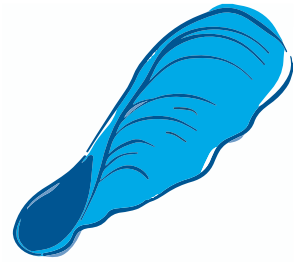


3 Testing Helicopters

Build Knowledge

INTRODUCTION

What Students Do in this Activity

In this activity, students compare the flight of samara seeds to the flight of a paper helicopter. Then they experiment with how changing the amount of weight attached to the helicopter changes the time it takes for a helicopter to hit the ground.

Objectives

Students will:

- Explore how scientists conduct trials
- Investigate how weight affects helicopter drop time
- Share their results and discuss any conflicting results, as do scientists

Time

30–40 minutes

Materials

For the teacher:

- 1 maple samara seed
- Model paper helicopter created in previous activity
- Chart paper or whiteboard
- Markers

A-Ha

Adding weight to the helicopter helps to stabilize the helicopter and causes the rotors to better catch the air. The more weight, the more revolutions, and the better the lift that the rotors give the helicopter (causing it to spin better).

For the class:

- *Once Upon a Time in the Woods* book
- Copies of **Helicopter Template, Reproducible Master 5** (optional)
- Scissors (optional)

For each team:

- 9 stickers (a different color for each team)
- 1 copy of **Testing Helicopters with Different Weights, Reproducible Master 7**

For each student:

- 3 paper clips
- Paper helicopter built in Activity 2
- Science notebook (see Introduction, page ix, for more information)

Preparation for the Activity

For *Presenting the Activity*, you will need the model helicopter you built in the previous activity for demonstration, or you will need to build another.

For *Facilitating Student Exploration*, student teams will need space where they can test their helicopters. Have handy the helicopters students created in Activity 2.

Make a class data chart on a piece of chart paper so that students can enter their data on the chart. The chart should look like the following:

Helicopter Weight Results

1	2
One vs. Two	

1	3
One vs. Three	

2	3
Two vs. Three	

Have the book *Once Upon a Time in the Woods* available for students to consult, as needed.

CLASSROOM ACTIVITY

Presenting the Activity – Whole Group

1. **Have students get their science notebooks and get ready for a class discussion.**
   Remind students of the information they recorded in their science notebooks and suggest that they reread what they wrote during the discussion.

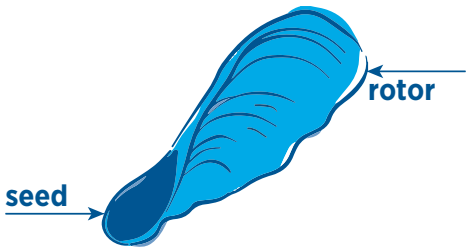
2. **Review with students the explorations they did in Activity 2.**
   Drop a maple samara seed again and ask students, *"How is this spinning of the seed similar to the paper helicopter? How is it different?"*

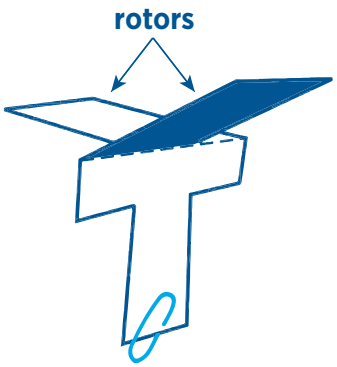
   Hold up the samara and the model paper helicopter and ask what differences they notice.

Note

Students will likely recognize that the maple seed has only one "wing," while the helicopter has two. Students may notice that the maple samara seed has a heavy end and a lighter end, as does the helicopter.

Point out the wing of the seed and the wings of the helicopter to students and explain that they are called rotors. Point out the similarities between the seed and the paper clip.





Facilitating Student Exploration – Teams

3. **Explain to students that they will be comparing the helicopters they built in Activity 2 by dropping them two at a time from the same height.**
   Tell students that they will break into teams, and one student will choose two helicopters and drop them at the same time. Each student will have the opportunity to drop helicopters. Explain that when they are not dropping helicopters, team members will watch to determine which helicopter hits the ground first.

4. **Discuss with students how they could keep track of their results as they test their helicopters.**
   Record their ideas on a piece of chart paper or a whiteboard.
5. **Assign a role to each team member.**
   Students will build and test paper helicopters. Assign tasks to team members (roles should rotate each activity so that all students have a chance to perform all jobs):
   - The materials manager keeps track of materials, handing them out in the beginning and storing them in the end.
   - The facilitator makes sure that the proper procedures are being followed.
   - The judge notes which helicopter stays in the air the longest.
   - The recorder keeps track of the results of the testing and makes notes about how the helicopters fly on the reproducible master (didn't spin around, rotors didn't open).
6. **Hand out a copy of Testing Helicopters with Different Weights, Reproducible Master 7, to each student.**
   Go over the items that should be recorded on the reproducible master.

   Point out the word Trials at the top of the table. Ask students, *"What do you think a trial is?"* If no one knows, tell them that during an experiment, a scientist may try the same thing over and over again to check results. Each time is called a trial.

   Point out that there is room for data from several trials for each helicopter.

   Ask students, *"Why do you think we would want to try out our helicopters more than once?"* Students should suggest that multiple trials will allow them to make sure that they really understand how a helicopter performs.

   They might express this by saying that a single trial could be flawed by some type of error.

   Follow up with, *"Why do you think one trial is not enough?"*

Teacher Tip:

The tape measure has measurements in both inches and centimeters. Be sure to tell students to use the meters units.

Teacher Tip:

All of the helicopters made so far have the same characteristics. They were built from the same template and carry the same amount of weight. They should perform similarly and hit the ground at almost the same time. If a team has helicopters that perform differently, you might wish to stop the class for a discussion of why the helicopters perform differently.

Some reasons might be:

- Using different paper clips
- Improper cutting and/or folding
- Dropping from different heights
- Dropping at different times

7. **Prepare the students for doing the investigation.**
   Explain to students that they will be conducting their helicopter experiments and keeping track of the results on **Testing Helicopters with Different Weights, Reproducible Master 7**.

   Explain that in these trials, they will be varying the weight of their helicopters by adding one paperclip.

   Have students race each helicopter against another helicopter three times, recording which helicopter stays in the air the longest in each trial.

   Remind them that they can take notes about each individual trial in the Notes box. Notes might include information about how the helicopter flew (didn't spin around, spun around fast) or anybother information students might care to note.

8. **Ask teams to make notes in their science notebooks about the procedures they will follow for testing the helicopters.**
   For example:

Our Procedure

1. We will build three helicopters that are exactly the same in every way.
2. We will add one paper clip to one helicopter, two to another, and three to another.
3. We will race the helicopters by dropping two at a time from the same height.
4. We will race each pair of helicopters three times.
5. First we will drop the helicopters with one paperclip and two paperclips.
6. Next we will drop the helicopters with one paperclip and three paperclips.
7. Last we will drop the helicopters with two paperclips and three paperclips.

9. **Distribute the helicopters students built in the previous activity. Have students test their helicopters to see which ones stay in the air the longest.**
   As you circulate, remind students that:
   - Both of the helicopters should be launched at the same time.
   - They should note which helicopter stays in the air the longest on their reproducible master.
   - One student is responsible for watching the launch and making sure both helicopters are launched at the same time.
   - The remaining students in the group are responsible for observing which helicopter stays in the air longest.

Teacher Tip:

Have scissors and extra copies of **Helicopter Template, Reproducible Master 5**, available in the event that students need them.

10. **As teams work, circulate among them to observe what they are doing, listen to their conversations, and use this to informally assess students.**
    Ask yourself the following:
    - Are students following the guidelines?
    - What are they noticing about the behavior of the helicopters?
    - Are they mentioning weight as a possible variable?
11. **After 10–15 minutes, ask teams to wrap up their work and make any additional notes about their experiences in their science notebooks.**
12. **Make copies of each team's recording sheet to give to team members and have students add their team's reproducible masters to their science notebooks.**

Teacher Tip:

Collect helicopters from students. They will be needed in the next activity.

Discussing and Interpreting – Whole Group

13. **Lead a large group discussion using the class data chart you prepared before the activity.**
    When students have finished testing the helicopters, ask teams to use stickers to add the data they collected to the class data chart before they sit down. Each sticker represents the helicopter that stayed in the air the longest in each trial.

    Ask the class to look at the chart.

    - What do they notice about the data?
    - How are the results of each team different? Similar?
    - Discuss the differences. For example:

    It looks like the green team's heavier helicopters stayed in the air longer than their light helicopters, but the red team found the opposite. Why might this have happened? What do you think we should do now?

Note

Students should recognize that similar helicopters should perform similarly. If groups did not generally find the same results, it is important for them to retest to make sure that their data are valid.

TESTING HELICOPTERS WITH DIFFERENT WEIGHTS

Names: _____

Circle the number of paper clips that are on the helicopter that stayed in the air the longest in each trial. For Notes, you might include information about how the helicopter flew (didn't spin around, spun around fast) or any other information you think is important.

Stayed in the Air the Longest				Notes
Trial	**# paper clips**	**vs.**	**# paper clips**	
1.				
2.				
3.				
1.				
2.				
3.				
1.				
2.				
3.				