Exploring Drag

Suggested Grades: K–12

Activity Overview
Explore the effect of drag on the motion of various objects of different weights, shapes and sizes.

Drag acts opposite to the direction of motion of the object that is moving. Drag is the resistive force on an object as it attempts to move through a fluid (such as air or water).

Time: 30 minutes

Materials:
- 25 standard size coffee filters
- Paper cupcake/muffin liners
- Stapler
- Marker
- Kitchen scale (or other means of determining the weight of a small object)

Optional Materials:
- Large (10-gallon) coffee filter
- Timer

STEPS

1. First, let's explore how weight affects drag.

2. Prepare sets of regular coffee filters of different weights by creating stacks of one, two, three four and nine coffee filters. Staple the stacks together at the base so they will not come apart. Label each stack with the number of coffee filters in that stack. Because each stack has a different number of filters in it, each stack has a different weight. See Figure 1.

Figure 1: Make five coffee filter stacks, each containing a different number of filters

3. Hold the stacks containing one and two filters next to each other at the same height. Drop them both at the same time and note any differences in motion.

4. Repeat Step 2 with the stacks of one and three, one and four, and one and nine filters.

5. If you have a timer, drop each stack from the same height, and record how long it takes to fall to the ground.

6. Was there a difference in how quickly each stack fell? Remember that drag slows down motion through the air. Based on what you observed, how do you think weight affects the drag on an object?

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7. Next, let's explore how an object's shape affects the force of drag that acts on it.

8. Remove the staple from the stack of nine coffee filters.

9. Crumple up one of the coffee filters so it has the same weight but a different shape than a regular filter. See Figure 2.

Figure 2: The coffee filters weigh the same but have different shapes

10. Hold the regular and crumpled filters next to each other at the same height. Drop them at the same time and pay attention to any differences in motion.

11. Use the other filters to try different shapes. Can you make a filter into a shape that falls at about the same rate as the regular filter?

12. If you have a timer, drop each shape you made and the regular filter from the same height. Record the amount of time it takes for a filter to hit the ground. Try dropping one coffee filter face up and another one face down.

13. Was there a difference in the time it took each shape to fall? Based on what you observed, would you say that the shape of an object affects the drag that acts on it?

Figure 3: Use similarly shaped objects that are different sizes

14. Finally, let's see how the size of an object affects the drag that acts on the object.

15. Gather one large (ten-gallon) coffee filter, one regular sized coffee filter and one cupcake/muffin liner as shown in Figure 3.
16. Drop the coffee filters and the cupcake/muffin liners at the same time from the same height. Describe any differences in their motion that you see.

17. Based on what you observed, do you think the size of an object affects the drag that acts on it?

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