B6.3 Harnessing the energy of water

You're spending your summer vacation in the country. On a bike ride along a river, you see a waterwheel whose blades are moving steadily. You ask your mother why the waterwheel is moving. She explains to you that the flow of the river water drives the blades. The energy produced by this is frequently converted to electrical energy.

How can water be converted to energy (current)?

Write down your ideas and guesses:

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You need the following for the experiment:

- ☐ 1 container with a hole in the bottom (for example, a flowerpot)
- ☐ 1 large plastic container
- ☐ 1 drinking straw
- ☐ Modeling clay
- ☐ Packing tape
- ☐ Ruler
- ☐ 1 sheet of thin cardboard or thick paper
- ☐ Thick tubing, approx. 50 cm long
- ☐ 1 wooden skewer
- ☐ 1 wristwatch with a second hand
- ☐ Water

Figure 1: Required materials.

How to set up the experiment:

Lay out all the materials as shown in the photo.

For your hydroelectric plant, you need a waterwheel:

1. Cover the cardboard with tape. Cover the cardboard and the glued joints as completely as possible with tape so that the cardboard does not get soaked too quickly.
2. Cut six strips of the waterproof cardboard, each 2 cm wide and 6 cm long.
3. At one end of each strip, fold over a section measuring about a half a centimeter so that it can stand on a table.
4. Tape these strips next to each other on a drinking straw so that they form a star (see figure).
5. Cut the drinking straw to a length of 10 to 15 cm.
6. Insert the wooden skewer through the drinking straw. The wheel can already rotate.
7. Take the container and attach the tubing to the hole on the bottom. Use modeling clay to seal the connection.
8. If the container has other holes, also seal them with modeling clay or tape.
9. Now tape the end of the water tubing, for example, to the edge of a table. About 3 to 5 cm of the tubing should hang over the edge.

Figure 2: How to attach the cardboard strips to the drinking straw.

How to conduct the experiment:

Tip: Always let your experiment run for a certain amount of time, such as 10 seconds. That way, you can easily compare your results with other students' results.

Now you must work in pairs.

1. Hold a finger on the opening of the tubing and fill the container with water.
2. Your team partner will hold the waterwheel below the opening of the tubing, preferably over a basin or outdoors.
3. Lift the container approx. 40 cm high and remove your finger from the tubing opening.

4. Your team partner must now position the waterwheel so that the water stream hits it. Now begin the time measurement.
5. Repeat the experiment twice, reducing the container's height by 10 cm each time.
6. Enter in the table what you notice after a certain amount of time.

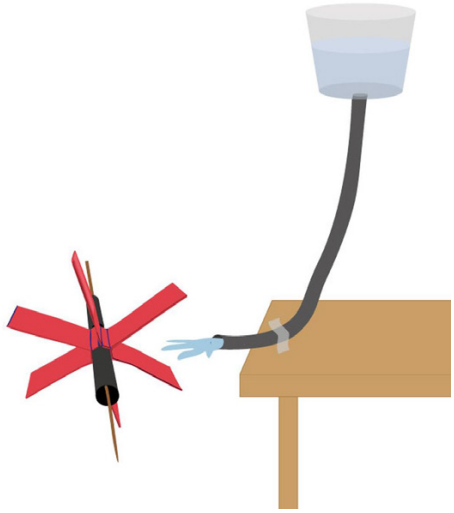

Figure 3: Experiment setup.

Write your observations in the table:

Container's height	Time in seconds	Observation
40 cm		

Evaluate your observations:

1. What happens when you hold the water container higher or lower?

2. What do you observe when the stream of water stops flowing?

3. The following text describes the energy conversion chain that occurs during this experiment. Read the text and then explain it in your own words.

The higher the water container is held, the more energy the water has. This energy of the water is called potential energy. When the water begins to flow, the potential energy is converted to kinetic energy. The water in the tubing moves in a straight line, and the wheel moves in a circle.

4. Draw the energy conversion chain.

5. Compare what happens when you drop a stone from a height of 10 cm and from a height of 1 m into a sandbox.

Doing further research:

1. Attach a small object, such as a small stone or small piece of wood, to a piece of string.
2. Tie or tape the string to the wooden skewer and repeat the experiment.
3. What do you notice?

In principle, you now have a small hydroelectric plant: An object is moved using the water's energy.

1. Use an encyclopedia or search online to find out when people began using this principle to make work easier.
2. Also, find out what a watermill that grinds grain and a hydroelectric plant that generates electricity have in common and how they differ.