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Bottle flip challenge year

I'll admit I'm a little late in this game - the Flip Challenge bottle, that is! I thought about inventing a challenge over a year ago, but I just didn't have time and I also knew that I would like my version to be a little different... But I couldn't decide how. So recently I had one of these Brain Pops I have a few times and I thought this: What if I tested the bottles with water and then students could use the data gathered and design their own challenge? Sounds great, doesn't it? But you know me! I thought of a really neat twist. What if we could fill the bottles with anything other than water? Is it going to work? Well, we tried it, and I have some stories to tell you. Let's conquer the challenge of the bottle! Just some background ... Just in case you don't know about the bottle flip challenge, it works very simply. You put a bottle of water on it and you try to land it at the bottom of it. The trick is the amount of water inside the bottle and also what kind of plastic the bottle is made of. Now, let's be honest here! I knew there might be a lot of preparation for this challenge. Turns out I was right. But, as always, my experiences will help you save oodles time! (and it's really not a huge amount of preparation!) Let's break this into smaller steps: Materials RequiredThe water levelsOffer for GroupsThe Data TablesSpillageResults and material design required This is very basic and extremely simple. You just need empty water bottles. I had 16.9 ounce bottles already and just bought the smaller packs of the other three sizes. I did this plan in advance so I drank the water (and Mt. Dew) and saved all these bottles! TIP: Ask for donations. That's one of those things the parents are going to send you. Just ask for specific sizes and you'll probably get a lot of bottles. I used four sizes and needed eight bottles in each size. Other Materials: For the experimentation part of this challenge you need water and bottles. You will also need towels, containers to use for pouring water, calculators, and filling items for design challenge. We used beans, beads, sand, marbles, pins, corn candy, rice, and un-popped popcorn. My first inclination was to just have the kids measure the bottles with rulers and highlight the levels. But my bottles were all different heights and had different diameters. I knew this wouldn't be mathematically correct! Thus, I used the amount of water - in ounces - as a guide to signal water levels. The photo will show you what I did! Using the ten-ounce bottle I poured in 2.5 ounces of water and marked the level Water. Then I added 2.5 ounces more and noted the bottle. That gave me measures of a quarter and a half. I repeated it twice more and had three quarters and a full bottle. For the remaining 10-ounce bottles I just put the marked bottle next to an unmarked one, lined them up, and repeated the marks on the plain bottle. For the 16.9 oz bottle, I used 16 ounces as a full amount and poured in 4 ounces to make marks. 12 and 20 ounces It was the easiest. I promise you, it only really took about ten minutes. They also highlight each bottle with its size - 10 ounces, 12 ounces, 16 ounces, and 20 ounces. Were my bottles perfect? No, I guess not. But it was close! You could have older students doing it themselves, but I marked my bottles to save time. What do kids need to get started? I prepared a container with four bottles and a large measuring cup with water inside. Each group also had two lab sheets with the data table ready for use. TIP: If you don't have measuring cups or any type of cup with a pouring spout, don't worry. A paper cup (3 ounces) will actually work. Students can simply squeeze the sides of the cup to create a spout. ANOTHER TIP: Children may not be very specialized in pouring water into those tiny bottle openings. Be prepared for leaks. More on that later! Obviously, this effort is heavy in preserving the items and analysing them in order to design the best bottle later. So I created a great data table with rules about who the flipper and recorder will be. My initial thought was that only one student should be the flipper (check these variables). I completely ignored how exciting this project was and that everyone would want to be the flipper. And I also chose the number FIFTEEN as the times when a bottle should be reversed. Think about it for a minute- a student will flip all four bottles fifteen times at each water level. yes, it took about ten minutes to know that this wasn't going to work. There were too many students out of work and the flipper was tired. So we revised the rules right in the middle of the first category and from the second category, I also had a new data table. With the second edition, the students were collaborators. Each student flipped a bottle five times and recorded the number that landed. After each bottle was flipped two collaborations were joined as a group of four. The largest group overall all landed their flips and used these larger numbers for analysis. The data analysis included the determination of a fractional quantity of unloaded flips against total inversives. We've turned this fraction into a landing rate. Using these percentages students could quickly determine which bottle at which water level was the most accurate. Now, let's take a short break from the challenge to talk about water leakage. Guys, it's going to happen. It's just water so I just laughed- especially when someone forgot to secure the lid on a bottle and threw away soaking everyone around the table. TIP: real towels. You can bring in a large roll of napkins, but you are going to use many of them. They work better than napkins! Are you ready for the best? Design your own bottle flipping challenge! This included deciding what to reverse and creating its own data table. First, we thought of a lot of different things we could try. Fill the bottles as full as you can. Change water levels in different quantities than has already been tested. Fill the bottle with something besides Which one do you think the kids chose to try? Yes, putting wacky stuff in bottles was the unanimous choice for all my classes! We tried all the items you see pictured! I had rules on design (of course): Students could only choose 2 items for use in bottles. The data table had to have room for a fractional amount and a percentage. The team had to invent its own rules. The data table they designed had to have room to complete their experiment. Here's what we learned: It doesn't really matter what's in the bottle, as long as it has some weight on it. Rice and corn candy were very difficult to land. The sand and beans worked well. The marbles were quite heavy, but they tended to clunk on the table and not land at all. Overall, this was a lot of fun! Easy adjustment and easy cleaning! Surprise! Want to try this challenge? I've added it to my Teachers Pay Teachers store with a 6-page Teacher Guide! Click here or any of the pictures! LINKS FOR YOU- if you like experiment and design challenges: The Great Flood ExperimentLet's design of PancakesAmazing Planes Bring Science HomeA flipping fun science project from Science BuddhasDon't flip out - is natural! Credit: George RetseckAdvertisement Basic Concepts Physical Mass Gravity Angular Momentum Introduction The bottle-flipping craze may be dying down, but it's not too late to explore the physics of this internet sensation. Even if you've never heard of it, try this project, not only can you impress your friends with a fun new trick, but you'll also be able to explain the science behind it! Historic Bottle flipping took the internet by storm in 2016. If you haven't seen it yet, see the links in the More to explore section below or search for it on YouTube or your favorite social network. You're forced to find some videos. The process involves flipping a partially filled water bottle into the air so it lands upright. This may seem like a very simple concept, but the physics behind it is actually quite complicated–and it takes some practice to master the feat! To understand the physics of bottle-flipping, first you need to understand the angular momentum. The angular momentum of an object depends on its angular speed (how fast it rotates) and its moment of inertia (how much its mass spreads from a central point). When there is no external torque on an object, its angular momentum must be maintained. The classic example of this is a rotating ice skater. If it is the first rotation with its hands extended, it has a high moment of inertia (its mass is spread, away from the of her body). If she pulls her hands tight, her moment of inertia diminishes. In order for its angular momentum to remain the same, its angular speed must be increased to rotate faster. You can notice this for yourself in a rotating office chair (see the link in More to explore). What does that have to do with the bottle flip? Imagine throwing away a rigid object, object, as a currency. Gravity will pull the coin back to the ground. Because the object is solid, its mass distribution does not change as it flies and rotates through the air, and the torque of inertia and angular speed remains the same. This makes it very difficult to predict whether the coin will land heads or tails because it continues to rotate as it falls. A bottle of water is different, however. Contains liquid water, which is free to slosh around inside the bottle changing the distribution of mass. Just like an ice skater that spreads or pulls into its hands, this changes the moment of inertia of the bottle and therefore its angular speed (because the overall angular momentum must remain the same). You can take advantage of this event to make it easier to successfully flip a bottle. How? Try this activity to find out! Ingredients Plastic water bottle Preparation tap water If you have never tried bottle-flipping before, you should practice before you start this task. You want your technique to remain consistent (for example, how high you throw the bottle, how far you throw it horizontally, and how fast you rotate it) throughout the activity. Fill a plastic water bottle about a quarter to a third filled with water and put the lid tightly. Keep the bottle loose from the neck, and toss it forward (so that the bottom rotates away from you). Try to throw the bottle so that it makes a full flip and lands upright without falling over. This can take a lot of practice! If you are disappointed, at least try to notice which side the bottle initially lands on (up, down or side), even if it falls over after it. Can you get the bottle to land consistently at the bottom of it? Procedure Once you have practiced the method of inversion of the bottle, try it 10 times in a row. Remember to keep your technique as consistent as possible. How many times can you make the bottle land upright? Now try it 10 times with an empty bottle. Can you still land the bottle? Now try it 10 times with a completely full bottle. Can you still land the bottle? Try to see if you can find the optimal amount of water in the bottle. What if the bottle is half or three quarters? What amount of water gives you the best success rate? In addition: Put a few bottles of water filled with different amounts of water in the freezer during the night (make sure they sit upright). Try to turn them around the next day. Is it easier or harder to successfully flip bottles with ice instead of liquid water inside them? In addition: Try to dispose of the bottle at different distances and heights and differentiate how much you rotate it. It's easier to get the to land upright if you throw it across the room or so it lands right in front of you? What if you try to land it on a table instead of the floor? What if you try to get it to complete two flips instead of one? In addition: Try to land the bottle on different surfaces, such as carpet, wooden floors, tiles, etc. It is easier to land the bottle upright on certain surfaces than Additional: Try the activity with a different size or shape bottles. Some work better than others? Do you have a favorite kind of bottle? Observations and results Although the results may vary slightly depending on a person's technique, you may have found that you had the greatest success with a bottle of about a quarter to a third full of water. It was very difficult (perhaps almost impossible) to successfully flip either an empty or completely full bottle. The explanation for this phenomenon depends on angular momentum, which you will remember must be maintained when there is no external torque acting on an object, and depends on the moment of inertia and angular speed. When a water bottle rotates through the air, no torque is exerted on it (neglecting air resistance). Also remember the moment of inertia of a rigid object, such as an empty water bottle, does not change as it rotates. The angular speed of the empty bottle, therefore, remains the same as it flies in the air just like a rotating coin. This makes it very difficult to control the descent of the bottle and difficult to get it to land upright. The same goes for the completely full bottle. Even though it is full of liquid water, there is no room for water to slosh around, so the distribution of mass inside the bottle remains the same, and its angular speed remains constant. All this changes when you use a partially filled bottle of water. Initially the mass of water is concentrated at the bottom of the bottle. When you throw away the bottle, there is room for water to slosh around. It spreads along the length of the bottle, increasing the moment of inertia and reducing the angular speed (maintaining angular momentum). The rotation of the bottle slows down as it flies in the air, making it possible, if dated correctly, to get the bottle to land upright. If this process is difficult to visualize, see more to explore for some great charts. If you try the same trick with ice, even if the bottle is full the same amount, it doesn't work because the solid ice can't slosh around. Cleaning Don't forget to recycle your bottle when you're done with it! More to explore the complex physics of this viral water bottle trick, explained, by Vox The Water Bottle Flipp, from the Institute of Natural Water Bottle Flipping Physics (pdf), University of Twente, from Cornell University Library arXiv Rotating Science: Keeping Momentum in a Rotating Chair, by Scientific American Science Activities for All Ages!, by Science Buddies This activity brought you together with Science Buddies Scientific American Space & Physics is a summary of the most important stories about the universe and beyondEed now! Nwo!

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