Water Locked

Students will use volume formulas to calculate the amount of water in a lock.

Teacher Notes for Discussion

A good pre-activity for this activity is to bring in containers (boxes work well) and challenge students to figure out how much liquid each can hold. Use small groups and allow the students to come up with their own strategies for figuring volume. After they have explored and shared strategies, introduce the concept and formula for volume.

Objective

By the end of this activity, students should be able to calculate cubic feet of water and rate of flow, given the formulas for volume, rate of flow and specific dimensions.

Time Considerations

Instructor preparation: 30 minutes

Student activity: two classes

Answer Key

Boats going upstream enter the 600-foot-long and 110-foot-wide lock at the lower pool. The gates are closed and the water must rise 8 feet. What is the volume of water that will enter the lock?

V = length • width • height
V = 600 ft. • 110 ft. • 8 ft.
V = 528,000 $ft.^3$
528,000 $ft.^3$ of water

Calculate the amount of water that will enter the same lock if it only has to rise 3.5 feet.

V = length • width • height
V = 600 ft. • 110 ft. • 3.5 ft.
V = 231,000 $ft.^3$
231,000 $ft.^3$ of water

If 264,000 cubic feet of water is brought into the lock, how many feet will that raise the water?

V = length • width • height
264,000 = 600 ft. • 110 ft. • h
264,000 = 66000 ft. • h

$$\frac{264{,}000}{66000} = \frac{66000h}{66000}$$

4 = h
The water in the lock would be raised 4 feet.

If the water is entering the lock at a rate of 3,550 cubic feet per second, how long will it take to raise the water level of the lock 9 feet? (The lock is 600 feet long and 110 feet wide.)

First, find the volume of water.
V = length • width • height
V = 600 ft. • 110 ft. • 9 ft.
V = 594,000 $ft.^3$

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V = rate • time

$594{,}000 = \frac{3550 \text{ ft.}^3}{1 \text{ sec.}} \bullet \text{time}$

$\frac{1}{3550 \text{ ft.}} \bullet 594{,}000 = \frac{3550 \text{ ft.}^3}{1 \text{ sec.}} \bullet \text{time} \bullet \frac{1}{3550 \text{ ft.}}$

167.32 sec. = time or 2.79 min.

RELATED STANDARDS AND BENCHMARKS

National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics.* <http://standards-e.nctm.org/1.0/normal/standards/intr_MAIN.html>, March 16, 2000.

Standards 6: Problem Solving

- build new mathematical knowledge through their work with problems

Standards 2: Patterns, Functions, and Algebra

- use symbolic forms to represent and analyze mathematical situations and structures
- use mathematical models and analyze change in both real and abstract contexts

Standard 4: Measurement

- understand attributes, units, and systems of measurement

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UNDERSTAND YOUR MISSION

By the end of this activity, you should be able to calculate, in cubic feet, the amount of water needed to raise the water levels in the locks and how long the water takes to reach the desired levels for travel.

LEARN THE LINGO

volume	amount of space occupied by a 3-D object (a bowl, a shoe, a cupcake)
distance	the degree or amount of separation between two points
rate unit	a quantity, amount, or degree of something measured per of time
time	the measured or measurable period during which an action, process or condition exists or continues; duration

Gather Your Supplies

- ❑ paper
- ❑ pencil
- ❑ calculator

BACKGROUND

Economically, the Mississippi River is important for transporting barge loads of products to and from New Orleans. The Mississippi River is not man-made like the Panama Canal; it is a natural body of moving water where water levels are inconsistent. Without help, depths are often not sufficient for the barges to travel. As a result, a series of locks and dams have been built along the river to assist in transportation.

Mississippi River m a t h

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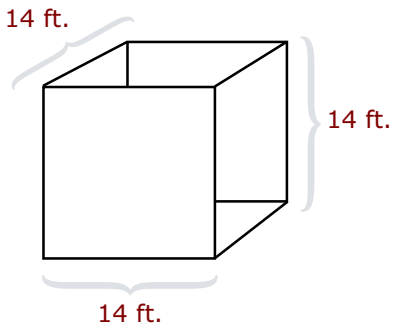
Chart a Course for Exploration

V = length • width • height
V = rate • time

If the side of a square measures 14 feet, the volume of the square would be

V = l • w • h
V = 14•14•14
V = 2,744 ft.^{3}



Go Beyond

Find the dimensions of a barge, train car, and semi-truck and calculate the volume of each.

Boats going upstream enter the 600-foot-long and 110-foot-wide lock at the lower pool.

1. The gates are closed and the water must rise 8 feet. What is the volume of water that will enter the lock?

2. Calculate the amount of water that will enter the same lock if it only has to rise 3.5 feet.

3. If 264,000 cubic feet of water are brought into the lock, how many feet will that raise the water? Remember to use the same formula as before but to substitute the amount of water in the volume place of the equation: 264,000 = 600 • 110 • h.

4. If the water enters the lock at a rate of 6,000 cubic feet per second, how much time will it take to raise the water level of the lock 9 feet?

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Write a paragraph accurately explaining volume and rate, giving examples used in the lock and dam lesson.

REFERENCES

Chapin, Suzanne H., Mark Illingworth, Marsha S. Landau, Joanna O. Masingila, and Leah McCracken. *Middle Grades Mathematics,* Prentice Hall Publishing, Inc., 1995 ed.

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