design features in the middle section, and their results and reflections for improvement on the right. Encourage peer review of each group's presentation by having students view all of the mini posters before they are presented.

Preparation

Day 1

Connections and Energize Demonstration

1. Photocopy the Connections page of the Student Guide for each student.
2. Photocopy the remainder of the Student Guide for each student or group.

Design Activity

1. Set up eight workstations. Stock each station with the materials that students will have access to during the Design Activity. Refer to the Materials list in the Student Guide for details.

Day 2

Design Activity

1. Before groups begin building, approve their designs. Check for safety issues, and make suggestions and alterations as appropriate.
2. Prepare a central station where students will have access to the roll of string and any other materials you wish the groups to share.
3. Prepare a beaker of water (200–500 mL) for each group.

Procedure

Day 1

Connections

1. Distribute the Connections page to each student. Distribute the remainder of the Student Guide to each student or group. Assign the Connections reading and Connections Questions for students to read and answer in class (alternatively, as homework before the activity).
2. Describe the Notebooking process to students. As a class, discuss the expectations for Notebooking and any specific presentation instructions.

Energize Demonstration

1. Demonstrate the use of the hand generator. Have students turn the crank and observe the lighting of the bulb.
2. Discuss the similarities between the hand generator and a water- or wind-powered generator.
3. Have students turn the crank very slowly. As they do so, have them brainstorm about why the bulb does not light up.

Notebooking Tips

➤ Have students reserve a page at the front of their notebook for a Table of Contents, which will list the order and location of specific components of the assignment. At the end of the project, have students number the notebook pages and complete the Table of Contents.

➤ For students using bound notebooks, have them paste the photocopied Connections page on the left side of a 2-page spread, and write their answers on the right-hand page. For students using loose-leaf notebooks, have them hole-punch the Connections page along its right-hand margin and then insert it as the left-hand page of a 2-page spread. Have them write their answers on the right-hand page.

NAME _____

DATE _____

Carolina STEM Challenge™

Hydroelectric Power

Background

As of 2012, hydroelectric power is the leading source of renewable energy in the United States. Energy is produced from moving water, and the faster the flow of the water, the more energy that can be produced. Hydroelectric power is typically produced in one of two ways. In a run-of-the-river system, water flows through a pipe and the force of the current pushes and turns the blades of a turbine to spin the generator, which produces electricity. In a storage system, the water is contained behind a dam in a reservoir, and the water is released as needed to produce electricity.

To address the concern that dams on rivers prevent the upstream migration of fish, some dams are designed with features commonly called fish ladders, which help fish such as salmon and shad "step up" past the dam. The operation of a dam also can change the conditions of a river, such as the temperature, and increase the amount of silt on the stream bed. Furthermore, diverting waterways alters the landscape and causes changes to plant and animal habitats.

Design Activity

Objectives

During this activity you will model the production of electricity by harnessing the energy of falling water to do work. Using only the equipment provided, your group will compete with other groups in the class to meet the following challenge:

Design and build a device that will lift a paperclip at least 10 centimeters using 100 milliliters of water.

Materials

- ring stand and clamp
- plastic tank
- funnel
- tubing
- tube clamp
- foam cup
- 2 plastic lids
- 8 small spoons
- 8 large spoons
- 6 medicine cups
- pipet
- 3 straws
- paperclip
- roll of adhesive tape
- 2 squares of Parafilm®
- string (shared)
- metric ruler
- scissors
- container of water
- 100-mL graduated cylinder

Other materials may be available. Consult your teacher.

Procedure

1. Look at the materials that are available to your group.
2. Figure out a way to use the materials to create a device that can turn the energy from falling water into work. This serves as a model hydroelectric generator.