San Diego Unified
SCHOOL DISTRICT

FIFTH GRADE

Unit 6

Volume, Data and Measurement

20 days

enVision 2.0 Topics 10 - 12

Overarching Understandings:
Some attributes of objects are measurable and can be quantified using unit amounts. Length, area, volume, weight/mass, and capacity are attributes that provide different ways of describing the size of an object. Within the same measurement system, the measurements can be converted to different sized units. Measurement data can be represented in tables, graphs, and line plots.

Essential Questions:
- In what real life situations would you need to be able to measure and convert measurements?
- What is volume?
- How are area and volume alike and different?
- How do we measure volume?
- How can you find the volume of rectangular prisms?
- Why is volume represented with cubic units and area represented with square units?

Common Core State Standards:
5.MD.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
5.MD.2 Make a line plot to display a data set of measurements in fractions of a unit (1/2, ¼, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. 5.MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement a. A cube with a side length of 1 unit, called a “unit cube” is said to have “one cubic unit” of volume b. a solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units
5.MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units
5.MD.5 Relate volumes to the operations of multiplication and addition and solve real world and mathematical problems involving volume a. Find the volume of a right rectangular prism whit whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. b. Apply the formulas V = l x w x h and V = b x h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

Key Vocabulary:	**Sentence Frames:**
measurement conversion volume rectangular prism unit cubic units height area of base	This measurement is _____ or it is _____. The volume of this rectangular prism is _____ cubic ___. I found the volume by…..

Suggested Materials:		
Unit cubes	rulers, measuring tape	connecting cubes
Scales	clocks with second hand or timer	tape
Scissors	construction paper or card stock	markers, colored pencils

Number Talks: *Number Talks are used to build number sense, develop fluency, and make sense of problems.*
Problem Solving Number Strings

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Unit 6

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20 days

18 lessons
1 Assessment Day
1 Re-teaching/Enrichment Day

Suggested Order of Lessons

Objective 1: Students will recognize volume as an attribute of solid figures by packing figures with unit cubes. (5.MD.3, 5.MD.4)

Day	Source	Lesson Title	Page Number	Notes
1	enVision 2.0	10-1 Model Volume	ENV TE p. 587	
2	Georgia	Differentiating Area and Volume	Unit p.10	
3	Engage NY	Exploring Volume	Unit p.16	
4	enVision 2.0	10-3 Volume of Prisms	ENV TE p. 599	
5	Engage NY	Finding Volume	Unit p.23	

Objective 2: Students will relate volume to multiplication and will recognize volume as being additive by solving real world problems. (5.MD.5)

Day	Source	Lesson Title	Page Number	Notes
6	enVision 2.0	10-2 Develop Volume Formula	ENV TE p. 593	
7	enVision 2.0	10-4 Combine Volume of Prisms	ENV TE p. 605	
8	Engage NY	Volume of Figures	Unit p.32	
9	Engage NY	Volume of Figures	Unit p.36	
10	enVision 2.0	10-5 Solve Problems using Volume	ENV TE p. 611	

Objective 3: Students will solve multi-step problems by converting standard measurements. (5.MD.1)

Day	Source	Lesson Title	Page Number	Notes
12	SDUSD	Converting Metric units of Measure	Unit p.40	
13	SDUSD	Converting Customary Units of Measure	Unit p.43	
14	enVision 2.0	11-7 Solve Word Problems Using Measurement Converstions	ENV TE p.675	
15	SDUSD	Measurement Problem Solving	Unit p.46	

Objective 3: Students will solve problems by displaying data sets with fractions of units. (5.MD.2)

Day	Source	Lesson Title	Page Number	Notes
16	enVision 2.0	12-2 Make Line Plots	ENV TE p. 705	
17	enVision 2.0	12-3 Solve Word Problems Using Measurement Data	ENV TE p. 711	

18	Georgia	Survival Badge	Unit p.48	
19	Re-Teaching/Enrichment			
20	Assessment			

Notes:
enVision lessons 11-1 through 11-6 were combined into two days to allow students more problem solving time with this concept. enVision lessons 12-1 and 12-4 were not suggested in order to have time for a real-world experience with line plots.

SDUSD Math Lesson Map

Number Talks
15 minutes

Number Talks are a chance for students to come together to practice fluency and share their mathematical thinking by engaging in conversations and discussions around problem solving and number sense activities.

The structure of math lessons should follow the Launch, Explore, Summarize format. This structure allows students to explore mathematical concepts with rigor (fluency, concept development, and application) to develop understanding in ways that make sense. Some rich tasks may take multiple days for students to explore. In these cases, each day should still follow the Launch, Explore, Summarize format.

LAUNCH (5–10 minutes)

The teacher sets the stage for learning by ensuring the purpose and the rationale of the lesson are clear by connecting the purpose to prior learning, posing the problem(s), and introducing the Explore task for students. During this time the teacher is identifying the tools and materials available, reviewing academic vocabulary, and setting the expectations for the lesson.

The students are actively engaged in a short task or discussion to activate prior knowledge in preparation of the Explore task. Students may be using tools and/or manipulatives to make sense of the mathematical concept.

WHOLE GROUP

EXPLORE (15–20 minutes)

The teacher provides opportunities and support for students to develop conceptual understanding by providing meaningful explorations and tasks that promote active student engagement.

The teacher monitors the development of student understanding by conferring with students and asking students questions in order to understand and stimulate their thinking. The teacher uses this information to plan for the Summarize and, if needed, to call the students together for a mid-Explore scaffold to focus or propel student thinking.

The students are actively engaged in constructing meaning of the mathematical concept being taught. Students engage in private reasoning time before working with partners or groups. Students use multiple representations to solve rich tasks and communicate their mathematical understanding.

INDIVIDUAL, PAIRS, OR SMALL GROUP

SUMMARIZE (15–20 minutes)

The teacher provides opportunities to make public the learning that was accomplished by the students by sharing evidence of what was learned, and providing opportunities for students to analyze, compare, discuss, extend, connect, consolidate, and record thinking strategies. A summary of the learning is articulated and connected to the purpose of the lesson.

The students are actively engaged as a community of learners, discussing, justifying, and challenging various solutions to the **Explore** task. The students are able to articulate the learning/understanding of the mathematical concept being taught either orally or in writing. Students can engage in this discussion whether or not they have completed the task.

WHOLE GROUP

PRACTICE, REFLECT, and APPLY (10–15 minutes)

This time is saved for after the Summarize so students can use what they have learned to access additional tasks. The opportunities that teachers provide are responsive to student needs.

The students may have the opportunity to: revise their work, reflect on their learning, show what they know with an exit slip, extend their learning with a similar or extension problem, or practice with centers or games.

The teacher confers with individual students or small groups.

INDIVIDUAL, PAIRS, OR SMALL GROUP

FORMATIVE ASSESSMENT

The teacher determines what students are learning and are struggling with by conferring with students and by examining student work throughout the lesson. This formative assessment informs ongoing adjustments in the lesson and next steps for the class and each student.

The students are actively engaged in showing their learning accomplishments related to the mathematical concept of the lesson.

SDUSD Mathematics Units

We understand that for deep and sustainable change in mathematics to take place, teachers, students, and leaders must grapple with what the rich mathematics asked for by Common Core State Standards-Mathematics looks like in the classroom, in pedagogical practice, in student work, in curriculum, and **in** assessments. It is our goal that teachers and site leaders work collaboratively toward a shared vision of math instruction that develops mathematically proficient students as defined by the CCSS-Mathematics. It is our hope that these units provide a common instructional foundation for this collaboration.

The SDUSD Mathematics Units are designed to support teachers and students as we shift from a more directive style of teaching mathematics toward a more inquiry-based style. In problem-based learning, students develop the habits of mind and interaction of mathematicians through engaging in mathematical discourse, connecting representations, asking genuine questions, and justifying and generalizing ideas. These mathematical habits reflect the shifts in pedagogy required to support the Common Core Standards for Mathematical Practice.

The SDUSD math units are compiled with multiple sources to ensure students have a variety of mathematical experiences aligned to the CCSS. All lessons should follow the structure of Launch, Explore, and Summarize. The following document will guide teachers in planning for daily lessons, by helping them understand the structures of each of the sources.

Structure for enVision 2.0 Lessons

Use Step 1 Develop: Problem-Based Learning is the Launch, Explore, and Summarize for every enVision 2.0 Lesson.

Launch: (Before)

Start with the Solve-and-Share problem. Pose the problem to the students making sure the problem is understood. This does not mean you explain *how* to do the problem, rather you ensure that students understand what the problem is about. Establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore: (During)

Students engage in solving the problem using a variety of strategies and tools. Use the suggested guiding questions to check in briefly with students as needed, in order to understand and push student thinking. You may want to use the "Extension for Early Finishers" as needed.

Summarize: (After)

Select student work for the class to analyze and discuss. If needed, use the Sample Student Work provided for each lesson in enVision 2.0.

Practice, Reflect, Apply: (Select Problems from Workbook Pages, Reteach, Games, Intervention Activity)

During this time, students may revise their work from the Explore time or you may use pieces of Step 2 Develop: Visual Learning and Step 3 Assess and Differentiate. Note: The Quick-Check component is now a few select problems that are highlighted with a pink checkmark in the Teacher's Edition. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Structure for Engage NY Lessons

Launch/Explore: (Concept Development)

The Concept Development constitutes the major portion of instructional time when new learning is introduced. During this time, the lessons move through a deliberate progression on material, from concrete to pictorial to abstract. Your word choice may be slightly different from that in the vignettes, and you should use what works from the suggested talking points to meet your students' needs.

Summarize: (Student Debrief)

The student debrief piece helps develop students' metacognition by helping them make connections between parts of the lesson, concepts, strategies, and tools on their own. The goal is for students to see and hear multiple perspectives from their classmates and mentally construct a multifaceted image of the concepts being learned. Through questions that help make these connections explicit, and dialogue that directly engages students in the Standards for Mathematical Practice, they articulate those observations so the lesson's objective becomes eminently clear to them.

Practice, Reflect, Apply: (Problem Set/Exit Ticket)

The Problem Set often includes fluency pertaining to the Concept Development, as well as conceptual and application word problems. The primary goal of the Problem Set is for students to apply the conceptual understandings learned during the lesson.

Exit Tickets are quick assessments that contain specific questions to provide a quick glimpse of the day's major learning. The purpose of the Exit Ticket is twofold: to teach students to grow accustomed to being individually accountable for the work they have done, and to provide you with valuable evidence of the efficacy of that day's work which is indispensible for planning purposes. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Structure for Georgia Standards Lessons

The Georgia Standards tasks have been included in the units to provide students opportunities for rich, engaging, real-world mathematical experiences. These tasks allow students to develop conceptual understanding over time and may take more than one math lesson to complete. The extra time for these lessons has been allotted for in the units. When planning for a Georgia Task, it is suggested that you start by doing the mathematics the students will be engaging in before presenting it to the students.

Launch:

You may need to activate prior knowledge for some of the tasks that will be presented by showing images, letting students engage in partner talk about real-life situations, or using the suggested activity from the background knowledge component. Pose the task to the students making sure the task is understood. This does not mean that you explain *how* to do the problem, rather you ensure that students understand what the problem is about. You establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore:

Students will engage in working on the task using a variety of strategies and tools. You may use the Essential Questions or Formative Assessment questions provided in the lesson as needed in order to understand and prompt student thinking.

Summarize:

Select student work for the class to analyze and discuss. Use partnerships and whole-class collaborative conversations to help students make sense of each others' work. The Formative Assessment questions may also be used during this time to facilitate the conversation.

Practice, Reflect, Apply:

At this time, provide students time to reflect and revise their work from the Explore after they have engaged in the conversation in the Summarize portion of the lesson. This time provides an excellent opportunity to pull small groups of students that may need additional support.

Common Core Approach to Assessment

Assessments provide ongoing opportunities for students to show their learning accomplishments in addition to offering students a pathway to monitor their progress, celebrate successes, examine mistakes, uncover misconceptions, and engage in self-reflection and analysis. A central goal of assessments is to make students aware of their strengths and weaknesses and to give them opportunities to try again, do better and, in doing so, enjoy the experience of seeing their hard work pay off as their skill and understanding increases. Furthermore, the data collected as a result of assessments represent invaluable tools in the hands of teachers and provides specific data about student understanding that can inform instructional decisions.

For each Topic in enVision 2.0 the following assessments are available:

In the Student Workbook:
- -Topic Assessment
- -Performance Assessment

Online Teacher's Edition:
- -Additional topic assessment Black-line Master
- -Additional performance assessment Black-line Master

Online Student Assessment
- -Teacher can modify the number of items on an assessment
- -Teacher can rearrange order of problems

All of the assessment items for enVision 2.0 are aligned to the types of problems students may encounter on state testing. We have found enVision 2.0 has an excessive amount of items suggested for each topic. To avoid over-assessing, we recommend that school sites work collaboratively in grade-level teams to determine how to best use all the assessment resources available to evaluate student understanding and reduce the amount of items assessed. The SDUSD math units have grouped related topics together within a unit. Sites may choose to only give an assessment at the end of each unit, consisting of items from multiple topics, rather than using multiple days to assess each topic individually.

SCAFFOLDING TASK: Differentiating Area and Volume

Students create a display of square and cubic units in order to compare/contrast the measures of area and volume.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.MD.3 *Recognize volume as an attribute of solid figures and understand concepts of volume measurement.*

a. *A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.*

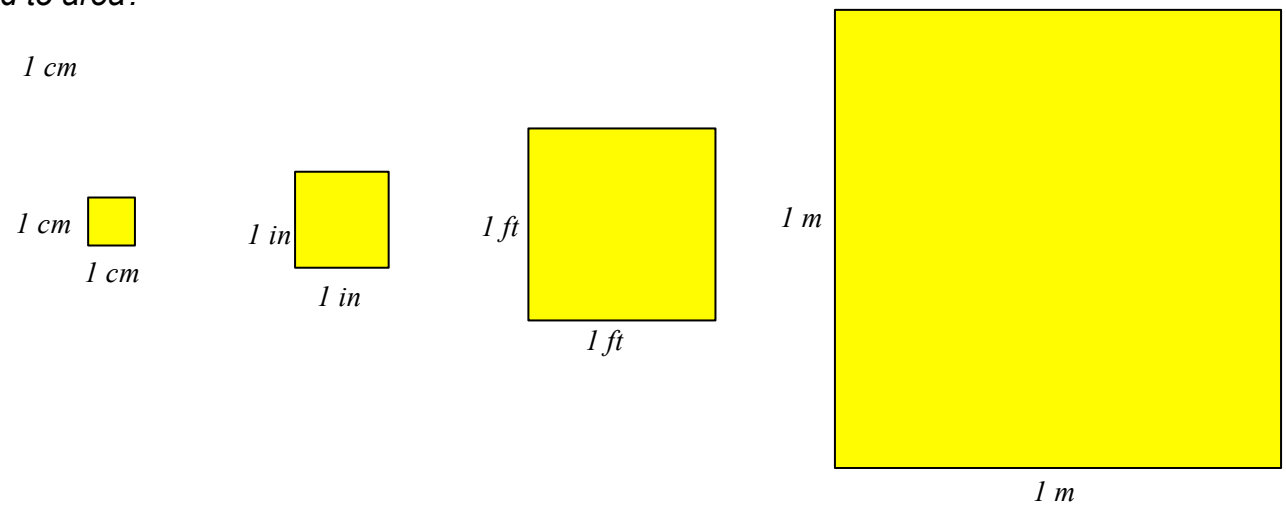
b. *A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.*

STANDARDS FOR MATHEMATICAL PRACTICE

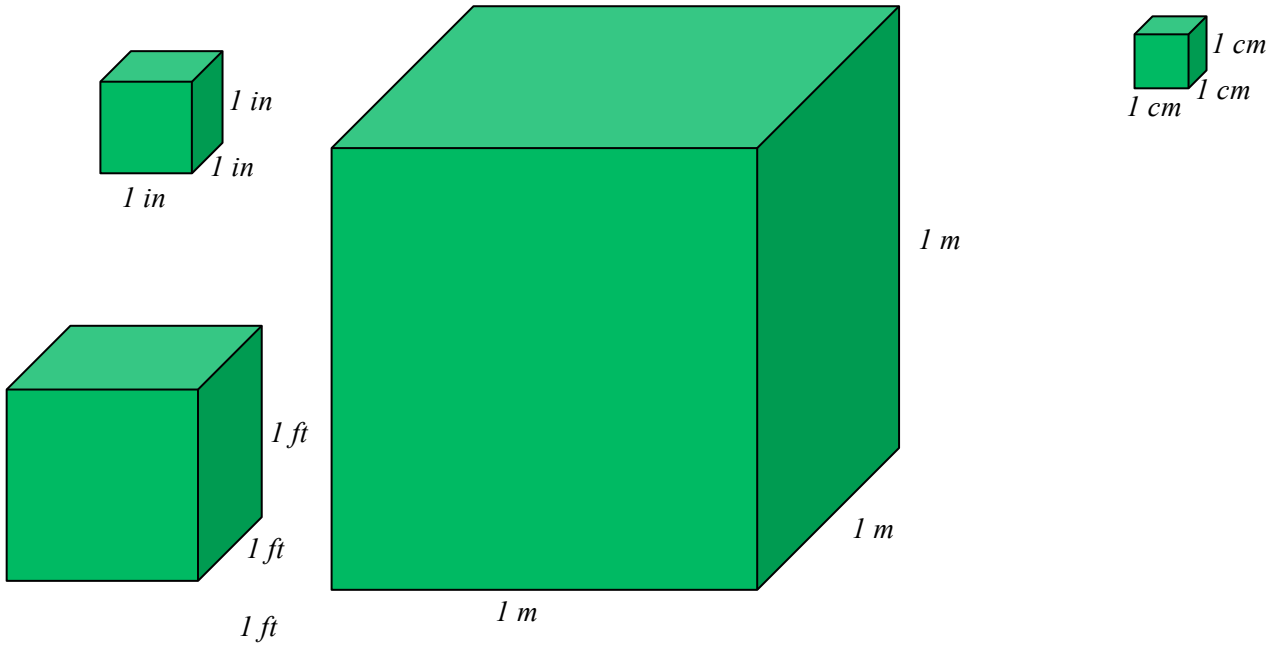
SMP 1. Make sense of problems and persevere in solving them. SMP 2. Reason abstractly and quantitatively.
SMP 3. Construct viable arguments and critique the reasoning of others.
SMP 4. Model with mathematics.
SMP 5. Use appropriate tools strategically.
SMP 6. Attend to precision.
SMP 7. Look for and make use of structure.
SMP 8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students should realize that the square units represent 2-dimensional objects and have both length and width. If students are having difficulty determining how to create these, have a class discussion about the word "square." What comes to mind? How do you think this word might be related to area?



Students should also realize that the cubic units represent 3-dimensional objects and have length, width, and height. If students are having difficulty determining how to create these, have a class discussion about the words "cube" and "cubic." What comes to mind? How do you think these words might be related to volume?



Note: The figures above are not drawn to scale.

Common Misconceptions:

Some students may think the term "square" refers only to the geometric figure with equal length sides. They will need to understand that area of any rectangle is measured in square units. The same idea may be present in "cubic units". Students may think it only has to do with the geometric solid "cube". They need to understand that "cubic units" are used to measure any rectangular prism.

ESSENTIAL QUESTIONS

- *Why is volume represented with cubic units and area represented with square units?*
- *How are area and volume alike and different?*

MATERIALS

- *"Differentiating Area and Volume" student recording sheet*
- *newspaper*
- *construction paper*
- *copy paper*
- *grid paper (cm, in)*
- *scissors*
- *masking tape*
- *rulers*
- *meter sticks*
- *measuring tape*
- *cardstock or poster board*
- *markers*

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Students create a display of square and cubic units in order to compare/contrast the measures of area and volume.

Comments

This is a cooperative learning activity in problem solving. Students are provided with materials, but no initial instruction is given on how to build the models. This task will help give students a tangible model of square units and cubic units.

To open this task, students can discuss in their small groups what they know about area and volume. Key points of a class discussion can be recorded on chart paper.

Students will work in small groups to build models to represent units of area and units of volume. When the groups have completed their projects they will share with the class what they built, what each is called, and how each compares to some of the other models built by other groups.

Task Directions

Students will follow the directions below from the "Differentiating Area and Volume" student recording sheet.

Create a display for area and volume by creating the following models.
Use newspaper, construction paper, copy paper, grid paper, scissors, masking tape, meter sticks, markers and/or cardboard to build the models.

- *Area models – 1 cm^2, 4 cm^2, 1 in^2, 4 in^2, 1 ft^2*
- *Volume models – 1 cm^3, 8 cm^3, 1 in^3, 8 in^3, 1 ft^3*

At the end of the work period, each group will share their completed models and explain what has been built, what each is called, and how your models compare with some of the other models built by the other groups.

Individually, answer the following questions:

- *How are area and volume alike?*
- *How are area and volume different?*
- *Why is area labeled with square units?*
- *Why is volume labeled with cubic units?*
- *Think about your home – bedroom, kitchen, bathroom, living room.*
  - *What would you measure in square units? Why?*
  - *What would you measure in cubic units? Why?*

FORMATIVE ASSESSMENT QUESTIONS

- *What does cm^2 mean? cm^3? How do you know?*
- *What does in^2 mean? in^3? How do you know?*
- *What does ft^2 mean? ft^3? How do you know?*
- *What objects in everyday life could you use to represent cm^2? cm^3? in^2? in^3? ft^2? ft^3?*
- *How can you create a shape that represents 4 cm^2? What length would you use? How do you know?*
- *How can you create a shape that represents 8 cm^3? What length would you use? How do you know?*

DIFFERENTIATION

Extension

- *Ask students to describe the relationship between 4 cm^2 and 8 cm^3 as well as 9 cm^2 and 27 cm^3. Then have students generate other pairs of numbers that have the same relationship. What do they notice? (Students may use 1 cm cubes placed on a 4 cm^2 or 9 cm^2 square to determine the dimensions of a cube built on the square.)*

Intervention

- *Allow students to create at least some of the figures using a word processing or a drawing computer program. This will allow students to easily create right angles, equal side lengths, and cubes with equal edge lengths.*
- *Students may benefit from using 1" square tiles, 1" cubes, and similar 1 cm materials to create some of these models, especially 4 cm^2, 4 in^2, 8 cm^3, and 8 in^3.*

*Name*_____*Date* _____

Differentiating Area and Volume

Create a display for area and volume by creating the following models. Use newspaper, construction paper, copy paper, grid paper, scissors, masking tape, meter sticks, markers and/or cardboard to build the models.

- Area models – 1 cm^2, 4 cm^2, 1 in^2, 4 in^2, 1 ft^2
- Volume models – 1 cm^3, 8 cm^3, 1 in^3, 8 in^3, 1 ft^3

At the end of the work period, each group will share their completed models and explain what has been built, what each is called, and how your models compare with some of the other models built by the other groups.

Individually, answer the following questions:

1. How are area and volume alike?

2. How are area and volume different?

3. Why is area labeled with square units?

4. Why is volume labeled with cubic units?

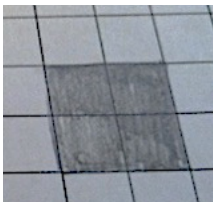
5. Think about your home – bedroom, kitchen, bathroom, living room. What would you measure in square units? Why?

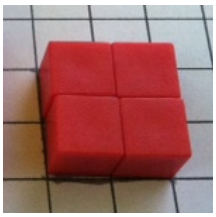
What would you measure in cubic units? Why?

Objective: Explore volume by building with and counting unit cubes.

Concept Development (34 minutes)

Materials: (T) 20 centimeter cubes (S) Ruler, 20 centimeter cubes, centimeter grid paper (Template 1), isometric dot paper (Template 2)





Problem 1: Build a solid from cubes.

T: Shade a square on your centimeter grid paper with an area of 4 square units. (Pause to allow students to do this.)

T: This is going to be the foundation for our structure. Place 4 cubes directly on top of that square.

S: (Do so.)

T: Think of the first 4 cubes as the ground floor of a building. Make a second floor by putting another 4 cubes on top of them. (Pause.) How many cubes are there now?

S: 8 cubes.

T: Did we change the ground floor? Why or why not? Turn and talk.

S: No. We just built on top of it. → The second layer of cubes doesn't make it take up more space on the ground. → We built up, not out, so the structure got taller, not longer or wider.

T: Put one more layer of 4. (Pause.) Explain to your partner how you know the total number of cubes.

S: I just counted up from 8 as I put each cube. → Each floor had 4 blocks, so it's 3 fours. → I thought of 3 times 4, 12.

T: What is the total number of cubes in your solid?

S: 12 cubes.

Problem 2: Build solids with a given volume with cubic centimeters.

T: Since this is a cube with each edge measuring 1 centimeter, we call this a **cubic centimeter**.

T: (Hold up a centimeter cube.) These cubes can serve as a unit to measure the **volume** of your solid, the amount of space it takes up. What do we call this unit?

S: A cubic centimeter.

T: Just like we use squares to measure area in square units, we use cubes to measure volume in cubic units. (Write *cubic unit, cubic centimeter,* and cm^3 on the board.)

T: (Hold up 2 cubes.) How many cubes?

S: 2 cubes.

T: How many cubic centimeters?

S: 2 cubic centimeters.

T: (Hold up 4 cubes in a square formation.)

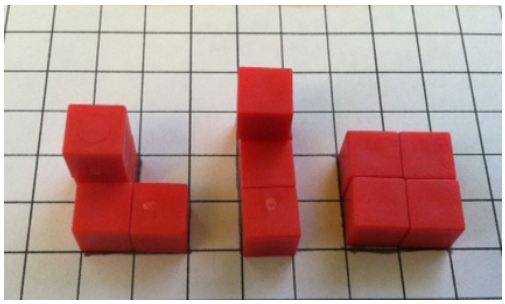
T: What is the volume of these 4 units together?

S: 4 cubic centimeters.

T: Work with a partner. On your grid paper, build three different solids with a volume of 4 cubic centimeters.

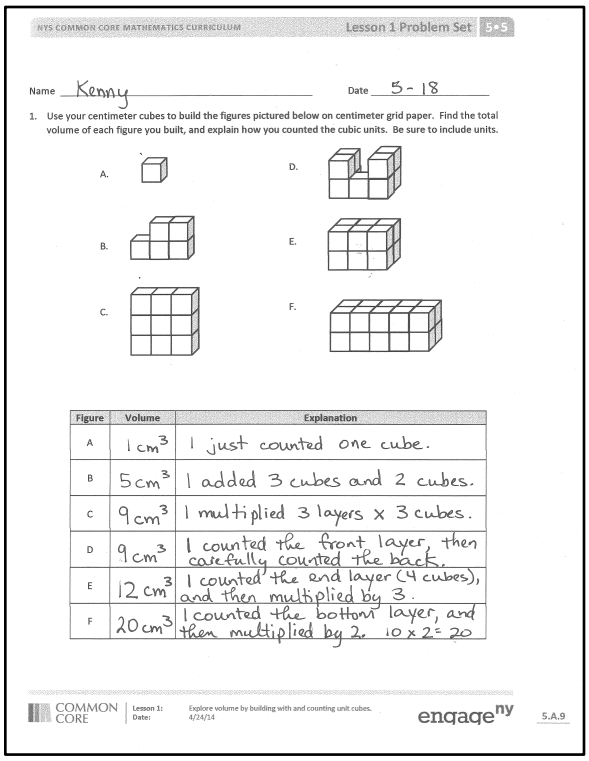
Give the students time to build the structures. Move on to do likewise with five and then six cubes as time allows. As you circulate, encourage students to use the words *volume* and *cubic centimeters* as you ask questions.

Possible Solutions



Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. Some problems do not specify a method for solving. This is an intentional reduction of scaffolding that invokes MP.5, Use Appropriate Tools Strategically. Students should solve these problems using the RDW approach used for Application Problems.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 1 Problem Set 5•5

Name Kenny Date 5-18

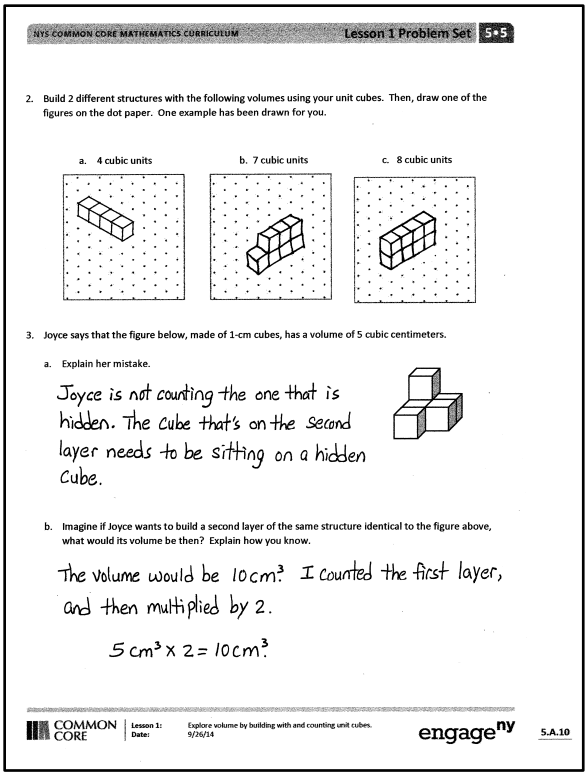
1. Use your centimeter cubes to build the figures pictured below on centimeter grid paper. Find the total volume of each figure you built, and explain how you counted the cubic units. Be sure to include units.

A. B. C. D. E. F.

Figure	Volume	Explanation
A	1 cm^3	I just counted one cube.
B	5 cm^3	I added 3 cubes and 2 cubes.
C	9 cm^3	I multiplied 3 layers x 3 cubes.
D	9 cm^3	I counted the front layer, then carefully counted the back.
E	12 cm^3	I counted the end layer (4 cubes), and then multiplied by 3.
F	20 cm^3	I counted the bottom layer, and then multiplied by 2. 10 x 2 = 20

COMMON CORE Lesson 1: Explore volume by building with and counting unit cubes. Date: 4/24/14 engage^ny 5.A.9

For some classes, it may be appropriate to modify the assignment by specifying which problems students should work on first. With this option, let the purposeful sequencing of the Problem Set guide the selections so that problems continue to be scaffolded. Balance word problems with other problem types to ensure a range of practice. Consider assigning incomplete problems for homework or at another time during the day.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 1 Problem Set 5•5

2. Build 2 different structures with the following volumes using your unit cubes. Then, draw one of the figures on the dot paper. One example has been drawn for you.

a. 4 cubic units b. 7 cubic units c. 8 cubic units

3. Joyce says that the figure below, made of 1-cm cubes, has a volume of 5 cubic centimeters.

a. Explain her mistake.

Joyce is not counting the one that is hidden. The cube that's on the second layer needs to be sitting on a hidden cube.

b. Imagine if Joyce wants to build a second layer of the same structure identical to the figure above, what would its volume be then? Explain how you know.

The volume would be $10 cm^3$. I counted the first layer, and then multiplied by 2.

$5 cm^3 \times 2 = 10 cm^3$

COMMON CORE Lesson 1: Explore volume by building with and counting unit cubes. Date: 9/26/14 engage^ny 5.A.10

Student Debrief (10 minutes)

Lesson Objective: Explore volume by building with and counting unit cubes.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- In Problem 1, compare your answers for Figures C and D. What patterns do you notice?
- Compare your answers to Problem 2 with a partner. How were your drawings the same? Different?
- What was Joyce's mistake in Problem 3? What do you need to think about when counting cubic centimeters in drawings? How is it different from counting them in person? Is it possible for a drawing to fool you? Might some cubes be hidden, or might there be gaps that you cannot see?

Exit Ticket (3 minutes)

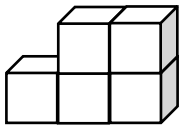
After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Name _____ Date _____

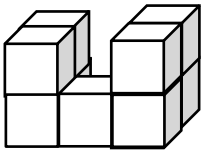
1. Use your centimeter cubes to build the figures pictured below on centimeter grid paper. Find the total volume of each figure you built, and explain how you counted the cubic units. Be sure to include units.

A.

B.



C.



D.

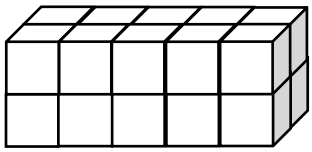
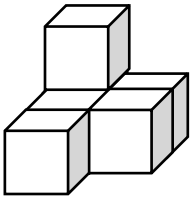


Figure	Volume	Explanation
A		
B		
C		
D		

3. Joyce says that the figure below, made of 1 cm cubes, has a volume of 5 cubic centimeters.

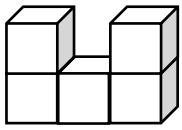
a. Explain her mistake.

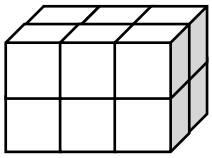


b. Imagine if Joyce wants to build a second layer of the same structure identical to the figure above. What would its volume be then? Explain how you know.

Name _____ Date _____

1. What is the volume of the figures pictured below?

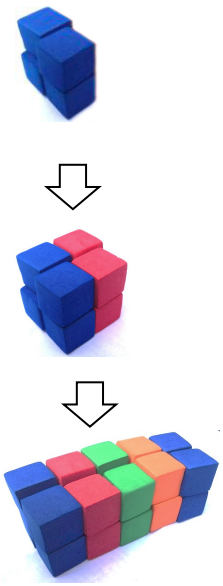
a. 

b. 

centimeter grid paper

Objective: Compose and decompose right rectangular prisms using layers.

Concept Development (32 minutes)



Materials: (T) 27 centimeter cubes (S) 27 centimeter cubes, rectangular prism recording sheet (Template)

T: Build this with your own cubes. (Show 4 cubes in a square formation stacked vertically—2 layers with 2 cubes in each layer.)

T: What's the volume of this rectangular prism?

S: 4 cubic centimeters.

T: Let's add layers horizontally. Add another layer *next* to the first one.

S: (Work.)

T: What is the volume?

S: 8 cubic centimeters.

T: Add 3 more layers next to the first two. (Pause for students to do this.)

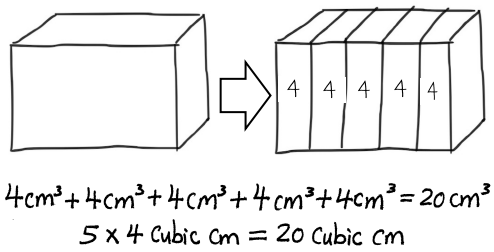
T: What is the volume now?

S: 20 cubic centimeters.

T: How did you figure that out? Turn and talk.

S: I added the first 8 to the 12 more that I added. → I saw 5 along the bottom, and there were 2 layers going back, so that makes 10, and 2 layers going up makes 20. → I knew that I had 27 cubes to start, and I only have 7 left.

T: (Project a blank rectangular prism from the recording sheet, or draw one on the board.) Let's record how we built the layers. Use the first rectangle in the row of your recording sheet.



T: How many layers did we build in all?

S: 5.

T: Let's show that by partitioning the prism into 5 layers. Partition the prism vertically into 5 equal sections.) Make your prism look like mine. How many cubes were in each layer?

S: 4 cubes.

T: Record that on each layer that we drew. (Write a 4 on each of the vertical layers.) Write a number sentence that expresses the volume of this prism using these layers. Turn and talk.

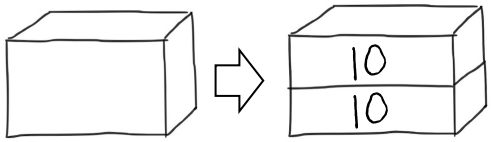
S: We could write 4 cm^3 + 4 cm^3 + 4 cm^3 + 4 cm^3 + 4 cm^3 = 20 cm^3. → Since all the layers are the same, we could write 5 × 4 cubic cm = 20 cubic cm.

Number of Layers	Cubes in Each Layer	Volume
5	4	20 cm^3
2	10	20 cm^3
2	10	20 cm^3

T: (Draw the table on the board.) I'll record that in a table. Now, imagine that we could partition this prism into layers like a cake, like our ice cube trays. What might that look like? Work with your partner to show the layers on the next prism in the row, and tell how many cubes would be in each. Use your cubes to help you.

MP.

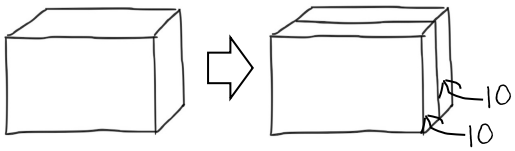
S: The prism is 2 units high, so we could cut the prism in half horizontally from left to right. That would be 10 cubes in each one. → We could make a top layer of 10 cubes and a bottom layer of 10 cubes.



$10 cm^3 + 10 cm^3 = 20 cm^3$
2 × 10 cubic cm = 20 cubic cm

T: Let's record your thinking. (Draw the figure to the right.) Write a number sentence that expresses the volume of the prism using these layers.

S: 10 cm^3 + 10 cm^3 = 20 cm^3.
→ 2 × 10 cubic cm = 20 cubic cm.



$10 cm^3 + 10 cm^3 = 20 cm^3$
2 × 10 cubic cm = 20 cubic cm

T: Let's record that information in our table. (Record.) Work with your partner to find one last way that we can partition this prism into layers. Use the third prism on your recording sheet to label the layers, and write the number of cubes in each layer. Then, write a number sentence to explain your thinking.

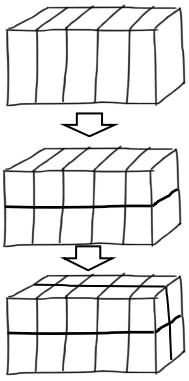
S: (Work to draw the third figure and write the number sentences.)

T: I'll record this last bit of information in our table. (Record.)

T: Now, let's draw the different layers together. Use the last prism in the row of your recording sheet.

Step 1: Draw vertical lines to show the 5 layers of 4 cubes each that remind us of bread slices. (Point to table's first line.)

Step 2: Draw a horizontal line to show the two layers of 10 cubes each that remind us of layers of cake. (Point to table's second line.)



Step 3: Draw both a horizontal and a vertical line to show the front and back layers of 10 each. (Point to table's last line.)

T: What is the volume of the prism?

S: 20 cubic centimeters.

T: Build a prism with a partner that has one 3 cube by 3 cube layer. (Demonstrate building this with cubes.)

T: What is the volume?

S: 9 cubic centimeters.

T: Add another layer of cubes on top.

T: What is the volume now? How do you know?

S: It's 18 cubic centimeters because now, we have 2 groups of 9 cubic centimeters. → Two layers with 9 cubes each is 18 cubic centimeters.

T: Now, add another layer. What is the volume?

S: 27 cubic centimeters.

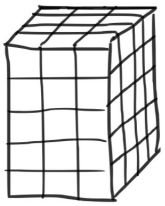
T: What is the overall shape of your rectangular prism?

S: A cube!

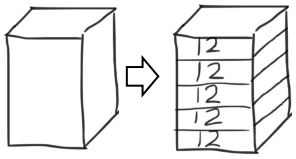
T: Use the set of cubes on your recording sheet to show the three ways of layering using the same system we just did with our 2 by 2 by 5 rectangular prism.

S: (Work.)

T: (Project or draw an image of a 3 × 4 × 5 rectangular prism. Direct students to the set of vertical prisms on the rectangular prism recording sheet.) Imagine what the bottom layer of this prism would look like. Describe it to your partner, and then build it.



S: There would be 3 rows with 4 cubes in each row. → There would be 12 cubes in all. It would be 3 cubes wide and 4 cubes long and 1 cube high. → This would be like a 4 by 3 rectangle, but it is 1 centimeter tall. (Build.)



T: Here's the same prism but without the unit cubes drawn. How might we represent the bottom layer on this picture? Use your recording sheet, and talk to your partner.

$12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 = 60\text{ cm}^3$

5 × 12 cubic cm = 60 cubic cm

S: We could draw a horizontal slice toward the bottom and label it with 12. → I can see in the drawing that there are 5 layers in all, so I'll need to make the bottom about 1 fifth of the prism and put 12 on it.

T: What is the volume of the single layer?

S: 12 cubic centimeters.

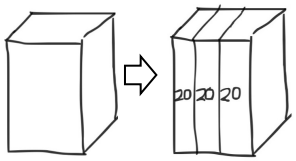
T: What is the volume of the prism with 5 of these layers?

S: I know there are 5 layers that are the same, so 12 cm^3 + 12 cm^3 + 12 cm^3 + 12 cm^3 + 12 cm^3, so 60 cm^3. → It's 5 × 12 cubic cm, so 60 cubic cm.

T: What other ways could we partition this prism into layers? Turn and talk, and then draw a picture of your thinking on the recording sheet.

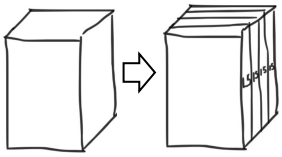
S: (Draw.)

Possible Solutions



$20cm^3 + 20cm^3 + 20cm^3 = 60cm^3$

3 x 20 cubic cm = 60 cubic cm

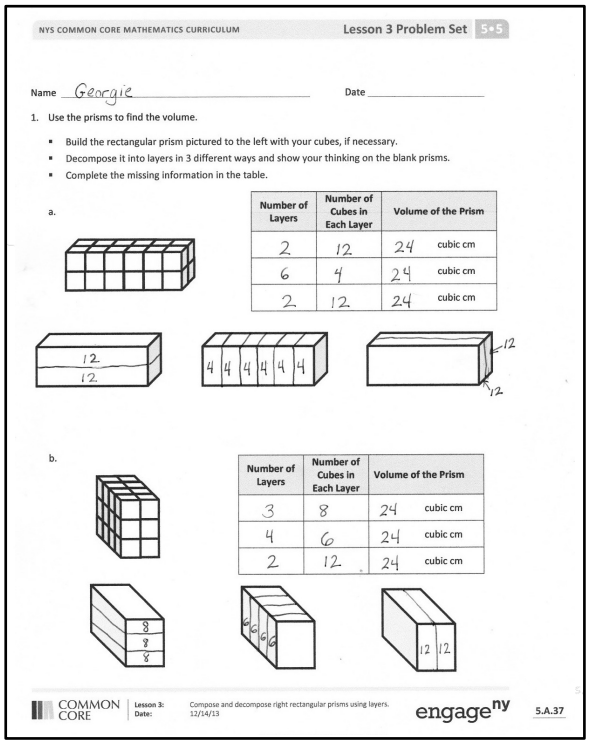


$15cm^3 + 15cm^3 + 15cm^3 + 15cm^3 = 60cm^3$

4 x 15 cubic cm = 60 cubic cm

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 3 Problem Set 5•5

Name Georgie Date

1. Use the prisms to find the volume.

- Build the rectangular prism pictured to the left with your cubes, if necessary.
- Decompose it into layers in 3 different ways and show your thinking on the blank prisms.
- Complete the missing information in the table.

a.

Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
2	12	24 cubic cm
6	4	24 cubic cm
2	12	24 cubic cm

b.

Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
3	8	24 cubic cm
4	6	24 cubic cm
2	12	24 cubic cm

COMMON CORE Lesson 3: Compose and decompose right rectangular prisms using layers. Date: 12/14/13 engage^ny 5.A.37

Student Debrief (10 minutes)

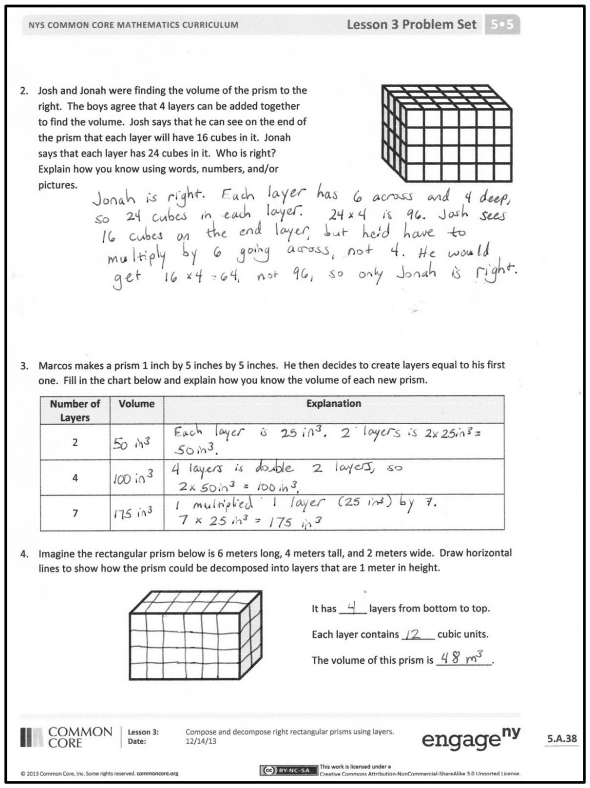
Lesson Objective: Compose and decompose right rectangular prisms using layers.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- In Problem 1, how did you decide how to go about decomposing the prisms? Is there a different way or order in which you could have done it?
- Problem 4 uses meters instead of centimeters. What, if anything, did that change in how you drew your picture? How about in how you figured out the volume?
- What was Josh having a hard time visualizing in Problem 2? Which layers are easier for you to visualize? Which are the hardest? How can you make the hardest layers easier to see?
- At what point did you not need to model with the physical cubes anymore?
- How did the Application Problem connect to today's lesson? How are stacks of ice trays different from the prisms in the lesson?



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 3 Problem Set 5•5

2. Josh and Jonah were finding the volume of the prism to the right. The boys agree that 4 layers can be added together to find the volume. Josh says that he can see on the end of the prism that each layer will have 16 cubes in it. Jonah says that each layer has 24 cubes in it. Who is right? Explain how you know using words, numbers, and/or pictures.

Jonah is right. Each layer has 6 across and 4 deep, so 24 cubes in each layer. 24 x 4 is 96. Josh sees 16 cubes on the end layer, but he'd have to multiply by 6 going across, not 4. He would get 16 x 4 = 64, not 96, so only Jonah is right.

3. Marcos makes a prism 1 inch by 5 inches by 5 inches. He then decides to create layers equal to his first one. Fill in the chart below and explain how you know the volume of each new prism.

Number of Layers	Volume	Explanation
2	50 in^3	Each layer is 25 in^3. 2 layers is 2 x 25 in^3 = 50 in^3.
4	100 in^3	4 layers is double 2 layers, so 2 x 50 in^3 = 100 in^3.
7	175 in^3	1 multiplied 1 layer (25 in^3) by 7. 7 x 25 in^3 = 175 in^3

4. Imagine the rectangular prism below is 6 meters long, 4 meters tall, and 2 meters wide. Draw horizontal lines to show how the prism could be decomposed into layers that are 1 meter in height.

It has 4 layers from bottom to top.

Each layer contains 12 cubic units.

The volume of this prism is 48 m^3.

COMMON CORE Lesson 3: Compose and decompose right rectangular prisms using layers. Date: 12/14/13 engage^ny 5.A.38

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Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

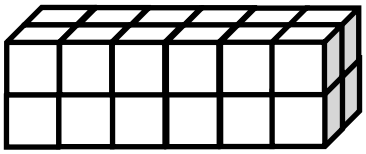
Name _____ Date _____

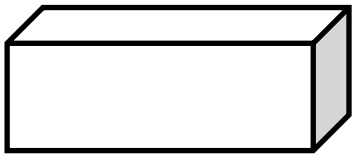
1. Use the prisms to find the volume.

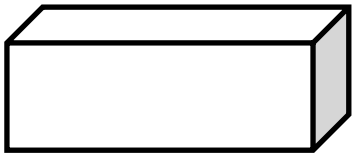
- Build the rectangular prism pictured below to the left with your cubes, if necessary.
- Decompose it into layers in three different ways, and show your thinking on the blank prisms.
- Complete the missing information in the table.

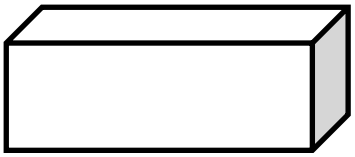
a.

Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
		cubic cm
		cubic cm
		cubic cm

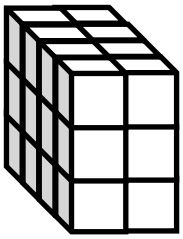




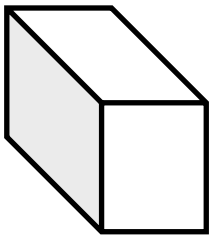


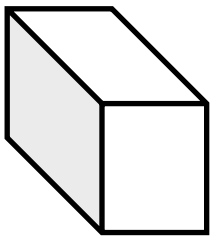


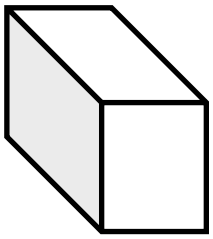
b.



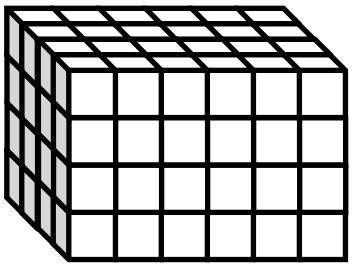
Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
		cubic cm
		cubic cm
		cubic cm







2. Josh and Jonah were finding the volume of the prism to the right. The boys agree that 4 layers can be added together to find the volume. Josh says that he can see on the end of the prism that each layer will have 16 cubes in it. Jonah says that each layer has 24 cubes in it. Who is right? Explain how you know using words, numbers, and/or pictures.



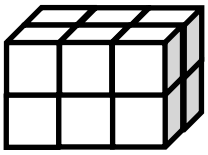
Name _____ Date _____

1. Use unit cubes to build the figure to the right and fill in the missing information.

   Number of layers: _____

   Number of cubes in each layer: _____

   Volume: _____ cubic centimeters

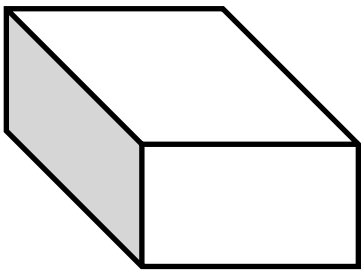


2. This prism measures 3 units by 4 units by 2 units. Draw the layers as indicated.

   Number of layers: 4

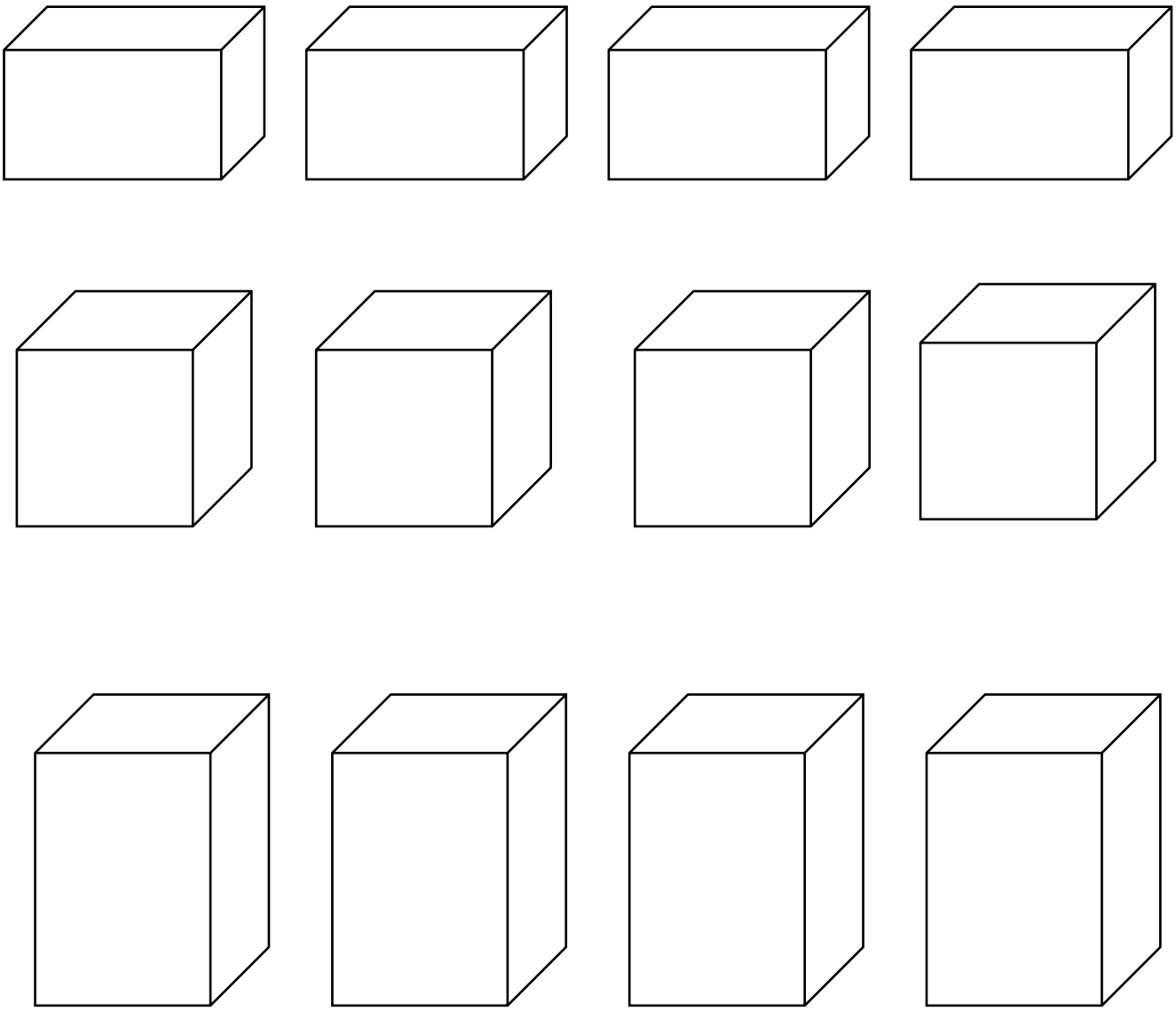
   Number of cubic units in each layer: 6

   Volume: _____ cubic centimeters



Name _____ Date _____

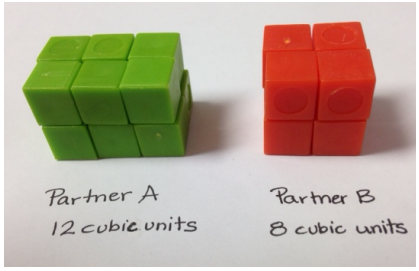
Use these rectangular prisms to record the layers that you count.



rectangular prism recording sheet

Objective: Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

Concept Development (30 minutes)



Materials: (T) Drawing of rectangular prism figures
(S) 15 centimeter cubes, dot paper

Problem 1

Build and combine structures, and then find the total volume.

T: Partner A, use one color cube to build a structure that is 3 cm by 2 cm by 2 cm. Partner B, use a different color to build a cube that is 2 cm long on every side. Record the volume of your structures.

S: (Work.)

T: Keeping their original dimensions, how could you combine the two structures you've built? Turn and talk. Then, find the volume of your new structure.

S: We could put the cube on top of the rectangular prism. → We could put them beside each other on the end. → We could make an L. → The volume is 20 cubic units.

T: Now, build a different structure using the two prisms, and find the volume.

S: (Work.)

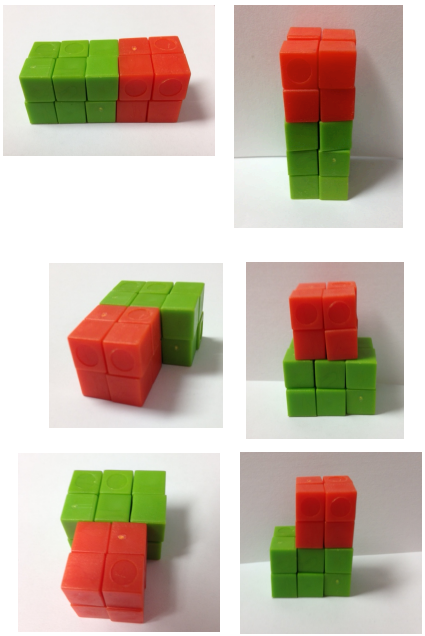
T: How did you find the volume of your new structures?

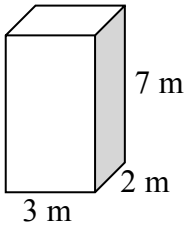
S: We counted all the blocks. → We knew that one was 12 cubic units and the other one was 8. We just added that together to get 20 cubic units.

T: When you built the second structure, did the volume change? Why or why not?

S: It did not change the volume. There were still 20 cubic units. → It doesn't matter how we stacked the two prisms together. The volume of each one is the same every time, and the volume of the whole thing is still 20 cubic units. → The total volume is always going to be the volume of the red structure plus the volume of the green structure, no matter how we stack them.

Possible Combinations





Problem 2

T: (Project or draw on the board the 3 m × 2 m × 7 m prism on the right.) What is the volume of this prism?

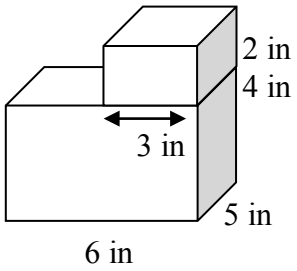
S: 42 m^3.

T: Imagine another prism identical to this one. If we glued them

together to make a bigger prism, how could we find the volume? Turn and talk. Then, find the volume.

S: We already know that the volume of the first one is 42 m^3. We could just add another 42 m^3 to it. That would be 84 m^3. → We could multiply 42 by 2 since they are just alike. That's 84 m^3.

Problem 3



T: (Project or draw on the board the composite structure.) How is this drawing different from the last one?

S: There are two different size boxes this time. → The little box on top only has measurements on the length and the height.

T: There are a lot of markings on this figure. We'll need to be careful that we use the right ones when we find the volume. Find the volume of the bottom box.

S: (Work to find 120 cubic inches.)

T: What about the one on the top? I heard someone say that there isn't a width measurement on the drawing. How will we find the volume? Turn and talk.

S: The boxes match up exactly in the drawing on the width. That means the width of the top box is the same as the bottom one, so it's still 5 inches wide. → You can tell the top and bottom box are the same width, so just multiply 3 × 5 × 2.

T: What is the volume of the top box?

S: 30 cubic inches.

T: How could we find the total volume?

S: Add the two together.

T: Say the number sentence with the units.

S: 120 cubic inches + 30 cubic inches = 150 cubic inches.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- What advice would you give to a friend who was having trouble picturing the dimensions on a composite figure? What helps you to figure out missing dimensions?
- If all students use an addition strategy to find the total volume of the figures, suggest to them the alternate strategy of subtracting the missing part.

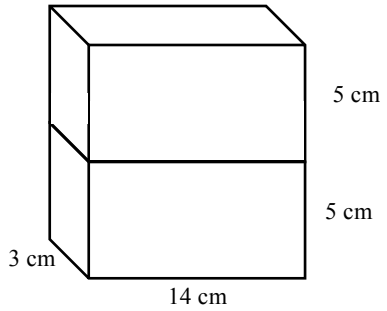
Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Name _____ Date _____

1. Find the total volume of the figures, and record your solution strategy.

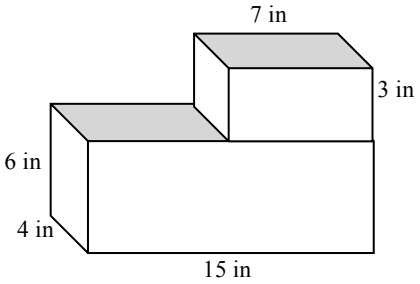
a.



Volume: _____

Solution Strategy:

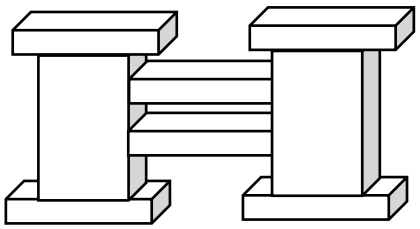
b.



Volume: _____

Solution Strategy:

2. A sculpture (pictured below) is made of two sizes of rectangular prisms. One size measures 13 in by 8 in by 2 in. The other size measures 9 in by 8 in by 18 in. What is the total volume of the sculpture?

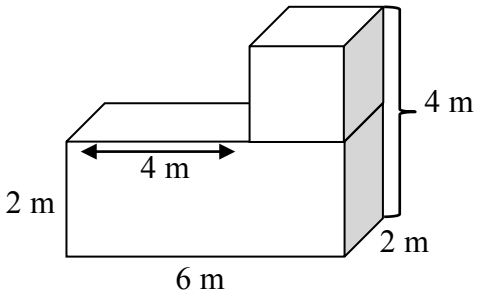


Objective: Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

Concept Development (30 minutes)

Materials: (T) Drawing of rectangular prism figures
(S) 15 centimeter cubes, dot paper

Problem 4



T: (Project or draw the figure given on the right.) Compare this figure to yesterday's figures.

S: There are two different boxes again. → There's a little one and a big one, like last time. → This time, there's a bracket on the height of both boxes. → There's no length or width or height measurement on the top box this time.

T: If there are no measurements on the top box alone, how might we still calculate the volume? Turn and talk.

S: We can tell the length of the top box by looking at the 6 meters along the bottom. The other box has 4 meters sticking out on the top of the box. That means the box must be 2 meters long. → The length is 6 minus 4. That's 2. → The width is easy. It's the same as the bottom box, so that's 2 meters. → The height of both boxes is 4 meters. If the bottom box is 2 meters, then the top box must also be 2 meters.

T: What is the volume of the top prism? Say the number sentence.

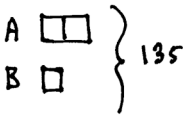
S: 2 m × 2 m × 2 m = 8 cubic meters.

T: What is the volume of the bottom prism? Say the number sentence.

S: 6 m × 2 m × 2 m = 24 cubic meters.

T: What's the total volume of both? Say the number sentence.

S: 8 cubic meters + 24 cubic meters = 32 cubic meters.



3 units = 135
1 unit = $\frac{135}{3}$ = 45

Prism A's volume is 2 x 45 cm^3 = 90 cm^3.
Prism B's volume is 45 cm^3.

Problem 5

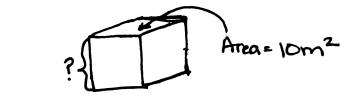
Two rectangular prisms have a combined volume of 135 cubic meters. Prism A has double the volume of Prism B.

a. What is the volume of each prism?

b. If one face of Prism A has an area of 10 square meters, what is its height?

T: Let's use a tape diagram to help us with this problem. Read it with me.

T/S: (Read.)



90 = 10 × ___

$\frac{90}{10}$ = 9

Prism A is 9 meters high.

T: What can we draw from the first sentence?

S: A tape diagram for each prism. → Two tape diagrams labeled Prism A's volume and Prism B's volume. → A bracket on both to show they are 135 cubic meters total. → Their total volume is 135 cubic meters.

T: What does the next sentence tell us, and how can we represent it?

S: Prism A is double the volume of Prism B. → We need 2 units for Prism A. → Prism A's tape should be twice as long as Prism B's.

T: Show that in your diagram. What is the volume of each prism?

S: Prism A is 90 cubic meters, and Prism B is 45 cubic meters.

T: To find the height of Prism A, what do we need to think about? Turn and talk, and then solve.

S: We know the area of one face. If we multiply the area by something, we should get the volume of 90 m^3. The area is 10 m^2, and 10 times 9 is 90. It is 9 meters tall. → We can divide 90 by 10 and get 9 meters tall.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- Compare your approach to solving Problem 2 with that of the person sitting next to you. How is your thinking alike? How is it different?
- Is a shorter container always a smaller volume? Give some examples of prisms to support your answer.

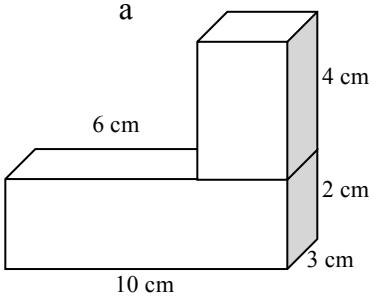
Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

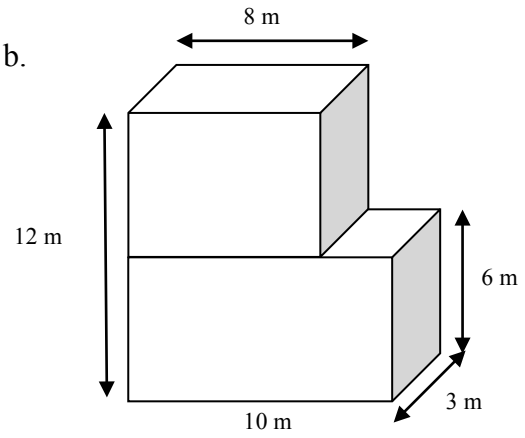
Name _____ Date _____

1. Find the total volume of the figures, and record your solution strategy.

a



b.



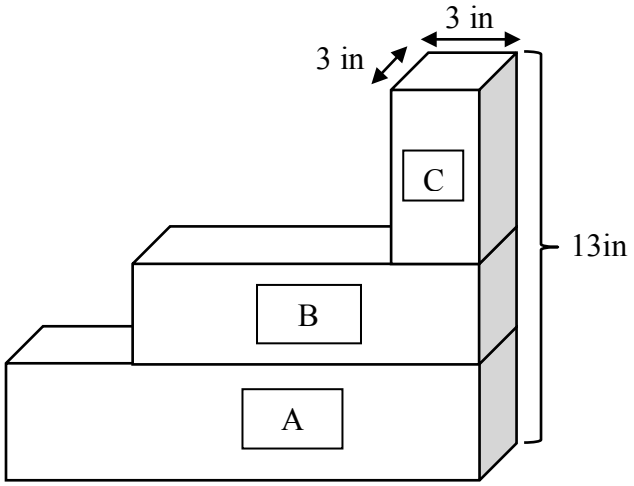
Volume: _____
Solution Strategy:

Volume: _____
Solution Strategy:

2.The combined volume of two identical cubes is 128 cubic centimeters. What is the side length of each cube?

Name _____ Date _____

Find the total volume of soil in the three planters. Planter A is 14 inches by 3 inches by 4 inches. Planter B is 9 inches by 3 inches by 3 inches.



Fifth Grade Unit 6 Lesson 12	
LESSON FOCUS	**Converting Metric Units of Measure**
MATERIALS	Textbook, recording sheet, problem set
LAUNCH	Be an Expert Give students a recording sheet or explain another way they need to display the information. 1. Say, "Today you are going to become an expert with converting units of measure." 2. Say, "You can use the glossary in your text book, pages 640, 646 and 652 of your textbook, or the internet to help you complete the conversion chart." 3. Students work with their partner or small groups to research and complete the conversion chart/recording sheet. 4. Students fill in the conversion chart/recording sheet.
EXPLORE	Problem set: choose appropriate problems from attached sheet After 5 minutes PTT have students partner talk. They are explaining what they did, and why it makes sense. After each partner is able to share, have them compare work looking for similarities and differences
SUMMARIZE	Refocus students at meeting area in circle. Display student work from problems selected, and ask following: What do you understand about _____ work, how does it make sense? Or Explain how you used the conversion recording sheet to help you solve this problem, and how it makes sense.

Metric Units of Measure Problem Solving

1. Every morning John runs 1500m on his treadmill. How many kilometers does he run in one week?

2. If you make 2.5kg of popcorn and eat 1250g of it while watching a movie. How much popcorn do you have left?

3. A fifth grade class was selling lemonade to raise money for a field trip. They had 8 liters of lemonade to sell. They were selling cups with 200ml of lemonade for 75 cents. If they sold all of the lemonade, how much money would they make?

4. Evan is 142cm tall. Tyler is 1240mm tall. Who is taller? How much taller?

5. The common earthworm has an average length of 25cm. The giant gippsland earthworm from Australia has an average length of 3m. What is the length of the giant gippsland earthworm in centimeters and millimeter.

6. Adam plants a tree in his backyard. The plant measured 2.37 meters high. How tall is that in centimeters(cm), in millimeters (mm), in kilometers (km)?

7. You are filling a 2-liter bottle with liquid from a full 80-millimeter container. How many containers will it take to fill the 2-liter bottle?

8. Terri is buying juice. He needs 3 liters. A half liter of juice cost $2.39. A 250-milliliter container of juice cost $1.69. What should Terri buy so she gets the 3 liters at the lowest price. Explain your thinking.

9. Judi is making a recipe for pasta with vegetables and herbs. The recipe calls for 130 grams vegetables, twice as much pasta as vegetables, and ¼ as much herbs as vegetables. What is the total mass of the meal?

10. Marcia walked 1 2/3 kilometers on Friday. On Saturday, she walked 4.23 kilometers. On Sunday, she walked 2398 meters. How far did Marcia walk over the 3 days in meters, kilometers?

Name _____ Date _____

Metric Units of Measure Length

1 centimeter (cm) = _____ millimeters (mm)

1 meter (m) = _____ cm = _____ mm

1 kilometer (km) = _____ m = _____ cm = _____ mm

Mass (weight) 1 gram (g) = _____ milligrams (mg)

1 kilogram (kg) = _____ g = _____ mg

Liquid Volume 1 liter (l) = _____ milliliters (ml)

Name _____ Date _____

Metric Units of Measure Length

1 centimeter (cm) = _____ millimeters (mm)

1 meter (m) = _____ cm = _____ mm

1 kilometer (km) = _____ m = _____ cm = _____ mm

Mass (weight) 1 gram (g) = _____ milligrams (mg)

1 kilogram (kg) = _____ g = _____ mg

Liquid Volume 1 liter (l) = _____ milliliters (ml)

Fifth Grade Unit 6 Lesson 13	
LESSON FOCUS	**Converting Customary Units of Measure**
MATERIALS	Textbook, recording sheet, problem set
LAUNCH	Be an Expert Give students a recording sheet or explain another way they need to display the information. 1. Say, "Today you are going to become an expert with converting units of measure." 2. Say, "You can use the glossary in your text book, pages 658, 664 and 670 of your textbook, or the internet to help you complete the conversion chart." 3. Students work with their partner or small groups to research and complete the conversion chart/recording sheet. 4. Students fill in the conversion chart/recording sheet.
EXPLORE	Problem set: choose appropriate problems from attached sheet After 5 minutes PTT have students partner talk. They are explaining what they did, and why it makes sense. After each partner is able to share, have them compare work looking for similarities and differences
SUMMARIZE	Refocus students at meeting area in circle. Display student work from problems selected, and ask following: What do you understand about _____ work, how does it make sense? Or Explain how you used the conversion recording sheet to help you solve this problem, and how it makes sense.

Customary Units of Measure Problem Solving

1. A marathon is a running race that is about 26 miles long. How many yards is a marathon? How many feet is a marathon?

2. The Statue of Liberty is 151 feet tall and weighs 450,000 pounds. How many inches tall is it? How many tons does it weigh?

3. There are two popular large dog breeds from Germany, rottweilers and German shephards. A grown rottweiler weighs an average of 120 pounds. A grown German shephard weighs an average of 1280 ounces. Which breed weighs more and how much more?

4. Most years are 365 days. About how many days old are you? About how many hours old are you?

5. Ellen has a 50 gallon fish tank. She needs to fill it with water. She only has a 2 quart bucket to use to fill it. How many times will she need to fill the bucket in order to fill the fish tank?

6. Four friends each took a different route walking home. Rowan walked 150 yds., Janelle walked 429 ft 8 in., Domingo walked 130 yds. 4 ft., and Lydia walked 460 ft. Who walked the farthest, how much further did they walk than the shorted distance? Write the distance Domingo walked in feet and in inches.

7. The class aquarium holds 2 gallons of water. How many cups is this? How many ounces?

8. Callie bought 2 gallons of juice for $2.58 per gallon. She sold the juice in 1-cup servings for $0.75 each. Each serving is 1/16 gallon. How much more did she get for the selling the juice than she paid for it? Tell me how you found your answer.

9. What would be the most appropriate unit to measure the combined weight of 4 horses?

10. The world's heaviest lobster weighed 44 pounds 6 ounces. How many ounces did the lobster weigh?

Name _____ Date _____

Customary Units of Measure Length

1 foot (ft) = _____ inches (in.) 1 yard (yd) = _____ ft = _____ in.

1 mile (mi) = _____ yd = _____ ft = _____ in.

Mass (weight) 1 pound (lb) = _____ ounces (oz)

1 ton (t) = _____ lb = _____ oz

Liquid Volume 1 pint (pt) = _____ cups (c)

1 quart (qt) = _____ pt = _____ c

1 gallon (gal) = _____ qt = _____ pt = _____ c

Time 1 minute (min.) = _____ seconds (sec.) 1 hour (hr.) =
_____ min. = _____ sec.

1 day = _____ hr. = _____ min. = _____ sec.

Fifth Grade Unit 6 Lesson 15	
LESSON FOCUS	**Measurement Problems**
MATERIALS	Problem Set
LAUNCH/EXPLORE	Problem set: choose an appropriate problem from attached sheet After 5 minutes of Private Think Time have students partner talk. They are explaining what they did, and why it makes sense. After each partner is able to share, have them compare work looking for similarities and differences
SUMMARIZE	Refocus students at meeting area in circle. Display student work from problems selected, and ask following: What do you understand about _____ work, how does it make sense? Or Explain how you used the conversion recording sheet to help you solve this problem, and how it makes sense.

Measurement Problems

1. Every morning John runs 1500m on his treadmill. How many kilometers does he run in one week?

2. If you make 2.5kg of popcorn and eat 1250g of it while watching a movie. How much popcorn do you have left?

3. A marathon is a running race that is about 26 miles long. How many yards is a marathon? How many feet is a marathon?

4. The Statue of Liberty is 151 feet tall and weighs 450,000 pounds. How many inches tall is it? How many tons does it weigh?

5. A fifth grade class was selling lemonade to raise money for a field trip. They had 8 liters of lemonade to sell. They were selling cups with 200ml of lemonade for 75 cents. If they sold all of the lemonade, how much money would they make?

6. There are two popular large dog breeds from Germany, rottweilers and German shephards. A grown rottweiler weighs an average of 120 pounds. A grown German shephard weighs an average of 1280 ounces. Which breed weighs more and how much more?

7. Evan is 142cm tall. Tyler is 1240mm tall. Who is taller? How much taller?

8. Most years are 365 days. About how many days old are you? About how many hours old are you?

9. Ellen has a 50 gallon fish tank. She needs to fill it with water. She only has a 2 quart bucket to use to fill it. How many times will she need to fill the bucket in order to fill the fish tank?

10. The common earthworm has an average length of 25cm. The giant gippsland earthworm from Australia has an average length of 3m. What is the length of the giant gippsland earthworm in centimeters and millimeters?

Practice Task - Survival Badge

In this activity, students will create line plots to evenly distribute a supply of water for a scout troop.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.MD.2 *Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.*

STANDARDS FOR MATHEMATICAL PRACTICE

SMP 1. Make sense of problems and persevere in solving
SMP 2. Reason abstractly and quantitatively.
SMP 4. Use appropriate tools strategically.
SMP 6. Attend to precision.
SMP 7. Look for and make use of structure.
SMP 8. Look for and express regularity in repeated reasoning.

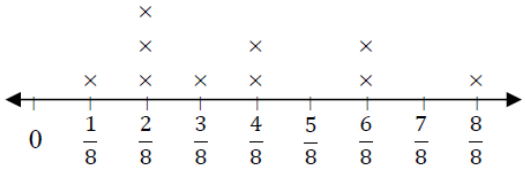
BACKGROUND KNOWLEDGE

One example of using line plots to solve real world problems might be illustrated in the following scenario. Given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were equal.

This standard provides a context for students to work with fractions by measuring objects to one-eighth of a unit. This includes length, mass, and liquid volume. Students are making a line plot of this data and then adding and subtracting fractions based on data in the line plot.

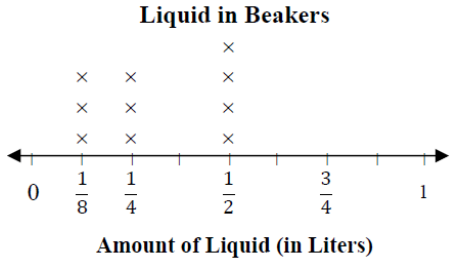
Example:

*Students measured objects in their desk to the nearest $^1/_2$, $^1/_4$, or $^1/_8$ of an inch then displayed data collected on a line plot. How many objects measured $^1/_4$? $^1/_2$? If you put all the objects together end to end what would be the total length of **all** the objects?*



Example:

Ten beakers, measured in liters, are filled with a liquid.



The line plot above shows the amount of liquid in liters in 10 beakers. If the liquid is redistributed equally, how much liquid would each beaker have? (This amount is the mean.)

Students apply their understanding of operations with fractions. They use either addition and/or multiplication to determine the total number of liters in the beakers. Then the sum of the liters is shared evenly among the ten beakers.

COMMON MISCONCEPTIONS

Students may not understand that in order to share the items equally, you must first find the total number of items. This portion of the standard gives them a visual model and becomes the background for finding the mean in grade 6.

ESSENTIAL QUESTIONS

- *How can we use a line plot to show fractional parts of a whole?*
- *How can the information on the line plot be used to re-distribute the items equally?*

MATERIALS

- *Graph paper*
- *"Survival Badge" recording sheet - 2 versions are included: 1 that includes mixed numbers and 1 that only has fractions*

GROUPING

Pairs/small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

This task provides students with the opportunity to explore using information in a table to create a line plot. They will use the line plot to re-distribute the supply of water so that the same amount is in each canteen.

TASK

A Boy Scout Troop is working on a badge for survival. In order to earn the badge, they must decide how to use their available water supply equally. The water is in 12 canteens with varying amounts in each canteen. Students will use the data in the table to construct a line plot showing the various amounts of water in the canteens. Then they will re-distribute the water so that each canteen holds the same amount of water.

FORMATIVE ASSESSMENT QUESTIONS

- *How can you show the various amounts of water in each canteen?*
- *How did you share the water equally?*
- *How do you know the amounts in the canteens are equal?*

DIFFERENTIATION:

Extension

- *Students can add additional canteens to their line plots and re-distribute the water again.*

Intervention

- *Students could use linking cubes to model the line plot and physically move them for re- distribution.*

TECHNOLOGY

http://illuminations.nctm.org/LessonDetail.aspx?ID=L520 In this lesson, one of a multi-part unit from Illuminations, students conduct a survey based on a food court theme and then create pictographs and line plots.

*Name*_____*Date*_____

Survival Badge

The 132nd Troop Boy Scouts were on a wilderness adventure to earn one of their survival badges. The 12 boys in the troop were only given pocket knives and water canteens. Each canteen could hold 3 cups of water but only one of them was full. As part of their survival training the boys recognized that they needed to divide the water evenly amongst the troop.

Below is a table containing the amount of water that each canteen was holding.

Canteen	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Amount of Water in Cups	2 ¼	2 ¾	2 ¼	2 ¾	2 ¼	2 ½	2 ½	2 ¾	3	2	2 ½	2 ½

1. *Create a line plot to represent the data.*

2. *If the boys shared the water evenly amongst the 12 canteens, how much water would each boy get in their canteen? Explain your thinking.*

Name_____Date_____

Survival Badge

The 132nd Troop Boy Scouts were on a wilderness adventure to earn one of their survival badges. The 12 boys in the troop were only given pocket knives and water canteens. Each canteen could hold water but only one of them was full. As part of their survival training the boys recognized that they needed to divide the water evenly amongst the troop.

The table below contains how full each canteen was full.

Canteen	1	2	3	4	5	6	7	8	9	10	11	12
How much of the canteen was full	¼	¾	¼	¾	¼	½	½	¾	full	empty	½	½

2. *Create a line plot to represent the data.*

3. *If the boys shared the water evenly amongst the 12 canteens, how would each canteen be after sharing? Explain your thinking.*