



Curiosity Guide #301

Wheel and Axle

Accompanies Curious Crew, Season 3, Episode 1 (#301)

Waterwheel Work

Investigation #6

Description

Woo hoo, a water investigation! Make a waterwheel and watch it work.

- 2-liter bottle
- Wooden dowel
- Spoon
- Styrofoam. Egg cartons work well.
- Duct tape
- Pitcher of water
- String
- Washer
- Basin
- Drill
- Hot glue

Procedure

- 1) Drill two $\frac{1}{4}$ -inch holes, one through the bottom end of the bottle and the other through the top to the bottle.
- 2) Slide the wooden dowel through each end of the bottle. Verify that the dowel can spin freely.
- 3) Remove the wooden dowel.
- 4) Hot-glue the wooden spool to the end of the cap so that the spool hole and drilled hole line up.

- 5) When the glue is dry, slide the dowel back through the spool and the bottle.
- 6) Cut the lid off the egg carton. Cut the egg-holder side in half lengthwise and then each section in half. You should have four catch cups of 3 chambers each. These are your paddles.
- 7) Use duct tape or hot glue to fasten the paddles on each side of the bottle so that the paddles are equidistant.
- 8) Cut a 5-foot length of string.
- 9) Tie one end of the string around the spool attached to the bottle. Tape the string to the spool securely.
- 10) Tie a washer on the other end of the string.
- 11) Fill the pitcher with water.
- 12) Lay the bottle across the basin so that the dowels rest on the sides of the basin.
- 13) Pour the water over the water wheel and watch it wind up the string with the washer.

My Results

Explanation

The elevated water holds gravitational potential energy and equates to water in a mountain lake or water that has been dammed up. As the water descends, it has kinetic energy that can be transferred onto the paddles of the water wheel. The transferred kinetic energy creates mechanical energy and winds up the string. In this example, the cartons act as spokes in a wheel, and the turning dowel serves as the rotating axle. Because the "wheel" is so much bigger than the dowel, it multiplies the force turning the dowel and winds up the wooden spool.

Systems for capturing the energy in falling water can be transferred into mechanical energy in a mill, or electrical energy if the energy system is attached to a turbine and generator.

Explore further: Look for photos of windmills and waterwheels on the internet. Then think about this: Windmills are great examples of a wheel and axle. The sails of the windmill are like spokes in the wheel that catch the wind and rotate the axle. Because the blades are so much larger than the axle, the force turning the axle is multiplied. In fact if the outside circle of the windmill is 10 times bigger than the diameter of the axle, then it only takes one-tenth the energy to turn the axle. People have learned that by using the power of wind and water, they can get a great mechanical advantage!

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