5E Lesson Plan Format
Volume for Rectangular Prisms

***teach*HOUSTON Student Name(s):**

Mentor Teacher Name: **Grade Level:** 5th

Lesson Teaching Date and Time:

Concept Statement: Volume is the amount of space occupied by a three-dimensional figure. Volume is used in real life for measuring liquids such as in cooking or for designing buildings such as in architecture.

TEKS: The student is expected to:
5.10. B: Connect models for perimeter, area, and volume with their respective formulas.

Objectives The student will be able to:	Evaluation Questions for each Objective
1. Identify the length, width, and height of rectangular prism, and use this to find the perimeter of the base, area of the base, and volume of a rectangular prism by counting.	
2. Calculate perimeter of the base, area of the base, and volume of rectangular prism using formulas.	
3. Solve word problems from real-life situations that involve volume.	

Materials List

For the teacher:

- Dry Erase Board
- A box with the top cut off; try to find one whose dimensions are integers when measured in inches
- A bucket of inch cubes

For each student:

- Box It Up Worksheet
- Figure It Out Worksheet
- Volume Quiz

For each group:

- Inch Cubes
- Interlocking Gram Unit Cubes
- Various small boxes (i.e. band-aids, macaroni and cheese, cereal bars, etc.)
- Ruler

Advanced Preparations:

- Obtain the necessary boxes (see above – depending on the size of your class you will need approximately 4 of each size)
- Make copies of the worksheets and evaluation
- Have all necessary materials sorted and grouped together for group activities so they can be passed out efficiently.

ENGAGEMENT		
What the Teacher Will Do	**Eliciting Questions/ Student Responses**	**What the Students Will Do**
The teacher will hold up a box and a inch cube. Encourage many students to make predictions. Tell students there are no wrong answers; they should make their best educated guess. The teacher will record students' predictions on the board or overhead.	How many inch cubes do you think will fit in the box? *Any answer is valid* How did you get your prediction? *-I imagined how many cubes could fit along the bottom of the box and then added that number several times to account for the height* *-I compared the size of the cube to the size of the box and that helped me make my prediction* *-I just guessed*	Students will estimate the number of cm cubes that will fit in the box.
	How could we find the exact number of cubes it will take to fill up this box? *Stack cubes into the box until it is full and then count how many there are.*	Students will brainstorm how to find the exact number of cubes that will fit in the box.
	There is a special name for the measurement that tells us how much space is inside a 3-D figure like this box. What is that measurement called? *Volume* How does the number of cubes in the box compare	Two selected students will come to the front of the room and stack cubes inside the box. The remainder of the class will count the cubes as the two students stack them inside the box.

	with your predictions? Did you make a good prediction? *Answers will depend on students' original predictions* What information could have helped you make a better prediction? *We could have made a better prediction if we had known some or all of the dimensions of the box*	

TRANSITION
We have predicted the volume of a box and then found it by filling it with cubes. Now you will continue to explore volume on your own at stations.

EXPLORATION		
What the Teacher Will Do	**Eliciting Questions/ Student Responses**	**What the Students Will Do**
The teacher will facilitate students getting into groups of 4. The teacher will pass out the materials for each activity to the groups. Monitor the students as they work at the various stations.	<u>Questions for Station#1:</u> How did you determine the area of the base of the box? *I multiplied the length of the box by the width of the box.* How did you determine the perimeter of the base of the box? *I measured the distance around the outside of the*	In groups, students will complete two different activities. Half of the groups will complete the activity for Station#1, while the other half completes the activity for Station#2. Then groups will switch. Station #1: Students will determine the measurements of various

	box. What do you notice about the number of cubes needed for the box and the volume of the box? *They are the same.* How did you determine the volume of the boxes? *I saw that volume corresponded to the number of cubes needed to fill the boxes.* <u>Questions for Station #2:</u> How did you know how long to make the length and width of the rectangular prism just given the area of the base? *I know that area is l x w, so I determined the factors of the area.*	boxes first by using inch cubes, then by using a ruler. Station #2: Students will use interlocking unit cubes to build rectangular prisms with given specifications. Students will calculate the volume of the prisms.

TRANSITION
You have built several rectangular prisms and you have investigated the number of cubes each of the 3 boxes will hold. Now you will have an opportunity to share the results of your activities with the class.

EXPLANATION		
What the Teacher Will Do	**Eliciting Questions/ Student Responses**	**What the Students Will Do**
The teacher will facilitate student presentations	<u>Questions for Station #1:</u> What is the length of a rectangular prism? *The length is the number of cubes from left to right.* Where is the length on this	Selected groups will present a portion of the results of one of the activities and respond to questions.

	box? *Students will point to the length.* What is the width of a rectangular prism? *The width is the number of cubes from front to back.* Where is the width of this box? *Students will point to the width.* What is the height of a rectangular prism? *The height is the number of cubes from top to bottom.* Where is the height of this box? *Students will point to the height.* What did you notice between the first part of the activity and the second part of the activity? Where there any similarities when you used the cubes and when you used the ruler? *The measurements for the dimensions and the volume were the same whether you measured them in cubes or with the ruler.* Why do you think that is? *Since the cubes are all 1 inch long and we used the inches on the ruler to measure, it makes sense that the measurements would have been the same.* <u>Questions for Station#2:</u> When you built the	

	rectangular prisms did you notice anything about the area of the base and the height of the rectangular prisms? *Yes, when I built the area of the base I then built it again to get the right height of the rectangular prism. So when the height was 2 I built the area of the base twice and stacked them on top of each other.* If we know the area of the base and the height of a 3-D figure, how can we find the volume? *Multiply them.* In addition to counting the number of cubes, how else can we find the volume of a rectangular prism *-Multiply the area of the base (l x w) times the height* *-Mulitply the length times the width times the height* What are the advantages and disadvantages of calculating the volume by counting? By using the formula? *-Counting cube is simple, but it could take a long time especially if the rectangular prism is large* *-Using the formula is a faster way to find the volume* Did you include units when your recorded your volume? What units should	

	volume have? *Units cubed = units^3*	

TRANSITION
You have explored two different ways of calculating volume. Now we will apply what we have learned to several word problems.

ELABORATION		
What the Teacher Will Do	**Eliciting Questions/ Student Responses**	**What the Students Will Do**
The teacher will distribute the "Figure It Out" worksheet to students.	Which box do you think will hold more? *-Box A* *-Box B* Why? *-It looks bigger* *-It's wider* *-It's taller* How could we find out for sure which box could hold more? *Calculate the volume* What is the volume of Box A? Box B? How did you find it? *Box A has a volume of 24 in^3. Box B has a volume of 27 in^3. I found the volume by multiplying the length by the width by the height.* How were you able to find the height of Box C? *By working backwards. I figured out that 4 x 2 x 5 = 40 so the height must be 5 in.*	In groups, students will work on the "Figure It Out" worksheet.

TRANSITION
Now you will have an opportunity to show what you have learned.

EVALUATION

Box It Up

1. Fill up each box with 1 inch cubes. Record the information in the table below.

	Box 1	Box 2	Box 3
Box Length (in cubes)			
Box Width (in cubes)			
Perimeter of the base of the Box			
Area of the base of the Box			
Box Height (in cubes)			
Total # Cubes Needed			

2. Use the ruler to measure the length, width, and height of each box. Determine the perimeter, area, and volume of the boxes. Record the information in the table below.

	Box 1	Box 2	Box 3
Box Length (in inches)			
Box Width (in inches)			
Perimeter of the base of the Box			
Area of the base of the Box			
Box Height (in inches)			
Volume			

Box It Up

Build each of the following rectangular prisms with interlocking unit cubes based on the given information. Find the volume.

1. Length = 4 units
   Width = 5 units
   Height= 1 unit

   Volume _____

2. Length= 3 units
   Width= 3 units
   Height= 3 units

   Volume _____

3. Area of the base= 12 units units^2
   Height = 2 units

   Volume _____

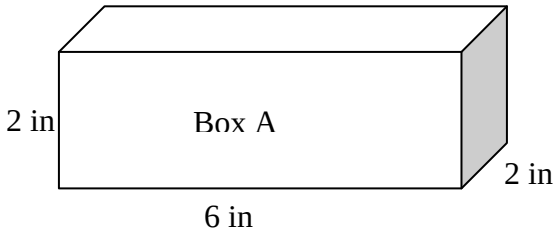
4. Area of the base = 18 units^2
   Height = 3 units

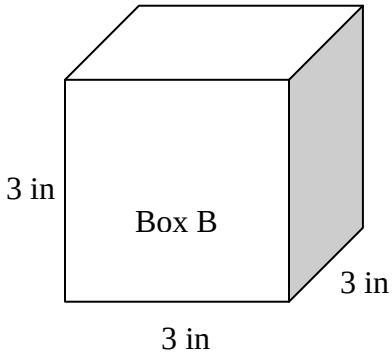
   Volume _____

Name _____ Date _____

Figure It Out

Consider the two boxes shown. Answer the following questions about the boxes. Be sure to include units when necessary.





1. Look at Box A and Box B. Which box do you think will hold more?

2. Why?

3. If you have not already done so, calculate the volume of each box. Now which box do you think will hold more?

5. Angelica is measuring Box C shown below. She measured the length, width, and height of the box and found out that it has a volume of 40 $in^{3.}$

Unfortunately, she forgot to write down the height. Help her out by figuring out what the missing height could be.