

ACTIVITY SEVEN:**ALL CLOGGED UP****TIME:**

(1) 45-minute lesson

This activity is to be done by half the class at the same time Activity Six is done by the other half of the class.

SCIENCE PROCESS SKILL:

Predicting and model building

SCIENCE CONCEPT:

Zebra mussels can restrict the flow of water by congregating in water lines.

BENCHMARKS:

Students should:

Know that scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments.

Know that seeing how a model works after changes are made to it may suggest how the real thing would work if the same change were made.

Keep records of their investigations and observations and not change the records later.

Use numerical data in describing and comparing objects and events.

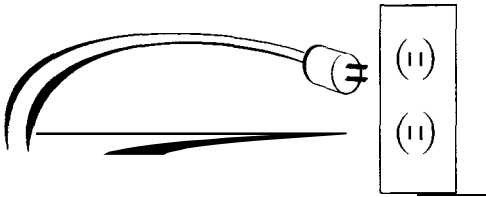
OBJECTIVE:

Students will use a model to predict the rate of flow of water in a pipeline.

WHAT YOU OUGHT TO KNOW

Zebra mussels are gathering on water intake lines of the power companies and water treatment plants along rivers and lakes. The resulting economic impact to these companies is very serious and costs thousands of dollars for clean-up and repairs. Have students brainstorm problems that might occur if these industries and water utilities were unable to easily draw incoming water. This activity shows students how the flow of water through a pipe can be reduced by zebra mussels. Students will be estimating the rate of water flow in a pipe when colonized by zebra mussels.

Each tube used by the students represents one of the multiple tubes present in the cooling system of a power plant. When the pipes are clean, the water moves through quickly and in known amounts. As soon as zebra mussels come into the pipes, water flow is reduced. The more mussels in the pipes, the less water is allowed to pass through. If the cooling process is stopped, the power plant could overheat and a shutdown could occur.



WHAT'S THE CONNECTION??

TO LANGUAGE:

Write a newspaper account of a nuclear power plant being shut down because of a water flow shortage.

TO MATHEMATICS:

Estimate the rate of flow of a 5-liter bucket draining through a 4 cm hose, 8 cm hose, etc.

TO ART

Use straws and aquarium tubing to build a water or power plant structure.

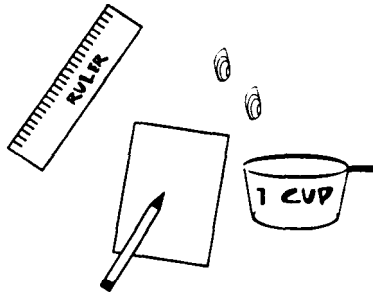
TO SOCIAL STUDIES:

Locate your area's water plant and power plant on a map.



WORDS OF WISDOM

Congregate, flow restriction, intake lines, siphon (see also glossary on page 7)



RESOURCES AT THE READY

EACH GROUP WILL NEED-

One 2.5 cm inside diameter, vinyl tubing, 1 m long
with attached screen (see drawing)

2-liter bottle (4) (teacher collected)

Gravel

Ruler

Buckets (2) (teacher collected)

Clean-up equipment and water-holding materials

Watch or clock to record elapsed times

All Clogged Up! Data Sheet 7.1

All Clogged Up! Record Sheet 7.2

Piece of graph paper

(use Data Sheet 5.3)

Zebra mussel journal



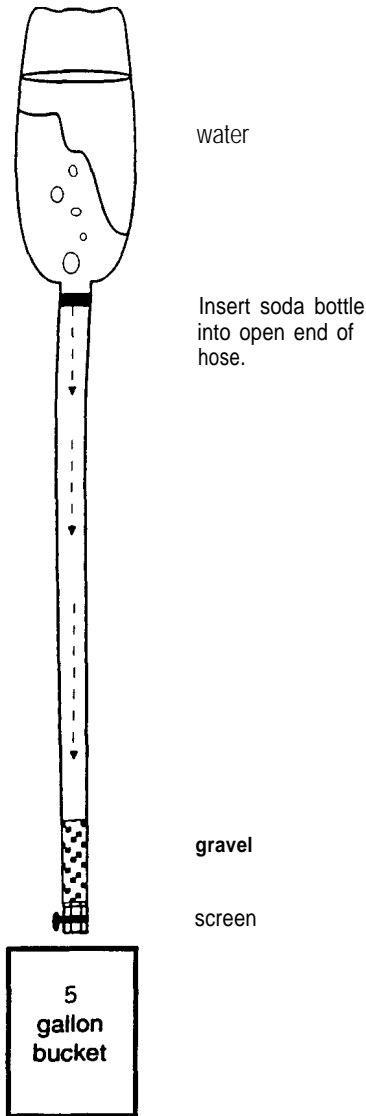
GETTING YOUR ACT TOGETHER

This will be a wet and messy activity. Have a mop on hand in case of spills. You will need to have an adequate supply of water nearby or will want to prepare for the lesson by having the water brought into the classroom. From the cafeteria, collect buckets, pickle jars, vegetable cans, even milk jugs to use for water, cleaning up, and collecting dirty water.

NOTE: You will want to consider teaching this lesson simultaneously with Activity Six, "Filtering Fools."

TIME TO EXPERIENCE ZEBRA MUSSEL MANIA!!

STEPS 1-5



1. Have each group fill a 2-liter bottle with water and place it on a desk or table. This bottle becomes your water intake source.
2. Securely attach the open end of the tube over the opening of a 2-liter bottle.
3. Watch the clock as you drain water through the tube. Start timing when the bottle is inverted. Note the number of seconds that have elapsed by subtracting the times on the Data Sheet 7.1. Repeat this process at least three times. The three times should all be similar. If not, why?
4. Add 5 cm of gravel to the open end of the tube and shake the gravel down to the screen. Repeat steps 1 through 3 three times. Have students record data for each repetition.
5. Add an additional 10 cm of gravel, repeat steps 1 through 3, and record the data.
6. Now have the students predict the rate of flow if you would add 5 cm more of gravel (20 cm total) to the hose. Make one prediction for 5 cm less of gravel (10 cm total gravel). Record these two predictions.
7. Check your predictions by completing steps 1 through 3 to find the actual time required. Have the students compare predictions. Which was the most accurate, the 10 cm or the 25 cm prediction?
8. Have the groups create a graph of their results without the predictions. Then have them draw a line through the observation points and develop extrapolations and interpolations for 10 cm and 25 cm of gravel. Were the graphs useful for this task?

9. Answer question on Record Sheet 7.2. Have each group share their data with the class and compare the water output values.
10. Have the students draw the apparatus in their journals. When they have finished the drawing, have them draw a power plant with cooling tubes blocked with zebra mussels.
11. Have the Reporters for each group prepare a presentation for the group doing Activity Six. They should demonstrate the procedure and show the results.

WHAT DID YOU LEARN??

Compare the students' predictions to actual observations. Can you determine if their final prediction is fairly accurate? Are the children able to demonstrate how the zebra mussels block pipes in water or power plants.

WAIT, THERE'S MORE . . .

- Field trips to water utilities or power plants can provide an ideal opportunity for a first-hand look at the problems caused by zebra mussels.
- Invite a power plant operator or engineer to discuss zebra mussel impacts with the class.
- Make predictions about what would occur if the entire tube used in the lesson were clogged.