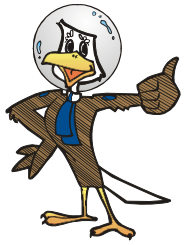
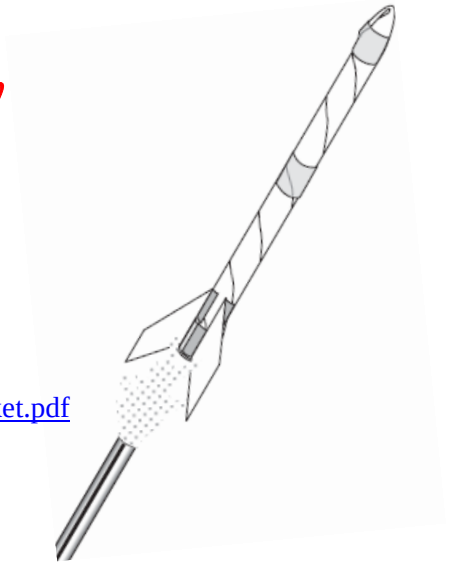


Civil Air Patrol's ACE Program

Straw Rockets
Grade 2 Aerospace Lesson #3



Subject: Science (and Math)

Lesson Reference: NASA's educator guide, *Rockets* and http://solarsystem.nasa.gov/educ/docs/Straw_Rocket.pdf

Length of Lesson: 30 minutes

Objective:

- Students will identify action and reaction.
- Students will construct and fly paper rockets.
- Students will measure the distance paper rockets travel.

National Standard Alignment:

Science Standards:

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science
  - Position and motion of objects
- Content Standard E: Science and Technology
  - Abilities of technological design
- Unifying Concepts and Processes

Mathematics Standards:

- Measurement

Background Information:

Although the activity uses a solar system target range, the Paper Rockets activity demonstrates how rockets fly through the atmosphere. An emphasis is made on the importance of fins. A rocket with no fins is much more difficult to control than a rocket with fins. The placement and size of the fins is critical to achieve adequate stability while not adding too much weight.

Materials:

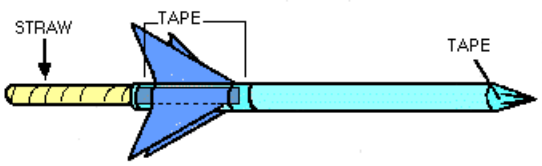
- student copies of rocket template (one copy attached)
- crayons, markers, or colored pencils
- straws (Milkshake straws work well.)
- tape
- meter stick or ruler
- eye protection (optional)
- pictures of the Sun and planets (optional)

Lesson Presentation:

1. Ask students if they have heard of or remember Newton's third law of motion. (Students who participated in this program in first grade should recognize this law of motion.) Make sure students understand that Newton's third law of motion states that each action has an equal and opposite reaction. Provide them with an example of letting go of a balloon filled with air. Air comes out one direction, and the balloon travels in the opposite direction. If needed, provide students with other examples of action and reaction.

2. Tell students that Newton's third law explains how rockets work. The action of the hot gases rushing out of the engine cause the rocket to react by moving upward, in the opposite direction of the hot fire and gases coming out of the rocket. (You may choose to show students a picture or video clip of a rocket launch - video clip available at http://www.tcd.ie/Science/videos/apo17_rocket_launch.mov.)

3. Tell students that they will make a straw rocket today to demonstrate Newton's action and reaction law. Also, students may practice measuring and aiming as they try to hit a target. Show students an example of a completed straw rocket, and demonstrate how it works. Tell students that when they have their straw rocket completed, they are never to launch it without permission, and they are never to aim it at a person.



4. Distribute a rocket template and straw to each student. Have tape and crayons/markers available. You may have rocket building work areas already set up.

5. Allow students to color the body of the rocket (the rectangle) and the fins on the rocket template sheet. Remind students that the rectangle will be folded like a tube around the straw and demonstrate.

6. Have students carefully cut out the rectangle. Tell students that this will be used to create the body of the rocket.

7. Wrap the rectangle around the straw length-wise and tape the rectangle so that it forms a tube around the straw. (Do **NOT** tape the paper to the straw! The paper overlaps onto itself, and that is where it should be taped.) They have now created the rocket's body tube.

8. Instruct students to carefully cut out the two fin units. Align the rectangle that extends between the two fins with the end of the body tube, and tape it to the tube. Do the same thing for the other fin unit, but tape it on the other side of the

pencil. Bend each fin so that it sticks outward from the body tube. This now results in four fins at the end of the body tube.

9. Tell students that the fins help keep the rocket stable. In other words, it helps the rocket to fly straight instead of flipping. (There are other factors that contribute to the stability of a rocket also.)

10. Remove the partially completed rocket from the straw.

11. Twist the top of the body tube into a point in order to make the nosecone. They may use some tape on the nosecone. Remind students that the top, pointed part of the rocket is called the nosecone. (Students may want to place their partially made rocket on a sharpened pencil to help twist the top of their rocket to make a nosecone.)

12. Place the completed rocket onto the straw and prepare for launch. The teacher may desire students to wear safety goggles during launch. When permission is granted to students for launch, the students blow quick and hard into the straw, which launches their rocket.

13. Have students launch their rockets three times and measure the distance their rocket flew each time. Designate the units of measurement students need to use, such as centimeters, inches, feet, yards, meters, or even hand or ruler lengths. Have students write their launch measurements on a piece of paper.

Summarization:
Gather students and discuss how far their rockets flew. Ask students to explain why their rocket flew. (Newton's third law of motion explains why the rockets flew. The action was the air being pushed through the straw. The air quickly slammed into the nosecone of the rocket, which propelled the rocket off of the straw and into the air. This was the reaction.) Ask students what made their rocket stop flying. (Gravity caused it to slow down and come back to the ground. The action of gravity caused the rocket to react by slowing down and falling back to the ground.)

Remind students that in life, sometimes we all need a little push to help us get going when we don't want to. So, the next time their parents or teachers see a need to be stern or strict with them, they should remember the straw rocket. Sometimes a little push from a teacher, parent, or friend will help them take off and achieve better things.

Assessment:
- teacher observation
- rocket construction
- student answers to class discussion questions

Additional activity ideas to enrich and extend the primary lesson:

- Using the greatest rocket distance recorded for each student, create a graph showing the information.

- List the greatest rocket distance recorded for each student in order from least to greatest. Have students find the median (middle number) and mode (number occurring most often) in the list of numbers.

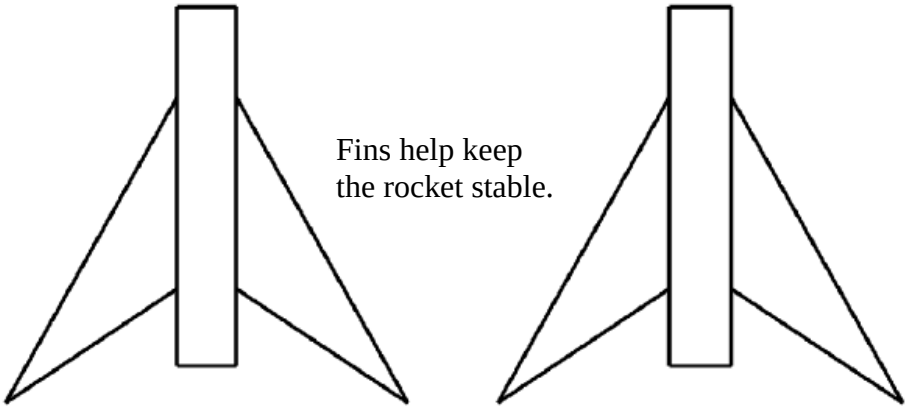
- Try to determine how high the rockets fly. To do so, place masking tape markers on the wall at measured distances from the floor to the ceiling. While one student launches the rocket along the wall, another student compares the height the rocket reached with the tape markers. Swap roles and repeat.

- Have students make rockets with no fins, one fin, and two fins. Compare the flights of the rockets in terms of stability and distance traveled.

- Arrange the planetary target range on the floor in order from the sun to Neptune. (As of 2006, Pluto became classified as a dwarf planet.) A room with open floor space or a hallway is preferable. Have students launch from the sun, and tell them to determine the farthest planet they are able to reach with their rocket. Pictures of the planets are attached and can be enlarged as desired.

ROCKET TEMPLATE

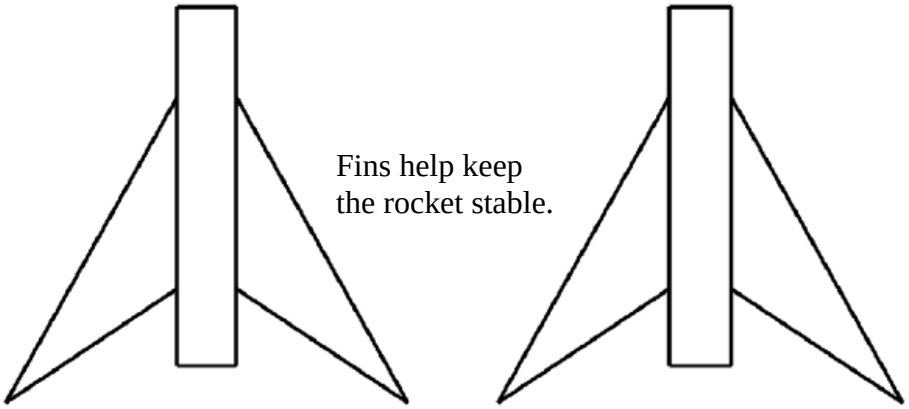
Distribute one rectangle and set of fins to each student.



Fins help keep
the rocket stable.

This rectangle will be used to make the body tube of your rocket. Cut this rectangle out and wrap it around the straw. Tape it in place. Don't leave gaps where air can leak out when it's time to launch vour rocket!

Courtesy…John Callas (JPL)



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ROCKET TEMPLATE

Distribute one rectangle and set of fins to each student.

Enlarge these copies or cut these out and arrange the planets in order from the sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. (As of 2006, Pluto was classified as a dwarf planet.) If you wish to make the planets to scale, refer to the numbers beside the names indicating the relative sizes of each body. Have students stand near the sun and launch their straw rockets. How far can their rocket travel in our solar system? (You may choose to use the color planet pictures from physical fitness lesson 4.)