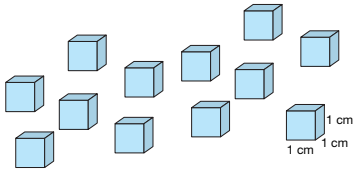
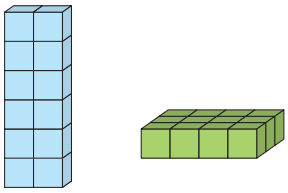
Problem Solving with Volume

Volume of Boxes

Here are 12 cubic centimeters. A **cubic centimeter** is the volume of cube that is 1 centimeter long on each side.



These 12 cubic centimeters can be put together face-to-face to make several different shapes.



Each of the shapes above has a **volume** of 12 cubic centimeters. This is sometimes written 12 cm^3. You can think of volume as the space in an object.

1. Use 12 cubes to make two more shapes with a volume of 12 cm^3.

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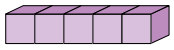
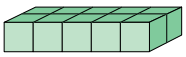
2. Five centimeter cubes are put together to form one row.



A. What is the volume of the row?

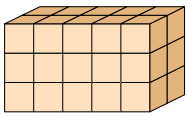
B. What is the length of the row?

3. Two rows of 5 centimeter cubes are put together to form a layer.



What is the volume of one layer?

4. Three of these layers are stacked.



What is the volume of this box?

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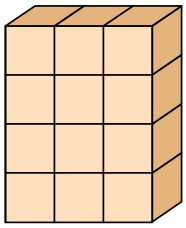
Student Guide

Problem Solving with Volume (SG pp. 195–197) Questions 1–8

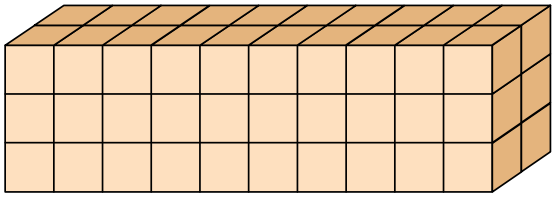
1.* Shapes will vary but each must have a volume of 12 cm^3. One sample shape:

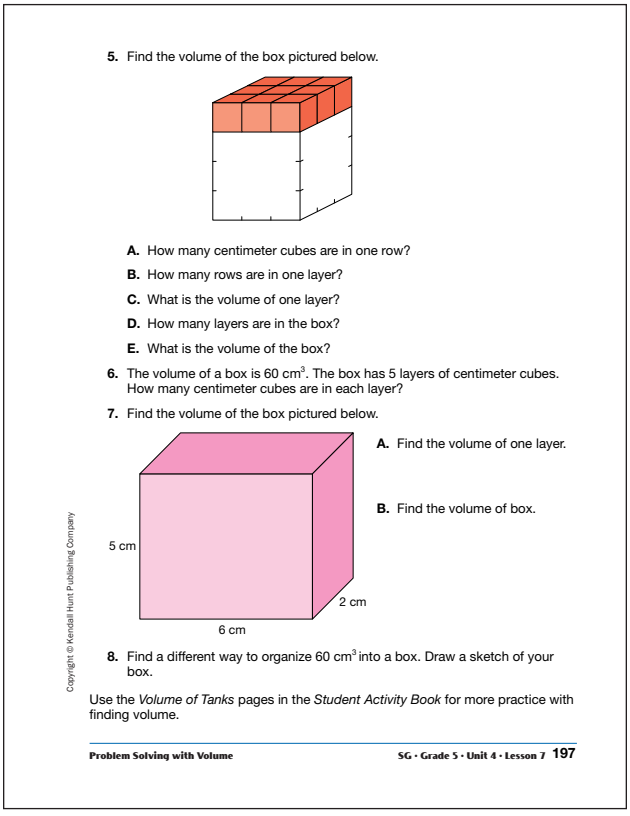


2. **A.** 5 cm^3
   B. 5 cm
3. 10 cm^3
4. 30 cm^3

***Answers and/or discussion are included in the lesson.**

5. **A.*** 3
   B.* 3
   C.* 9 cm^3
   D.* 4
   E.* 36 cm^3
6. * 12 cubes
7. **A.*** 12 cm^3
   B.* 60 cm^3
8. Boxes will vary but should have a volume of 60 cm^3. One sample box:





5. Find the volume of the box pictured below.

A. How many centimeter cubes are in one row?
B. How many rows are in one layer?
C. What is the volume of one layer?
D. How many layers are in the box?
E. What is the volume of the box?

6. The volume of a box is 60 cm^3. The box has 5 layers of centimeter cubes. How many centimeter cubes are in each layer?

7. Find the volume of the box pictured below.

5 cm
6 cm
2 cm

A. Find the volume of one layer.
B. Find the volume of box.

8. Find a different way to organize 60 cm^3 into a box. Draw a sketch of your box.

Use the *Volume of Tanks* pages in the *Student Activity Book* for more practice with finding volume.

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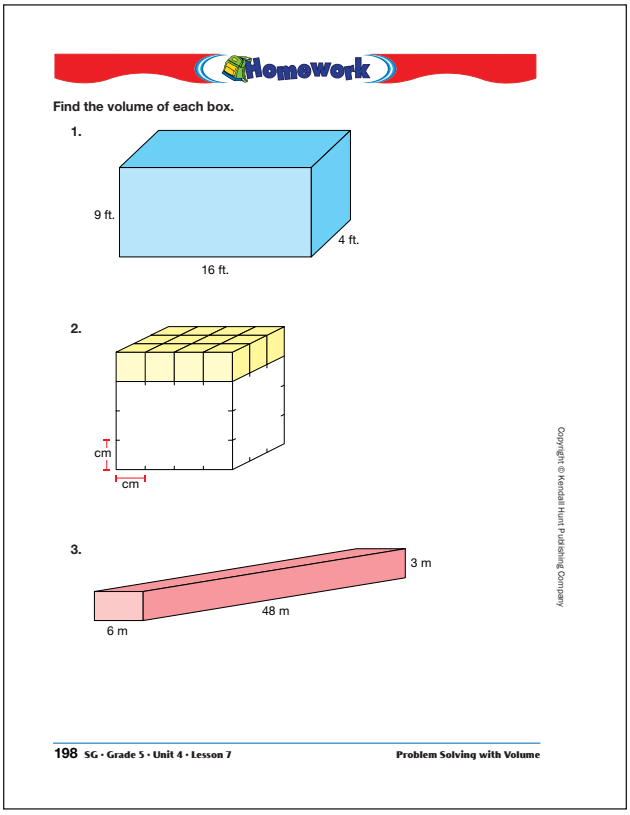
***Answers and/or discussion are included in the lesson.**



Homework

Find the volume of each box.

1.

2.

3.

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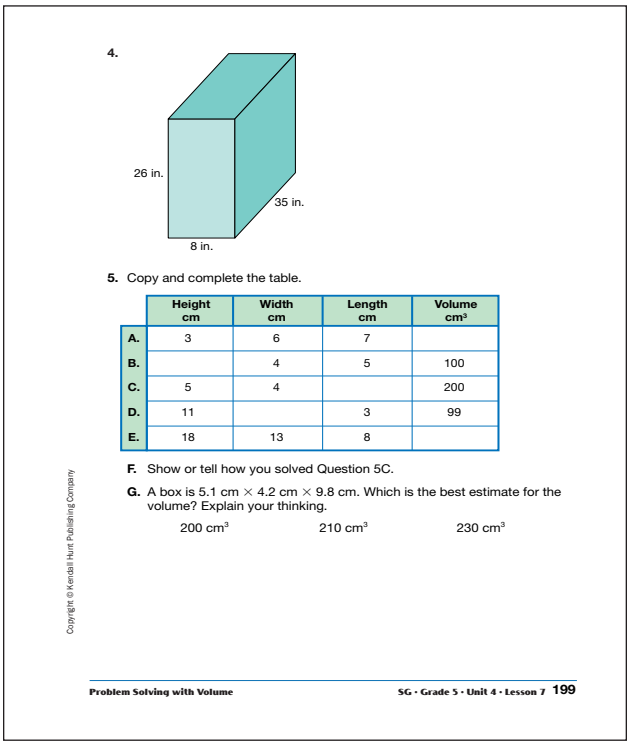

4.

5. Copy and complete the table.

	Height cm	Width cm	Length cm	Volume cm³
A.	3	6	7	
B.		4	5	100
C.	5	4		200
D.	11		3	99
E.	18	13	8	

F. Show or tell how you solved Question 5C.

G. A box is 5.1 cm × 4.2 cm × 9.8 cm. Which is the best estimate for the volume? Explain your thinking.

200 cm³ 210 cm³ 230 cm³

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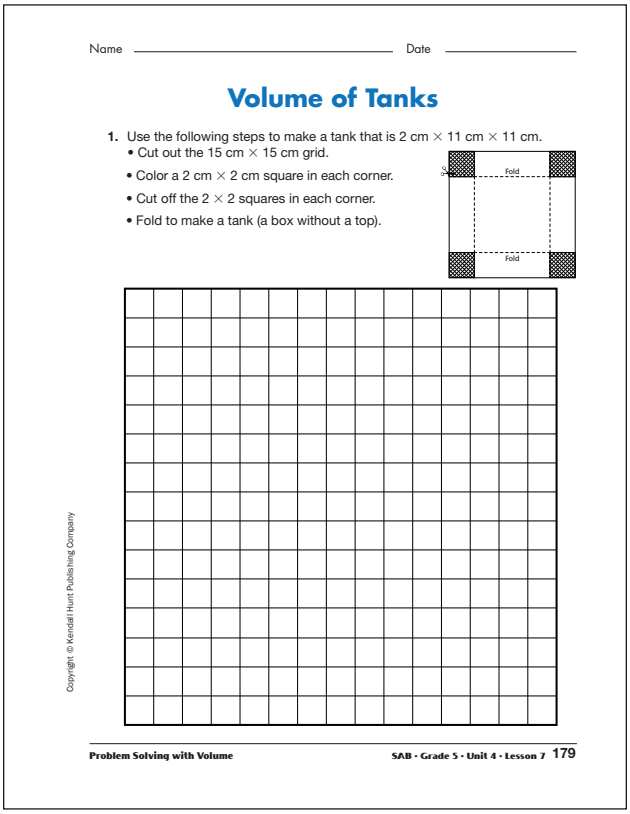
Homework Section (SG pp. 198–199) Questions 1–5

1. 576 ft.^{3}
2. 48 cm^3
3. 864 m^3
4. 7280 in.^{3}
5. A. 126 cm^3
   B. 5 cm
   C. 10 cm
   D. 3 cm
   E. 1872 cm^3
   F. $5 \times 4 \times \boxed{10} = 200$
   G. 210 cm^3 is a reasonable estimate. The numbers are close to $5 \times 4 \times 10 = 200$.

Student Activity Book

Volume of Tanks (SAB pp. 179–182)
Questions 1–6

1. Students will construct a 2 cm × 11 cm × 11 cm tank.



Name _____ Date _____

Volume of Tanks

1. Use the following steps to make a tank that is 2 cm × 11 cm × 11 cm.
   - Cut out the 15 cm × 15 cm grid.
   - Color a 2 cm × 2 cm square in each corner.
   - Cut off the 2 × 2 squares in each corner.
   - Fold to make a tank (a box without a top).

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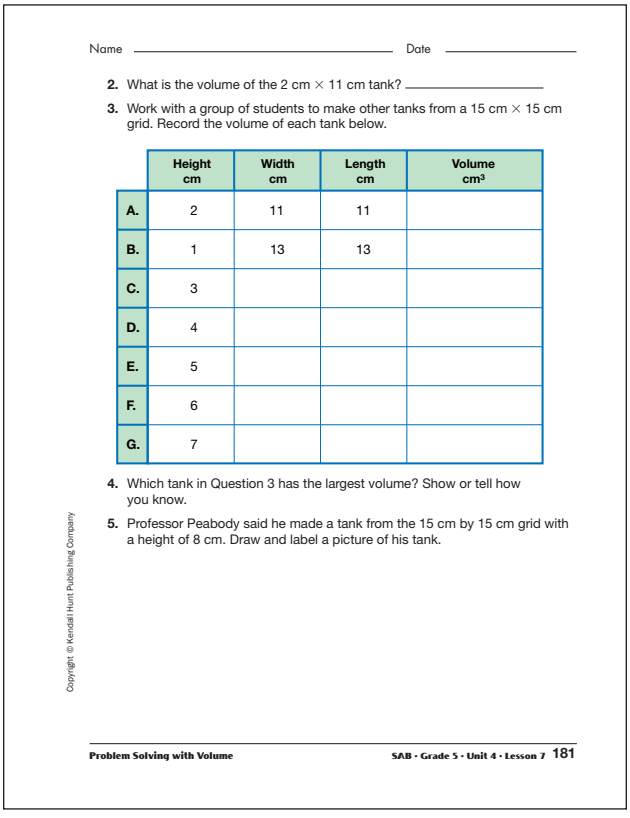
2. 242 cm^3
3. **A.** 242 cm^3
   B. 169 cm^3
   C. 243 cm^3; The width and length are 9 cm.
   D. 196 cm^3; The width and length are 7 cm.
   E. 125 cm^3; The width and length are 5 cm.
   F. 45 cm^3; The width and length are 3 cm.
   G. 7 cm^3; The width and length are 1 cm.
4. The tank that is 3 cm tall has the greatest volume because 3 cm × 9 cm × 9 cm = 243 cm^3.
5. * Possible response: Professor Peabody cannot make that box from a 15 cm × 15 cm grid. The paper needs to be a least 16 cm × 16 cm.



Name _____ Date _____

2. What is the volume of the 2 cm × 11 cm tank? _____
3. Work with a group of students to make other tanks from a 15 cm × 15 cm grid. Record the volume of each tank below.

	Height cm	Width cm	Length cm	Volume cm^3
A.	2	11	11	
B.	1	13	13	
C.	3			
D.	4			
E.	5			
F.	6			
G.	7			

4. Which tank in Question 3 has the largest volume? Show or tell how you know.
5. Professor Peabody said he made a tank from the 15 cm by 15 cm grid with a height of 8 cm. Draw and label a picture of his tank.

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***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

6. Use a calculator to complete the table. Each shape is a box.

	Height	Width	Length	Volume
A.	5 cm	15 cm	15 cm	
B.	10 yd.	12 yd.	yd.	960 yd.^{3}
C.	in.	45 in.	70 in.	47, 250 in.^{3}
D.	117 ft.	98 ft.	ft.	573, 300 ft.^{3}
E.	50 cm	cm	50 cm	125,000 cm^3
F.	m	6.5 m	5.5 m	429 m^3

G. Show or tell how you solved Question 6B.

H. A tank is 5.1 cm × 15.2 cm × 15.2 cm. Circle the best estimate for the volume. Explain your thinking.

1125 cm^3 1200 cm^3 2000 cm^3

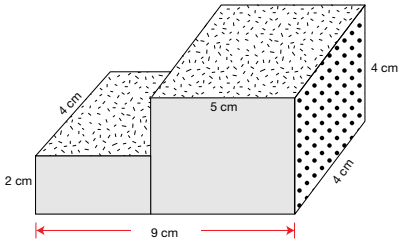
***Student Activity Book* - Page 182**

6. **A.** 1125 cm^3
   B. 8 yd.
   C. 15 in.
   D.* 50 ft.
   E. 50 cm
   F. 12 m
   G. 960 ÷ 10 ÷ 12 = 8 yd.
   H. 1200 cm^3 seems most reasonable. The lengths are close to 5 × 15 × 15 = 1125

Name _____ Date _____

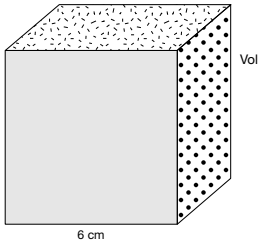
Volume Problems

1. Two boxes are put together in the following sketch. Find the volume of the boxes in the sketch.



Volume _____

2. Find the volume of the cube in the sketch.



Volume _____

***Student Activity Book* - Page 183**

Volume Problems (SAB pp. 183–186)
Questions 1–7

1. 112 cm^3
2. 216 cm^3

***Answers and/or discussion are included in the lesson.**

3. 1000 cm^3

4. The volume of this cube is a little larger than 1000 cm^3.

5. length = 3 cm; width = 3 cm; height = 3 cm

Name _____ Date _____

3. What is the volume of a 10 cm cube?

Volume _____

4. A cube has an edge length of 10.5 cm. Choose your best prediction for the volume of this cube.

_____ The volume of this cube is a little smaller than 1,000 cm^3.

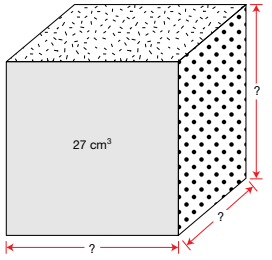
_____ The volume of this cube is much smaller than 1,000 cm^3.

_____ The volume of this cube is 1,000 cm^3.

_____ The volume of this cube is a little larger than 1,000 cm^3.

_____ The volume of this cube is much larger than 1,000 cm^3.

5. The volume of this cube is 27 cm^3. Find the length, width, and height of the cube. Include units.



length _____

width _____

height _____

***Student Activity Book* - Page 184**

6. A. 27 cm^3

B. 72 cm^3 − 27 cm^3 = 45 cm^3

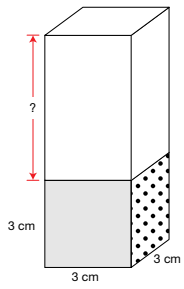
C. 3 cm

D. 3 cm

E. 5 cm

Name _____ Date _____

6. The following shape is built from a white box and a shaded cube. The volume of the shape is 72 cm^3.



Use the following steps to find the height of the white box. Include units.

A. Find the volume of the cube. _____

B. Find the volume of the white box. _____

C. What is the length of the white box? _____

D. What is the width of the white box? _____

E. Find the height of the white box. _____

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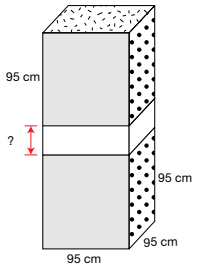
Name _____ Date _____

7. The shape in the sketch is built from two identical cubes and a small white box. The volume of the shape is 1,985,500 cm^3. Find the height of the small white box. Show your work.



Height of the white box _____

***Student Activity Book* - Page 186**

7.* 30 cm

Name _____ Date _____

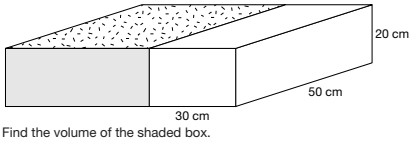
Multiply to Find Volume

Homework

1. Find the volume to complete the table. Include labels.

	Height	Width	Length	Volume
A.	15 ft.	5 ft.	30 ft.	
B.	24 cm	15 cm	5 cm	
C.	39 m	12 m	9 m	
D.	200 in.	500 in.	50 in.	
E.	42 yd.	8 yd.	21 yd.	
F.	25 m	10 m	40 m	

2. The shape in the sketch is built from two smaller boxes. The shape has a volume of 80,000 cm^3.



Find the volume of the shaded box.

Volume _____

***Student Activity Book* - Page 187**

Multiply to Find Volume (SAB pp. 187–188)
Homework
Questions 1–5

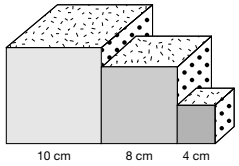
1. **A.** 2250 ft^3.
   B. 1800 cm^3
   C. 4212 m^3
   D. 5,000,000 in^3.
   E. 7056 yd^3.
   F. 10,000 m^3
2. 50,000 cm^3

***Answers and/or discussion are included in the lesson.**

3. 1576 cm^3; $10^3 + 8^3 + 4^3$
4. 342 in^3; $6^3 + 5^3 + 1^3$
5. Possible response: The shape in Question 4. The boxes are a lot larger than those in Question 3.

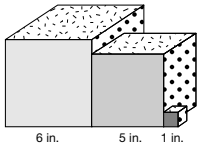
Name _____ Date _____

3. The figure is built from three cubes. Find the volume of the entire figure. Show your work and include unit.



Volume _____

4. Another figure is built from three cubes. Find the volume of the entire figure. Show your work and include units.



Volume _____

5. Look at the shapes in Questions 3 and 4. Which shape will hold more water? Explain your thinking.

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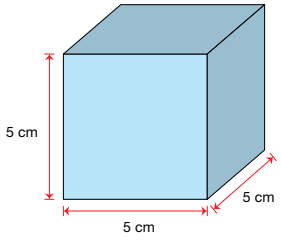
Teacher Guide

Confused Contessa Finds Volume (TG)

* Contessa is incorrect. To find the volume of a 5 cm cube, she incorrectly multiplies × 3, but that is not the same as 5 × 5 × 5.

Confused Contessa Finds Volume

Contessa is finding the volume of this cube.



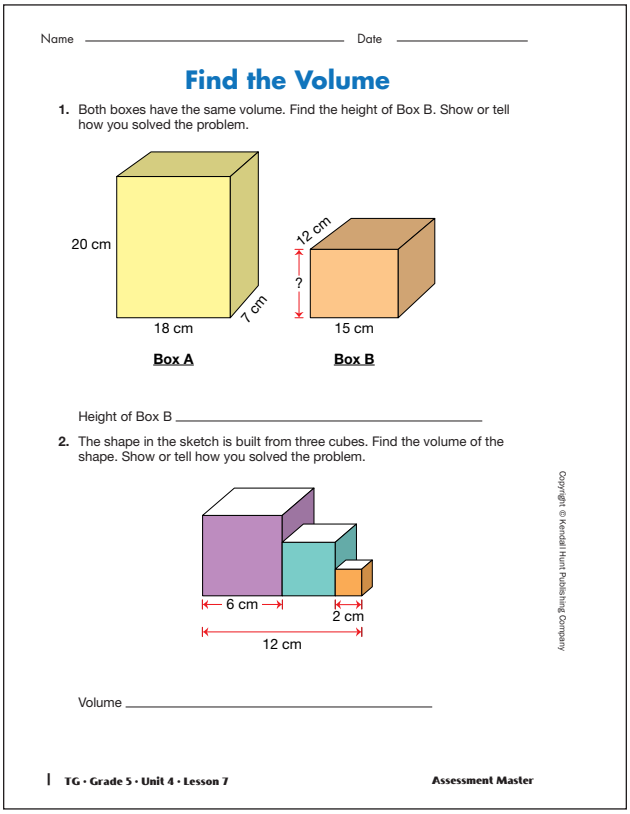
Here is her thinking:

The width is 5 cm.
The height is 5 cm.
The length is 5 cm.
So the volume is 5 cm × 3 = 15 cm^3.

Discuss Contess's solution with a partner. Do you agree with Contessa? Why or why not?

Teacher Guide

***Answers and/or discussion are included in the lesson.**



Name _____ Date _____

Find the Volume

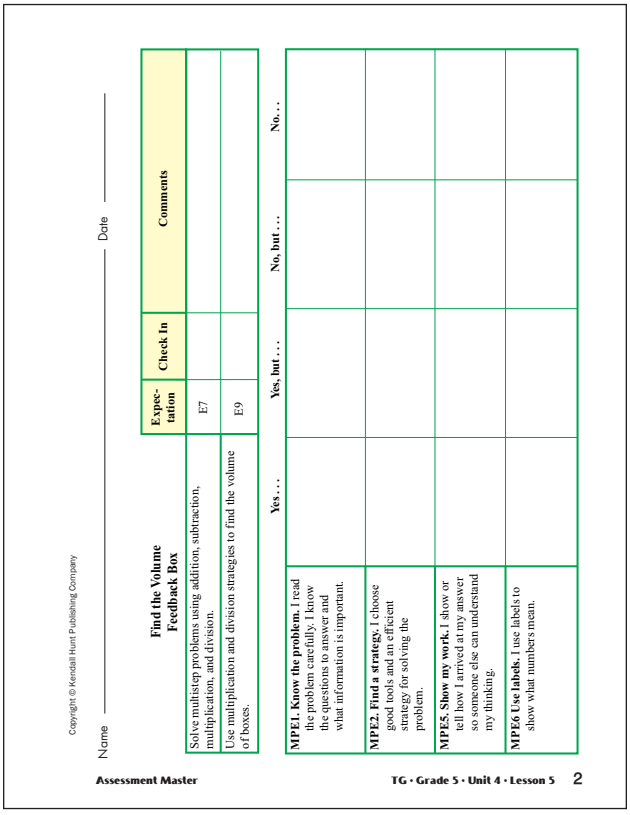
1. Both boxes have the same volume. Find the height of Box B. Show or tell how you solved the problem.

Height of Box B _____

2. The shape in the sketch is built from three cubes. Find the volume of the shape. Show or tell how you solved the problem.

Volume _____

Teacher Guide - Page 1



Name _____ Date _____

Find the Volume Feedback Box

	Expectation	Check In	Comments
Solve multistep problems using addition, subtraction, multiplication, and division.	E7		
Use multiplication and division strategies to find the volume of boxes.	E9		

	Yes . . .	Yes, but . . .	No, but . . .	No. . .
MPE1. Know the problem. I read the problem carefully, I know the questions to answer and what information is important.				
MPE2. Find a strategy. I choose good tools and an efficient strategy for solving the problem.				
MPE5. Show my work. I show or tell how I arrived at my answer so someone else can understand my thinking.				
MPE6 Use labels. I use labels to show what numbers mean.				

Teacher Guide - Page 2

Find the Volume (TG p. 1–2)
Questions 1–2

1.* 14 cm; Possible response: Both boxes have the same volume. Box A is 20 cm × 7 cm × 18 cm = 2520 cm^3. Box B has a length of 15 cm and a width of 12 cm. 15 cm × 12 cm = 180 cm^2. To find the height, I divided the volume, 2520 cm^3 by 180 cm^2 and got 14 cm.

2.* 288 cm^3; Possible response:

Volume of largest cube:
6 cm × 6 cm × 6 cm = 216 cm^3

Volume of smallest cube:
2 cm × 2 cm × 2 cm = 8 cm^3

To find the length of the medium cube:
12 cm – 6 cm – 2 cm = 4 cm

Volume of the medium cube:
4 cm × 4 cm × 4 cm = 64 cm^3

Volume of the shape:
216 cm^3 + 8 cm^3 + 64 cm^3 = 288 cm^3

*Answers and/or discussion are included in the lesson.