

Grade Six: Energy
Lesson 6.6: Energy from Water Wheels

Lesson Concept Over time, humans have used moving water as a source of energy.

Link In the previous lesson wind energy is transferred to mechanical energy using windmills to capture the wind. This lesson deepens the understanding of mechanical energy doing work with moving water as the source of energy. In the next lesson, students will learn that food energy is transformed to useable energy to fuel your body.

Time 50 minutes

Materials **Whole class**

Printed copy of R1 Waterwheel photos

Video footage of waterwheel from

http://www.youtube.com/watch?v=cEL7yc8R42k&edufilter=edSoYA_dpmsn525eW_pWpw

Per Group (groups of 2)

2 Styrofoam cups

Cup of water

1" x 1" x 1" cube of waterproof clay

Wagon-wheel pasta

Bits of other types of pasta (ie: fettuccini, small shells, etc.)

Pan to catch spills

Bamboo skewer or straightened paper clip

Towel per group of 4

Individual

H1 Energy from Water Wheels

Advance preparation

1. Print copy of **R1 (Water Wheel Photos)**.
2. Duplicate **H1a,b (Energy from Water Wheels)**.
3. Assemble materials for lab. Refer to **R2 (Setup Photos)**.

4. Bookmark on computer or download before the lesson:
http://www.youtube.com/watch?v=cEL7yc8R42k&edufilter=edSoYA_dpmsn525eW_pWpw

Procedure:

Engage ***(10 minutes) Moving water has been used over time to generate energy.***

1. Display the first picture of a **R1 (Water Wheel Photos)** on the document camera. Ask students to share with their partner what they know about water wheels and chart student responses.
2. Show students the other two pictures on **R1 (Water Wheel Photos)** and video footage of water wheels. Discuss the questions: What is the water wheel? How does it work? How is it used to do work? What makes it move?

Explore / Explain #1 ***(15 minutes) Water wheels are designed to transfer energy from moving water to the water wheel.***

3. Distribute worksheet to students. As a class, read the introduction. Explain the procedure to the students and model how to build the water wheel.
4. Distribute materials to partner students. Ask student partners to build the water wheel following the directions.
5. Once the water wheel is built, ask students to draw their design. Discuss how they know the water wheel is built correctly and how they expect it to work.
6. Use notebooks to collect observations of how the water wheel works. Students will now test their machine with several trials.
7. Debrief by asking the following questions: What did you notice about the water wheels? What did you have to hold constant? What happened if you changed the amount of water poured or the height of the water poured?
8. Explain how energy from the water is transferred/transformed to do work.

Explore #2 ***(10 minutes) Water wheels can transfer more energy by changing the height of the drop.***

9. Teacher will pose the question, "If you were to raise the height from which the water is poured, how might that affect the spin?" Ask student groups to make a prediction.
10. Ask students to test their hypothesis with several trials by raising the height of the water.

Explain #2 ***(15 minutes) Water wheels can transfer different amounts of energy depending on the design.***

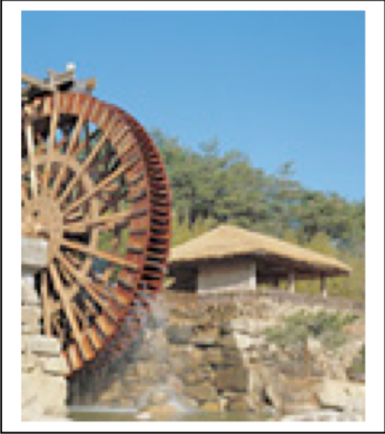
11. Debrief changes by discussing what happened when the height of the water was changed.
12. Ask students to develop a new design for their water wheel that will make it go faster. Ask students to draw their new design explaining the reason for changes in the design.
13. Ask students to test their newly designed machine with several trials. Write a summary statement about the results of the challenge to develop a faster water wheel.

Extend/Evaluate ***(10 minutes) Mechanical energy transferred by water wheels is dependent on variables that increase or decrease the speed.***

14. Ask students to do a quick write in their notebooks: What made their wheel design efficient? What would you do to change the design again to develop a faster wheel?

Name _____

ENERGY FROM WATER WHEELS!



Thousands of years ago, water was used to turn a paddle wheel to grind grain. Villages and towns were established near streams and rivers in order to harness the energy of moving water. Actual hydroelectric power plants that produce electrical energy have been in use in the United States since 1882. Today, hydroelectric power plants use the energy of motion (falling water due to gravity) to power electric generators turning enormous turbines, generating 12% of our nation's electrical energy.

Materials:

- ∞ Cup with small notches cut out on opposite sides
- ∞ Cup of water
- ∞ Clay
- ∞ Wagon-wheel pasta
- ∞ Bit of other types of pasta
- ∞ Paper clip (straightened) or skewer to form the axle
- ∞ Pan to catch any spills

Set up:

1. Roll out a thin strip of clay. Firmly press this strip along the outer rim of the wagon-wheel pasta. Make sure the rim is completely covered with a thick layer of clay.
2. Along the length of the clay, insert pasta pieces to form a pattern of paddle-like extensions.
3. Insert the paper clip or skewer into the center of the pasta.
4. Lay the skewer/water wheel across the cup, so both ends of the axle to the rim of your cup inside the notches. The wheel should be positioned over the center of the cup. Spin the wheel and adjust to make sure it spins freely.

Draw your design:

Observations:

1. Fill the other cup with water. Carefully pour the water onto the paddles of your water wheel. Repeat several times and record your observations.
2. How is energy from the water transferred/transformed to do work?
3. If you were to raise the height from which the water is poured, how might that affect the spin?
4. Create your hypothesis: If I raise the height of the water, then _____
(what happens)
_____ because _____
(tell why)
5. Test your hypothesis by raising the height the water falls before reaching your water wheel. Test it several times and record your findings.
6. Using the knowledge you have gained through your trials, create a new design for your water wheel.

Draw your design:

7. Explain the changes you made and why.
8. Test your new design. Is your new wheel more efficient? (ie: spin faster, easier, ...) Explain.
9. What could you do to further increase the energy & efficiency of your water wheel?



WATER WHEEL PHOTOS



Sample set up for Water Wheels using pasta paddles

