Candy Water Bottle Flip

How much candy does it take to consistently flip a plastic bottle exactly 360 degrees? Channel your inner physicist—and sweet tooth—to master the art of water bottle flipping!

TEKS:

SCI 2.6 C: The student is expected to trace and compare patterns of movement of objects such as sliding, rolling, and spinning over time.

SCI 5.6 D: The student is expected to design a simple experimental investigation that tests the effect of force on an object.

MATH 3.3 A: The student is expected to represent fractions greater than zero and less than or equal to one with denominators of 2, 3, 4, 6, and 8 using concrete objects and pictorial models, including strip diagrams and number lines.

Materials:
- Empty water bottle
- Paper
- Pencil
- Small candies (Enough to fill one water bottle. Candy corn, jelly beans, M&Ms, Skittles, or similar. If you don’t have candy, water works too.)

Experiment/How-To:
Before you start this experiment, practice your water bottle flipping technique:

- Take the empty water bottle and try to “flip” it. To “flip” a water bottle, hold the cap of the water bottle in your dominant hand. Then, flick your wrist upwards so that the water bottle fully rotates one time in the air. Let the bottle fall to the ground. If it lands facing straight up, you have successfully flipped the water bottle! This will probably be very difficult with an empty water bottle.
Practice flipping the empty bottle a few times so that you get the hang of the process before beginning the experiment.

1. Try to “flip” your empty water bottle 5 times. Write down how many times you successfully flip the empty water bottle.
2. Now, fill the empty bottle completely with candy (or water). Try and flip this full water bottle 5 times and record how many times you were successful.
3. Now, remove some of the candy in the water bottle so that the bottle is approximately ¾ full of candy. Record how many times you can successfully flip this bottle.
4. Repeat this testing process with the water bottle candy level at ½ and ¼ full. Once you have tested all candy levels, use the most successful level to amaze family and friends with your flipping skills!

**STEM Connection:**

This water bottle flipping challenge may seem simple, but there are some pretty complex physics concepts going on! To understand what is happening, let’s first think of a coin. When you flip a coin into the air, gravity brings it back to the ground. A coin is solid and its mass is evenly distributed, so it has an equal chance of landing on heads or tails. Now, think about the water bottle that you flipped. You probably found that it was very difficult to flip the water bottle that was completely empty or full. These water bottles acted similarly to a flipping coin—their mass was evenly distributed. This means that they were just as likely to land facing upright as on their side. For a successful water bottle flip, you want to flip a bottle that is more likely to land facing upright.

You probably found that the water bottles only partially filled with candy (or water) were the easiest to successfully flip. These bottles have a mass that is unevenly distributed. When flipped through the air, the candy was able to move around in the bottle, slowing down the bottle’s rotation. This allowed you to have greater control over the water bottle flip and made it more likely that the water bottle landed facing up. With more practice flipping the partially-full water bottle, you may be able to successfully flip it almost 100% of the time!

**Career:**

*Physicists* study the natural world, from the tiniest subatomic particles to the largest galaxies. They do experiments to discover the laws of nature. They study what things are made of (matter) and how things behave. They also learn about energy, studying how it changes from one form to another.

**Resources:**