Water Wheels

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Related Subjects: Physics, Environmental Science

Recommended Grades: 9-1st Year

Through designing and creating a water wheel, this activity brings to light many physics concepts, including conservation of energy, work, energy, torque, and friction. By isolating the variables of the water wheel design, students should be able to determine how to maximize the weight that a water wheel can lift.

Materials

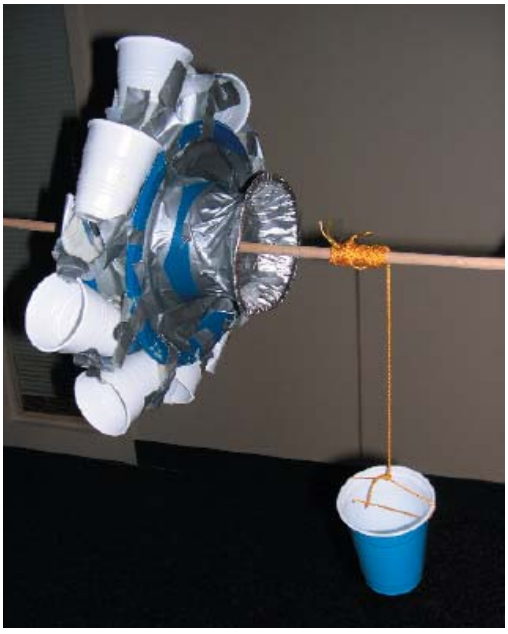
- ☐ Plastic dinner plates of verying diameters
- ☐ Plastic cups of varying sizes
- ☐ 3-5 gallon buckets
- ☐ Large plastic basin
- ☐ Wooden dowels
- ☐ String
- ☐ Duct tape or packing tape
- ☐ Nails, pennies, or other weights

Suggested Time

- ☐ Intro to Hydro Power/Project: 1 period
- ☐ Lab (build, test, modify): 2 periods
- ☐ Review/Discussion: 1 period

Introduction

Show students one model water wheel so that they have an idea of what they will be designing. The foundation of the water wheel is two dinner plates secured back-to-back. Cups should be taped around the circumference of the plates. These cups will catch the water that will power the wheel. The wheel will act as a pulley to lift a cup filled with nails, pennies, or other weights.



Break students into groups and explain that each group will be testing one water wheel variable. Have students brainstorm a list of variables. Suggestions might include:

- ☐ diameter of wheel
- ☐ size of cup
- ☐ spacing of cups
- ☐ height of water
- ☐ diameter of tube delivering water

Tell students that their goal is to design a water wheel that can lift the most weight.

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Set Up

The water wheels will be positioned above the large plastic basin. You will need to create a stand (two dowels or yardsticks attached vertically to two opposite sides of the basin work well). You will also need to secure a pulley nearby which will be attached to the water wheels to create a weight lifting system.

A water source should be established. A 3-5 gallon bucket with a hole punched on the side near the bottom should work well. You can place a spigot in the hole that will allow for control of the water flow. Attach a hose to the end of the spigot. Place the bucket on a high surface. Students can use the hose to direct water towards their wheels.

Designing the Wheels

Remind students that they are responsible for making sure their water wheel designs will operate properly on the stand. They will need to punch a hold in the center of their wheels so that a dowel will fit through the wheel and allow it to spin freely on the stand. They will also need a spool or bobbin of some kind on the side of the wheel to gather string as the water wheel turns.

Redesign the Wheels

Allow students to share with classmates what they learned about the variable they were testing. Let students redesign their wheels so that they can lift the most weight–do the most work. You may also ask students to consider the power of their water wheel–the amount of work the wheel does compared to the time it takes to do that work.

Resources

Wheels At Work by Bernie Zubrowski

http://www.energyquest.ca.gov/projects/waterenergy.html

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