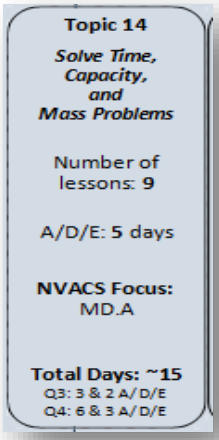
Grade 3 Topic 14: Solve Time, Capacity, and Mass Problems



3rd Grade Curriculum Pacing Framework: Balanced Calendar

Big Conceptual Idea: Measurement and Data (Measurement Part) (pp. 16-18)

Prior to instruction, view the Topic 14 Professional Development Video located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 733A-733F), the Topic Planner (pp.733I-733K), all 9 lessons, and the Topic Assessments (pp. 803-804A).

Mathematical Background: Read Topic 14 Cluster Overview/Math Background (TE, pp. 733A-733F)	Topic Essential Question: How can time, capacity, and mass be measured and found? *Reference Answering the Topic Essential Question (TE, pp. 799-800) for key elements of answers to the Essential Question.*

The lesson map for this topic is as follows:

14-1	14-2	14-3	14-4	14-5	14-6	14-7	14-8	14-9	Assessment

5 A/D/E days used strategically throughout the topic.

Instructional note:

Topic 14's big idea is that some attributes of objects are measureable and can be quantified using unit amounts. In this topic students learn to solve a variety of problems involving measurement of such attributes as time, capacity (liquid volume), and mass. The Measurement Data (Measurement Part) progression document states that working problems with intervals of time, liquid volumes, and masses of objects supports, "the work done in multiplication and the mathematical practices of making sense of problems (SMP 1) and representing them with equations, drawings, or diagrams" (NVACS, 2010, SMP 4).

In Topic 14, students first investigate time by extending the second grade understanding from standard 2.MD.C.7, "Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m." (NVACS, 2010). In third grade students, "Tell and write time to the nearest minute and measure time intervals in minutes and solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram" (NVACS, 2010, 3.MD.A.1). In Topic 14, students will develop this understanding by finding that:

- Time can be measured using seconds, minutes, and hours. Lengths of time can be found by adding or subtracting time intervals.
    - There is more than one way to write and tell time to the nearest minute. We can use analog clocks, digital clocks, words, numbers, and symbols to show and tell time as precisely as possible (TE, p. 740).
    - When solving for elapsed time it is helpful to first count the number of elapsed hours and then the number of elapsed minutes (TE, p. 746). Sometimes the elapsed time is provided and students need to figure out the start or end time.
    - The methods used to solve elapsed time questions are similar to those used to solve for other addition and subtraction problems (TE, p.752).

Another unit of measure that students will be exploring in Topic 14 is capacity. Capacity is the amount a container can hold measured in liquid units. To help students develop benchmark measurements in capacity and to make concepts more concrete, consider providing students with concrete experiences with measuring liquids. In Topic 14 students will be introduced to milliliters and liters as metric units for measuring capacity. Students may need support on the conventions of reading the markings in a 1-liter container or graduated cylinder. Again, consider introducing this with concrete models (e.g., graduated cylinders), if available, before having students read measurements from a pictorial representation. Measurement Data (Measurement Part) progression document states that:

> "Compared to the work in area, volume introduces more complexity, not only in adding a third dimension and thus presenting a significant challenge to students' spatial structuring, but also in the materials whose volumes are measured. These materials may be solid or fluid, so their volumes are generally measured, e.g., "packing" a right rectangular prism with cubic units or "filling" a shape such as a right circular cylinder" (2012, p.19).

Finally, students will be exploring mass as a unit of measurement. Mass is the amount of matter in an object. Metric units for measuring mass include grams and kilograms. In this topic, students will develop understanding that knowing benchmark measurements of mass is helpful in estimating the mass of other objects. Students will also come to realize that one way to measure

the mass of an object is to use a pan balance and metric weights. Please note that the measure of mass is different from weight. Mass is a measurement of the amount of matter something contains, while weight is the measurement of the pull of gravity on an object.

While teaching this topic you may want to consider providing experiences and facilitating discussions that help students to develop benchmark measurements for the different units of measure explored. This is often accomplished by providing concrete learning experiences with the units of measure and comparing new units of measure to known measurements. For example, students that are comfortable with the size of a measuring cup can visually see how many milliliters are equivalent to the cup and then decide what others amounts would be appropriate to measure with milliliters. As much as possible, experiences with the following materials are recommended to facilitate students developing benchmark measurements:

- Pan balance
- Metric weights
- Gram weights
- Kilogram weights
- 1-Liter bottle
- Large bowls
- Eye dropper or pipette
- Gallon container
- Graduated cylinder
- 1-Liter beaker

Focus Math Practice 2: Reason abstractly and quantitatively

The Nevada Academic Content Standards state that, "Mathematically proficient students make sense of quantities and their relationships in problem situations. 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" (NVACS, 2010, SMP 2). Focus on opportunities for students to develop Mathematical Practice 2 behaviors throughout the entire topic, as this is the focus of the Math Practices and Problem Solving lesson 14-9. Resources to support students' development of MP. 2 include the Teacher's Edition (pp. F22 - F22A) and the Nevada Academic Content Standards for Mathematical Practice.

Looking ahead to the Topic Performance Assessment, students need select an appropriate units of measure and be able to use a number line to represent elapsed time.

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)
time interval volume capacity (liquid volume) millimeter liter mass gram kilogram	*estimate* *analog clock* *minute hand* *hour hand* *elapsed time* *A.M.* *P.M.*

Additional terminology that students may need support with: *clock face, nearest, past, volume, abbreviations*

*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 evidence of mathematical understanding:

Guiding questions: "Are students able to determine the elapsed time?"
"Are students able to use their knowledge of operations to solve real world mass and liquid volume problems?

Lesson	Evidence	Look for
14-2	*Quick Check* (digital platform)	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources". • students understand time as a measurement (elapsed time).
14-8	*Solve & Share* (student work samples)	Focus CTC around the big idea: • student strategies and models. • use of operational knowledge to solve mass and/or liquid volume problems

Learning Cycle Assessments (summative)	*Topic Assessments* SE pp. 799-804	Use *Scoring Guide* TE pp. 799-804A

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

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 14-1: Time to the Minute		
3.MD.A.1 MP.3 MP.4 MP.5 MP.6	Access Prior Learning: In Topic 8, Grade 2, students learned to tell time to the nearest 5 minutes. In Topic 2, Grade 3, students learned about patterns with 5 as a factor. Developing the Big Idea: Students are further *developing* time concepts by applying their knowledge of counting by 5s and 1s to tell time to the nearest minute.	Topic Opener: Introduce the *Topic Essential Question*, "How can time, capacity, and mass be measured and found?". Consider using this question to begin a class anchor chart to which new ideas can be added each day. This allows students to see the development of their own thinking and ideas and make new connections with the content of this topic. Consider having students complete the *Review What You Know* prior to beginning instruction on Topic 14 so that you can respond to students' instructional needs using the *Item Analysis for Diagnosis and Intervention* (TE, p. 734). Consider introducing vocabulary terms as they are encountered in the lessons rather than introducing all terms at the beginning of the topic. Solve & Share: Consider having tools readily available for students to use such as clocks or Teaching Tool 20. Watch for students who struggle to begin the *Solve & Share*. Ask students what the tic marks on the clock represent to help them connect to the work they did in 2nd grade. Consider having students share their solution methods and reasoning that match the samples provided. Both Jasmin & Timothy's work correctly marks the minutes; however, only Jasmin's work accurately notes where the hour hand would be for the given time. Showing both of these solution methods provides the opportunity to discuss movement of the hour hand. Consider wrapping up the whole class discussion by asking students how they can tell time to the nearest minute. The *Visual Learning Animation* can then be used to confirm, clarify or correct students' ideas. Visual Learning: Consider pausing and discussing after it poses the question, "Why is an analog clock a good tool for showing time to the nearest minute?" Use tools to have students show time in different ways. For example, contrasting the difference between digital and analog time. Assess and Differentiate: If time permits, teach students how to play *Display the Digit* (TE, p. 743A). All students should have the opportunity to play this game. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 743A).

Lesson 14-2: Units of Time- Measure Elapsed Time		
3.MD.A.1 MP.1 MP.2 MP.3	Access Prior Learning: In Topic 14, Grade 2, students learned about elapsed time. In Topic 8, Grade 2, students were introduced to the abbreviations A.M and P.M. In the previous lesson, students learned to tell time to the nearest minute. Developing the Big Idea: Students further *develop* time concepts by finding elapsed time in 1-hour and 5-minute intervals.	Solve & Share: Consider having blank clock faces available (Teaching Tool 20). After introducing the *Solve & Share*, consider asking the questions provided in *Build Understanding* to ensure all students are problem solving with the same constraints of the problem. Look Back: After students have shared their solution methods and reasoning, consider discussing the *Look Back!* prompt to build students' estimation skills with time. Visual Learning: Consider pausing the *Visual Learning Animation* to discuss the questions, "How can you find elapsed time?" and "How long did the walk last?" Convince Me: Consider discussing the *Convince Me!* prompt to confront confusion that often occurs regarding A.M. and P.M times with elapsed time. Independent Practice/Math Practices and Problem Solving: Consider assigning item 12 to provide distributed practice of "Put Together/Addend Unknown" (see page 88 of NVACS, 2010 for more information of problem types) problem type and algebraic reasoning. Assess and Differentiate: If time permits, teach students how to play *Clip and Cover* (TE, p. 749A). All students should have the opportunity to play this game. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 749A). *CTC: *Quick Check* (digital platform)
Lesson 14-3: Units of Time- Solve Word Problems		
3.MD.A.1 MP.1 MP.2 MP.3 MP.4	Access Prior Learning: In previous lessons, students told time to the nearest minute and measured elapsed time. Developing the Big Idea: Students are further *developing* time concepts by solving problems that involve addition and subtraction of time intervals and using the number line or bar diagram to model the math.	Instructional note: Students should be allowed to choose whether they would like to model the addition or subtraction of the time intervals with a bar diagram or a number line. However, while students work on the *Solve & Share*, they should be allowed to solve with any model/method they choose. Solve & Share: After introducing the *Solve & Share*, consider asking the questions provided in *Build Understanding* to ensure all students are problem solving with the same constraints of the problem. Independent Practice/Math Practices and Problem Solving: Consider discussing item 8 to provide students distributed practice with representing whole numbers as fractions and the opportunity to reinforce fractional number sense development. Assess and Differentiate: If time permits, you consider replacing the *Problem Solving Reading Mat* with the games *Display the Digit* (TE, p. 743A), *Clip and Cover* (TE, p. 749A), or the *Fluency Practice Activity* (TE, p. 793). Child watch to identify students who need additional support and pull them in a small group to do the *Intervention Activity* (TE, p. 755A).
Lesson 14-4: Estimate Liquid Volume		
3.MD.A.2 MP.1 MP.2 MP.4 MP.6 MP.8	Access Prior Learning: In Topic 8, Grade 3, students learned to estimate sums and differences. Developing the Big Idea: Students further *develop* an understanding of estimation and units of measurement by developing benchmarks to estimate capacity (liquid volume).	Instructional note: A 1-liter bottle and large bowls are necessary for the *Solve & Share* to help students develop benchmark measurements. If available, consider also having a gallon container to address ideas introduced in the *Visual Learning Animation*. Consider reading the *Coherence* section for more suggestions on developing benchmark measurements of milliliters (TE, p. 757A). Solve & Share: After introducing the *Solve & Share,* consider asking the questions provided in *Build Understanding* to ensure all students are problem solving with the same constraints of the problem. *-continues on next page-*

		Look Back: After students have shared their solution methods and reasoning, consider discussing the *Look Back!* prompt. Visual Learning: Consider discussing the ideas provided in the *Prevent Misconceptions* section (TE, p. 758) during the *Visual Learning Animation*. Convince Me: To support students' development of MP. 2 consider discussing the *Convince Me!* prompt. Independent Practice/Math Practices and Problem Solving: Consider discussing item 18 to help students develop familiarity with liters (L) and milliliters (mL) to be able to select the appropriate unit of measure for the items listed. Assess and Differentiate: If time permits, teach students how to play *Toss and Talk* (TE, p. 761A). All students should have the opportunity to play this game. Child watch to identify students who need additional support and pull them in a small group to do the *Intervention Activity* (TE, p. 761A).
Lesson 14-5: Measure Liquid Volume		
3.MD.A.2 MP. 3 MP.4 MP.5 MP.6 MP.8	Access Prior Learning: In the previous lesson students developed benchmarks to estimate capacity (liquid volume) in L and mL. Developing the Big Idea: Students further *develop* an understanding of estimation and units of measure by using standard units, liters (L) and milliliters (mL), to estimate capacity (liquid volume).	Instructional note: A marked 1-liter beaker and 6 containers are necessary to complete the *Solve & Share* and to help students develop benchmark measurements. Look Back: Consider discussing the *Look Back!* to support students' problem solving and appropriate use of mathematical tools after students have had an opportunity to work on the *Solve & Share*. Visual Learning: Consider pausing and discussing the following questions from the *Visual Learning Animation*: • "How can he find the capacity of the fish bowl?" • "What does the abbreviation mL mean?" • "How many mL are represented by each little mark on the 1-Liter container?" • "If the top mark were labelled in mL, what would it say?" Convince Me: Consider discussing the *Convince Me!* to support students' development of benchmark measurements and choosing an appropriate unit of measure. Assess and Differentiate: If time permits, consider teaching students how to play *Teamwork* (TE, p. 767A). All students should have an opportunity to play this game. Based upon child-watching, identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 767A).
Lesson 14-6: Estimate Mass		
3.MD.A.2 MP.2 MP.3 MP.4 MP.5	Access Prior Learning: In Topic 8, Grade 3, students learned to estimate sums and differences. Students have also applied estimation skills to measurement throughout this topic. Developing the Big Idea: Students further *develop* an understanding of units of measure by finding that mass is a measure of the quantity of matter in an object. Students also further *develop* understanding of units of measure by estimating mass measurements in grams and kilograms.	Instructional note: If available, have a pan balance, gram, and kilogram weights to help students develop benchmark measurements. To support students' understanding of mass and their development of MP. 6, "Attend to precision" watch for students that confuse weight and mass. Consider correcting inaccurate language of describing an object as "weighing" some amount by providing the language "has the mass of" to describe the object. Assess and Differentiate: If time permits, you may consider replacing the *Math and Science Activity* with the game *Display the Digit* (TE, p. 743A), *Clip and Cover* (TE, p. 749A), *Toss and Talk* (TE, p. 761A), *Teamwork* (TE, p. 767A), or the *Fluency Practice Activity* (TE, p. 793). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 773A).

Lesson 14-7: Measure Mass		
3.MD.A.2 MP.1 MP.2 MP.3 MP.6 MP.7	Access Prior Learning: In the previous lesson, students learned about estimating mass. Developing the Big Idea: Students further *develop* understanding of estimation and units of measure by using standard units, grams (g) and kilograms (Kg), to estimate mass.	Instructional note: A pan balance, metric weights, and assorted objects are necessary to complete the *Solve & Share* and to help students develop benchmark measurements. Look Back: After student solution methods and reasoning have been shared, consider using the *Look Back!* to facilitate a class discussion. Convince Me: To support students' reasoning with the appropriate unit of measure, consider discussing the *Convince Me!* Assess and Differentiate: If time permits, you may consider replacing the *Problem Solving Reading Mat* with the game *Display the Digit* (TE, p. 743A), *Clip and Cover* (TE, p. 749A), *Toss and Talk* (TE, p. 761A), *Teamwork* (TE, p. 767A), or the *Fluency Practice Activity* (TE, p. 793). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 779A).
Lesson 14-8: Solve Word Problems Involving Mass and Liquid Volume		
3.MD.A.2 MP.1 MP.2 MP.4 MP.6	Access Prior Learning: In previous lessons in this topic, students have estimated and measured for capacity and mass. Developing the Big Idea: In this lesson, students are *developing* an understanding of measuring capacity and mass by using all four operations to solve problems.	Visual Learning: During the *Visual Learning Animation*, consider doing the *Try It!* activity as this connects the context of the problem to the visual representations and model. After the *Try It!*, the *Visual Learning Animation* makes the connections between the context and the bar diagram explicit. Consider pausing the video after it shows the connections to discuss what is known and unknown, what operation is needed to solve, and how to complete the bar diagram. Independent Practice/Math Practices and Problem Solving: Consider assigning item 9 to provide students distributed practice with elapsed time. On *Quick Check* item 12 *Common Core Assessment*, watch for students that have incorrect responses as a result of struggling to read the pictorial representations of the containers. Assess and Differentiate: If time permits, consider teaching students how to play *Teamwork* (TE, p. 785A). All students should have an opportunity to play this game. Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 785A). *CTC: *Solve & Share* (student work samples)
Lesson 14-9: Math Practices and Problem Solving- Reasoning		
3.MD.A.1 MP.2 MP.1 MP.3 MP.4 MP.6 MP.8	Access Prior Learning: In previous lessons, students solved problems involving time. Developing the Big Idea: Students are *developing the* understanding of elapsed time by making sense of the quantities and relationships to solve problems in real-world contexts.	This lesson provides an opportunity to focus on the Thinking Habits and display the behaviors associated with Math Practice 2. Refer to the *Math Practices and Problem Solving Handbook* for suggestions on how to develop, connect and assess this Math Practice (TE, pp. F22-F22A, F29). Also reference the handbook in the Student Edition (SE, p. F22). Solve & Share: Consider reintroducing MP. 2 Thinking Habits (SE, p. F22) before introducing the *Solve & Share*. Also consider using the time students are working on the *Solve & Share* as an opportunity to child-watch for behaviors associated with MP.2 that are listed in the *Math Practices and Problem Solving Handbook* (TE, p. F22A). After discussing student solution methods and reasoning, have students self-score for the behaviors associated with this math practice. Look Back: After discussing students' solution methods and reasoning, consider discussing the *Look Back!* prompt to support students understanding of when a time when be the answer versus minutes being the answer to elapsed time problems. Convince Me: To support students' development of MP. 2, consider discussing the *Convince Me!* prompt. *-continues on next page-*

		Assess and Differentiate If time permits, you may consider replacing *the Math and Science Activity* with the game *Display the Digit* (TE, p. 743A), *Clip and Cover* (TE, p. 749A), *Toss and Talk* (TE, p. 761A), *Teamwork* (TE, p. 767A), *Teamwork* (TE, p. 785A), or the *Fluency Practice Activity* (TE, p. 793). Child watch to identify students who need additional support and pull them into a small group to do the *Intervention Activity* (TE, p. 791A).

References

Common Core Standards Writing Team. (2013). *Progressions for the Common Core State Standards in Mathematics (draft). K-5, Measurement and data—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. A., Bay-Williams, J. M., Lovin, L. H., & Karp, K. S. (2014). *Teaching student-centered mathematics: Developmentally appropriate instruction for grades 3-5* (2nd ed.). New York, NY: Pearson.

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