Straw Rockets

EAA eActivities

Name: ______________________________ Date: ____________________

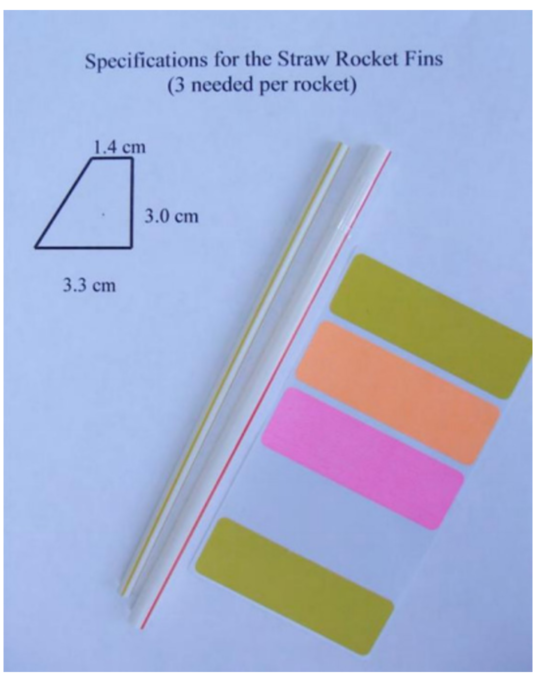
Lesson Focus

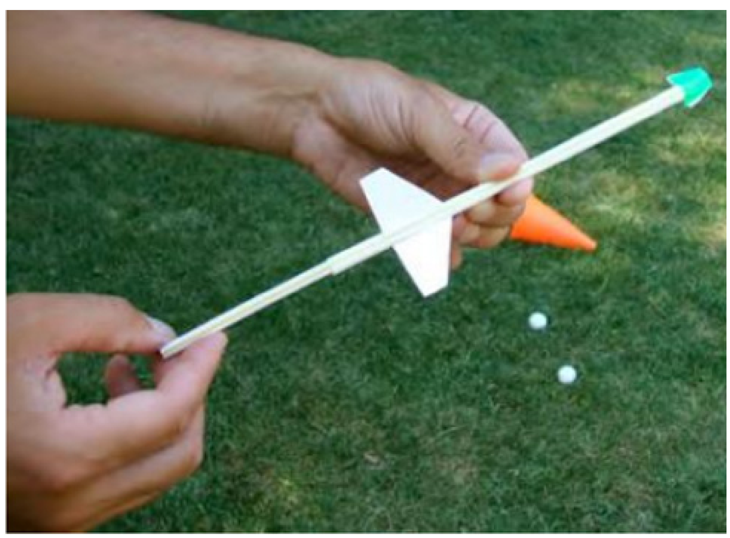
This lesson focuses on the "push" (force) needed to move the straw rocket through the air and allows students to adjust their "push" to get the rocket through obstacles. This relates to the four forces of flight (thrust, drag, lift, and gravity) by describing thrust. The lesson also covers stabilization of flight and center of mass.

This lesson also covers Newton's third law of motion, as the students should realize through the activity that more force will give their straw rockets more distance.

Materials

1. Scotch tape
2. A pair of two different sizes of drinking straws
3. Label stickers (or use tape)
4. Simple fin pattern
5. Scissors
6. Balloon





Pre-Lab Questions

1. What is the Bernoulli principle? Look it up and paraphrase it in your own words.

2. What is Newton's third law of motion? Look it up if you don't know it.

3. What is the formula for volume of a sphere?

4. Define "fluid." Is air considered a fluid in this experiment?

5. What are the four forces of flight?

Procedure

1. Wrap a label sticker or a 7.5 cm piece of tape over one end of the larger straw to close off the opening.
2. Carefully cut out three fins.
3. Using two pieces of tape approximately 1.25 cm long, tape each fin about 2.5 cm from the back opening of the straw.
4. Place the smaller straw into the larger straw rocket and blow into the smaller straw.
5. If the straw does not fly level, add tape near the front of the glider or just behind the fins.

6. Fill a balloon with air until the measurement of its diameter is 40 cm.
   a. If we assume that an air balloon is a sphere, then the volume of the balloon is:

      $V = (4/3) * Pi * R^3$

      where R is the radius of the balloon (remember that the radius is half the diameter)
   b. So, $(4/3) \times 3.14 \times (20\text{ cm})^3$
   c. $(4/3) \times 3.14 \times 8000\text{ cm}^3$
   d. $(4.19) \times 8000\text{ cm}^3$
   e. 33,520 cm^3 volume of air in the balloon
7. Fill the balloon to the desired diameter and wrap the mouth of the balloon tightly around the inner straw, releasing the air to propel the outer straw.
8. Measure how far the straw traveled.
9. Repeat with 50 cm diameter of balloon and 60 cm diameter of balloon.

   For 50 cm diameter, volume would be 4.19 x 15,625 cm^3 = 65,468.75 cm^3 of air

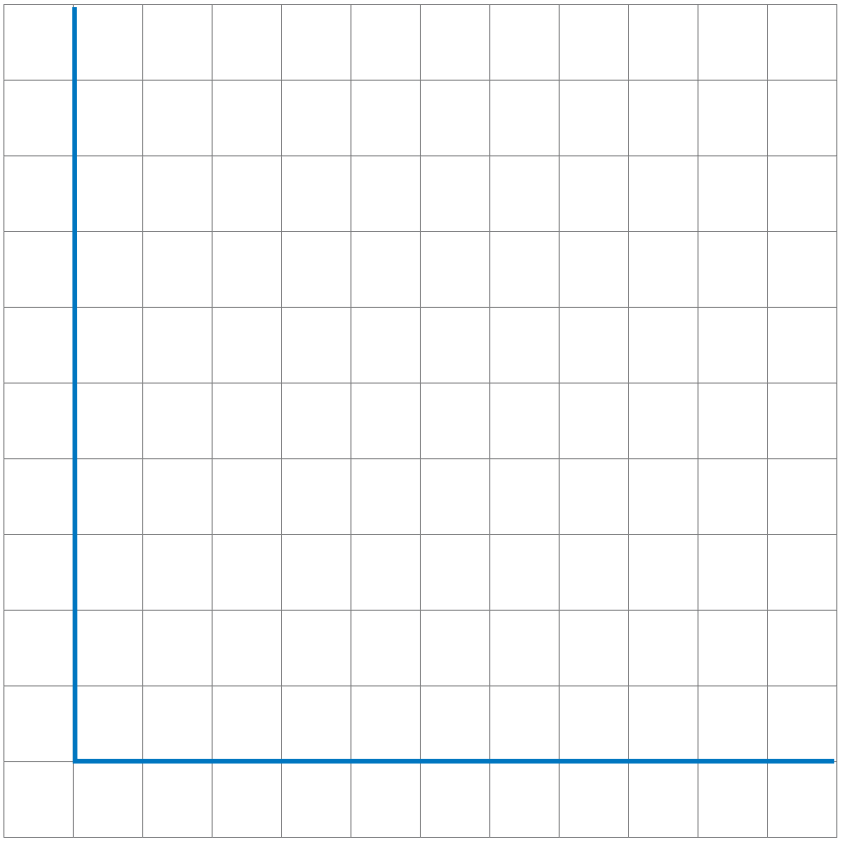
   For 60 cm diameter, volume would be 4.19 x 27,000 cm^3 = 11,313.0 cm^3 of air
10. Guess what another one would be and test to confirm your idea.

Data

Sample Data Table: The Effect of Air "Push" on a Straw Rocket

Trial	Volume of Air in Balloon (cm^3)	Distance (cm)	Observations
1	40 cm		
2	40 cm		
3	40 cm		
4	50 cm		
5	50 cm		
6	50 cm		
7	60 cm		
8	60 cm		
9	60 cm		
10	__ cm		

Graph



Analysis Questions

Grades 6-8

1. Did your graph make a straight line? What do you theorize that 80 cm might result in?

2. What is your independent variable and which is your dependent variable?

3. Is using the volume of a sphere an accurate way to measure the balloon? Why or why not?

4. What amount of air made your rocket easiest to control?

5. What other variables could introduce error into your experiment?

6. Explain the application of Bernoulli's principle in what happened in your experiment.

7. What factors could give you a different graph than your fellow students?

8. How would you improve the design of this lab? What part of it gave you the most problem while doing it? How would you fix it?

9. What provided the thrust for the rocket?

Grades 9-12

1. Did your graph make a straight line? What can you theorize from your limited data?

2. Is the straw/balloon system open or closed? Why?

3. What is the independent variable and the dependent variable?

4. Which goes on the x-axis and which on the y-axis?

5. Is lift provided by Newton's third law or by Bernoulli's principle? Defend your answer using illustrations from your lab.

6. What factors could give you a different answer than your fellow students?

7. How would you improve the design of this lab? What gave you the most problems while doing it? How would you fix it?

8. What provided the thrust for the rocket?