Unit cubes and volume

Original lesson by Andrea Palmer

Objective

In this lesson we will:

- define volume
- use a unit cube to find the volume of rectangular prisms and cubes
- use a formula to find the volume of rectangular prisms and cubes.

Big idea

What is volume? How many unit cubes would it take to fill this box? Students work to develop formulas for finding the area of rectangular prisms and cubes.

Do now

7 MINUTES

Often, I create 'do now's that have problems that connect to the task that students will be working on that day. Today I want students to review the difference between surface area and area. I want students to recognise that area is covering a two-dimensional figure while surface area is covering a three-dimensional figure. I also want students to start using their spatial reasoning to determine the number of cubes that make up a figure. Some students may struggle to count the cubes that they cannot see. Other students may count the faces of the cubes without realising that some cubes have multiple exposed faces. If students struggle, I encourage them to think about the solid as several layers.

I ask students what strategies they are thinking about to answer the questions. I call on students to share what they think and why. If there is disagreement, build the first cube out of connecting cubes. Students construct viable arguments and critique the reasoning of others.

= Mathematics Hub

Objectives:

I will be able to:

- Define volume.
- Use a unit cube to find the volume of rectangular prisms and cubes.
- Use a formula to find the volume of rectangular prisms and cubes.

Do Now:

1. What is the difference between finding the area of a figure and finding the surface area of a figure?

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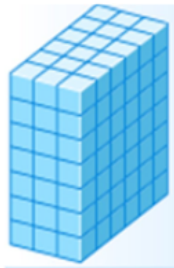
____

____

In problems 2-3 each solid is made up of cubes. Figure out how many cubes it will take to create each solid.

2.

3.



Number of cubes needed = __________ Number of cubes needed = __________

What are two things you are going to do to make today a productive math class?

- ____
- ____

How many cubes will it take to fill up the box?

8 MINUTES

For this lesson I have collected 12 open boxes that can be filled with unit cubes. I use place value cubes and wooden cubes depending on the size of the box. I only give students a few unit cubes, not enough to fill a complete layer of the box.

If you don't have boxes, you can use inch grid paper to create boxes. I show students that we can create a net for the rectangular prism. Some students struggle to use the three labelled dimensions to label the other sides of the net. I explain that each rectangular prism is composed of three matching faces. Two faces that fold together to make one edge must share the same measurement.

I explain the task to the students and review expectations. I pass out materials. As students work, I walk around to monitor student progress and behaviour. Students use appropriate tools strategically, attend to precision, and look for and express regularity in repeated reasoning/

If students are struggling, I may ask them one or more of the following questions:

- What is your job?
- How many unit cubes do you have?
- How many unit cubes would it take to fill the bottom of the box? How do you know?
- Is there another way to find the number of unit cubes it would take to fill the box?

If students complete the problem and explain their thinking on their paper I may ask them:

- How many unit cubes would it take to fill half of the box?
- How many unit cubes would it take fill 1/3 of the box?
- Another box takes up 75% of the space of your box. How many cubes would it take to fill it?

How many cubes fit will take to fill up the box?

You and your partner are going to be working with a box and some cubes. Your job is to figure out how many cubes it will take to fill up the box.

What color is your box:________________________

How many cubes will it take to fill up the box?

Show or explain how you figured it out:

Volume

8 MINUTES

We fill in the notes and complete the examples together. I want students to look for patterns when finding the volume of the boxes. Some students may notice that if you multiply the length, width, and height the result is the total number of cubes it takes to fill the box. Other students may notice that if you multiply the number of cubes it takes to fill the bottom of the box by the height the result is the total number of unit cubes that it takes to fill the box. I push students to see whether these ideas work for each of the different boxes. Students look for and express regularity in repeated reasoning.

Mathematics Hub

Volume:

- Volume is the amount of ________________ a solid occupies.
- For volume we use __________ units.

Write the dimensions (in units) of your box that you used:

__________ by ___________ by __________

How many unit cubes would it take to fill the box?

____

How can you find the volume of any box?

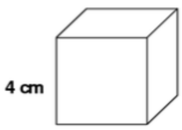
Guided practice

5 MINUTES

We work on these questions together. I ask students, "How can we apply the work we just did to answer these questions?" I call students up to the front to show their ideas and explain their thinking under the document camera.

Guided Practice:

1. Find the volume of the cube below. Show your work!



Volume = ___________________________

2. Find the volume of the rectangular prism below. Show your work!

Volume = ___________________________

Practice

12 MINUTES

Note:

- I **Post a Key** for these problems around the room.

We go over directions and expectations. As students work I walk around to monitor student progress and behavior. Students are engaging in **MP6: Attend to precision** and **MP8: Look for and make sense of repeated reasoning.**

If students are struggling, I may ask them one or more of the following questions:

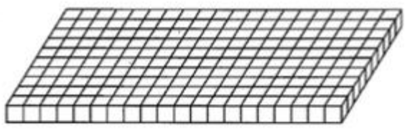
- What do you know? What are you trying to figure out?
- Make an estimate for your answer.
- What strategies do you have for finding volume?
- Does your answer make sense?

When students complete their work, they raise their hands. I quickly scan their work. If they are on track, I send them to check with the key. If there are problems, I tell students what they need to revise. If students successfully complete the problems they can move onto the challenge problems.

Practice:

1. Markelly uses blocks to build models. Each block is a centimeter long.

a. He builds the bottom layer of a box. How many blocks did he use?

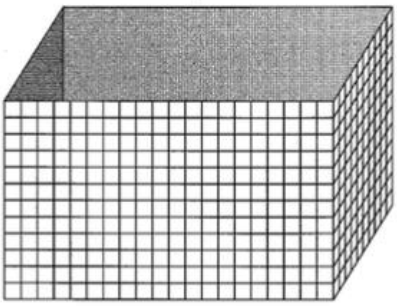


b. Markelly then adds on 11 more layers so that his model is big enough to fill this box. What are the dimensions of the box?

Length: ___________

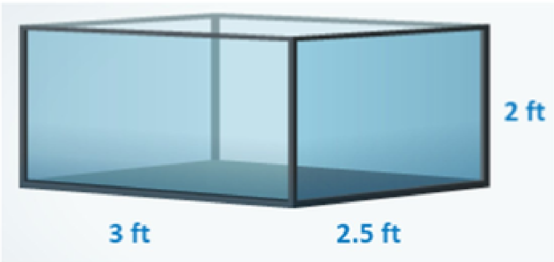
Width: ___________

Height: ___________



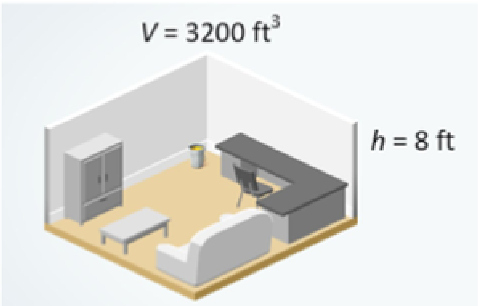
c. What is the volume of the box?

2. Look at the aquarium below. How much water will it take to fill the aquarium?



Answer: ________________________

3. A room is shaped like a rectangular prism. It holds 3200 cubic feet of air. The height of the room is 8 feet.



What is the area of the floor in the room?

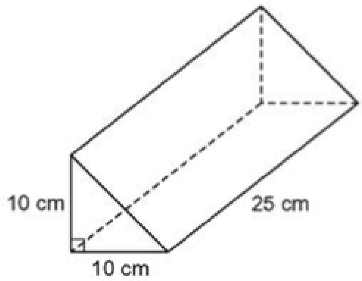
Answer: The area of the floor is ______________ because ____________________

____

Challenge:

1. What is the name of this 3D figure?

2. What is the volume of this figure? Explain your thinking.



Answer: ____________________________

My thinking:

____

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____

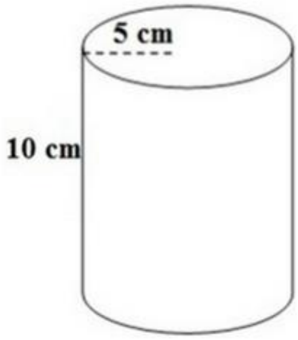
____

____

____

3. What is the name of this 3D figure?

4. What is the volume of this figure? Explain your thinking.



Answer: ___________________________

My thinking:

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____

____

____

Closure and ticket to go

10 MINUTES

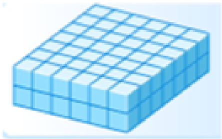
For the **Closure**, I have students turn to the first challenge problem. Students participate in a **Think Pair Share**. I call on students to share their answer and explain their thinking. I want students to apply their knowledge of triangles to this situation. Some students may mistakenly think that they can multiply the base of the triangle by the height of the triangle and then by the height of the prism. If this comes up I ask, "How do we find the area of a triangle?" I want students to see that we can find the area of the triangle base and then multiply it by 25 cm. This connects to the V = Bh method for a rectangular prism. Students are engaging with **MP3: Construct viable arguments and critique the reasoning of others and MP8: Look for and make sense of repeated reasoning.**

I pass out the **Ticket to Go** and the **Homework**.

Ticket to Go: 7.11 Unit Cubes and Volume

You must show your work to get full credit!

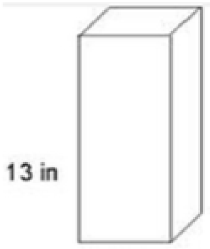
1. Look at the rectangular prism.



How many cubes would it take to create this figure?

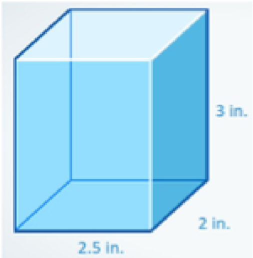
____

2. Look at the figure. It has a volume of 143 in^3. What is the area of the base?



Area of the base = ____________________

3. What is the volume of this figure?



Class work and Participation:

Did you:

- come to class prepared?
- follow classroom expectations?
- try your best?
- support the learning of other students?

$$Self-evaluation: \frac{\quad}{4} \quad Teacher\ evaluation: \frac{\quad}{4}$$

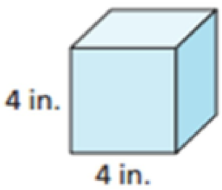
Criteria for Success:	Student Assessment			Teacher Assessment		
Your homework is completed in pencil or blue/ black pen.	1	2	3	1	2	3
All problems are completed.	1	2	3	1	2	3
All work is shown and solutions are circled.	1	2	3	1	2	3
Your homework is legible.	1	2	3	1	2	3

1. This is a Rubix Cube. It is created by smaller cubes. It is a puzzle that was made popular in the 1980s.

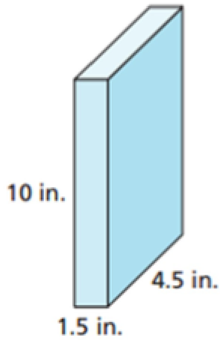
How many smaller cubes does it take to create a Rubix Cube?

Answer: ________________

2. The volume of this figure is $32\ in^3$. What is the missing measurement?

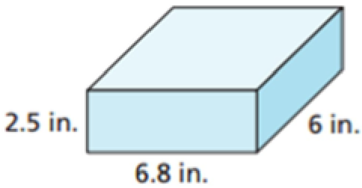


3. Find the volume of the figure.



Answer: ________________

4. Find the volume of the figure.



Acknowledgement

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https://betterlesson.com/lesson/560468/unit-cubes-and-volume?from=breadcrumb_lesson