Grade Level	3	**Content Area**	Mathematics
Course Title (grades 9-12 Only)	NA		
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	The students measured a variety of things, such as time, distance, mass, and volume and used specific tools for those measurements. The students learned that specific units of measure are used for measuring time, distance, mass, and volume. The students learned the importance of measuring with precision.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	In mathematics, we have transitioned from a "mile wide, inch deep" approach to a focused and deep concentration on math skills with an emphasis on hands-on practice. Instruction is given in small groups to ensure personalized attention and to help students develop a strong conceptual basis of general problem solving, geometric and algebraic skills, and concepts. We stress the application of skills to practical, real-world situations.		
Standard Number and Description *List the Number* and full description for the Required Standard or Science Performance Objective listed in section A.6.*	**3.MD.2** Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Excludes compound units such as cm^3 and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.		
Materials/Resources Needed	Lesson 1: paperclip (with a mass of approximately 1 g), box of 100 paperclips (with a mass of approximately 100 kg, text book (with a mass of approximately 1 kg), stapler, pan balance with weights (several sets would be ideal, one for you and one for each group), various items that will fit on a pan balance, items (not measured on the pan balance) of varying masses (globe, deck of cards, lunch box, brick, etc.) and pictures of items too large or dangerous to bring, number cube Lesson 2: a variety of empty, clean bottles and containers that hold liquids, with volumes labeled: large (approximately gallon-size) bottle, 2-liter drink bottle, 1-liter water bottle, large shampoo bottle, sports drink bottle, pancake syrup bottle, juice can, small bottle of hand sanitizer, etc, 1-liter measuring cup with milliliters and liters marked (several measuring cups would be ideal, one for you and one for each group), clear 4-liter bowl, large picture of a measuring cup with milliliters and liters marked, water, a variety of empty, clean bottles and containers that hold liquids, with volume NOT labeled: large salad bowl, large soup pot or Dutch oven, cereal bowl, coffee travel mug, juice cup, spoon, etc., pictures of items that may be too difficult or dangerous to bring: fish aquarium, bathroom sink, glass lemonade pitcher, small fancy perfume bottle, etc., number cube Lesson 3: 1-liter measuring cups with milliliters and liters labeled, pipette with milliliters labeled (optional), drink pitchers, cups, ice (optional)		

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed)	Instructional Strategies The teacher will:	Student Activities The students will:
1	**Before the Lesson**: Put students in groups. **Vocabulary**: Explain that the mass is a measure of the amount of matter in an object. Grams and kilograms are two metric units of mass, and they are abbreviated g and kg. There are 1000 grams in a kilogram. **Introduction**: Have the paperclip, box of paperclips, stapler, book, and items that will fit on a pan scale in the front of the room. Allow students to pick them up and compare them. Explain that since the mass is the amount of matter in an object, and since the more matter there is in an object, the heavier it is, then objects with less mass weigh less and objects with more mass weigh more. Ask students to put the items in order from the least mass to the greatest mass. Write the list of objects on the board in order and check their masses later. **Warm-Up**: Hold up the paperclip and tell students that a paperclip has a mass of about 1 g. Hold up the box of 100 paperclips, and ask students to infer its mass. Hold up the text book and tell students it has a mass of about 1 kg. Hold up the stapler, and ask students to infer if the stapler's mass is less than, equal to, or greater than 1 kg. How do they come to their conclusions? **Demonstration**: Show students the pan balance and weights and explain how it works. Demonstrate how you can measure the mass of several objects by adding or subtracting weights. Interaction: • Set up stations around the room with a pan scale, weights, and object(s) to be measured at each one. • Tell students it is time for a game. Put out the items or pictures that were not measured on the pan balance and assign them the numbers 1-6. (You can play more than one round if you have more than 6 items.) **Wrap-up**: Measure the masses of the objects students put in order from least to greatest and record their masses on the board. Check to see if students were correct in their comparisons and discuss.	**Review**: Name things we measure (time, distance, mass, etc). Explain how and why we measure these things. Discuss how and why we measure precisely and accurately. **Introduction**: Pick up and compare items in the front of the room that will fit on the pan scale. **Introduction**: Put items in order from the least mass to the greatest mass. **Warm-Up**: Infer the mass of 100 paperclips. Infer if the stapler's mass is less than, equal to, or greater than 1kg. Explain conclusions. **Interaction**: Rotate (in groups) through the stations, measuring objects and recording their masses. Interaction: Roll the number cube, one group at a time. The number they roll will correspond to an item or picture. Each group must decide if they think their item has a greater or lesser mass then a 1 g, 100 g, and 1kg.

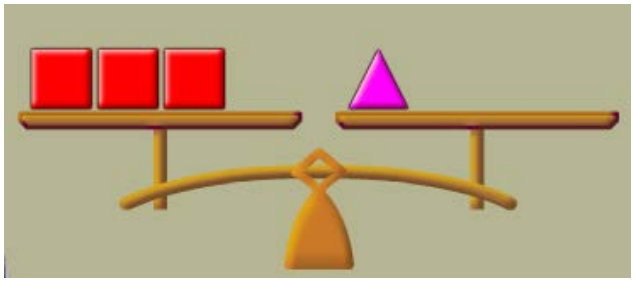
		Independent Practice: Students will complete a paper with pictures of objects, such as a football, penny, and watermelon, and must decide the most appropriate measure of mass for each object.
2	**Before the Lesson**: Put students in groups. **Review**: Review previously learned vocabulary: mass, gram, kilogram. Explain that grams and kilograms measure mass and ask what else we measure. **Introduction**: Have variety of bottles and containers in front of the class. Hold up a 1-liter water bottle. Ask students to name something that has a volume close to the same as the water bottle (without saying its volume is 1-liter). Ask students why they think these items may have about the same volume. **Warm-Up**: Hold up the 1-liter water bottle and the 4-liter bowl. Walk around the room with them so students can look at them closely. Remind students that they estimated that the large shampoo bottle (or whatever they chose) has about the same volume as the water bottle because they are about the same size. Show them that the bowl is bigger than the water bottle and ask if it will have the same volume. Explain that the bottle has a volume of one unit of water. If the bottle has a volume of one unit of water, how many units of water will the bowl hold? Write estimates on the board. **Vocabulary**: Review that the word <u>volume</u> means how much space an object occupies, and <u>capacity</u> is a measure of the amount of liquid that object can hold. We will be using metric units to measure <u>volume</u>: <u>liters</u> and <u>milliliters</u>, abbreviated <u>L</u> and <u>mL</u> or <u>l</u> and <u>ml</u>. Explain that there are <u>1000 milliliters in a liter</u>. Write this information on the board, and display the large picture of the measuring cup. **Demonstration**: Direct attention back to the 1-liter bottle and the 4-liter bowl. Remind them that you had said that the bottle has a volume of one unit of water and that you asked them to estimate the volume of the bowl. Tell them to think about the new vocabulary they learned today and to name the unit of measure you use. Is the volume of this water bottle closer to a milliliter or a liter? When they say that it is a liter, using your own measuring cup, pour in one liter of water to show them. Direct their attention to the board where you wrote the estimates of the volume of the bowl. Erase where you wrote "units" and write "liters," explaining again that the units we are using today are metric units. Now ask how they can	**Introduction**: Respond to question and may say the large shampoo bottle is probably about a liter. Introduction: Respond to question and may say that the containers look like they are close in size. **Warm-Up**: Discuss in groups and report to the class their estimate of how many units the bowl will hold and an explanation of how they got it. **Vocabulary**: Examine real measuring cup with milliliters and liters labeled. **Demonstration**: Count each time you pour and report its volume when the bowl is full. **Demonstration**: Respond to question and report if they are surprised that the volume of the bowl is 4 liters and explain responses.

	check their estimates. How can we find out the real volume of the bowl? After discussing this, fill the 1-liter bottle with water and pour it into the bowl and repeat until it is full. Ask students to keep track of each time you pour, and then ask them to report its volume when the bowl is full. If you have "4 liters" written on the board, circle it. If not, write it now. Ask students if they are surprised that the volume of the bowl is four liters and have them explain their responses. **Interaction**: • Allow each group to examine one of the various bottles or containers that has volume labeled so they can gain an understanding of the relationship between the size of the container and its volume. Each group should choose a spokesperson, and the spokesperson for each group should hold up the container you gave them earlier and tell the class its volume. After all groups have showed their container, ask groups to bring containers to the front of the room and place them in order from smallest volume to greatest volume. If you have more than six containers, give one to each group and leave the others in the front and allow students to add them to the correct order. • Tell students it is time for a game. Put out the items and pictures that are not labeled with volume (fish tank, soup bowl, spoon, etc) and assign them the numbers 1-6. (You can play more than one round if you have more than 6 items.) Have a student from a group roll the number cube. The number they roll will correspond to an item or picture. The group must decide whether the volume of that item would best be measured in liters or milliliters.	**Independent Practice**: Complete a paper with pictures or names of various items, such as a large bucket, a punch bowl, a medicine bottle, a juice box and match them to the most appropriate estimation for the volume of each.
3	**Review**: Ask students to explain mass and name the metric units of measure discussed and their abbreviations. Ask them how many kilograms are in a gram. Ask students to explain volume and name the metric units of measure discussed and their abbreviations. Ask them how many milliliters are in a liter. Write the information on the board. Review how they measured mass and volume. **Introduction**: Explain that today the class will solve word problems	**Review**: Interact with teacher and other students and answer questions regarding mass, volume, and their units of measure.

	using measurement of mass and volume. **Warm-Up**: Use a simple recipe for a fruit drink. It can call for real fruit or can be a powder mix. Read the recipe to the students noting how many servings it will make. Ask how many students you have in the class. Then ask how many batches of the recipe will you need to make to serve everyone? What if we want everyone to have two servings? Do the math together on the board so everyone can see it. **Demonstration**: Make the fruit drink. As you are serving the fruit drink to the students, ask about the importance of precision. What would happen if you added too much water? Too little? How can we be precise when measuring liquids? Interaction: Set up several stations around the room through which groups will rotate. Each station will have a one-step word problem, and appropriate tools for measurement. Each student will have their own paper where they can work to solve the problems. When groups have visited all stations, they will have completed addition, subtraction, multiplication, and division word problems measuring mass and volume.	**Warm-Up**: Calculate how many batches are required to serve everyone with one or two servings. **Demonstration**: Discuss the importance of precision when measuring. **Interaction**: Move through stations with groups, solving one-step addition, subtraction, multiplication, and division word problems, using appropriate tools for measurement. **Independent Practice**: Draw diagrams to demonstrate answers to word problems regarding mass and volume.

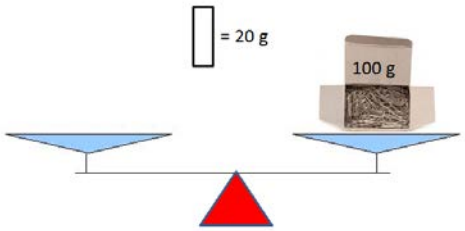
Summative Assessment Items:

1. If each square has a mass of 5kg, what is the mass of the triangle? Be sure to label your answer.

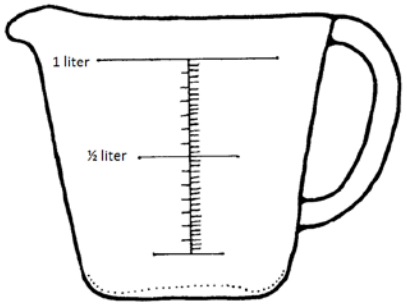


2. A recipe calls for milk, and I measured the correct volume in a liquid measuring cup. What is the measure of the milk pictured here? Be sure to label your answer.

3. A box of 100 paperclips has a mass of 100 g. A rectangular weight has a mass of 20 g. Draw on the left pan the number of rectangular weights required to balance the pan balance.



4. Color in the measuring cup below to show that it is filled to 500 milliliters.

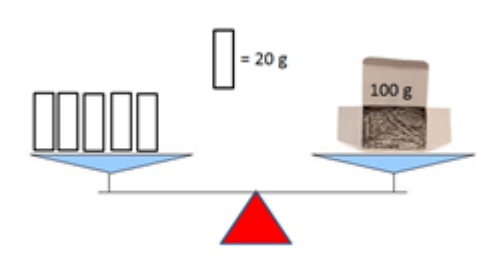


5. What is the best estimate for the mass of a bicycle?
    A. 12 g
    B. 12 kg
    C. 12 L
    D. 12 mL
6. Which unit would be best to measure the mass of two quarters?
    A. Grams
    B. Kilograms
    C. Liters
    D. Milliliters
7. Correct the mistakes in the shopping list below:
    - ✓ 2 L milk
    - ✓ 1 kg juice
    - ✓ 5 mL flour
    - ✓ 4 kg oranges
8. What is the best estimate for the volume of a juice box you would bring to lunch?
    A. 250 g
    B. 250 kg
    C. 250 L
    D. 250 mL
9. Which unit would be best to measure the volume of liquid in a bathtub?
    A. Grams
    B. Kilograms
    C. Liters
    D. Milliliters

10. Which cup holds a greater volume when full of water? Explain your thinking.

Answer Key: One point is awarded for each correct answer. Half credit may be awarded for questions 1 and 2 for correct values that are not labeled, but correct values with incorrect labels will earn no credit. Half credit may be awarded for question 7 if only the juice or only the flour is identified with a correct measure. Half credit may be awarded for question 10 if the correct cup is identified but no explanation is provided, but no credit will be awarded if the correct cup is identified with an incorrect explanation. A score of 8/10 is required to demonstrate mastery.

1. 15 kilograms or 15 kg or 15,000 grams or 15,000 g
2. 150 milliliters or 150 ml or 150 mL or 0.15 liters or 0.15 l or 0.15 L
3.



4. The measuring cup should be colored to the line labeled ½ liter.
5. B
6. A
7. Sample Answer: Juice should be measured in mL or L. Flour should be measured in g or kg.
8. D
9. C
10. Sample Answer: Cup B holds a greater volume when full of water because it is bigger.