

Changing Attributes

Strand:	Measurement and Geometry
Topic:	Changing attributes of rectangular prisms
Primary SOL:	8.6 The student will b) describe how changing one measured attribute of a rectangular prism affects the volume and surface area.
Related SOL:	8.14, 8.17

Materials

- Changing Attributes Notes activity sheet (attached)
- Changing Attributes Activity Sheet (attached)
- Rulers
- Different types of cardboard boxes (rectangular prisms) such as cereal boxes, snack boxes, etc. Try to have each one a different size.
- Demonstration tool (e.g., document camera, digital display)

Vocabulary

height, length, scale factor, surface area, volume, width (earlier grades)

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

1. Display the Changing Attributes Notes page, zooming in to the first row. Show students how to find the volume of the first rectangular prism. Then apply the scale factor. Make sure to show students that the overall volume increased by the same factor as the length (or any of the following attributes).
2. Apply the next scale factor, and show students that the overall volume changed by the same factor again.
3. After doing the three volume questions, move to the surface area questions. These will take a little longer, but make sure to have students show their work. Apply the scale factor. Ask students whether there is any observable pattern from the original surface area to the new surface area. The goal is that they see *no* pattern. Reinforce this by applying the next scale factor. Be sure the students see no pattern from original surface area to new surface area. Also, be sure that, for every question (row), they write in complete sentences for the “Describe the Change” box.
4. Write the words “Volume,” “Surface Area,” and “Scale Factor of x” on chart paper and post around the room as a gallery walk. The students’ goal is to first calculate the surface area and volume of their box showing all of their work. Once you give them the go-ahead, students can walk to each paper (station) around the room. Students need to calculate either the new surface area or volume, whichever the paper says, based on the given scale factor. (Example: A station might read “Volume: Scale Factor of $\frac{1}{2}$.” Students would need to find the new volume. Then they would have to write a sentence or two describing the change. Try to have six stations, three for volume and three for surface area, with a good combination of whole-number and fraction/decimal scale factors.

5. Display the Changing Attributes activity sheet and distribute copies to students. Discuss the problems with students.

Assessment

- **Questions**
 - What happens to the volume of a prism when you double the height of the figure? How do you know?
 - What happens to the surface area of a prism when you double the height of the figure? How do you know?
 - What happens to the volume of a prism when you halve the height of the figure? How do you know?
 - What happens to the surface area of a prism when you halve the height of the figure? How do you know?
- **Journal/writing prompts**
 - Explain why a scale factor change for volume is easier to calculate than the scale factor change for surface area.
 - Explain the difference between volume and surface area.
- **Other Assessments**
 - Go to Kahoot! website and search for Changing Attributes.

Extensions and Connections (for all students)

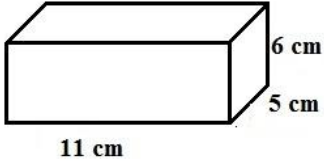
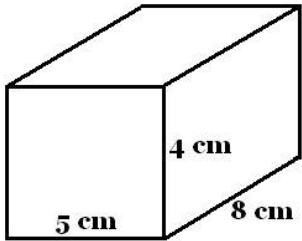
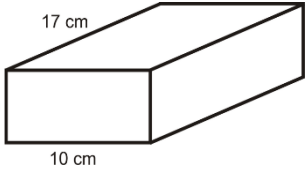
- Have students create practical problems that involve finding the volume or surface area of various rectangular prisms.
- Ask students whether anything like this would work for other shapes, such as cylinders, cones, pyramids, etc. Hopefully, at least one student comes up with “cube.”

Strategies for Differentiation

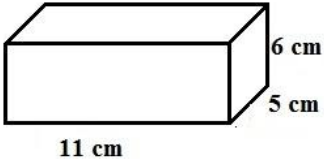
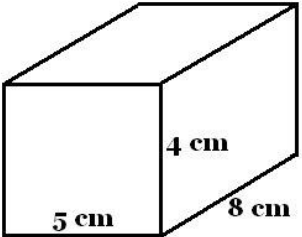
- Give students a completed copy of the Changing Attributes Notes activity sheet.
- Walk around with student groups during the stations activity.
- During independent work, have small groups work with teacher.
- Provide students with dimensions that are ratios of whole numbers.

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

Changing Attributes Notes

	<p><u>Find the Volume</u></p>	<p><u>Scale factor:</u></p> <p>Length → 2</p>	<p><u>New Volume:</u></p>	<p><u>Scale factor:</u></p> <p>Length → 3 (from original)</p>	<p><u>New Volume:</u></p>
<p><u>Describe change:</u></p>					
	<p><u>Find the Volume</u></p>	<p><u>Scale factor:</u></p> <p>Width → 2</p>	<p><u>New Volume:</u></p>	<p><u>Scale factor:</u></p> <p>Height → 2 (from original)</p>	<p><u>New Volume:</u></p>
<p><u>Describe change:</u></p>					
	<p><u>Find the Volume</u></p>	<p><u>Scale factor:</u></p> <p>Length → $\frac{1}{2}$</p>	<p><u>New Volume:</u></p>	<p><u>Scale factor:</u></p> <p>Height → 4 (from previous change)</p>	<p><u>New Volume:</u></p>
<p><u>Describe change:</u></p>					

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 <p>11 cm 6 cm 5 cm</p>	<p><u>Find the Surface Area:</u></p>	<p><u>Scale factor:</u></p> <p>Width → 4</p>	<p><u>New Surface Area:</u></p>	<p><u>Scale factor:</u></p> <p>Length → 3 (from original)</p>	<p><u>New Surface Area:</u></p>
<p><u>Describe change:</u></p>					
 <p>5 cm 4 cm 8 cm</p>	<p><u>Find the Surface Area:</u></p>	<p><u>Scale factor:</u></p> <p>Height → $\frac{1}{4}$</p>	<p><u>New Surface Area:</u></p>	<p><u>Scale factor:</u></p> <p>Height → 3 (from previous change)</p>	<p><u>New Surface Area:</u></p>
<p><u>Describe change:</u></p>					

Changing Attributes

1. Go to <http://www.shodor.org/interactivate/activities/SurfaceAreaAndVolume/>.
2. Move the levers on the page to find the volume and surface Area for each number. Record the numbers in columns labeled **Volume** and **S. Area**.
3. Change the attribute using the levers and record the new volume and surface area.

#	W	D	H	Volume	S. Area	Change the Attribute	New Vol	New SA
1	1	2	3			Double h		
2	2	2	2			Square w		
3	8	6	10			Divide h by 2		
4	5	4	8			Times d by 3		
5	3	3	6			Divide h in half		

4. Answer the questions below.
 - a) Look at #1 and compare the new volume to the old volume. What changes do you see?
 - b) Look at #2 and compare the new volume to the old volume. What changes do you see?
 - c) Look at #3 and compare the new volume to the old volume. What changes do you see?
 - d) Look at #4 and compare the new volume to the old volume. What changes do you see?

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- e) Look at #5 and compare the new volume to the old volume. What changes do you see?

- f) What can we conclude about how the volume will change when an attribute changes?

- g) Compare the surface areas. Is there a pattern?