Curiosity Guide #303
Momentum

Accompanies Curious Crew, Season 3, Episode 3 (#303)

Racing Cans

Investigation #7

Description

It's another race, this time between cookie tins!

Materials

- 2 identical metal cookie tins
- 10 large, 1-inch washers
- Tape
- Board, about 4 feet long, to use as a ramp
- Milk crate
- Scale or pan balance

Procedure

1) Prepare the tins by opening the lids.
2) In one tin, tape five of the washers so that they are spaced around the perimeter of the inside of the tin.
3) Put the lid back on the first tin.
4) In the second tin, stack the five washers on top of one another. Tape the stack of washers in place in the center of the tin.
5) Put the lid back on the second tin.
6) Measure each tin with a scale to verify their similar mass, or compare with a pan balance.
7) Place the board so that one end is on the milk crate and the other is on the floor, forming a ramp.
8) Place both tins side by side at the top of the ramp.

9) Have observers predict what will happen.
10) Release the two tins at the same time.
11) Remove the lids and compare the washer configurations of the winner versus the loser.
12) What did you notice?

My Results

Explanation

Even though the two tins have a comparable mass, one will always beat the other to the bottom. When you remove the lids, you can see that the tin with the washers wins every time. The washers stacked in the center make this tin rotate more quickly. Both tins have the same potential energy at the top of the ramp, but the tin with the spread out washers takes more time to gain speed.

When objects are rotating, the objects are said to have angular momentum. These objects will continue to rotate with constant angular momentum unless another force acts on the system. Angular momentum is the product of angular velocity, where angular velocity is rotations per second, and the moment of inertia, which includes both the mass of the object and how the mass is distributed.

When the mass is further away from the object's center, like the spread-out washers, the object will rotate more slowly. When the mass is more centrally located, like the stacked washers, the object will spin faster. Angular momentum is conserved as well. So, if the moment of inertia increases and the mass moves away from the center, then the velocity decreases. If the moment of inertia decreases, the velocity increases. This is visible when an ice skater brings his or her arms in toward the body to spin more quickly. The skater slows down when he or she opens the arms up.

Parents and Educators: use #CuriousCrew #CuriosityGuide to share what your Curious Crew learned!

Curious Crew is a production of Michigan State University.
Learn more at WKAR.org.