



Curiosity Guide #406

Torque

Accompanies Curious Crew, Season 4, Episode 6 (#406)

Design a One-Handed Spoon Catapult

STEM Challenge

Description

Design and build a catapult that can launch a marshmallow with one hand!

Materials

- Plastic spoon
- Craft sticks
- Rubber bands
- Mini marshmallows
- Hot glue
- Hot glue gun
- Tape
- Measuring tape

Procedure

1. Use the available materials to design a catapult that can launch a marshmallow with one hand.
2. How can you build the base to make it stable enough to handle the torque when pulling on the launchpad?
3. How long should the launch arm be to maximize the torque on the spring arm?
4. How does the length of the arm relate to the distance the marshmallow travels?
5. Design your prototype, build it, test it, and refine it.

My Results

Record your thoughts about your original design here. Make a chart to note down changes to your design and the results of each test.

Explanation

Catapults are used to launch projectiles and take advantage of stored potential energy, that is converted to kinetic energy, in the arm and projectile. In this case, the potential energy is in the spoon or throwing lever. Pulling back on the spoon applies torque to the catapult itself. If the catapult is stable, the arm will spring back when released and will launch the marshmallow. If the base is not stable enough, the torque could cause the base to rotate, flip, or come apart. Generally, a large, flat base that can resist rotation, when the force is applied to the spoon, will work. Using a longer lever arm increases the amount of torque applied to the spoon against the stationary base. An increase in torque will result in an increase in the distance the marshmallow will travel.

Think about this: Torque is a force that causes something to rotate, and resisting that torque takes energy, just like in our catapults. Did you know that our bodies experience torque all the time at our joints? It's true. When we lift a heavy weight, there is torque on our elbow joint. The heavier the weight is or the longer the forearm is, the more torque the elbow hinge-joint feels. The same is true when we throw an object. Baseball pitchers have to be very careful that they don't apply too much torque on their elbows when pitching, so establishing good routines when lifting or throwing can help prevent an injury.

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