled holes in your soda can engine, the can is pushed in the opposite direction, resulting in a spinning turbine effect.

MATERIALS:

- Several empty aluminum soft drink cans
- Carpenter's nails of different sizes
- String
- Large container for water
- Towels
- Bright stickers or markers

PROCEDURE:

1. Using a nail, carefully push a hole into the can near the bottom. Be careful not to smash the can.
2. Once the nail is in the side of the can, push the nail slightly to the left or the right so that the hole is at an angle.
3. Rotate the can about $\frac{1}{4}$ of the way around and repeat. Use the same direction for your angle as in step 2.
4. Repeat 2 more times so that you have 4 total holes.
5. Tie a string to the tab on the top of the can.
6. Immerse the can in water.

7. When can is full, lift the can out of the water by the string. What do you notice about the motion of the can?

TRY THIS:

- What do you notice if you do not angle the holes in your can? Why is this?
- What if the holes are angled differently?
- How does your motor perform with a different number of holes?

INTEGRATE:

- Have students practice their table-making and data-recording skills by having them design tables to keep track of their results.
- Have students sketch their soda can engines using detailed labeling and scale.
- Discuss how technologies like this made life easier for the Greeks much like a modern day vehicle's engine makes life easier for people today.

