Unit 3 : Volume and Measurement

Content Area: **Mathematics**
Course(s): **Math - Grade 5**
Time Period: **3rd Marking Period**
Length: **4-6 Weeks**
Status: **Published**

Unit Overview

Students will recognize volume as an attribute of solid figures and understand concepts of volume measurement.

Students will learn to convert like measurement units within the customary and metric systems and how to represent and interpret data using a line plot.

Benchmarks:

At the end of Unit 1, students compelted the second benchmark assessment (LinkIt Form B SGO) covering all units. Use these scores to determine previous knowledge of volume and measurement, and identify strengths and weaknesses within the unit.

Transfer

Students will be able to independently use their learning to solve real world multi-step problems involving unit conversions. Students will also be able to apply their ability to interpret and create line plots when solving real world word problems.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand...

- How to convert among different-sized standard measurement units.
- Represent and interpret data.

Essential Questions

Students will keep considering...

- How can I use measurement conversions to solve real-world problems?

Application of Knowledge and Skill

Students will know...

Students will know...

- How to convert between different units of measurements.
- How to create and interpret a line plot

Students will be skilled at...

Students will be skilled at...

- Measuring objects length, height, and capacity in the customary unit of measurement.
- Converting among different-sized standard measurement units within the customary and metric systems.
- Creating and interpreting line plots to display a data set of measuremts in fractions of a unit.
- Redistributing data from a line plot into equal groups.

Academic Vocabulary

capacity

centimeter (cm)

convert

cup (c)

customary system

fair share

fluid ounce (fl oz)

foot (ft)

gallon (gal)

gram (g)

inch (in.)

kilogram (kg)

kilometer (km)

length

liter (L)

mass

meter (m)

metric system

mile (mi)

milligram (mg)

milliliter (mL)

ounce (oz)

pint (pt)

pound (lb)

quart (qt)

ton (T)

weight

yard (yd)

LEARNING GOAL 1: Volume

Students will be able to independently use their learning to...

Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

MyMath chapter 12 lessons 6-11

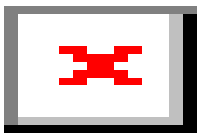
Daily Targets: Three-Dimensional Figures and Volume

SWBAT:

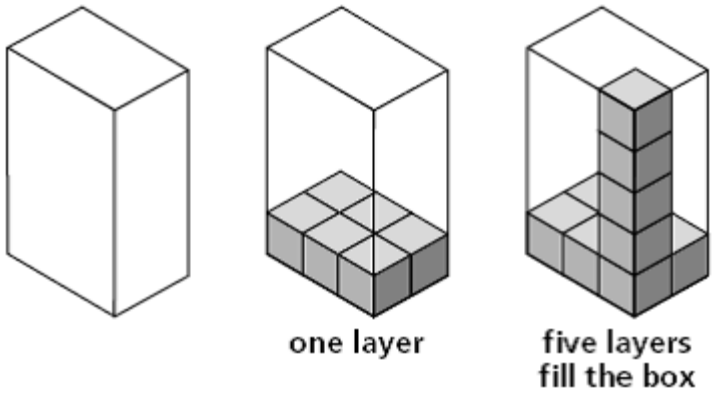
- Build nets and explore and describe properties of three-dimensional figures. **(Chapter 12, Lessons 6-7) (DOK 3)**
- Use models and formulas to find the volume of rectangular prisms. **(Chapter 12, Lessons 8-9) (DOK 2)**
- Use models to build composite figures and find the volume of composite figures by relating volume to the operations of multiplication and addition. **(Chapter 12, Lesson 11) (DOK 3)**
- Solve real-world problems by making a model. **(Chapter 12, Lesson 12/ "Power Up!" resource for practice state testing problems) (DOK 4)**

Examples:

1. Find the volume using the formula below.



2. How many units in a 1000 cube?



(3 x 2) represented by first layer

(3 x 2) x 5 represented by number of

3 x 2 layers

(3 x 2) + (3 x 2) + (3 x 2) + (3 x 2)+ (3 x 2) = 6 + 6 + 6 + 6 + 6 + 6 = 30

6 representing the size/area of one layer

MA.5.MD.C	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
MA.5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
MA.5.MD.C.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and non-standard units.
MA.5.MD.C.5	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
MA.5.MD.C.3a	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.
MA.5.MD.C.3b	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.
MA.5.MD.C.5a	Find the volume of a right rectangular prism with 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. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
MA.5.MD.C.5b	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ 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.
MA.5.MD.C.5c	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.

LEARNING GOAL 2- Measurements

The students will be able to convert like measurement units within a given measurement system.

Daily Targets- Customary System

SWBAT:

- Measure length to the nearest half inch and quarter inch. **(Chapter 11, Lesson 1) (DOK 2)**
- Convert measurements of length within the customary system. **(Chapter 11, Lesson 2) (DOK 3)**
- Solve problems by using logical reasoning. **(Chapter 11, Lesson 3/ "Power Up" resource) (DOK 4)**
- Estimate the weight of objects and use a balance to measure the weight of objects. Convert measurements of weight within the customary system. **(Chapter 11, Lessons 4-5) (DOK 3)**
- Estimate and measure the capacity of liquids. Convert measurements of capacity within the customary system. **(Chapter 11, Lessons 6-7) (DOK 3)**

Example:

1. 45 ft = ___ yds; Since 3 feet = 1 yard, and feet are smaller than yards, divide by 3. 45/3=15; Answer:15 yards

2. Three friends each measured their height. Their heights are 4 feet 10 inches, 4 feet 9 inches, and 4 feet 7 inches. Use the clues to determine the height, in inches, of each person. a) Elliot is taller than Jorge. b) Nicole is 3 inches taller than the shortest person. c) Elliot is 57 inches tall. Answer: Nicole is 58 inches tall. elliot is 57 inches tall. Jorge is 55 inches tall.

3. 3 lb = __ oz; Since 16 oz = 1 lb, and a pound is larger than an ounce, multiply by 16. 3 x 16= 48; Answer: 48 ounces

4. 18 pt = __ qt; Since 2 pt = 1 qt, and a pint is smaller than a quart, divide by 2. 18/2= 9; Answer: 9 quarts

MA.5.MD	Measurement and Data
MA.5.MD.A	Convert like measurement units within a given measurement system.
MA.5.MD.A.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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.8	Look for and express regularity in repeated reasoning.
	Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Daily Targets- Metric System

SWBAT:

- Measure the length of objects to the nearest centimeter and millimeter and convert measurements of length within the metric system. **(Chapter 11, Lessons 10) (DOK 2 and 3)**
- Estimate the mass of objects, use a balance to measure the mass of objects, and convert measurements of mass within the metric system. **(Chapter 11, Lessons 11-12) (DOK 3)**
- Convert metric units of capacity within the metric system by using multiplication or by moving the decimal place to the right or left. **(Chapter 11, Lesson 13) (DOK 3)**

Example:

1. 12kg = _____ g ; Since there are 1,000 grams in 1 kilogram, and kilograms are larger than grams, multiply by 1,000. 12 x 1000 = 12,000; Answer = 12,000 g
2. K-H-D-B-d-c-m ; Since kg to g is 3 places to the right, move the decimal point at the end of the 12, 3 places to the right. This leaves 3 empty spaces after the 12. Add zeros in these spaces and you get 12,000. 12 kg = 12000 g

MA.5.MD.A	Convert like measurement units within a given measurement system.
MA.5.MD.A.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.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.6	Attend to precision.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Daily Targets- Line Plots

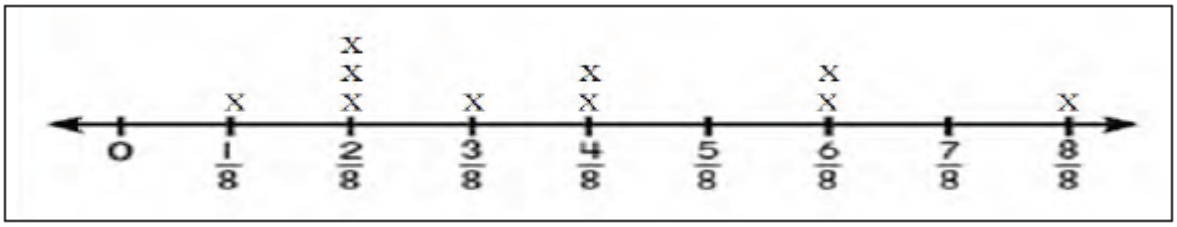
SWBAT:

- Display measurement data in fractions of a unit on a line plot. Solve real world problems. **(Chapter 11, Lesson 8). (DOK 4)**

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.

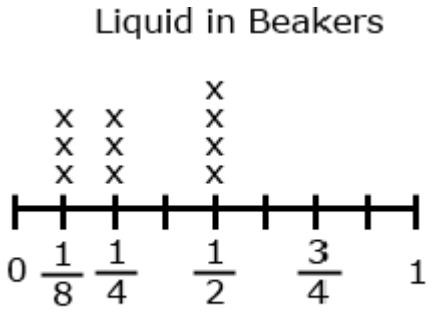
Example:

1. Students measured objects in their desk to the nearest ½, ¼, or 1/8 of an inch then displayed data collected on a line plot. How many object measured ½? ¼? If you put all the objects together end to end what would be the total length of **all** the objects?



Example:

2. 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.

MA.5.MD.B	Represent and interpret data.
MA.5.MD.B.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.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically. For example, 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 redistributed equally. Mathematically proficient students can apply the mathematics they know to solve

problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

Summative Assessment

- Vocabulary Quiz
- Skill Specific Quiz (Conversion or Line Plots)
- My Math Chapter 11 Assessment
- Teacher Created Project(s)
- Rubrics
- Short & Extended Constructed Response
- ALEKS

21st Century Life and Careers

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater

	good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
TECH.8.1.5.A.2	Format a document using a word processing application to enhance text and include graphics, symbols and/or pictures.
TECH.8.1.5.A.CS2	Select and use applications effectively and productively.
TECH.8.1.5.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media
TECH.8.1.5.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.2.5.C.7	Work with peers to redesign an existing product for a different purpose.

Accommodations and Modifications

- IEP modifications
- 504 accomodations
- BSI support
- ELL vocabulary/ word webs
- English Learner Support Interactive Guide/ Tiered Questions: ***Exploring the World By Sea & How***

Big Is the Solar System **Spanish Reader & Real- World Problem Solving Spanish Reader**

- Leveled Readers: ***Exploring the World By Sea & How Big Is the Solar System*** **is available in 3 lexile reader levels**
- Interactive Guide: Scaffolded differentiated activities (emergenging, expanding, bridging levels)
- Leveled learning centers
- Use of manipulatives/ models: **Ruler, balance scale, reference sheet with convesions and formulas, nets, 3-D shapes**
- Performance Tasks
- Reteach lesson pages: **Chapters 11- 12**
- Enrich lesson pages: **Chapters 11- 12**
- Co-teach environment
- Small group instuction
- Various forms of assessments
- Math fact charts: **When necessary**
- Divisibility rule chart: **When necessary**
- Advanced Learners: **Project Based Learning**

Unit Resources

MyMath Grade 5, Vol. 2 Teacher Edition Chapter 11 & 12 and Student Workbook: 2014 McGraw-Hill Education

My Math Online Portal

Google Classroom and Google Apps

http://www.estimation180.com/ This website allows students to estimate various units of measurement.

http://www.101qs.com/3675 Three act lessons- Girl Scout Cookie Lesson is on volume of rectangular prisms.

Math Games App (links to Google Classroom)

- Coherence Map used to enhance student learning
- http://achievethecore.org/coherence-map/#4/17/160/214/1

YouCubed math games and activities

- https://www.youcubed.org/

Proficiency Scale

Unit3 -- Proficiency Scale -- Measurement & Data -- Chapter 11 and 12		
Topic:In this unit, students will learn to convert like measurement units within the customary and represent and interpret data using a line plot.		
Grade: 5 • **(5.MD.A.1) Convert among different-sized standard measurement units within a given measurement system use these conversions in solving multi-step, real world problems.** • **(5.MD.B.2) Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use o to solve problems involving information presented in line plots**		
Score 4	**I can extend my understanding of measurement and line plots to develop my own strategies to solve problems.**	
Score 3 (Learning Goal) What students will be able to do	**Use conversions to solve multi-step word problems.** **Use operations to solve problems involving line plots with data in fractions of a unit.**	
Score 2 What students will know	**I can:** • **convert measurement units within a given measurement system.** • **create a line plot in fraction units**	
Score 1	**I can perform some of the foundational knowledge found in level two with help.**	

Interdisciplinary Connections

The *Exploring the World By Sea* Real-World Problem Solving Reader gives students an opportunity to read informational text and answer mathematical questions relating to the text. Some of the real-world problems in this text related to this unit include: finding the volume of Christopher Columbus' ship, determining the

number of crew members that could fit onto a ship, and finding the area and volume of sails used on drakkars.

The *How Big is the Solar System?* Real-World Problem Solving Reader also gives students an opportunity to read informational text and answer mathematical questions relating to the text. Some of the real-world problems in this text related to this unit include: determining if meters or kilometers would be more approproate for measuring the diameter of Mars, converting the diameter of Jupiter from kilometers to meters, and creating a table to how the distance the Voyager can travel in 2, 3, and 4 hours.

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MA.5.MD.A.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.
MA.5.MD.C	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
MA.5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
MA.5.MD.C.5b	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ 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.
MA.5.MD.C.5c	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.
SCI.5-ESS1	Earth's Place in the Universe
SCI.5-ESS2	Earth's Systems
SOC.6.1.8.B.2.a	Determine factors that impacted emigration, settlement patterns, and regional identities of the colonies.
SOC.6.1.8.B.2.b	Compare and contrast how the search for natural resources resulted in conflict and cooperation among European colonists and Native American groups in the New World.