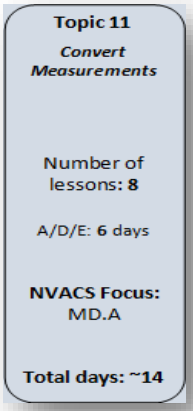
Grade 5 Topic 11: Convert Measurements



5th grade Curriculum Pacing Framework: Balanced Calendar

Big Conceptual Idea: Geometric Measurement (pp. 26-28)

Prior to instruction, view the Topic 11 Professional Development Video located in Pearson Realize online. Read the Teacher Topic Edition (TE): Cluster Overview/Math Background (pp. 631A-631F), the Topic Planner (pp. 631I-631K), all 8 lessons, and the Topic Assessments (pp. 693-694A).

Mathematical Background: Read Topics 11 Cluster Overview/Math Background (TE, p. 631A-631F)	Topic Essential Question: What are customary measurement units and how are they related? What are metric measurement units and how are they related? *Reference Answering the Topic Essential Questions (TE, pp. 691-692) for key elements of answers to the Essential Question.*

The lesson map for this topic is as follows:

11-1	11-2	11-3	11-4	11-5	11-6	11-7	11-8	Assessment

6 A/D/E days used strategically throughout the topic

Instructional Note

Instruction is focused on Nevada Academic Content Standards (NVACS) cluster 5.MD.A; "Convert like measurement units within a given measurement system" (2010). This cluster contains one standard:

- 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.

Topic 11 will also rely on application of understandings built from working with standards 5.MD.A.2, 5.NBT.B.5 and 5.NBT.B.6 (NVACS, 2010).

Topic 11 focuses on converting measurements of length, capacity and mass/weight of the customary system and the metric system. A big idea for this topic is equivalence. Students need to understand that any measure can be represented in multiple ways and have the same value. Students also need to have understanding of the attributes of the units used for measurement. Understanding attributes of measurement units includes knowing that length is used for linear two dimensional measurements, capacity measures three dimensions, mass measures the amount of matter in an object, while weight measures how heavy something is (using Earths gravitational pull). The differences between length, capacity, mass and weight determine how they are used. Confusion around these attributes can prevent students from sense making while converting measurements.

In addition to the attributes, students will also need to know the relative sizes of the units used for measurement within the metric and customary systems. The difference between an inch and a foot is much smaller than the difference when comparing a yard to a mile. Knowing the relative size of each unit is crucial for deciding which units to use and if an answer to a conversion problem is reasonable. Then, to convert units of measurements students will need to choose the appropriate operation, set up the problem and calculate. Read more about how these understandings fit together in Topic 11, refer to Teacher's Edition (pp. 631A-631E) in the *Volume 2 Teacher's Edition* of enVisionmath2.0.

In the *Topic 11 Professional Development video*, Caldwell offers insight on helping students build and apply the multiple understandings required. A question to ask students could be "If you measure something in centimeters and then in meters, which measure will be a greater number?" *(enVision*math2.0). This simple question raises many more possible questions for students and can be used to gauge current understandings about measurement. To begin, students need to know the relative sizes of meters and centimeters. What attributes are meters and centimeters measuring? What does centi- tell us about units in the metric system? How does this relate to place value? Which operation would be appropriate to make this conversion? Many students will want to know why we would measure something in different units. How can we use context to support understanding of this problem?

Estimation is a powerful tool that helps students build conceptual understanding of measurement units and their comparisons. Estimation allows students to focus on the attribute measured while building familiarity with the units. Using estimation also provides intrinsic motivation because students like to see how close they can get to the actual measurement. Estimation is highly recommended as an ongoing activity to promote understanding (Van de Walle, Karp, Lovin, & Bay-Williams, 2014).

Once students have an understanding of the units of measurement and equivalency, they still need to plan and perform calculations to convert the units. Which operations are used? This will be an important question to help students understand early in this topic.

Visual representations are an excellent tool for students to see why and how multiplication and division are used for making measurement conversions. A bar diagram allows students to visually represent the relationship between customary units with differing

conversion rates such as yards, feet, and inches. When working in the metric system, it will benefit students to appreciate the connections between converting metric units and our base-10 place value system. Connecting the prefixes used in the metric system to the base 10 place value system will allow students to apply previously built understandings and strategies to convert metric units.

Topic 11 brings in new mathematical content and requires the transfer and application of previous understandings. If students initially struggle with these concepts, consider spending more time on fewer problems. Taking time to build a classroom chart listing visible benchmarks of measurement units will enhance students' ability to compare units and make sense of conversion problems. Scaffolds such as physical tools, benchmarks, and visual representations will help students build the conceptual understanding of measurement conversions needed to make sense of problems and apply appropriate strategies and methods.

Math Practice 6: Attend to precision

Focus on opportunities for students to develop *Mathematical Practice 6* behaviors as this is the focus of the Math Practices and Problem Solving, lesson 11-8. Reference the Teacher's Edition (TE, pp. F26-F26A) and the NVACS (2010, p. 7). This topic relies heavily on knowledge of unit vocabulary, reference the vocabulary cards found in the *Teachers Edition Volume 2 (pp. 633-638)*.

Essential Academic Vocabulary Use these words consistently during instruction.		
New Academic Vocabulary: (First time explicitly taught)	Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)	
Ton (t)	*foot (ft.)* *inch (in.)* *yard (yd.)* *mile (mi.)* *capacity* *gallon(gal)* *quart (qt)* *pint (pt)* *cup (c)* *fluid ounce (fl. oz)* *weight* *pound (lb.)*	*ounce (oz)* *kilometer (km)* *meter (m)* *centimeter (cm)* *millimeter (mm)* *liter (L)* *milliliter (ml)* *mass* *milligram (mg)* *gram (g)* *kilogram (kg)*

Additional terminology that students may need support with:

Collaborative Team Conversations (CTC)

Consider using ***one*** of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for <u>evidence of mathematical understanding</u>:

Guiding questions: "Do students recognize customary units of measure, the relative sizes and relationships between them? Do students recognize metric units of measure, the relative sizes and relationships between them?
"Are students using multiplication to convert from larger units to smaller units? Are students using division to convert from smaller units to larger units?"

Lesson	Evidence	Look for
Topic 11	*Review What You Know* (student work samples) Items 17 through 21	Focus CTC around the big idea: • understanding of the relative sizes of given units. • understanding that different units are used to measure specific attributes such as length, capacity, and mass.
11-1	*Quick Check* (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".
11-2	*Homework and Practice* (student work samples) Items 19 and 20	Focus CTC around the big idea: • student strategies and models used to convert measurements. • use of the correct operation to convert measurements.
11-4	*Quick Check* (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	*Topic Performance Assessments* SE pp. 691-694	Use *Scoring Guide* TE pp. 691-694A

Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 11-1: Convert Customary Units of Length		
5.MD.A.1 5.NBT.B.5 5.NBT.B.6 MP.2 MP.4 MP.6 MP.8	Access Prior Learning: Students learned about size of customary units of length. Students also converted larger to smaller units using multiplication (4.MD.A.1). Developing the Big Idea: Students extend understanding of converting units of measurement to include converting smaller to larger units. Students build conceptual understanding through expressing relationships of equivalence between units of measurement.	Solve and Share: Students may use vocabulary cards, rulers, yardsticks, or Teaching Tool 17 to answer and support their answer. Expressing relationships between units to show equivalence is an important strategy to draw out. This method will help students throughout Topic 11. The *Look Back!* Introduces the new concept of dividing to convert measurements. How can we determine whether to multiply or divide when converting measurements? Visual Learning: The *Visual Learning Bridge* models both multiplication and division. The video includes reasoning about remainders found when converting units. How can the remainder be represented? (fraction, decimal, etc.). The *Convince Me!* also models representing a remainder. Are students able to generalize about how the sizes of the units can be used to determine whether to multiply or divide when making conversions? Is it more important to pay attention to the numbers ***or*** the sizes of the units to make conversions? Assess and Differentiate: The *Intervention Activity* has students use Teaching Tool 17 or a ruler to manipulate measurements and conceptualize conversion (SE, p. 643A). *CTC: *Quick Check* (digital platform)
Lesson 11-2: Convert Customary Units of Capacity		
5.MD.A.1 5.NBT.B.5 5.NBT.B.6 MP.2 MP.8	Access Prior Learning: Students in 4th grade converted larger to smaller units (4.MD.A.1). In Topic 9, students divided two whole numbers and got a fraction of a mixed number quotient. Developing the Big Idea: Students will multiply and divide to convert customary units of measurements.	Solve and Share: Students use context to make sense of the problem. Would dividing or multiplying be more appropriate to create an equivalent expression? Use the *Look Back!* to facilitate a discussion about why moving to smaller units means larger numbers of the unit are needed. Students may make a connection to creating smaller products when multiplying a fraction. Visual Learning: Converting smaller to larger units and larger to smaller units is shown. The problems model how to convert with a fraction and having a fraction as part of the answer. Students work to create expressions of equivalence on the *Guided and Independent Practice* items. Assess and Differentiate: The *Intervention Activity* assists students to develop conceptual understanding of the relative size of the units (SE, p. 649A). In addition, students also will have the ability to physically move, fill, and remove the containers. The "Toss and Talk" *Center Activity* allows students to practice conversions in a game setting. The 2-star version of the game offers more of a challenge for those students who demonstrate an understanding of converting. *CTC: *Homework and Practice* (student work samples) Items 19 and 20
Lesson 11-3: Convert Customary Units of Weight		
5.MD.A.1 5.NBT.B.5 5.NBT.B.6 MP.4 MP.5 MP.6 MP.8	Access Prior Learning: Students converted customary units by multiplying and dividing in previous lessons. Developing the Big Idea: Students will continue to practice converting customary units.	Solve and Share: Students need to convert a mixed number. Look for a variety of strategies used to model converting the fraction. Are students able to connect these models and written methods to those learned while working with fractions during earlier topics? Are students able to explain how they decided whether to multiply or divide and why their solution is reasonable? Consider focusing on mixed numbers as a review. How else can you represent this number? Visual Learning: The *Visual Learning Bridge* discusses converting a smaller unit to a larger unit. Two whole numbers are being divided but the quotient results in a fraction. A possible student misconception is that the greater number must be divided by the smaller number. Why is this not always true? Can students find different strategies to represent and solve this conversion?
Lesson 11-4: Convert Metric Units of Length		
5.MD.A.1 5.NBT.A.2 MP.2 MP.3	Access Prior Learning: In previous topics, students multiplied and divided by powers of 10. In previous lessons students converted units of measurements.	Solve and Share: The problem asks students to use a ruler and discover patterns between the units of measurements. The *Look Back!* extends the pattern seen in the *Solve and Share*. Can students describe the relationships between these units using mathematical reasoning? How can place value understanding help to solve this problem? *-continues on next page-*

MP.5 MP.7	Developing the Big Idea: Students will multiply and divide to convert metric length measurements.	Visual Learning: The metric system uses different units, yet deciding when to multiply ***versus*** divide still applies. How do the prefixes used in the metric system help to determine size of the units (kilo = thousand)? What connections can be made between metric prefixes and place value? The *Convince Me!* provides an opportunity to analyze mathematical thinking and support a claim. Assess and Differentiate: Students demonstrating understanding will find more challenge moving to problems on the *Math Practices and Problem Solving* (SE, p. 660) or *Homework and Practice* (SE, p. 662). *CTC: *Quick Check* (digital platform)
Lesson 11-5: Convert Metric Units of Capacity		
5.MD.A.1 5.NBT.A.2 MP.2 MP.3 MP.7 MP.8	Access Prior Learning: In previous lessons students converted units of measurements. Developing the Big Idea: Students will convert metric units of capacity.	Solve and Share: Look for different strategies and written methods used to solve this problem. Orchestrate a discussion focusing on specifically selected student strategies. Can students make connections between each of the different strategies and determine if they are appropriate for the given context? The *Look Back!* problem is Partitive division. The number of groups is given, so students need to use strategies to create equal sized groups. Visual Learning: Students think more about how to determine whether to multiply or divide. The movement of the decimal is discussed when multiplying or dividing by powers of 10. The *Convince Me!* asks students to think about relative size of measurements and order from greatest to least. *Independent Practice* items 9-22 focus on use of procedural skills. Problems on the *Math Practices and Problem Solving* instead provide students' opportunity to apply understanding to real world contexts (SE, p. 666). Assess and Differentiate: The *Another Look!* page demonstrates converting metric units using base-ten blocks.
Lesson 11-6: Convert Metric Units of Mass		
5.MD.A.1 5.NBT.A.2 MP.1 MP.2 MP.7	Access Prior Learning: Students converted units of measurement in previous lessons. Developing the Big Idea: Students will convert metric units of mass.	Solve and Share: Look for a range of strategies and written methods. How are students modeling the problem? Can they explain how they determined an appropriate operation? Consider facilitating a discussion allowing students to share and explain their thinking. Visual Learning: Students think more about how to determine whether to multiply or divide. The movement of the decimal is discussed when multiplying or dividing by powers of 10. Assess and Differentiate: The *Reteach* page helps students create a reference chart used to help set up metric conversions and solve problems with metric units of mass. Use *Math Practice and Problem Solving* (SE, p. 672) and *Homework and Practice* page (SE, p. 674) for students who need an additional challenge.
Lesson 11-7: Solve Word Problems Using Measurement Conversions		
5.MD.A.1 5.NBT.B.5 MP.1 MP.2 MP.3 MP.6 MP.8	Access Prior Learning: In grade 3 students solved problems relating to perimeter (3.MD.D.8). Students in previous lessons have converted units of measurements. Securing the Big Idea: Students solve real word problems by converting units of measurements.	Solve and Share: This problem asks students to convert measurements and give the perimeter of a picture frame in inches. Use the *Look Back!* to facilitate a discussion about which measurement students converted. Have students justify their reasoning. Can the problem be solved successfully if students convert to the other measurement? Visual Learning: A very similar problem to the *Solve and Share* is modeled. The *Visual Learning Bridge* guides students through solving the multi-step word problem. Can students determine what they do and do not know and use this knowledge to develop a plan before they solve the multi-step problem? Assess and Differentiate: The problems in this lesson are multi-step word problems, formatted in a similar way to the Smarter Balanced Assessment Performance Task. Consider asking students to complete fewer problems in order to focus on showing and explaining thinking. A separate piece of paper will be needed for students to model the problems and show their strategies.
Lesson 11-8: Math Practices and Problem Solving- Precision		
5.MD.A.1 5.NBT.B.5 MP.1	Access Prior Learning: Students have attended to precision in previous lessons and grade levels. Consider facilitating a discussion about.	Solve and Share: Students use a ruler to measure the frame precisely in millimeters. Students apply knowledge learned in previous lessons to answer the problem. Why it is important to be precise when using mathematical tools? When is it important to be precise? *-continues on next page-*

MP.2 MP.4 MP.6	Securing the Big Idea: Students apply understanding to a real world context.	Visual Learning: The problem extends the discussion about the importance of precision when measuring. The *Visual Learning Bridge* attaches mathematical language to the thinking habits of MP.6. The *Convince Me!* extends students thinking to fix a mistake and solve the given problem more accurately.

References

Common Core State Standards Writing Team. (2012). *Progressions for the Common Core State Standards in Mathematics (draft). K-5, Geometric Measurement.* Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.

Van de Walle, J., Karp, K., Lovin, L., & Bay-Williams, J. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades 6-8. (2nd ed.)*. New York, NY: Pearson.

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