# POP ROCKET—TRASH TO TREASURE

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## Lesson Summary for Grades 2–5

Students design a paper rocket propelled by an effervescent antacid tablet and water in a film canister. They use scrap paper to construct the body of the rocket and observe how various designs affect the height the rocket reaches. The lesson demonstrates Newton's third law of motion, with students observing an action creating an opposite reaction. Students theorize variables that might change the force or action.

## Science Activity: Pop Rockets

*Students build a simple rocket to observe Newton's third law.*

Key Science Topics:

- motion
- Newton's third law: for every action there is an equal and opposite reaction
- gravity

Key Processing Skills:

- observing
- predicting

Ohio Proficiency Learning Outcomes for Science:
Fourth Grade

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| I-2 | Select instruments to make observations and/or organize observations of an event, object, or organism. |
| I-3 | Identify and/or compare the mass, dimensions, and volumes of familiar objects. |
| I-6 | Evaluate a simple procedure to carry out an exploration. |
| I-9 | Demonstrate an understanding of safe use of materials and/or devices in science activities. |
| II-12 | Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects. |

National Science Standards:
Science as Inquiry Standards

- Plan and conduct a simple investigation.
- Employ simple equipment and tools to gather data and extend the senses.
- Use data to construct a reasonable explanation.

Physical Science Standards

- Determine position and motion of objects.

## Materials

Per student

- an empty film canister with lid that snaps **inside** (available from photographers or film developers)
- scrap paper
- markers, crayons, or colored pencils
- tape
- scissors
- effervescent antacid tablets (such as Alka Seltzer®)
- water
- eye protection

## Safety

Students should wear eye protection at all times while the rockets are being launched.

## Getting Ready

Have the above materials available. It is most important to use film canisters with lids that snap inside. Do not use lids that close around the outside of the canister. The rockets will need to be launched outside on a solid surface, such as a driveway or sidewalk. To more easily measure how high the rockets go, you might want to mark a nearby wall using masking tape with intervals of either feet or meters. You might want to construct the rockets one day and launch on another. Another time saver might be to have items available for tracing circles or even have the circles precut.

## Introducing the Activity

If you make the rockets on a day other than the launch, save the introduction for the day of the launch.

Discuss Newton's three laws of motion by using a kickball and bowling ball. State the first law of motion: An object at rest will stay at rest. Show the students the kickball and bowling at rest. Ask the students what they see. Is there any action? What will cause action with the two balls? Students should be able to come up with the idea that a force must be applied to the balls to get them to move. What kind of force can I apply to the balls to get them to move? In what direction will they move when I apply a force? If I use the same amount of force, will both balls move exactly alike? Why or why not? State the second law of motion: When a force is exerted on an object that is standing still but free to move, the object will accelerate in the direction of the force; the greater the force on the object, the greater the acceleration. State the third law of motion: For every action there is an equal and opposite reaction.

Explain to the students that the following experiment demonstrates this law of motion.

## Procedure

1. Have students use scrap paper to make the body of the rocket. The body can be long or short; there is no one right way to make it. Tape a piece of paper to the canister and then wrap it around the film case. Make the sure the lid end of the film case is down.
2. The students can make a nose cone by tracing a circle and cutting it out. Cut out a wedge from the circle and then tape together in the shape of a cone. Attach it to the body of the rocket.

3. The students can make fins for the rocket if they wish. (Remember the less the rocket weighs and the less air resistance, the higher it will go.)
4. Students can then decorate the rockets with markers, crayons, colored pencils, etc.

For the launch:

1. Put on eye protection.
2. Turn the rocket upside down and remove the lid. Fill the canister one-third full of water.
3. Drop in one-half of an effervescing antacid tablet into the canister and snap the lid on tightly and quickly.
4. Stand the rocket on the launch platform (sidewalk or driveway). Stand back and wait for the rocket to blast off, watching how high it travels. (The rocket can go up to 5 meters.)
5. Students record the heights reached by the rockets for later graphing. They then make conclusions about why some rockets went higher than others.

### Assessment

Students construct a flipbook of how the rocket works.

Students answer the questions on the assessment sheet.

## Math Activity

*Students measure and weigh their rockets, record the information on a data sheet, and construct a graph.*

Ohio Proficiency Learning Outcomes for Math:
Fourth Grade

VI-17 Apply the use of tools to measure lengths, using centimeters and inches including recognizing the positions of whole numbers and fractions on a number line.
VI-19 Illustrate the approximate size of units of length, capacity, and weight.
VIII-24 Make or use a table to record and sort information.

On the day the students make their rockets, they weigh their rockets in ounces and grams and record this information. They also measure and record their rockets' size in centimeters and inches. On the day of the launch, the students collect the data of launch heights and construct a graph.

## Language Arts Activity 1

*Students read and discuss* Magic School Bus Explores the Solar System, *by Joanna Cole.*

This activity addresses the Ohio reading PLOs for fourth grade.

## Language Arts Activity 2

*Students write a story about traveling to the moon for a moon adventure, describing what they might bring to the moon and why.*

This activity addresses the Ohio reading and writing PLOs for fourth grade.

## Citizenship Activity

*Students create a timeline of Neil Armstrong's life.*

Ohio Proficiency Learning Outcomes for Citizenship:
Fourth Grade

- I-1a Identify sequence of events in history.
- I-1b Group events by broad historical eras on a timeline.
- I-1c Recognize that change occurs in history.

## Art Activity

*Students build the rocket and decorate it using crayons, colored pencils, or markers.*

## Careers Activity

*Students explore the lives of astronauts and read the story* A Day in Space, *by Suzanne Lord and Julie Epstein.*

## References

The Space Place website. http:/spaceplace.jpl.nasa.gov/rocket.htm Hawaii Space Grant College (accessed March 3, 2002).

# POP ROCKET
## Student Data Sheet

Name _____

After constructing your rocket, answer the following questions.

1. How tall is my rocket? _____ inches

   _____ centimeters

2. How much does my rocket weigh? _____ ounces

   _____ grams

3. At the launch watch how high your rocket goes. Then record the height.

   How high did my rocket fly? _____ feet

# POP ROCKET
## Graph Interpretation

Name _____

1. What was the greatest height the rockets reached? _____

2. What was the least height the rockets reached? _____

3. How many rockets went over 6 feet? _____

4. How many rockets went under 6 feet? _____

5. What was the difference between the highest height and the lowest height?

   _____

# POP ROCKET—TRASH TO TREASURE

## Assessment

Name _____

1. What was the action that caused the rocket to move?

_____

_____

_____

2. What was the reaction of the rocket?

_____

_____

_____

3. Write down Newton's third law of motion.

_____

_____

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4. Name one thing you could change in the experiment that might make the rocket move differently.

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