Unit 2
How is Flowing Water an Energy Source?

Activity C

Will changing the slope of falling water affect how fast it flows?

Introduction

In the previous activities, students learned about water pressure and flow. In this activity, a flow meter is added as the first step to visualizing how the force of water can be used to create mechanical energy. Students will compare how fast water passes through a flow meter when the slope changes. Students will be able to conclude that more work (mechanical energy) can be created with a steeper slope because an increase in slope will equal an increase in flow rate and force.

Scientific Learning Goals and Objectives for this Activity:

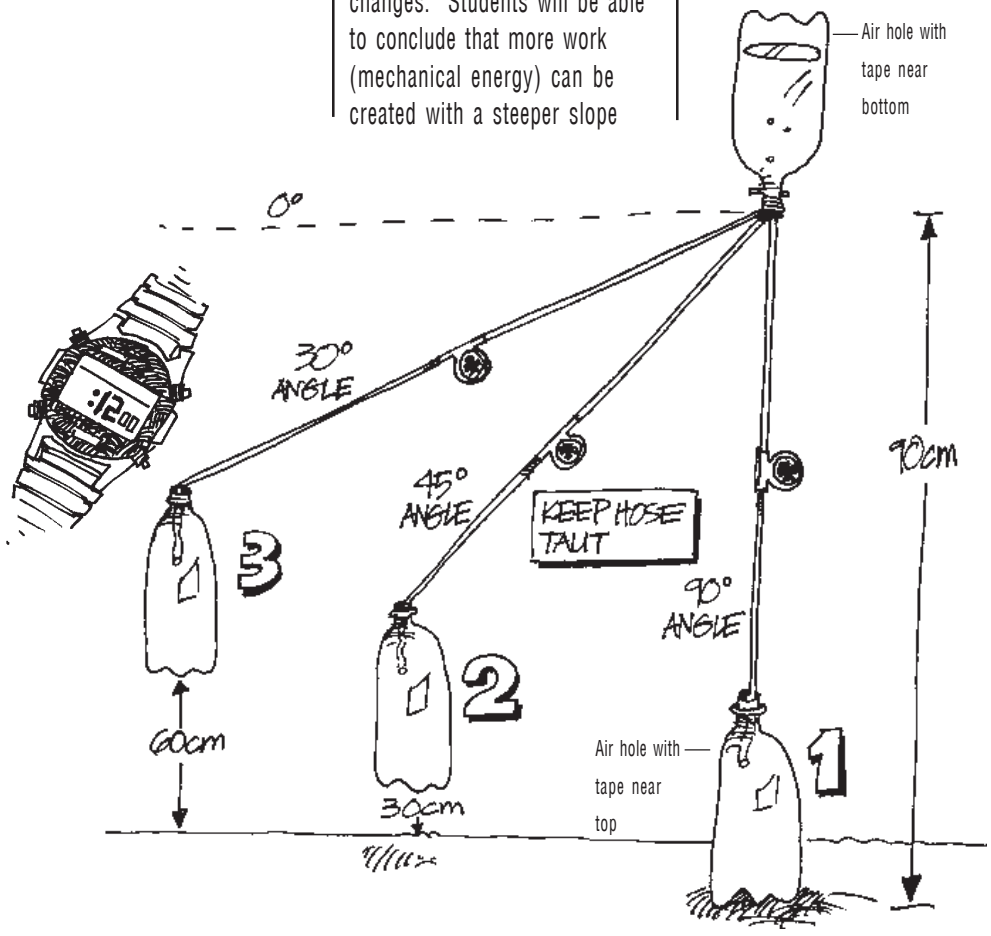
Washington Grade Level Expectations (GLE's): 1.1.4; 1.2.1; 2.1.1; 2.1.3; 2.1.4; 2.1.5; 2.2.5

Goals

- Students will understand and apply scientific concepts and principles.
- Students will understand and apply technological concepts as they relate to science.
- Students will conduct scientific inquiry.
- Students will communicate scientific understanding.

Objectives

- Students will observe, document, and understand that as the force of falling water increases, so does its potential as an energy source.
- Students will observe how the force of falling water can be used to turn a water wheel.
- Students will observe how the force of falling water through a tube or pipe can be adjusted by the diameter of the tube as well as its height.
- Students will represent data by averaging.
- Students will communicate data by graphing results.
- Students will draw conclusions from graphed data.



Teacher Preparation

Preparation Time:
15 minutes

Materials

Prepare for Each Team:

- 2 soda pop bottles (same size)
- 2 25 cm lengths of tube (cut from supply in box)
- 2 pour spouts (included in box)
- 1 flow meter (included in box)
- watch or clock with second hand
- permanent marker
- meter stick

Prepare for Each Student:

- copy of data page
- copy ofPlanning an Investigation Sheet

Student Involvement

Activity Time:
50 minutes

? What ways can water wheels be used to produce work?

Discuss responses and list on board or overhead. Examples include water wheels for grinding grain, turning gears, producing electricity, etc.

? Will changing the slope of falling water affect how fast it flows?

Discuss responses and have students enter prediction in Planning an Investigation Sheet.

1. Pass out materials and explain activity to test prediction.

2. Students set procedures and standards for measuring the rate of water flow and enter on Planning an Investigation Sheet. Include:

- Choose water level (volume) in bottle.
- Change slope by choosing 3 pour heights.
- Use stop watch or equivalent to time water flow through the flow meter.
- Count time from when the wheel starts and stops spinning.

3. Each team connects tubes to flow meter. Attach pour spouts to bottles and connect spouts to tubing. Air hole on top bottle's pour spout must not be covered by tube or bottle must be punctured to create air hole.

4. Add water to top bottle and hold at predetermined height. Place bottom bottle at lowest predetermined height and aim spout at tope bottle. Stretch tubing to avoid sagging. Flip top bottle as shown in the illustration so spout points toward bottom bottle. Measure and record results.

5. Change height of lower bottle and repeat process.

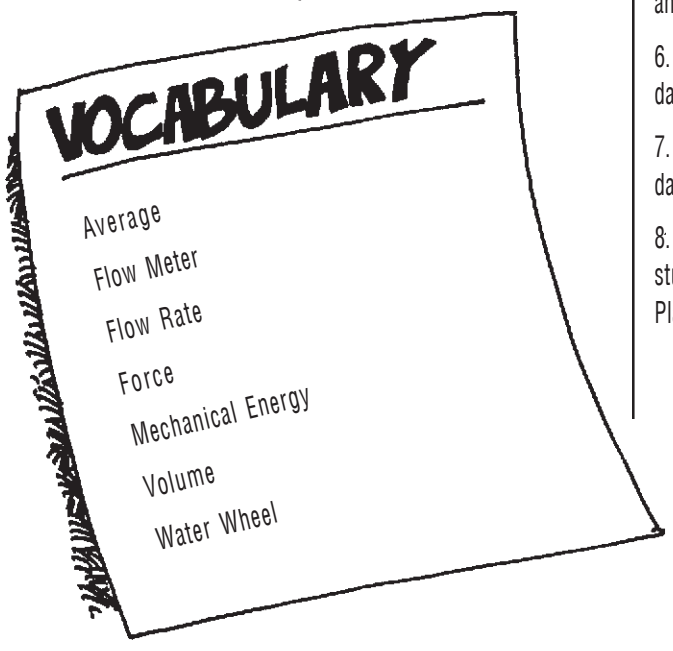
6. Average and record results on data sheet.

7. Graph the average results on data sheet.

8. Each team shares results and students record conclusions on Planning an Investigation Sheet.

? If the diameter of the entire tube and intake/outtake holes were larger, would it effect the water's rate of flow and force?

Discuss responses. Students answer questions on Planning an Investigation Page.



Notes

Cut tubing lengths according to preparation instructions. These lengths will be needed again in Unit 3.

Step 3:

Hose will fit better if wet when applied over pour spout. Air needs to get into bottle to allow water to flow. We suggest puching a hole in the bottom of one bottle to be the upper reservoir. The lower bottle needs a hole near the top. Make the hole with a nail or awl before you fill the bottle. Cover with duct tape and then fill. The bottle that is upside down in the illustration has a hole near the bottom.

If spouts are leaking around seal where plastic and metal touch, use silicone to reseal.

If students ask, flow meter could be at any point on tube and not effect results.

Step 4:

Keep hose taut but not stretched. Water may dribble slightly from pour spout hole but won't affect results of activity. Have container of water available if students lose a little water and want to set their water level again. Be careful not to pinch tubing at connections.

If the diameter of the tube is larger from beginning to end, more volume will equal more force. Likewise, wherever a pipe is narrowest, this will be a determining factor in flow rate. As a result, students should understand flow rate and force can be manipulated by the size of tube/pipe as well as its slope and height.

DATA PAGE 2C
Will changing the slope of falling water affect how fast it flows?

Flow meter results

In each box, record the flow time for the height chosen. Then calculate and record the average time water flowed.

	Flow Meter Time				
	Test 1	Test 2	Test 3	Total	Average
Slope at Height ____					
Slope at Height ____					
Slope at Height ____					

Graph the average flow meter time results: