Volume and Surface Area of Rectangular Prisms and Cylinders

Strand: Measurement and Geometry

Topic: Find the volume and surface area of rectangular prisms and cylinders

Primary SOL: 7.4 The student will
a) describe and determine the volume and surface area of rectangular prisms and cylinders; and
b) solve problems, including practical problems, involving the volume and surface area of rectangular prisms and cylinders.

Related SOL: 7.11

Materials

- Student Notes and Understanding the Formulas activity sheet (attached)
- Applying the Formulas activity sheet (attached)
- Practical Problem Stations (attached)
- Practical Problems Recording Sheet (attached)
- Various cylinders and rectangular prisms
- Scientific calculator

Vocabulary

base, cylinder, faces, height, length, rectangular prism, surface area, volume, width (previous grades)
net (7.4)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

Note: The following lesson will require multiple class periods.

Standard 7.4a

1. Distribute the Student Notes activity sheet to each student. Students should fill in the boxes/blanks throughout the discussion.
2. Activate prior knowledge by discussing the characteristics of a rectangular prism and a cylinder. Be sure to include discussions about the number of faces and the base of each object.
3. Ask students to provide real-world situations where volume and surface area would be used.
4. Complete the Understanding the Formulas section of the Student Notes activity sheet, using the net of each shape. Help students explore the formulas needed to determine the surface area and volume of each object. Include discussions about volume being measured in cubic units and surface area in square units.
5. Distribute the Applying the Formulas activity sheet and have students complete it.

6. Additional practice: Ask the students to find the volume and surface area for various objects around the room (e.g., can, book, box).

Standard 7.4b

7. Move forward with the Practical Problems activity sheet once the students have mastered using the formulas. Encourage the students to highlight/underline the key words that lead them to use a specific formula (surface area or volume).
8. Practical Problem Stations: Set up the six practical problems stations around the room.
9. Divide the class into groups of three or four, and provide each student with the Practical Problems Recording Sheet to complete the stations activity.
10. Each group should complete the six examples. The teacher should monitor the groups and check for accuracy as the groups are working.
11. All problems should be checked before the lesson has concluded.

Assessment

- **Questions**
  - How do you determine the surface area and volume of a cylinder?
  - How do you determine the surface area and volume of a rectangular prism?
  - How are volume and surface area related? How are they different?
  - What is volume? Why is volume measured in cubic units?
  - What is surface area? Why is surface area measured in square units?
- **Journal/writing prompts**
  - Describe to another student what surface area is and how to find it.
  - Explain how surface area differs from the volume of a rectangular prism.
  - Ask students to write about how surface area is used in the real world.
  - Describe a practical example of when you would need to find the volume of a rectangular prism or cylinder.
  - Describe a practical example of when you would want to know the surface area of a rectangular prism or cylinder.
  - Pretend that you are painting a cylinder-shaped water tank. Explain how the formula would change if you do not need to paint the bottom of the tank.
- **Other Assessments**
  - Provide real-life items and ask the students to determine the volume and surface area (e.g., soft drink can, potato chip can, oatmeal container, cereal box, shoe box). Students can use a ruler to determine the measurements.
  - Create nets on graph paper, and ask students to measure and determine the volume and surface area of the given shapes.

Extensions and Connections (for all students)

- Have students create posters showing the surface area and volume of cylinders and rectangular prisms. Posters should include definitions, diagrams, and examples.

- Have each student construct a cylinder and ask a partner to find the surface area and volume. Have students compare their cylinders.
- Given five rectangular prisms, have students put them in order from least to greatest according to volume and surface area.
- Have students design their own label for a cylinder.
- Provide the formula and ask students to find the surface area and volume for a triangular prism.
- Have each student create a rectangular prism and ask a partner to solve for the surface area.
- Ask students to create a Venn diagram that compares volume with surface area.

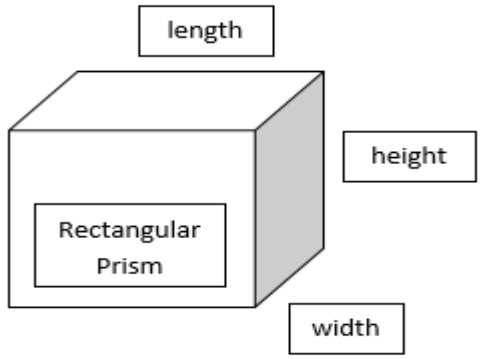
Strategies for Differentiation

- Use the formula sheet to stress what each variable represents.
- Stress that there are three steps to solving the problem: writing the formula, substituting the values, and solving including proper units.
- Place the net of the cylinder or rectangular prism on grid paper.
- Begin with prisms that have attributes that are whole numbers less than 10. Give plenty of practice building prisms with the cubes. Allow students to find the volume and surface area by counting the cubes.
- Relate the base of the prism to the classroom floor.
- Make a T-chart with length, width, and height to assist in calculating the surface area of a rectangular prism.
- Have the students create practical problems involving volume and surface area of rectangular prisms and cylinders.
- Allow students to work in pairs or small groups of three or four from beginning of activity, at step 1, instead of waiting until step 9.
- Provide worked examples on the recording sheet for some students, if necessary.

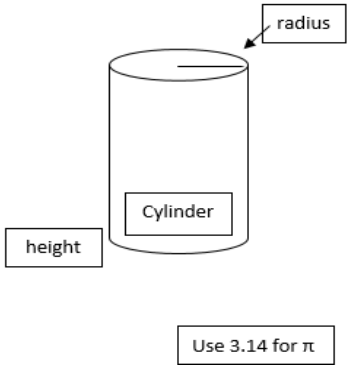
Note: The following pages are intended for classroom use for students as a visual aid to learning.

Student Notes

Characteristics of a Rectangular Prism



Characteristics of a Cylinder



Use 3.14 for π

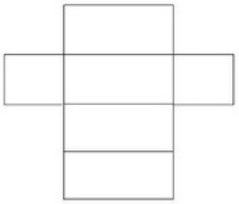
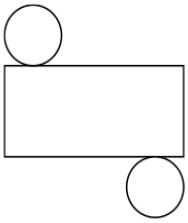
Practical Situations where Volume is used

Volume represents filling up an object

Practical situations where surface area is used

Surface Area represents covering an object

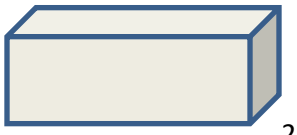
Understanding the Formulas

Rectangular Prism	**Cylinder**
	
Surface Area SA=_____	**Surface Area** SA=_____
Volume V=_____	**Volume** V=_____

Applying the Formulas

Directions: Find the volume and surface area for the following shapes.

-Write the formula *-Substitute the values* *-Find the answer*



3 in.

2 in.

10 in.

Volume

Surface Area

diameter 9 cm.

17 cm

Volume

Surface Area

Practical Problem Stations

STATION 1

Jessica is going to make a wooden jewelry box to give to her mom on her birthday. She is going to paint the box pink because it is her mom's favorite color. How much paint will be needed to paint the jewelry box? The length of the box is 9 inches, the width is 5 inches, and the height is 3 inches. Should she determine the volume or the surface area of the box to determine how many bottles of paint she will need if each bottle covers 100 square inches?

STATION 2

Mark is going to build a rectangular flower box to plant vegetables. The flower box he is designing will not need a top in order for the flowers to grow. He will purchase wood to build the planter. How much wood is needed to complete the project if the length is 14 feet, the width is 5 feet and the height is 4 feet? When Mark determines the number of cubic feet of soil to fill the planter half-full, which formula should he use: surface area or volume? How many cubic feet of soil does he need to fill the planter half-full?

STATION 3

The city of Atlanta wants to paint a cylindrical-shaped water tank. The height of the tank is 88 feet and the radius is 25 feet. How much paint will be needed to paint the water tank if the bottom is not painted? How much water will this tank hold? Which formula is used to find the amount of water in the tank?

STATION 4

LaShaun is in charge of designing a cereal box for a new company. The box will be 17.5 inches in height, 9 inches in length, and 3.5 inches in width. How much material will be needed to make one box? How much material would be needed to make 125 boxes? Which formula is used to determine the amount of material?

STATION 5

Edward is going to design a toy chest for his children. He knows the space he wants to put it in. The room can hold a rectangular prism with a surface area of 94 ft^2. Edward knows that the height will be 3 feet and the width will be 5 feet. What will be the total length of the new toy chest?

STATION 6

A soda can is made out of aluminum. It is 12 centimeters tall and has a diameter of 7.5 centimeters. How many square inches of aluminum would be needed to make the can? Which formula is used to determine the number of square inches of aluminum to make the can? How many cubic units of soda would be needed to fill the can?

Practical Problems Recording Sheet

STATION 1	**STATION 2**
STATION 3	**STATION 4**
STATION 5	**STATION 6**