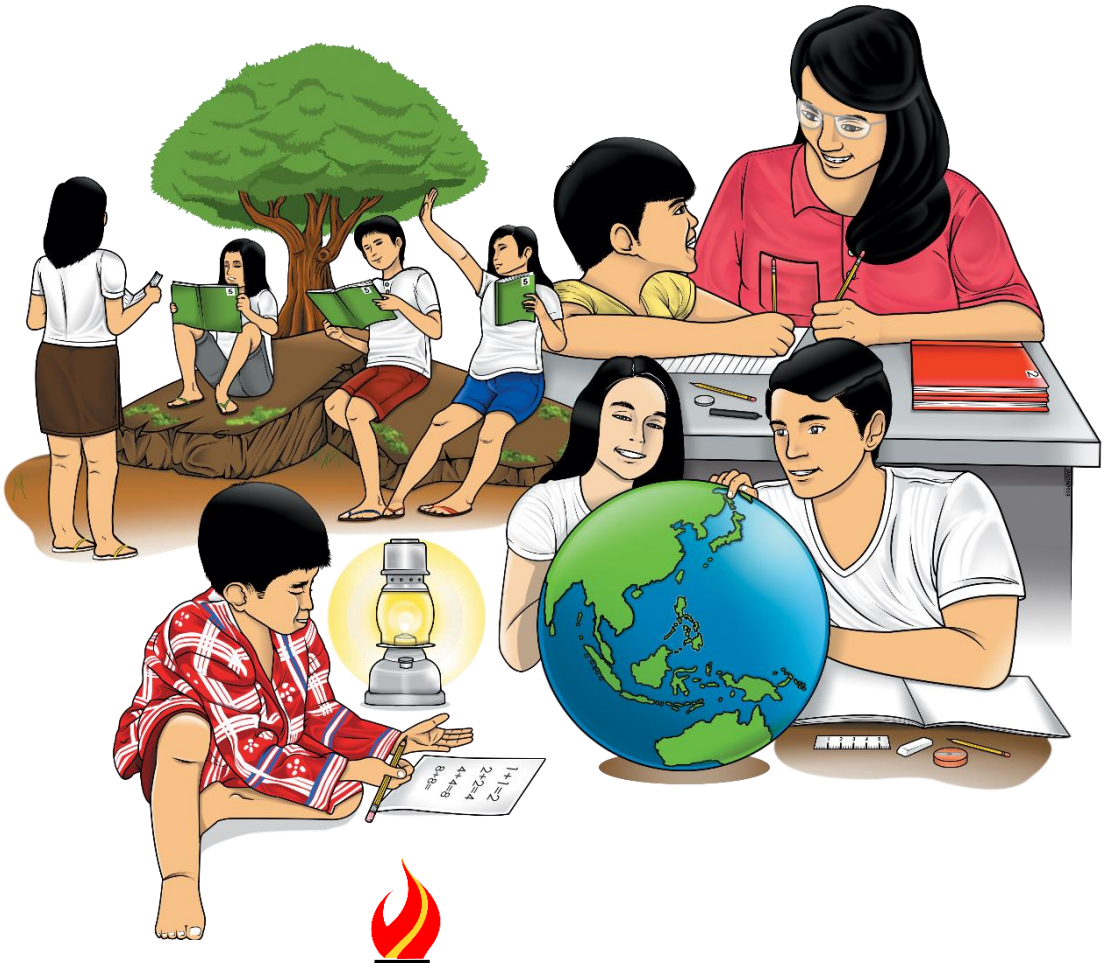
5

DepED
DEPARTMENT OF EDUCATION

Mathematics

Quarter 4 – Module 8:

Solving Routine and Non-routine Problems Involving Volume of a Cube and a Rectangular Prism in Real-life Situations Using Appropriate Strategies and Tools



ALTERNATIVE DELIVERY MODE
ADM

Mathematics – Grade 5
Alternative Delivery Mode
Quarter 4 – Module 8: Solving Routine and Non-routine Problems Involving Volume of a Cube and a Rectangular Prism in Real-life Situations Using Appropriate Strategies and Tools
First Edition, 2020

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Writer:	Marissa S. Ompad
Editor:	Niann L. Atis, Santiago Fabula Jr.
Reviewers:	Renato S. Cagomoc, Joshua Sherwin T. Lim, Rolando M. Lacbo, Geraldine P. Sumbise, Christopher Salino
Illustrator:	Manuel Y. Sapinit Jr, Jaime E. Sagayap Jr.
Layout Artist:	Noel E. Sagayap, Cherry Lou O. Calison
Management Team:	Ramir B. Uytico, Arnulfo R. Balane, Rosemarie M. Guino, Joy B. Bihag, Ryan R. Tiu, Sarah S. Cabaluna, Thelma Cabadsan-Quitalig, Elena S. De Luna, Renato S. Cagomoc, Noel E. Sagayap, Geraldine P. Sumbise, Joshua Sherwin T. Lim

Printed in the Philippines by Department of Education – Region VIII

Office Address: DepEd Regional Office No. 8
Candahug, Palo, Leyte
Telefax: (053)-323- 3156
E-mail Address: region8@deped.gov.ph

5

Mathematics

Quarter 4 – Module 8:

Solving Routine and Non-routine Problems Involving Volume of a Cube and a Rectangular Prism in Real-life Situations Using Appropriate Strategies and Tools

DepED
DEPARTMENT OF EDUCATION

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

What's Up, Mathgagaling? This module was made for you to learn on how to solve routine and non-routine problems involving volume of a cube and a rectangular prism in real-life situations using appropriate strategies and tools. Formulas may serve as guides in solving for the volume of a cube and a rectangular prism. Knowing how to derive and use the formula properly in real-life situations is important, especially that we are surrounded every day by objects that have volumes.

So, are you excited to learn? Ok! Let's start.

After finishing this module, you are expected to be able to:

- solve routine and non-routine problems involving volume of a cube and a rectangular prism in real-life situations using appropriate strategies and tools, and
- appreciate the value of being able to solve problems involving volumes of cubes and rectangular prisms.

But before going any further, let us check first your prior knowledge about the lesson.

What I Know

Directions: Read each problem carefully. Write your solutions and the letters of your answers on a separate sheet of paper. You may use a calculator.

1. The height of a storage room for meat products is 5 m. The width is 4 m. The length is 6 m. What is the the amount of space enclosed in the room?
   (A) 120 m^3 (B) 102 m^3 (C) 15 m^3 (D) 12 m^3

2. Find the volume of a Rubik's cube with edge measuring 9 cm.
   (A) 27 cm^3 (B) 81 cm^3 (C) 729 cm^3 (D) 879 cm^3

3. A wooden rectangular block has a volume of 64 cubic centimetres. Which of the following could be the dimensions of the block?
   (A) 2 cm, 4 cm, 20 cm (B) 1 cm, 8 cm, 10 cm
   (C) 2 cm, 4 cm, 8 cm (D) 8 cm, 8cm, 8 cm

4. If the amount of space that is enclosed in a Balikbayan box is 1 cubic meter, which of the following could be the dimensions of the box?
   (A) 1 cm, 1 cm, 1 cm (B) 2 cm, 5 cm, 100 cm
   (C) 20 cm, 50cm, 100 cm (D) 100 cm, 100 cm, 100 cm

5. The amount of space that is enclosed in a wooden box is 2 cubic meters. Which of the following could be the dimensions of the box?
   (A) 2 cm, 2 cm, 2 cm (B) 2 m, 2 m, 2 m
   (C) 200 cm, 50 cm, 100 cm (D) 200 cm, 500 cm, 20 cm

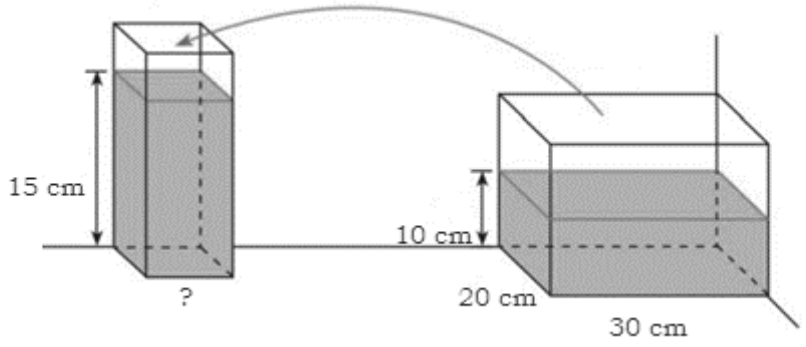
6. The Grade 5 Mathematics book's dimensions are 2 in, 6 in and 12 in. What is the volume of the book?
   (A) 144 in^3 (B) 24 in^3 (C) 20 in^3 (D) 14 in^3

7. If your grandmother has an old chest with width of 20 cm, height of 60 cm and length of 2 m, what is the amount of space that is enclosed in the chest?
   (A) 82 cm^3 (B) 280 m^3
   (C) 2 400 cm^3 (D) 240 000 cm^3

8. A plywood's dimensions are 12 mm, 1 220 mm and 2 440 mm. Which of the following is the plywood's volume?
   (A) 357. 21 m^3 (B) 3 672 mm^3
   (C) 35 721.6 cm^3 (D) 35 721.6 mm^3

9. A rectangular aquarium has a length of 120 cm and a width of 30 cm. A toy is placed in the aquarium. If the water level of the aquarium rises by 1 cm, which of the following can be the volume of the toy?
   (A) 151 cm^3 (B) 3 600 cm^3
   (C) 3 600 m^3 (D) It cannot be determined.

10. A rectangular plastic container has a base that is 30 cm long and 20 cm wide. The container is filled with water to a height of 10 cm. If all the water is poured into a square based container, it will rise to a height of 15 cm as shown. What is the length of the edge of the square based container?



(A) 15 cm (B) 20 cm (C) 60 cm (D) 75 cm

Compare your answers with the Answer Key at the end of this module. If you got 9 or 10 correct answers, you may skip this module and proceed to the next. Otherwise, go to the next page to gain a better understanding of the concept of solving routine and non-routine problems involving volume of a cube and a rectangular prism! Let's go!

Lesson 1 Solving Routine and Non-routine Problems Involving Volume of a Cube and a Rectangular Prism in Real-life Situations Using Appropriate Strategies and Tools

In solving word problems involving volume of a cube and a rectangular prism in real-life situations, you need to master the skills in multiplying numbers, determining if the given object is a cube or a rectangular prism, and familiarizing formulas that may help you understand the concept of this lesson.

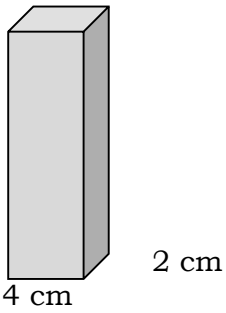
Here we go, Mathgagaling!

What's In

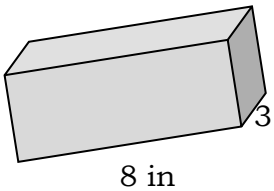
In the previous modules, you learned that **volume** is the amount of space enclosed in a *three-dimensional* object. You also learned the formula of finding the volume of a cube and a rectangular prism. The formula for the volume of a cube is written as $V = s^3$ where s is the length of the edge of the cube. The formula for the volume of a rectangular prism is given by V = lwh where l (length), w (width) and h (height) are the dimensions of the prism.

So, let us test your memory. Answer the following exercises below ~~in~~ by finding the volume of each figure. Write your solutions and your answers on a separate sheet of paper.

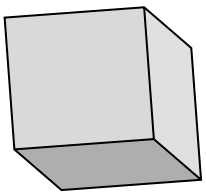
1.



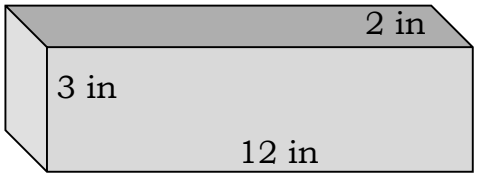
2.



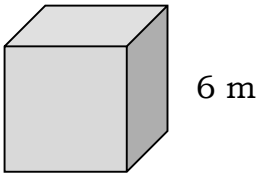
3.



4.



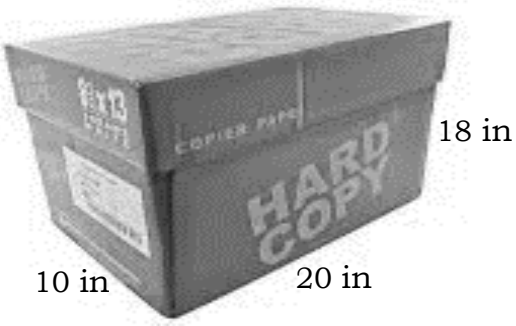
5.



What's New

In this lesson, we will deal with solving routine and non-routine word problems involving volume of a cube and a rectangular prism in real-life situations using appropriate strategies and tools.

Teachers need to print a lot of learning materials for their students such as modules and activity sheets for their pupils. Miss Santos bought a box of bond papers. Suppose in the back portion of the box it says, 20 in ×18 in × 10 in.



What is the amount of space that is enclosed in the box?

What Is It

In solving word problems involving volume of a cube and a rectangular prism, you have to determine if the object is a cube or a rectangular prism so that you can decide the formula to use.

Note that the unit of measure for the volume is expressed in cubic units. The edges of a cube are equal in length. Therefore, the formula is $V = s^3$ or $V = s \times s \times s$ where s is the length of an edge of the cube. The volume of a rectangular prism is $V = lwh$ or $V = l \times w \times h$ where l (length), w (width) and h (height) are the dimensions of the prism.

You need to remember as well how to solve routine and non-routine word problems. In solving routine word problems, it involves using at least one arithmetic operation. We will be using the following Polya's famous formulated steps in solving problems.

Step 1 – Understand

a. What is asked in the problem?
b. What are given?
c. What are the hidden questions?

Step 2 – Make a Plan

a. What operations will be used?
b. What is the mathematical sentence?

Step 3 – Carry Out the Plan

This includes the solution or solutions of the problem.

Step 4 – Look Back

Is the answer reasonable?
Estimate to check.

On the other hand, non-routine problems can be solved in multiple ways and strategies. The following are some of the different strategies in solving non-routine word problems.

- Look for a pattern.
- Guess and check.
- Work backward.
- Make a model or visualize the problem.
- Break up the problem into smaller parts and solve each part.

Example 1

Let us consider the earlier problem.

• **Understand.** - Identify the question. - Identify the relevant facts.	- The problem is asking about the volume of the box of bond papers. - The dimensions of the box are 20 in, 18 in and 10 in.
• **Plan.** - Choose a strategy.	- The strategy to use is using a formula.
• **Solve.** - Perform the strategy.	We know that the box is a rectangular prism. Therefore, we use $V = lwh$ or $V = l \times w \times h$ V = 20 in × 18 in × 10 in = 3 600 in^3
• **Check.** - Verify the reasonableness of the answer.	The product of 20, 18 and 10 is less than 4 000. Hence, the answer is reasonable.

***Answer*:** The volume of the rectangular box of bond papers is 3 600 in^3.

Example 2

Jessa has a box where she keeps all her little toys. Its length is 3 in. Its width is 4 in. Its height is 5 in. What is the amount of space enclosed in the box?

Step 1 What is asked?

The problem is asking for the amount of space that is enclosed in the box.

Step 2 What are the given facts?

The dimensions of the box are 3 in, 4 in and 5 in.

Step 3 What is the strategy to use?

Using the formula is the appropriate strategy to use.

Step 4 Write the answer.

$V = lwh$

$V = [3\text{ in} \times 4\text{ in}]\ 5\text{ in}$

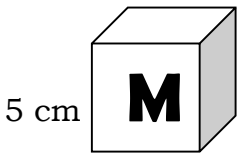
$V = 12\text{ in}^2 \times 5\text{ in}$

$V = 60\text{ in}^3$ or 60 cubic inches

Answer: The volume of the box is 60 in^3.

Example 3

Babies learn how to read letters at home in so many ways using different strategies. One example of these is by using a wooden letter cube. If an edge of a wooden letter cube measures 5 cm, what is the volume of the cube?



To solve this, we have the following.

Step 1: Write the formula appropriate to the given object.

$V = s^3$ where s is the length of an edge of the cube.

Step 2: Substitute s with the given length.

$V = 5\text{ cm} \times 5\text{ cm} \times 5\text{ cm}$

Step 3: Multiply the numbers

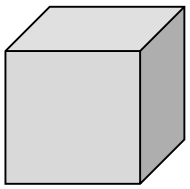
$V = 25\text{ cm}^2 \times 5\text{ cm}$

Step 4: Write the cubic units after your answer.

V = 125 cubic cm or 125 cm^3

Example 4

Your younger sister received a birthday gift. It was packed in a cube box with an edge measure of 12 inches. How are you going to solve for the amount of space enclosed in the box?



$V = s^3$

$V = (12 \text{ in} \times 12 \text{ in})\ 12 \text{ in}$

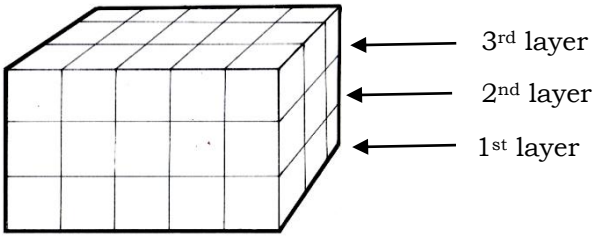
$V = 144 \text{ in}^2 \times 12 \text{ in}$

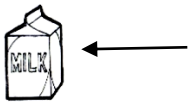
$V = 1\ 728$ cubic inches or $1\ 728 \text{ in}^3$

Hence, the amount of space enclosed in the box is 1 728 cubic inches.

Example 5

A box of fresh milk has 15 small retail boxes. The small boxes are arranged at the bottom layer of the box with no spaces in between them. The big box can hold three layers of the exact number of small boxes in each layer. See the illustrations below. What is the volume of the box?





There are 15 of this retail boxes inside fit perfectly in the bottom layer of the box.

You may notice that lengths, widths and heights of the boxes are not mentioned. We may visualize the situation to get the volume of the big box.

So, we can assume that in order to find its volume we simply multiply 15 boxes (for the base) by 3 layers (height or *h*).

$V = Bh$, wherein B is $l \times w$

$V = 15 \times 3$

$V = 45$

Therefore, the volume of the box of fresh milk is 45 

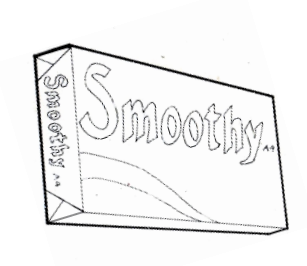
s.

What's More

Activity 1. Show Me How!

Directions: Read and solve the following word problems. Copy and complete the following on an extra sheet of paper. You may use a calculator.

1. A ream of a bond paper measures 12 in height, 2 in width, and 9 in length. What is the volume of the ream of paper?



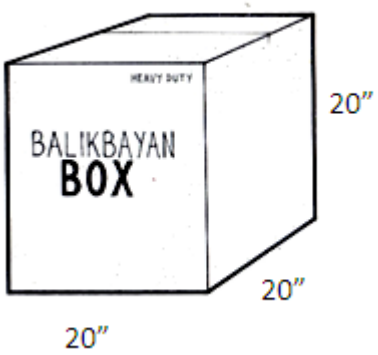
Solution: $V = lwh$

$V =$ ____ in $\times$ 2 in $\times$ 9 in

$V =$ _____ $in^2 \times 9$ in

$V =$ _____ in^3

2. The delivery boy brought us a Balikbayan box from my sister abroad. Its shape is a cube. It measures 20 inches on each edge. What is the amount of space enclosed in the box?



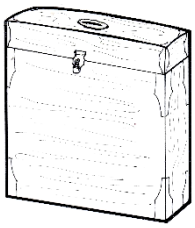
Solution: $V = S^3$

$V = (20$ in $\times$ ____ in) 20 in

$V =$ _____ $in^2 \times 20$ in

$V =$ _____ in^3

3. Cherrie Mae decided to save some of her money. Every day, she drops a few coins in her wooden coin bank. The coin bank dimensions are 50 cm, 40 cm and 9 cm. What is the amount of space enclosed in the coin bank?



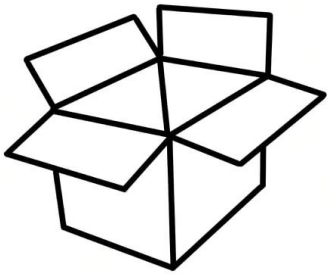
Solution: $V = lwh$

$V =$ ____ cm $\times$ 40 cm $\times$ 9 cm

$V =$ _____ $cm^2 \times 9$ cm

$V =$ _____ cm^3

4. Archie will be making a toy house from an empty box for his project in TLE. The width of the box that he will need is 20 cm. The height is 50 cm. The length is 6 cm. What is the amount of space enclosed in the box?



Solution: $V = lwh$

$V =$ ____ cm × ____ cm × ____ cm

$V =$ _____ cm^2 × ____ cm

$V =$ _____ cm^3

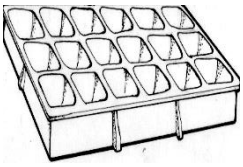
5. Marissa has a pack of succulent seeds to be planted in a seed box. The dimensions of the seed box are 5 in, 15 in and 25 in. What is the amount of space enclosed in the box?

Solution: $V = lwh$

$V =$ ____ in × ____in × ____ in

$V =$ _____ in^2 × ____ in

$V =$ _____ in^3



Activity 2: Match ME Up!

Directions: Read and understand the given. Choose the letter that corresponds to the correct answer. Write your solutions and the letters of your answers on a separate sheet of paper. You may use a calculator.

1. Brgy. Malipayon has a Purok Project which is an MRF (Materials Recovery Facility). The~~ir~~ MRF's dimensions are 2 m, 2 m and 10 m. What is the amount of space that is enclosed in the facility?

   (A) 14 m^3 (B) 16 m^3 (C) 20 m^3 (D) 40 m^3

2. An ice chest has dimensions of 14 in, 25 in and a 3 in. It is perfect food storage for camping. What is the amount of space that is enclosed in the ice chest?

   (A) 1 005 in^3 (B) 1 050 in^3 (C) 1 105 in^3 (D) 1 500 in^3

3. Mr. and Mrs. Ompad bought a Super Blender for their fruit shake business. It models a rectangular prism. Its dimensions are 8 in, 20 in and 9 in. Which of the following is the amount of spaced enclosed in the blender?

(A) 180 in^3 (B) 900 in^3 (C) 1 440 in^3 (D) 1 740 in^3

4. Edgar customized a bird cage for his love birds. It models a cube. It measures 75 cm on each side. What is the amount of space enclosed in the cage?

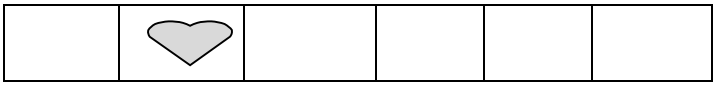
(A) 421 875 cm^3 (B) 421 758 cm^3 (C) 412 875 cm^3 (D) 225 cm^3

5. Sherryl is reviewing her clothes. The not needed clothes are placed in a plastic container. The width of the container is 50 cm. The length is 1 m. The height is 1.5 m. Which of the following is the amount of space enclosed in the container?

(A) 2.5 m^3 (B) 0.75 m^3 (C) 7.5 m^3 (D) 52.5 m^3

Activity 3 Tell Me What!

Directions: Solve the following word problems. Show your solutions on your answer sheet. Copy and complete the boxes below by writing the letter that corresponds to the value below each box.



720 in^3 154 cm^3 16 m^3 343 in^3 432 in^3

A What is the amount of space enclosed in a cargo truck with dimensions of 2 m, 4 m and 2 m?

H Melissa's bag measures 3 in wide, 16 in long and 9 in high. What is the amount of space enclosed in her bag?

I A shoe box's dimensions are 9 in, 20 in and 4 in. What is the amount of space enclosed in the shoe box?

T Today is Angela's 81st birthday. She received a gift from her grandchildren. The gift was wrapped in a huge box. The box is a cube with 7 inches in each edge. What is the amount of space enclosed in the box?

M The dimensions of a piece of wood are 2 cm, 11 cm, and 7 cm. What is the volume of the piece of wood?

What I Have Learned

A. In your own words, explain how to solve problems involving the volume of a cube or rectangular prism. You may use and solve the problem below for your explanation. Write your explanation and your answer on a separate sheet of paper.

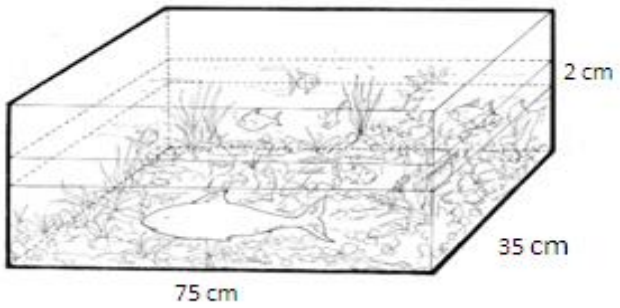
B. A piece of wood is in the shape of a rectangular prism. Its dimensions are 2 cm, 10 cm and 50 cm. What is the volume of the piece of wood?

What I Can Do

Directions: Read and understand the following. Write your solutions and your answers on a separate sheet of paper. You may use a calculator.

A. A chocolate bar is in the shape of a rectangular prism. Its dimensions are 60 mm, 10 mm and 1 mm. What is the volume of the chocolate bar?

B. A koi fish is placed in a rectangular aquarium that has a length of 75 cm and a width of 35 cm. If the water level rises 2 cm when the fish is placed in the aquarium, what is the volume of the fish?



Assessment

Directions: Read and understand the given. Choose the letter that corresponds to the correct answer. Write your solutions and the letters of your answers on a separate sheet of paper. You may use a calculator.

1. The dimensions of a wood are 1.8 cm, 122 cm and 244 cm. Which of the following is the wood's volume?
   (A) 367.8 cm^3 (B) 53 582.4 cm^3
   (C) 53 582.4 mm^3 (D) 367 800 cm^3

2. The dimensions of a chocolate bar are 10 mm, 20 mm and 45 mm. Which of the following is the chocolate bar's volume?
   (A) 9 000 mm^3 (B) 900 cm^3
   (C) 320 cm^3 (D) 75 cm^3

3. The center stone of a ring has dimensions of 14 mm, 12 mm and 5 mm. Which of the following is the volume of the center stone of the ring?
   (A) 31 mm^3 (B) 90 mm^3
   (C) 840 mm^3 (D) 900 cm^3

4. Ruby prepares souvenirs for her birthday. A souvenir is placed in a plastic box which measures 5 inches long, 3 inches wide and 6 inches high. What is the amount of space that is enclosed in the box?
   (A) 39 in^3 (B) 40 in^3 (C) 60 in^3 (D) 90 in^3

5. Your mother bought a new plastic shoe rack with dimensions of: h = 4 ft, w = 2 ft and l = 8 ft. What is the amount of space that is enclosed in the rack?
   (A) 64 ft^3 (B) 62 ft^3 (C) 48 ft^3 (D) 14 ft^3

6. A rectangular cake has dimensions of 10 cm, 20 cm and 45 cm. Which of the following is the cake's volume?
   (A) 75 cm^3 (B) 7 500 cm^3
   (C) 9 000 cm^3 (D) 9 000 mm^3

7. What is the amount of space that is enclosed in a sewing kit box that is 45 cm long, 32 cm wide and 24 cm high?
   (A) 101 cm^3 (B) 34 460 cm^3 (C) 34 500cm^3 (D)34 560 cm^3

8. The dimensions of a rectangular kakanin are 10 mm, 8 cm and 0.4 m. Which of the following is the volume of the kakanin?

   (A) 3.2 cm^3 (B) 18.4 cm^3

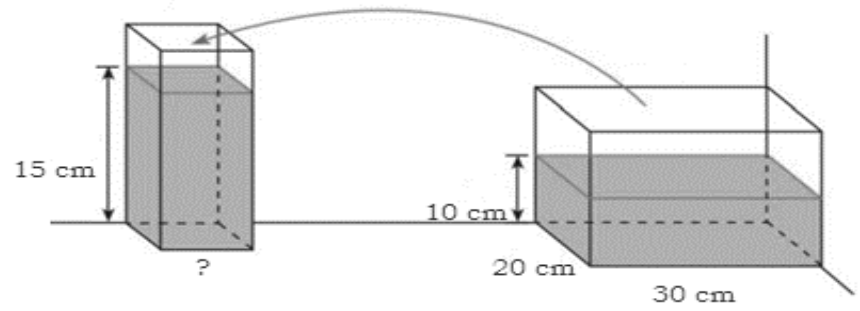
   (C) 320 cm^3 (D) 3 200 mm^3

9. A rectangular aquarium has a length of 110 cm and a width of 40 cm. A toy is placed in the aquarium. If the water level of the aquarium rises by 1 cm. Which of the following is the volume of the toy?

   (A) 150 cm^3 (B) 151 cm^3

   (C) 4 400 cm^3 (D) It cannot be determined.

10. A rectangular plastic container has a base that is 30 cm long and 20 cm wide. The container is filled with water to a height of 10 cm. If all the water is poured into a second container with a square base, it will rise to a height of 15 cm. What is the length of the edge of the square based container?



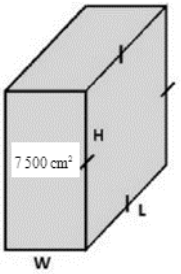
(A) 15 cm (B) 20 cm (C) 60 cm (D) 75 cm

Additional Activities

Hurraaaaaay!!! Finally, you're on the last activity. I'm sure you are excited to finish this module. Keep going!

Directions: Read and understand the following carefully. Write your solutions and your answers on a separate sheet of paper. You may use a calculator.

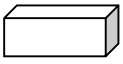
1. A wooden box is customized such that its length is 3 times its width. The length and height are equal. As shown, the rectangular base has an area of 7 500 square centimeters. What is the amount of space that is enclosed in the box?



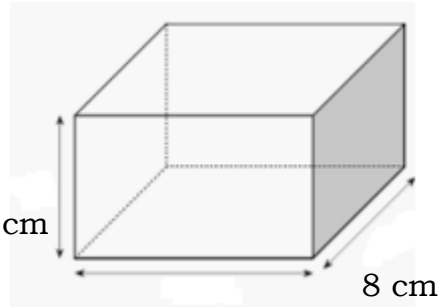
2. The inner dimensions of a glass container are shown below. There are two types of wooden blocks that can be used to fill the container. Give at least 3 arrangements of completely filling the blocks in the container. You may use Block As only, Block Bs only or combinations of both blocks. One arrangement is done for you.

Side = 2 cm

Block A



Length= 4 cm



Block B Width = 2 cm
Height = 2 cm

20 cm
Glass container

One Arrangement: It is possible to fill the container with 120 Block As.

Answer Key

What I Know

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

What's In

1. 96 cm^3
2. 144 in^3
3. 343 mm^3
4. 72 in^3
5. 216 m^3

What's More

Activity 1: Show ME How!

1. V = lwh
   V = 9 in × 2 in × 12 in
   V = 18 in^2 × 12 in
   V = 216 in^3

2. V = S^3
   V = 20 in × 20 in × 20 in
   V = 400 in^2 × 20 in
   V = 8 000 in^3

3. V = lwh
   V = 40 cm × 9 cm × 50 cm
   V = 360 cm^2 × 50 cm
   V = 18 000 cm^3

4. V = lwh
   V = 6 cm × 20 cm × 50 cm
   V = 120 cm^2 × 50 cm
   V = 6 000 cm^3

5. V = lwh
   V = 25 in x 15 in x 5 in
   V = 375 in^2 × 5 in
   V = 1 875 in^3

Activity 3: Tell Me What!

I		M	A	T	H
720 in^3		154 in^3	16 m^3	343 in^3	432 in^3

What I Have Learned

A. Explanations vary.

B. The volume is 1 000 cubic centimeters.

What's More

Activity 2: Match ME Up!

1. D
2. B
3. C
4. A
5. B

What I Can Do

A. 6 000 cubic millimeters

B. When the fish is placed in the aquarium, the rise in water level creates a right rectangular prism. The prism's volume is equal to the volume of the fish. So, to find the volume of the fish all we have to do is to find the volume of the prism that is formed in the rise of the water level.

Solution:

$V_{prism} = V_{fish}$

$V = Bh$ or $(lw)h$ or lwh
$= (75\text{cm} \times 35\text{cm})(2\text{cm})$
$= (2625)(2)$
$= 5\ 250\text{cm}^3$

Therefore, the volume of the fish is also 5250 cm^3.

Assessment

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

Additional Activities

1. The length is 150 cm. The width is 50 cm. The height is 150 cm. The volume is 1 125 000 cubic centimeters.

2. The following may be the arrangements.

- 60 Block Bs
- 30 Blocks As and 45 Block Bs
- 60 Blocks As and 30 Block Bs

There are other arrangements that can be made.

References

Caingat, Maria Rovil L.2005.*Enjoying Mathematics Workbook*. JEDIGAR Enterprises, Mandaluyong City.

For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph