

GATHERING EVIDENCE

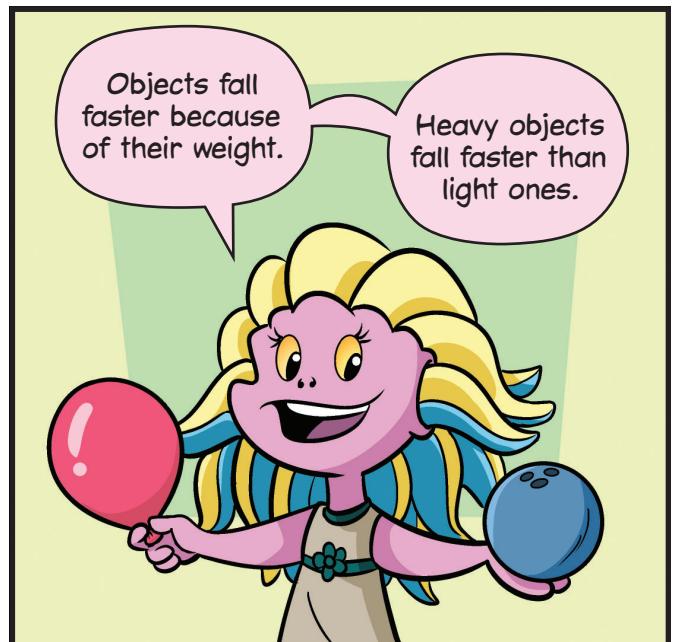
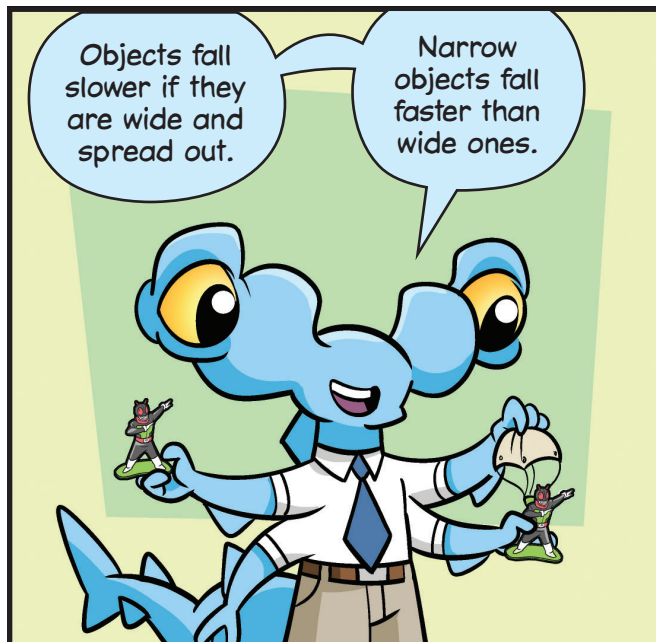
Scientists design tests that will provide evidence for (or against) their claims.

To make a claim, it helps to have a question to answer. In this chapter, we'll explore claims and evidence to help us answer the following question:



DISCUSSION:

- 7 Below, Alex and Winnie have each made a claim that answers the question above. How do the objects they are holding provide evidence that supports their claims?



PRACTICE:

Complete the tests below and answer the questions that follow.

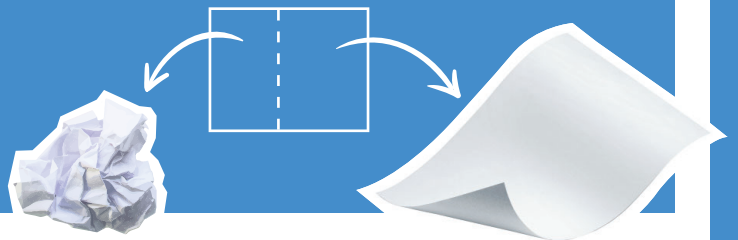
Drop a large ball and a smaller balloon from the same height at the same time.



8 Which is wider: the ball or the balloon? _____

9 Which lands first: the ball or the balloon? _____

Cut or tear a sheet of paper into a small piece and a big piece. Crumple the small piece, but leave the big piece flat. Drop both from the same height at the same time.



10 Which is heavier: the crumpled sheet or the flat sheet? _____

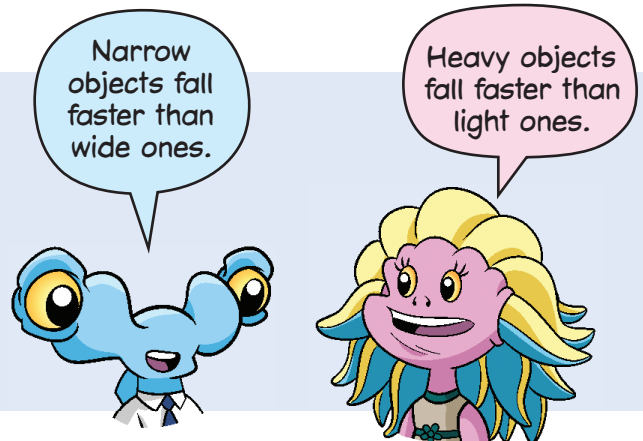
11 Which lands first: the crumpled sheet or the flat sheet? _____

JOURNAL:

12 Consider Winnie's and Alex's claims.

Which test above gives a counterexample to Alex's claim? Why?

Which test above gives a counterexample to Winnie's claim? Why?



AIR RESISTANCE

Alex and Winnie both had good ideas about what causes objects to fall faster or slower, but neither of their claims is completely true.

To understand why some objects fall faster than others, we need to understand how air affects falling objects.

For an object to fall, it has to push air out of the way. The push of air against a moving object is called **air resistance** or **drag**.

If you stick your hand out the window of a moving car, you can feel the air pushing against your hand. Turning your hand changes how much air your hand pushes. The less air you push, the easier it is to keep your hand where it is.

This helps explain why narrow objects usually fall through the air faster than wide ones.

Narrow objects don't have to push as much air out of the way when they fall.

Narrow objects usually fall faster than wide ones.



PRACTICE:

Answer the questions below about air resistance.

- 13 Parachutes are used to slow the falls of people and objects. Why does a person fall so much slower with an open parachute?

- 14 Cyclists often race wheel-to-wheel in a line as shown. Why do you think cyclists ride like this?



DOES WEIGHT MATTER?

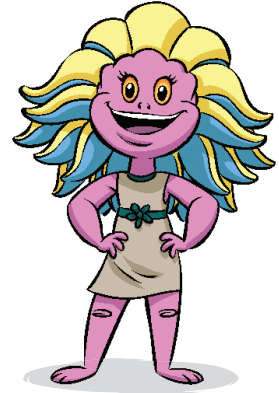
Think about how air affects objects of different weights that are about the same size and shape. A light breeze could blow a balloon for miles, but the same breeze wouldn't budge a bowling ball.

This helps explain why heavy objects usually fall through the air faster than light ones.

Heavy objects are not affected by air as much as light objects.

(This is due to a property called inertia. We explore inertia in Science 3B.)

Heavy objects usually fall faster than light ones.



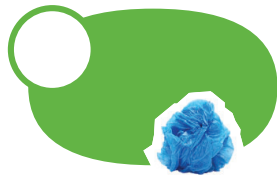
PRACTICE:

Circle the object you expect to fall faster, then circle the main reason why. Test your guesses by dropping objects like the ones below from the same height.

15 Which falls faster? (Mark one.)



Bag



Crumpled Bag

16 Why?

More weight

Less air resistance

17 Which falls faster? (Mark one.)



Bag



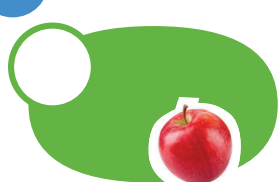
Bag + Apple

18 Why?

More weight

Less air resistance

19 Which falls faster? (Mark one.)



Apple



Bag + Apple

20 Why?

More weight

Less air resistance

SLOW YOUR ROLL

How can you slow an object's fall without changing its weight?

MATERIALS

You will need:

- Empty toilet paper rolls
The more, the better
At least one per person
- Scissors
- Camera or phone with a slow-motion video mode (optional)



This activity works great as a contest. Each participant begins with the same object. The goal is to modify it so that it falls as slowly as possible without adding or removing anything.

Empty toilet paper rolls are a good option, but you can use paper cups, large index cards, or any other common items.

Compete with yourself by making lots of different designs, or compete with a group to see who is best at slowing their roll.

Rules

- You may fold, cut, bend, crinkle, crease, crimp, notch, twist, or tear your roll, but...
- You may not add or remove anything. Your roll must stay in one piece. No glue, no tape, no changing the weight.
- To compare two designs, the same person should hold both as high as possible with the bottom of each design at the same height. Release both at the same time.
- Last to hit the ground wins the round. Do at least 3 rounds to determine which is slower. If it's too close to tell, try using slow-motion video to help judge.

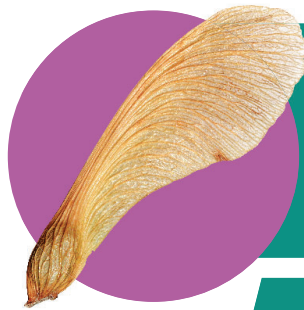


SEEDS FOR THOUGHT

We can look to nature for solutions to the problems we are trying to solve.

Many plants have seeds that fall slowly. The seeds can be carried great distances by the wind and spread out over a wide area.

Here are some examples of nature's slow-falling seeds that you can use as inspiration for your design.



Maple seeds have wings that cause the seeds to spin, slowing their fall.



The Javan cucumber plant has huge, 13 cm (5 inch) paper-thin seeds that fly like gliders as they fall.



These dandelion seeds dangle from tiny parachutes that allow them to fall slowly and travel for miles in the wind.



JOURNAL:

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Include sketches of the best designs in your journal and explain why you think they worked well.