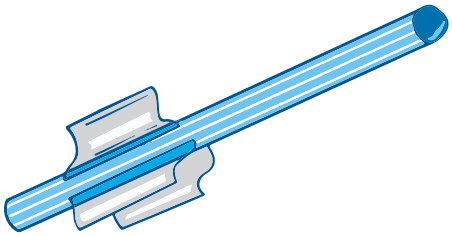

3. Straw Length

Build Knowledge

INTRODUCTION

What Students Do in this Activity

In this activity, students experiment with different straw lengths. They systematically test how straw length affects travel distance and accuracy.

Objectives

Students will:

- Systematically test how changing the straw length of a rocket affects flight distance and performance
- Learn the importance of conducting trials

Time

30–40 minutes

Materials

For the teacher:

- Square-ruled chart paper or whiteboard
- Markers

A-Ha

The longer the straw, the more force that will be needed to get it to lift off, but also the more thrust it will have. Of course, the longer the straw, the heavier the rocket will be. There will be a point at which the larger mass of the rocket overwhelms the increased thrust, causing the rocket to fly a shorter distance (although, the slightly increased weight of the straw in these tests will likely not be a factor).

For each team:

- Sticky Flags
- 1 retractable tape measure
- 1 pair of goggles
- 2 straws of the same size to cut for length

For each student:

- Copy of Reproducible Master 5 and 6
- Bag with their straws

Preparation for the Activity

Make a tally sheet, labeled like the one shown below, on a piece of square-ruled chart paper or on a whiteboard.

Which rocket flew the farthest?

			Results
			Predictions
8 cm	**14 cm**	**20 cm**	

Teacher Tip:

You may want to precut samples of the different straw lengths in the event that students have problems measuring and/or you are running short on time.

CLASSROOM ACTIVITY

Presenting the Activity – Whole Group

1. **Gather students for a class discussion.**
2. **Direct students' attention to the rocket poster. Ask students what they notice about the lengths of the rockets depicted on the poster.**
3. **Remind students of the straw exploration that they did in the previous activity. Ask students which straw they think will be the best one for the EarthToy Designs toy.**

   Students may have found that one size straw seems to fly the farthest at this point. Students may also recognize that the straw that fits the launch straw the most closely seems to go the farthest.

4. **Ask students to explain why they think particular straws or launcher/straw combinations worked best.**

   Students likely have their own theories about why a particular straw or combination seemed to perform best. Some students may be able to articulate a theory that involves the tightness of the fit between the straw and the launcher.

5. **Explain that students will be testing different lengths of straws in this activity. Ask students how they think the length of a straw will affect the distance flown.**

   Keep a record of students' responses on chart paper or a whiteboard.

6. **Ask students, "*When you launched the rockets in the last class, were there ways that you could launch them that made a difference in the distance the rockets flew?*"**

   If students don't suggest anything, demonstrate some rocket launches:

   - Puff out your cheeks, making a show of how much air you are filling them with. Blow audibly and forcefully.
   - Blow softly and quietly.

   Discuss the differences that students noted. Demonstrate two other launches:

   - Aim the rocket straight up into the air.
   - Aim the rocket directly in front of you.

   Discuss the differences that students noted with these two launches.

7. **Ask students, "*How can you make sure that you are testing how the length of the rocket affects how far it flies?*"**

   Remind them of your earlier launch demonstrations. It is important that students understand why you carried out the launching demonstration, which was to emphasize the following:

   - Different launch procedures yield different results.
   - It is important that they use similar methods every time they launch their rockets.

8. **Ask students to predict which rocket will fly the farthest and discuss why they think so.**

   Keep track of students' predictions on the tally sheet you created in *Preparation for the Activity.*

Teacher Tip:

If time allows, you may want students to vote on how the rockets will be launched for testing purposes from this point forward in the challenge.

Facilitating Student Exploration – Teams

9. **Make sure that all students have their own launch straw.**

   If not, give students new 6.5 mm launch straws and make sure that they label them with a permanent marker.

10. **Ask students to get into their teams. Give each team an area in which they can work. Explain that it is their job to explore how far each length of rocket flies.**

11. **Hand out the plastic bags containing the students' rockets, a retractable tape measure (one per team), and materials for rockets.**

    Each team should have a pair of scissors and three straws (all the same size).

12. **Hand out one copy of Does Length Matter?, Reproducible Master 5, to each team and go over it with students.**

    Explain that students will be testing how rocket length affects flight distance. Assign each team member a role.

13. **Point out the word *Trials* at the top of the table. Ask students what they think a trial is.**

    If students do not have an answer, encourage them to examine the table. What is directly below the word *Trials* in the table? If students still are unable to answer, discuss whether any of them have heard the word trials used in other circumstances. For example, there are often trials in sports, such as track and field and motorsports.

14. **Have each student build three straw rockets of varying length: 8, 14, and 20 cm (full length).**

    Students should already have the 20 cm straw from lesson one.

    *Note that all students are to use the same launch straw for all lessons. Students are to measure first before folding over the straw to make their straw rocket.

15. **In their teams, have students launch their rockets and have the recorder keep track of distances they fly on the team copy of Does Length Matter?, Reproducible Master 5.**

    If necessary, demonstrate how to use the tape measure to measure the distance flown by a rocket.

16. **Remind students to take turns launching the rockets.**

17. **After 10–15 minutes, distribute Rocket Length Reflection, Reproducible Master 6, and ask team members to write about one observation.**

    Tell them, for example:

    It is time for us to finish up this activity. As scientists, we need to write down what we've noticed. On your reproducible master, write a paragraph about one interesting thing that you observed today.

Teacher Tip:

If you are running short of time for this activity, you may want to provide student teams with samples of the different straw lengths to serve as templates.

18. **Make copies of each team's recording sheet to give to team members and have students add their team's reproducible master to their science notebooks.**

Sharing and Interpreting – Whole Group

19. **Record students' results on the tally sheet you created in *Preparation for the Activity*.**

    You can have students make their own tally marks or you can have students call out their results.

20. **Discuss students' results.**

    Did all teams get the same results? If not, probe students with questions such as the following:

    <This team> said that the longer rocket flew the farthest most of the time, but you found that the shorter one flew the farthest. Why might this have happened? What should we do now?

DOES LENGTH MATTER?

My name: _____

Team name: _____

Straw Length	Launcher's Name	Distance			Notes
		Trial 1	Trial 2	Trial 3	
20 cm					
20 cm					
20 cm					
20 cm					
14 cm					
14 cm					
14 cm					
14 cm					
8 cm					
8 cm					
8 cm					
8 cm					

ROCKET LENGTH REFLECTION

My name:_____

Write a paragraph about how you think length affected your straw rocket's performance.

_____

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