

ACTIVITY 5: ENGINEER A WORKING WATER WHEEL



The purpose of this activity is for students to design a working water wheel in order to better understand the mechanics behind water wheels and their significance in renewable energy generation.

Materials:

- 2 paper plates
- Thick long straws (e.g., smoothie, boba, etc.)
- 5 paper cups
- Scissors
- Tape
- Water
- A pouring source: pitcher, beaker, bottle, etc.
- String
- Paper clips
- Mass of some kind (marbles, beads, etc.)

First, inform students that they will be modeling how moving water can be used for energy generation by creating a working water wheel. Have students form groups of 3-4 and gather the materials needed to design their water wheel. Give them some time to consider how they might use the supplies to engineer a water wheel. They should sketch out their design.

Next, demonstrate the design of the teacher model water wheel. Offer students the opportunity to engineer their own design or to model theirs off of the teacher example.

Then, give students time to build their water wheels. You can provide them the following procedural steps or allow them to build theirs according to their own process. Regardless of design, all water wheels should be tested.

Last, invite students to reflect on ways they might improve their water wheel designs for increased efficiency. Discuss the environmental benefits of water wheels, their history, and how they relate to their hydropower generation process from the rushing water of Niagara Falls.

Prepare the Paper Plates:

- Carefully use the scissors to poke a hole in the center of both paper plates, making it large enough for the straw to fit through.

Attach the Cups:

- Tape 4 paper cups to the back of one plate.
- Start by holding two cups in place, with their open ends facing the outer edge of the plate, to determine where to tape the first cup, ensuring even spacing.
- Secure each cup to the plate using multiple pieces of tape, overlapping the tape for better adhesion.

Ensure Even Spacing:

- Repeat the process to attach the remaining three cups, making sure they are evenly spaced around the center hole of the plate.

Secure the Second Plate:

- Tape the second paper plate to the other side of the cups.
- Use rolled loops of tape, with the sticky side facing outward, on each cup. It is best to attach the tape near the wider top ends of the cups.
- Use the straw to help align the plates as you secure them together with tape, ensuring the wheel can roll freely on the straw axle.

Test the Water Wheel:

- Hold the water wheel firmly by the straw and place it under a slow stream of water from a sink faucet or another water source (e.g., a pitcher, bottle, etc.) to observe its operation.
- Make adjustments, as needed, if the water wheel is not performing as expected.

Extend the Design Challenge:

- For students who would like an extra challenge, have them use the string, paper clips, and additional cup to use their water wheel to lift the cup when it is full of some kind of mass.

***Teaching Tip:** Create a working water wheel of your own ahead of time to have a model to demonstrate.