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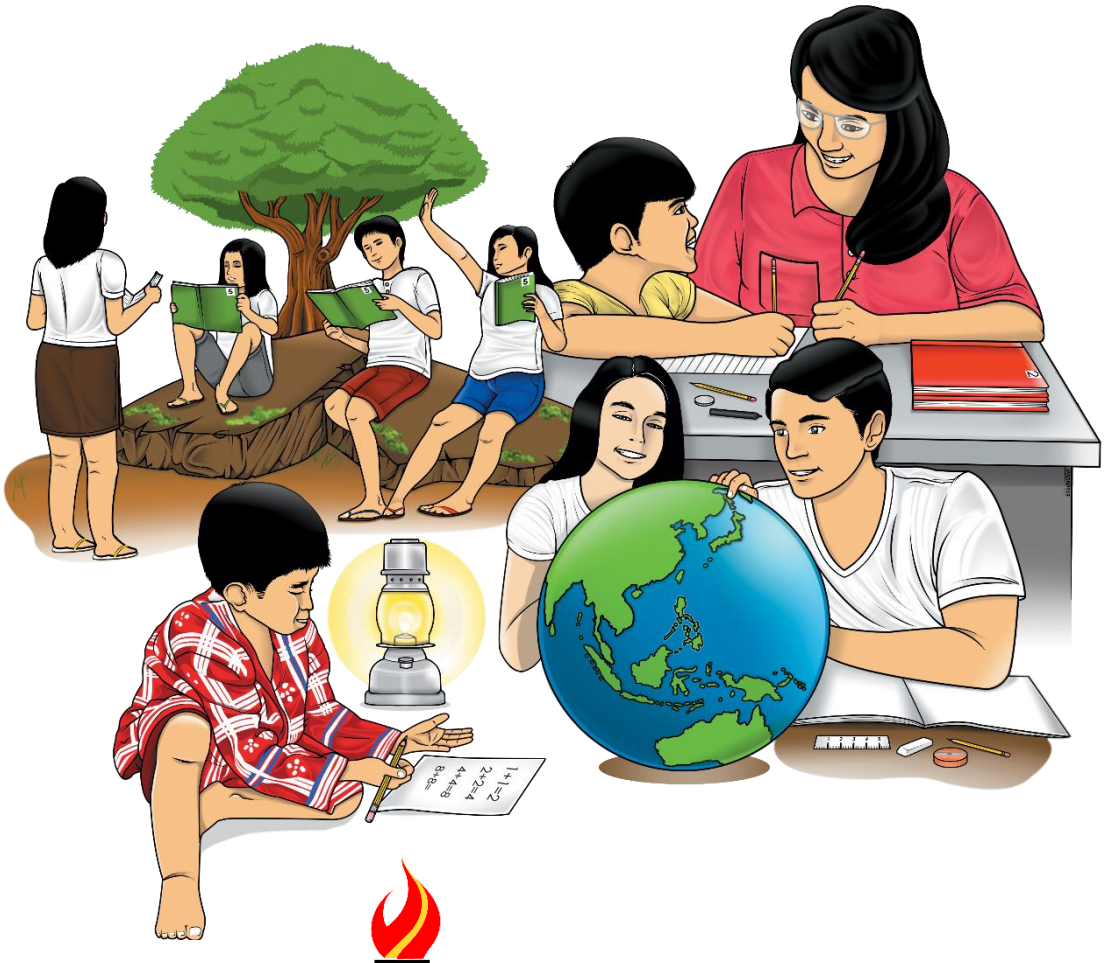
Mathematics

Quarter 4 – Module 3:
Visualizing the Volume of a Cube and a Rectangular Prism



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Mathematics

Quarter 4 – Module 3:
Visualizing the Volume of a Cube and a Rectangular Prism

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

Good day Mathletes! This module was written to help you gain an understanding of the volume of a cube and a rectangular prism. Always keep in mind that volume is the amount of space occupied by an object. It is very important to learn on how to visualize volume and use it in real-life situation. *So, what are you waiting for? Be ready and enjoy.*

At the end of this module, you should be able to:

- visualize the volume of a cube and a rectangular prism; and
- appreciate the importance of volume in daily living.

Before going any further, let us check your understanding about visualizing the volume of a cube and a rectangular prism.

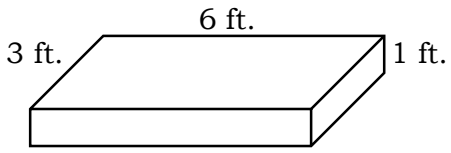
What I Know

Directions: Read and understand each statement below. Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

1. The washing machine measures 2 feet long, 3 feet wide and 4 feet high. Which is the correct expression to find the volume of the laundry that the washing machine can hold?

   (A) 2 + 3 + 4 B) 2 x 3 + 4 (C) 2 x 3 x 4 (D) 2 + 3 x 4

2. Ronnie is going to buy sand for his children's sandbox. The measurements for the sandbox are shown below.



   Which expression shows how to find the volume of sand that the sandbox can hold?

   (A) 6 x 3 (B) 6 x 3 x 1 (C) 6 + 3 + 1 (D) 6 x 1

3. Carlo works for a packing and mailing service. A costumer brings in a box that measures 9 inches on each side. Which is the correct expression to find the volume of the box?

(A) 9^1 (B) 9^2 (C) 9^3 (D) 9^4

4. Shane is going to buy a 3x3x3 Rubik's cube for the contest. How many unit cubes does the Rubik's have?

(A) 27 (B) 12 (C) 9 (D) 3

5. A dictionary measures 15 cm long, 6 cm wide and 3 cm high, what is its volume?

(A)270 cm^3 (B)100 cm^3 (C) 33 cm^3 (D) 24 cm^3

6. Shawn received a Balik-Bayan box from his mother. If the box measures 4 feet long, 3 feet wide and 6 feet high, what is the volume of the Balik-Bayan box?

(A) 13ft^3 (B) 18 ft^3 (C) 24 ft^3 (D) 72 ft^3

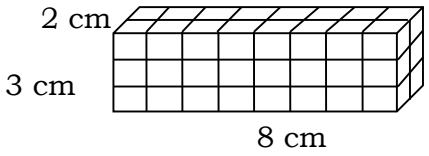
7. Mang Albert built an 8m by 4m by 7m swimming pool in his backyard. What is the volume of the swimming pool?

(A) 19 m^3 (B) 39 m^3 (C) 56 m^3 (D) 224 m^3

8. Mother bought a jewelry box for her accessories. The box measures 10 cm long, 5 cm wide and 3 cm high. Find its volume.

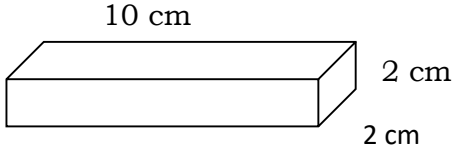
(A)150 cm^3 (B) 53 cm^3 (C) 25 cm^3 (D)18 cm^3

9. What is the volume of the figure below?



(A) 8 cm^3 (B) 24 cm^3 (C) 46 cm^3 (D) 48 cm^3

10. Find the volume.



(A) 40 cm^3 (B) 16 cm^3 (C) 8 cm^3 (D) 4 cm^3

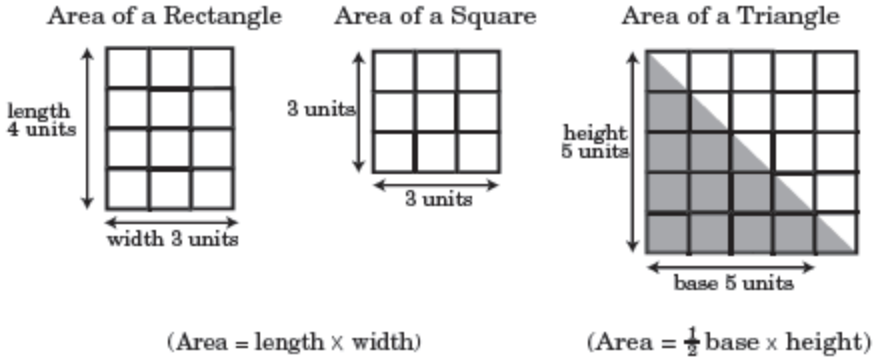
Lesson 1 Visualizing the Volume of a Cube and a Rectangular Prism

This lesson will help you understand how architects and engineers use measurement in finding the area and volume of structures they will construct. After this lesson, you will know that the volume of a box-refers to the amount of space the box can hold and that it is the product of the side lengths in the 3 dimensions (length, width and height). Your skill in multiplying numbers can help you complete this lesson.

Are you ready? Then, we better get starting.

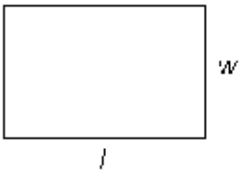
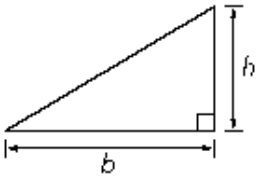
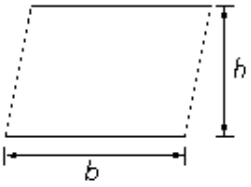
What's In

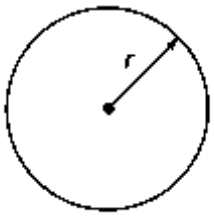
You learned how area of plane figures can be obtained. Area is the measure of how much space there is within a two-dimensional figure. A two-dimensional figure involves length and width such as a circle, a square, a rectangle, a parallelogram, a triangle, among others.



So, to find the area of the rectangle, the square and the triangle in the given examples above, we just count the unit squares enclosed by these. In general, we simply follow the formula, please see below.

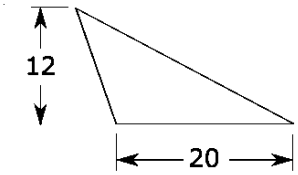
The area of a shape is a measure of the size of its surface.

Square Area = l^2	Rectangle Area = $l \times w$	Triangle Area = $\frac{1}{2} b \times h$	Parallelogram Area = $b \times h$
			

Circle Area = πr^2


Let's see if you have learned that by answering the ff.

1. What is the area of the triangle shown?



2. The surface of the teacher's table measures 1.5 m by 1 m. What is its surface area?
3. Each side of a square lot measures 10 m. What is its area?

What's New

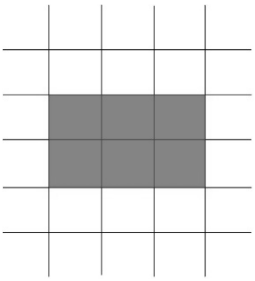
Now let's proceed. From areas of two-dimensional figures, let's move on to volumes of three-dimensional figures. In this lesson, we will deal with visualizing the volume of a cube and a rectangular prism. But, do you know what a volume is?

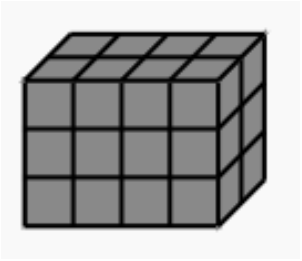
Volume is the amount of space occupied by an object. You will understand this concept as you go along with this module.

Consider the situation below.

Joseph has been a consistent champion for Rubik's Cube competition for three years in a row. His expertise is solving a 3x3x3 cube. If Joseph will dismantle his Rubik's Cube, can you figure out how many layers the cube is made of? How many rows and columns are there in each layer? In your own idea, how many small cubes are there in the cube?

If we measure area by the number of unit squares a plane figure occupies, for example there are 6 unit squares in the green rectangle, how do we measure the volume of a cube or a rectangular prism?





What Is It

In finding the volume of a cube and rectangular prism, you have to consider its dimensions: length, width and height. Always remember that volume is the amount of space a solid figure occupies. A **cube** is a solid figure whose length, width and height are equal while a **rectangular prism** whose length, width and height may or may not be equal. Volume is expressed in cubic units. We write the cubic units: unit^3.

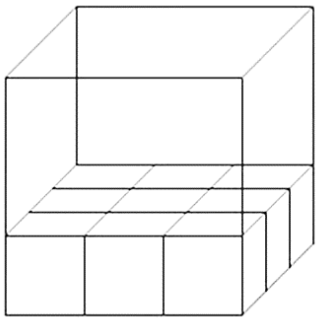
We can visualize the volume of a cube and a rectangular prism by:

a. Using non-standard units to fill the container (like the use of marbles, pebbles, rice grains, seed, etc.) However, Non-standard units do not give consistent and accurate measure of the volume of a container as these materials may differ in sizes and shapes.

b. Using standard units, to find the volume of a space figure, count the number of cubic units needed to fill the space. Standard units are consistent and accurate.

Example 1

Let's take the problem shown in the previous part of this lesson., Joseph's 3x3x3 Rubik's Cube.



The total number of small cubes in the transparent container is its volume.

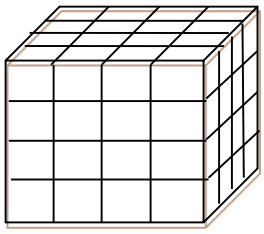
From the figure, consider each cube ( ) having each edge as **1 cm**. There are 3 layers and each layer has nine 1 cm cubes. Therefore, the Rubik's Cube contains 27 cubes. Its volume is 27 cubic centimeters or 27 cm^3.

Now, let's try another one. This time, with computations how to get the volume of the cube.

Example 2 a 4x4x4 Rubik's Cube

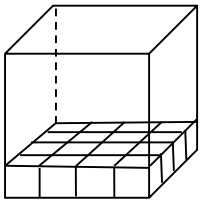
The volume of a Rubik's Cube can be measured by its cubic unit. If each  measures 1 cubic cm, how many cubes does the figure contain? We can get its volume by counting the cubes in each layer and then multiplying this with the number of layers. Also, we can find the volume by multiplying its length, width and the height.

 1 cm



Let us put small cubes in the container. Up to how many cubes can you place inside the container?

a. The number of cubes in one layer can be found by multiplying the length and the width. This is the area of the bottom face.
Example: 4 x 4 = 16 cubes
There are 16 cubes in each layer.



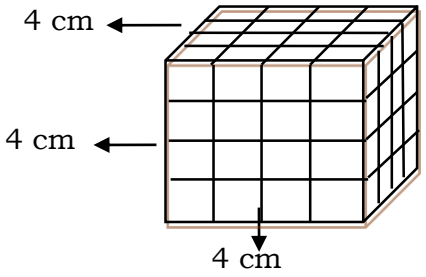
b. We then multiply the product we obtained by the number of layers or the height of the cube. In this case, we have 4 layers of 16 cubes each layer. So,

c. 16 x 4 = 64 cubes

Notice that the volume is equal to multiplying the length, the width and the height of the cube, each of which is 4 units: 4 x 4 x 4 = 64 cubic units.

In a cube, we are going to get the volume by multiplying its length, width, and height, all of which are equal. For cubes we can use "*S*" for sides because its dimensions are equal.

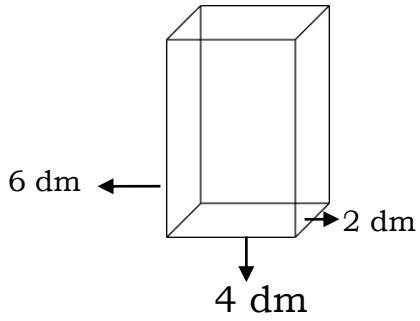
- V = S x S x S ($V = S^3$)
  V = 4 cm x 4 cm x 4 cm
  V = 16 cm^2 x 4 cm
  V = 64 cm^3



Example 3

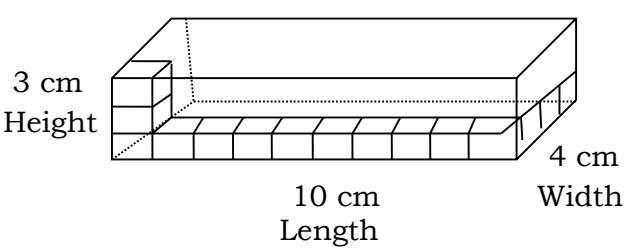
For a rectangular prism, we can get its volume by multiplying its length, width and height. Look at the figure. You can now visualize how it looks like inside based on the previous examples. Now, let us find the volume of a container with 4 dm long, 2 dm wide and 6 dm tall.

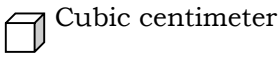
- V = length x width x height
  V = 4 dm x 2 dm x 6 dm
  V = 8 dm^2 x 6 dm
  V = 48 dm^3



Example 4

A box is 10 cm long, 4 cm wide and 3 cm tall. What is its volume? Let us visualize the problem.





1 cm

The figure above is a box whose dimensions are 10 cm long, 4 cm wide and 3 cm high. To find the volume, we need to know the number of cubes in the whole figure.

To find the total centimeter cubes,

- Multiply 10 and 4 to find the number of cubes on the bottom layer.
- Then multiply by the number of layers.

Multiply 10 cm by 4 cm by 3 cm:

10 cm x 4 cm x 3 cm = 120-centimeter cubes, the volume of the box is 120 cm^3.

Thus, always keep in mind the formula in finding the volume:

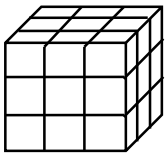
Volume = length x width x height (V = L x W x H).

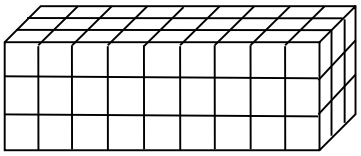
Answer the activities below to master the lesson.

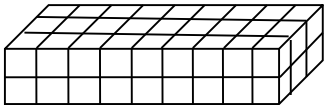
What's More

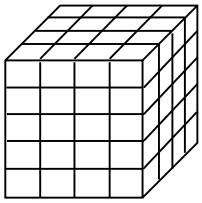
Activity 1: Count Me On!

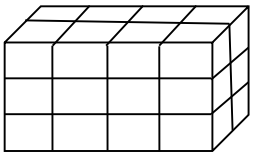
Directions: Look at the figures carefully. Count the cubic units to find the volume of each figure. Follow the steps given above. Number 1 is done for you.

1.  V = **<u>27 cubic units</u>**

2.  V = _____

3.  V = _____

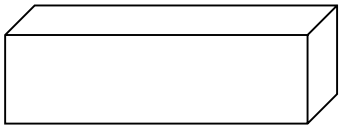
4.  V = _____

5.  V = _____

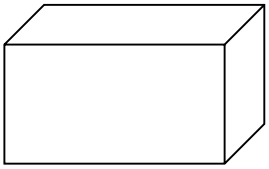
Activity 2: Color Me!

Directions: Color the box with the correct color that corresponds to the dimensions found in the table. Write the correct volume in the last column.

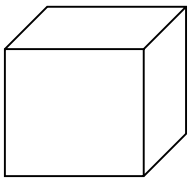
Box Color	Length	Width	Height	Volume
red box	5 mm	5 mm	5 mm	
green box	8 cm	2 cm	3 cm	
blue box	5 dm	3 dm	4 dm	
orange box	10 m	2 m	5 m	
yellow box	6 ft	4 ft	5 ft	

1. 

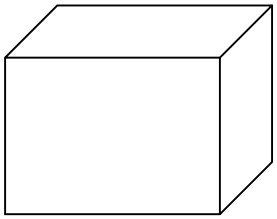
V = 48cm³



2. V = 120 ft³

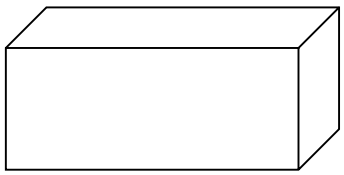
3. 

V = 125 mm³

4. 

V = 60 dm³

5. V = 100 m³



Activity 3: Reveal the Hidden Word!

Directions: Match each given volume with its corresponding dimensions found in the KEY by writing the letter on the box assigned to it.

512 cm^3	240 m^3	216 cm^3	30 mm^3	525 cm^3	8 cm^3

KEY:

M = L – 15 cm, W – 7 cm, H – 5 cm	*C* = S is 3 cm
A = 8 mm by 2 mm by 2 mm	*O* = L – 10 m, W – 6 m, H – 4 m
L = 6 cm x 6 cm x 6 cm	*V* = *length of each* side is 8 cm
B = L – 5 cm, W – 2 cm, H – 4 cm	*U* = 2 mm by 5 mm by 3 mm
E = S is 2 cm	*R* = L – 8 cm, W – 3 cm, H – 1 cm

Congratulations for reaching this far. Just keep learning!

What I Have Learned

Answer the following questions in one or two sentences.

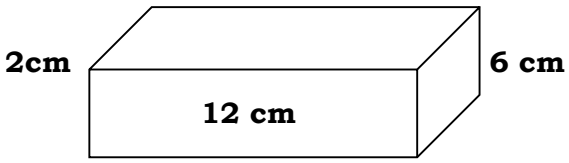
1. What is volume?
2. What do you call the 3 dimensions of a rectangular prism?
3. When is a rectangular prism a cube?
4. Given the dimensions of a rectangular prism, how do you compute for its volume?
5. How do you compute for the volume of a cube given the length of its edge?

What I Can Do

Remember that a volume of an object is the amount of space the object occupies. Volumes are a helpful tool for knowing the measurement of solid around us, because volumes help us know the size of our personal things or belongings.

Directions: In each situation below, draw a figure to show the given dimensions. Then find the volume of the object. You can use an extra sheet of paper for your illustration. The first one is done for you.

1. A shoebox measures 12 cm long, 6 cm wide and 2 cm high. **V = <u>144 cm³</u>**



2. The classroom's dimension is 9 m long, 7 m wide and 4 m high.

   V = _____

3. A dictionary is 14 cm long, 10 cm wide and 2 cm high.

   V = _____

4. A box of milk is 8 in long, 4 in wide and 11 in high.

   V = _____

5. A jewelry box is 8 cm long, 4 cm wide and 3 cm high.

   V = _____

Keep it up! You are almost done with this module.

Assessment

Directions: Read and understand each statement below. Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

1. Aling Letty bought an aquarium. It measures 5 dm long, 3 dm wide and 2 dm high. What is the volume of the aquarium?

   (A) 10 dm^3 (B) 11 dm^3
   (C) 17 dm^3 (D)30 dm^3

2. The air condition measures 2 feet long, 2 feet wide and 3 feet high. Which is the correct expression to find the volume of the air condition?

   (A) 2 x 2 x 3 (B) 2 x 2 + 3
   (C) 2 + 2 x 3 (D) 2 + 2 + 3

3. Mercy is going to buy a pair of shoes. The shoe box measures 30 cm by 20 cm by 12 cm. Can you tell how many cubic centimeters fit in the shoe box?

   (A) 7 200 cm^3 (B) 600 cm^3
   (C) 240 cm^3 (D) 62 cm^3

4. Jude bought a mathematics book, which measures 13 cm long, 6 cm wide and 2 cm high, find the volume.

   (A) 156 cm^3 (B) 80 cm^3
   (C) 25 cm^3 (D) 21 cm^3

5. Sam is shipping a carton, which is 11 inches long, 9 inches wide and 7 inches tall. Which expression shows how to find the volume of the shipping carton?

   (A) 11 x 7 (B) 11 + 9
   (C) 11 x 9 x 7 (D) 11 + 9 + 7

6. Cean bought a match for their experiment. The box measures 6 mm x 3 mm x 2 mm. What is the volume?

   (A) 11 mm^3 (B) 12 mm^3
   (C) 20 mm^3 (D) 36 mm^3

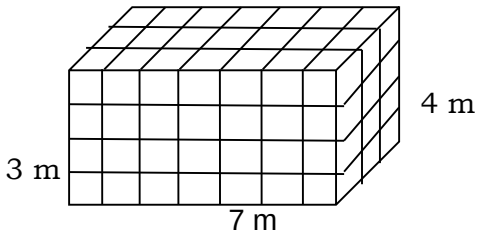
7. Andre played a 2x2x2 Rubik's Cube. How many 1-cm cubes does the Rubik's have?

   (A) 8 cm^3 (B) 6 cm^3
   (C) 4 cm^3 (D) 2 cm^3

8. Ana received a parcel from her auntie in Manila that measures 5 inches on each side. Which is the correct expression to find the volume of the box?

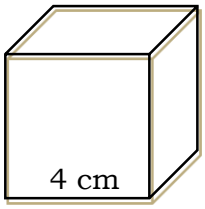
(A) 5^1 (B) 5^2 (C) 5^3 (D) 5^4

9. Find the volume of this figure.



(A) 84 m^3 (B) 21 m^3 (C) 19 m^3 (D) 14 m^3

10. What is the volume of the cube?



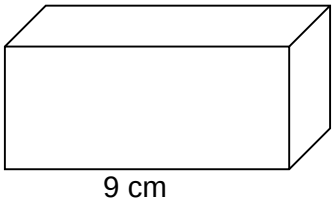
(A) 64 cm^3 (B) 20 cm^3 (C) 16 cm^3 (D) 12 cm^3

Good job you made it! Just one last activity to answer and you are done.

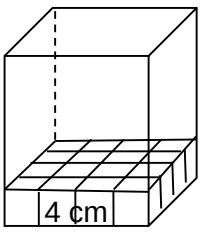
Additional Activities

Directions: Look at the figures very carefully. Find the volume of each.

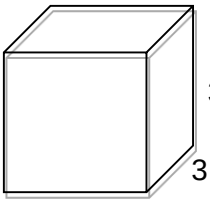
(1) 4 cm



(2) 6 cm



(3)



(4) Length = 10 units,
width = 6 units,
height = 4 units
V=_____

(5) 9 x 9 x 9
V=_____

Answer Key

What I Know

1.	C	6.	D
2.	B	7.	D
3.	C	8.	A
4.	A	9.	D
5.	A	10.	A

What's In

1. 120 square units
2. 1.5 m^2
3. 100 m^2

What's More

Activity 2: Color Me!

Box Color	Length	Width	Height	Volume
red box	5 mm	5 mm	5 mm	125 mm^3
green box	8 cm	2 cm	3 cm	48 cm^3
blue box	5 dm	3 dm	4 dm	60 dm^3
orange box	10 m	2 m	5 m	100 m^3
yellow box	6 ft	4 ft	5 ft	120 ft^3

What's More

Activity 1

1. 27 cubic units
2. 81 cubic units
3. 54 cubic units
4. 80 cubic units
5. 24 cubic units

What's More

Activity 2 Color Me

1. Green box
2. Yellow box
3. Red box
4. Blue box
5. Orange box

What's More

Activity 3: Reveal the Hidden Word

512 cm^3	240 m^3	216 cm^3	30 mm^3	525 cm^3	8 cm^3
V	O	L	U	M	E

What I Have Learned

1. Volume is the amount of a space an object occupies.
2. Length, width, and height
3. A cube is a rectangular prism where the length, the width, and the height are all equal.
4. Multiply the length, width and height. The unit of measurement is cubic units.
5. If we let s be the edge of the cube, the volume of the cube is s^3 = s x s x s

What I Can Do

1. 144 cm^3
2. 252 m^3
3. 280 cm^3
4. 352 in^3
5. 96 cm^3

Assessment

1.	D	6.	D
2.	A	7.	A
3.	A	8.	C
4.	A	9.	A
5.	C	10.	A

Additional Activities

1. 72 cm^3
2. 96 cm^3
3. 27 cm^3
4. 240 cubic units
5. 729 cubic units

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