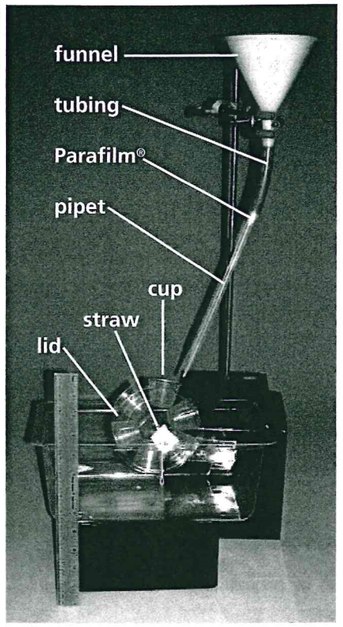
Notebooking Tips

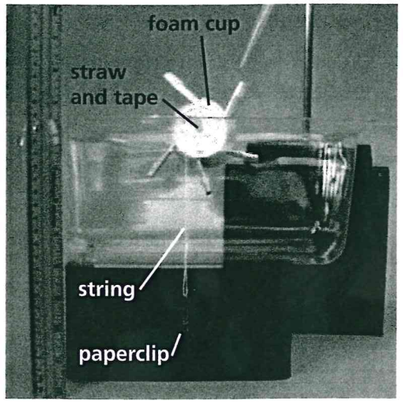
➤ For students using bound notebooks, have them paste the photocopied Questions page on the left side of a 2-page spread, and then write their answers on the right-hand page of the spread. For students using loose-leaf notebooks, have them hole-punch the Questions page along the right-hand margin and insert the page on the left so they can compile their answers on the right-hand page.

➤ After students have answered the questions, have them finalize their notebook's Table of Contents. Have them number every page in a specific location, and complete their Table of Contents by listing each part of the assignment and its corresponding page number.

blades are cut from the upper portion of the cup and inserted into slits in the hub.

- The straw can serve as an axle and can be held in place with tape loops attached to the tank.
- A pulley system can be designed to help lift the paperclip as the wheel turns. Students can measure the distance that they lift the paperclip. If they cannot lift the paperclip, they might count the number of rotations made by the wheel using 100 mL of water.
- Students can use Parafilm to seal connection points and prevent leaks at junctions between the funnel, tubing, and pipet.





Examples of waterwheel design. Students may choose to staple or glue the medicine cups to the plastic lid to create their water wheel. Alternatively, they may choose to create a water wheel and blades from the foam cup. Both of these examples use the straw as the axle.

Day 2

Design Activity (continued)

1. Return each group's design plan.
2. Provide students with requested materials.
3. Distribute one 100-mL graduated cylinder to each group. Each group also should have access to a container with 200–500 mL of water (or a water source).
4. Assist groups as needed during construction and testing.
5. Give students 30 minutes for construction and testing, with a clear start and finish time.
6. When time is up, have each group demonstrate its working model. Each group should have its water wheel already set up; have a student representative from each group introduce 100 mL of water from a graduated cylinder into the water wheel system, so that you and competing groups can

NAME _____

DATE _____

Carolina STEM Challenge™

Hydroelectric Power

Connections

Before electric motors were invented, humans had to rely on their own muscle power or the power of animals to do most types of work. The power of wind or falling water was used to accomplish some tasks, like the grinding of grain.

In 1820, Hans Christian Oersted discovered the relationship between electricity and magnetism, which led to the invention of motors and generators. He connected a copper wire to a large copper–zinc battery. An electrical current flowed through the wire and he noticed that when he brought a magnetic compass near the wire, the needle of the compass moved. The electrical current had generated a **magnetic field**.

Applying the concepts discovered by Oersted, Michael Faraday built the first **electric motor**. Faraday's motor was simple; it consisted of a battery, a spool of wire, and a bar magnet. When an electrical current ran through the wire, the magnet rotated. This process allowed the generation of **mechanical energy** from **electrical energy**. The same setup can be used in reverse to turn mechanical energy into electrical energy, as in wind- or water-powered generators.

Most turbines and water wheels work the same way. The blades rotate when water (or wind) flows across them. The blades are connected to a hub that turns a shaft. The shaft runs into a **generator**, which converts mechanical energy into electrical energy. Electrical current then flows from the generator though power lines to an energy user.

From the moment you wake up in the morning and flip on a light switch, you are consuming electricity. No single technology can effectively supply energy for the entire world. Over the last 200 years, **nonrenewable** energy sources such as coal and oil have provided most of the world's energy. During this time, these resources have become increasingly expensive to extract. Not only are these resources limited, their use generates many pollutants, some of which have been linked to climate change. Recently, greater emphasis has been put on identifying and developing **renewable** energies. The sun, wind, and running water all are potential sources of cleaner and more sustainable energy. Not only are the sources of solar power, wind power, and hydroelectric power renewable, their production typically creates less pollution than conventional fossil fuel energy sources.

Connections Questions

1. List 10 items that you use on a daily basis that use electricity.
2. List several examples of nonrenewable and renewable energy sources.
3. How could you harness the power of the water wheel to generate electricity?