Grade Level	Content Area	Course Title *(For 9-12 Samples Only)*	Unit Title
Grade 4	**Science**		Measurement Mania

Length of Unit	Time of Year Taught	Expected Prior Knowledge
8 days (approximately 2 days for each lesson)	1st Quarter of 1st Semester	Perform simple measurements using non-standard units of measure to collect data. Use of simple tools such as rulers, balances, scales and measuring cups. Introductory use of metric and US customary units to measure objects. Terminology: matter, length, width, mass, weight, U.S. customary, metric, prefixes: milli-, centi-, kilo-. Knowledge that tools are used to measure objects, specifically the ruler for measuring length, the scale for measuring weight, and the balance to measure the mass of matter. Describe objects in terms of measurable properties (length, mass, weight) using scientific tools.

Unit Description

By exercising the scientific method to facilitate scientific testing, students will perform length, mass, and weight measurements using appropriate measuring tools – the ruler, the scale, and the balance. Students should show progress toward mastery of the following skills: Understand basic concepts of length, mass, and weight measurement, including appropriate units of measure for a particular object; Identify customary and metric units of length, mass, and weight; Measure length, mass, and weight using customary and metric units of measurement; Be familiar with converting metric units to another metric unit (meters to kilometers); Be familiar with converting a customary unit to another customary unit (inches to feet). The student will understand and apply the appropriate units and procedures to measure length, mass, and weight.

Standards: Arizona State **Strand 1:** Inquiry Process **Concept 2:** Scientific Testing (Investigating and Modeling) **Performance Objective 4:**	**Performance Objective 4:** Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary). (See M04-S4C4-03 and M04-S4C4-07)

Summative Assessment	Students will be assessed based on written answers in a test. Summative Assessment attached. Students will demonstrate their ability to: • Measure length using the ruler using both U.S. customary and metric units • Measure mass using the pan balance both U.S. customary and metric units • Measure weight using the scale both U.S. customary and metric units • Estimate the length of an object • Determine the proper tool to measure length, mass, or weight
Scoring for Summative Assessment	A total of 20 points are available in the assessment. Eighty percent (80%) or above represents unit mastery (16 out of 20 points or better). Answer key attached
Materials/Resources Needed *Include all items for the entire unit.*	Houghton Mifflin Harcourt Science Fusion textbook, Meter stick (has both metric units and U.S. customary units); ruler (has both metric units and U.S. customary units) – one for each student and the teacher; *Measuring Length Data Sheet*; *Length in U.S. Customary and Metric Units*; kitchen scale – one for every 4 students and the teacher; bathroom scale – one for every 4 students and the teacher; *Weight Activity* worksheet, pan balance – one for every 4 students and the teacher, electronic mass balance, arm balance, triple beam balance, mass metric "weight" kit – one for every 4 students and the teacher, mass U.S. customary "weight" kit – one for every 4 students and the teacher, *Mass Activity* worksheet, in-class computer with Internet capability; computer projector; pull-down screen; computers for students – one for each student or minimum one for each pair of students – with Internet capability; and *Science Measurement Summative Assessment*

This table is consistent with the methods of instruction and assessment described in the narrative.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
Instruction and Timeline	Introduction: Give students the following true/false questions: ▪ A brand new pencil is about 8 cm long. (False – closer to 20 cm.) ▪ A piece of notebook paper is about 28 cm long. (true) ▪ An adult hand is about 5 ½ long. (true) ▪ A computer disk is about 12 inches long. (False: most are about 3 inches long) Ask: "Which questions were easier to answer? Why?" Lead a discussion about measuring, including inches, centimeters, and measuring tools. Review the conversions of length units, i.e., For U.S. customary: 12 inches = 1 foot, 3 feet = 1 yd, 5280 feet = 1 mile, and for metric: 1 km = 1000 m, 1 meter = 100 cm, and 1 cm = 10 mm. Show students the meter and ruler length measuring tools. Tell students that we are usually more used to using inches, which is a unit of length measure in the U.S. customary system, than centimeters, which is a unit of length measure in the metric system. Therefore, we are better at estimating inches. Write "U.S. Customary" and "Metric" on the board. Solicit from children units of measure for both of these systems. Start by listing "inches" and "centimeters" respectively. Students should list or should be assisted to list: feet, yard, mile, millimeter, meter, and kilometer. The lesson will introduce students to the measure using centimeters, the metric unit for length. Ask: What tool do we use to measure length in centimeters? (rulers or	Introduction: Ask: Which kind of measurement could a scale be used for: temperature, weight, or length? (weight) Could a scale be used to measure length? (no) Could you use a balance to measure temperature? (no) What are some things that are weighed? (people, food, mail, hardware nails, and gold). Many foods used to be weighed at the grocery story in the olden days, but now they are pre-weighed when manufactured – like sugar. Guided Practice: Show the students items that show the weight on the package: i.e., flour, cereal, and pre-packaged vegetables (cherry tomato pack). Discuss units for measuring weight. Explain that there are two systems: the U.S. customary system which uses the units of pounds and ounces, and the metric system, which uses the units of grams and kilograms. Write these on the board. Explain that sixteen ounces equals one pound. Explain that 1000 g equals one kg. Independent Small Group Practice: Gather light weight and heavy objects (but not greater than 25 lbs) – such as an eraser, pencil, box of paperclips, book, tennis ball, bowling ball, teacher tape dispenser, etc. Put students in groups of four. For each group, provide a kitchen scale that displays both ounces / pounds and grams / kilograms, and a bathroom scale that displays both pounds and kilograms. Give each student the *Weight Activity* worksheet. Hold up each object. Ask: which tool would you use to measure this? (Make sure	Introduction: Ask: What is matter? (Anything that takes up space and has mass). Ask: So, what is mass? (Mass is the amount of matter in an object) Ask: So, what is the difference between mass and weight? Explain that many people mix up these two measurements, because they are very similar and, in many cases, use the same units of measure. The difference is gravity. Weight takes into account the gravitational pull of an object, whereas mass does not. Ask: What are the units for mass? (They are the same as what was learned for weight, i.e., U.S. customary units are ounces and pounds, and metric units are grams and kilograms.) Write these on the board. Ask: What tool is used to measure mass? (The balance). Explain and show different types of balances: pan balance, electronic mass balance, arm balance, and triple beam balance. Explain to students that we for our lesson we will be using the pan balance. Guided Practice: Place a pan balance on the display table. Place a quarter in one of the balance pans. Ask: What happens to the balance? (The side with the coin went down) Add the mass "weight" unit of 1 gram, counting aloud, to the other balance pan, one at a time, until the pans balance. Ask: How many grams are needed to balance the pans? (6) What is the mass of the coin? (6 grams) Show the students other mass metric	Practice measurement using computer games. Using the in-class computer and projector, go to websites: **4th Math Study Zone:** Use a virtual ruler to measure feet and yards: http://www.studyzone.org/testprep/math4/d/ruler4l.cfm And **4th Math Study Zone:** Use a virtual ruler to measure centimeters: http://www.studyzone.org/testprep/math4/d/centimeter4l.cfm And **Standard Metric Pan Balance** http://www.teacherled.com/resources/oldscales/oldscalesload.html And **Metric Scales Reader** http://www.ictga

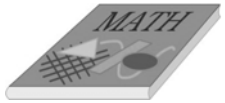
	meter sticks) Guided Instruction: To familiarize students with the metric length of objects, ask students to find three 1-cm long objects, then three 10-cm long objects, then three 50-cm long objects and finally 500-cm long objects in the classroom. Have them record their findings on the *Measuring Length Data Sheet.* Record student's answers on a chart and hang in a visible location as a quick reference guide. Individual Practice: Have students estimate the measurement of the following objects, then allow students time to find the actual measurements both in U.S. customary units (inches) and metric (cm) using a ruler: length of an unsharpened pencil, length of a new piece of chalk, width of pinky finger, length of hand span, and height of an apple. Have students record both their estimates and actual measurements on the worksheet: *Length in U.S. Customary and Metric Units* worksheet. Closure: Ask students for the definition of the term length. Then, ask students to name the tool that is used to measure length. Finally, ask them what unit they used to measure length and to give its abbreviation. For homework have students read pgs. 30 - 31 in their science textbook, Houghton Mifflin Harcourt Science Fusion,	students are measuring items that weigh more than 3 lbs on the bathroom scale and not on the kitchen scale and vice versa, make sure that students are measuring items that weigh less than 3 lbs on the kitchen scale and not the bathroom scale.) Have the student groups weigh each of the objects. Have the students record both U.S. customary and metric units of each object's weight on their worksheet. Share group findings as a class. Closure: Ask students for the definition of the term weight. Then, ask students to name the tool that is used to measure weight. Finally, ask them what unit they used to measure length and to give its abbreviation. Ask students if they noticed anything about the objects they weighed and the material it was made of, and if there was a relationship between the size of an object and its weight. Let them know that this topic will be explored in the upcoming weeks – the study of density.	"weight" units in the kit – 5 g, ten 10 g, four 20 g, two 100 g, one 500 g, and one 1,000 g. In addition, show the students the mass U.S. customary "weight" units in the kit - 1 oz., two 4 oz., two 8 oz., and one 1 lb Independent Small Group Practice: Gather different objects to be massed. (Objects should not weigh more that 5 lbs) – i.e., an eraser, pencil, box of paperclips, small book, tennis ball, and, teacher stapler, etc. Put students in groups of four. For each group, provide a pan balance, a set of U.S. customary "weights," and a set of metric "weights." Give each student the *Mass Activity* worksheet. Have the student groups mass each of the objects. Have the students record both U.S. customary and metric units of each object's mass on their worksheet. Share group findings as a class. Closure: Ask students for the definition of the term mass. Then, ask students to name the tool that is used to measure mass. Finally, ask them what unit they used to measure mass and to give its abbreviation. For homework have students read pgs. 32 - 33 in their science textbook, Houghton Mifflin Harcourt Science Fusion,	mes.com/weight.html Model how to use the programs. Arrange for students to have their own computer (or two students for every one computer) such that each student (or pairs of students) can play on their own game. Show and review the lesson using the computer and internet website: Assessment: Provide to students the *Science Measurement Summative Assessment.* 80% or better represents mastery of the assessment.
Student Activities and Timeline	Students will orally answer the teacher prompted length questions. Students will participate in the guided practice lesson by finding the objects as instructed by the teacher. Students will record their answers on the *Measuring Length Data Sheet*.	Students will orally answer the teacher prompted weight questions. Students will participate in the guided practice lesson with active listening as to the types of equipment and measures that are found for weight. Students will participate in small groups to	Students will orally answer the teacher prompted mass questions. Students will participate in the guided practice lesson with active listening and answer orally the teacher prompted mass questions. Students will participate in small groups to	Students will practice length, mass, and weight measurements using the computer. Students will complete the

	Students will estimate and measure the length of objects with a ruler (using both U.S. customary and metric units): length of an unsharpened pencil, length of a new piece of chalk, width of pinky finger, length of hand span, and height of an apple. Students will record their results using the *Length in U.S. Customary and Metric Units* worksheet. Students will participate orally in answering the teacher length / ruler summary questions. Students will complete the homework: reading from the Houghton Mifflin Harcourt Science Fusion, "Science Tools," pgs. 30 – 31.	demonstrate measuring the weight of different objects using the appropriate weight measuring tool: the kitchen scale or the bathroom scale. Students will record their answers as to weight of objects using both U.S. customary and metric units on the worksheet *Weight Activity.* Students will participate orally in answering the teacher weight / scale summary questions.	demonstrate measuring the mass of different objects using the pan balance. Students will use both the U.S. customary "weight" set and the metric "weight" set to measure the different objects. Students will record their findings on the *Mass Activity* worksheet. Students will participate orally in answering the teacher mass / balance summary questions. Students will complete the homework: reading from the Houghton Mifflin Harcourt Science Fusion, "Science Tools," pgs. 32 – 33.	*Science Measurement Summative Assessment*. 80% or better on the summative assessment represents mastery.

Grade 4 Science Measurement Summative Assessment – (Each question is worth 1 point except where noted)
Materials: Provide each student with access to a ruler, kitchen scale, and mass balance

Use the following pictures to answer questions 1 – 3.

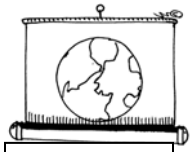
Pencil sharpener



Math book

Calculator

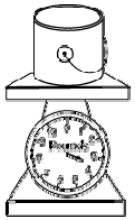
Waste basket


Wall map

Pencil tip

1. Which classroom object (real) is closest to 1-inch in length? _____
2. Which classroom object (real) is closest to 1-mm in length? _____
3. Which classroom object (real) is closest to 1-yd in length _____
4. Circle the tool to measure length.
5. Put a square around the tool that measures mass.
6. Put an "X" on the tool that is called a scale.

7. Circle the unit that is used to measures length: kg mL lbs in ^{o}F oz
8. Circle the unit that is used to measure mass:
9. Circle the unit that is used to measure weight:
10. Using the appropriate tool, measure the mass of an eraser. Record your answer with metric units: _____ U.S. customary units: _____
    Which tool did you use?_____ (3 points)
11. Using the appropriate tool, measure the length of an eraser. Record your answer with metric units: _____ U.S. customary units: _____
    Which tool did you use? _____ (3 points)
12. Using the appropriate tool, measure the weight of an eraser. Record your answer with metric units: _____ U.S. customary units: _____
    Which tool did you use? _____ (3 points)
13. What does the can shown in the diagram weigh? Circle the correct answer. $2\frac{3}{4}$ pounds $1\frac{3}{4}$ pounds $3\frac{1}{2}$ pounds $4\frac{1}{4}$ pounds



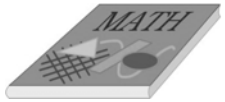
14. What measurement does the ruler indicate? Circle the correct answer.

    1.9 cm 5.1 in 6.2 cm 5.1 cm

Grade 4 Science Measurement Summative Assessment Answer Key – (Each question is worth 1 point except where noted)
Materials: Provide each student with access to a ruler, kitchen scale, and mass balance

Use the following pictures to answer questions 1 – 3.

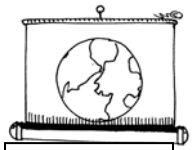
Pencil sharpener



Math book

Calculator

Waste basket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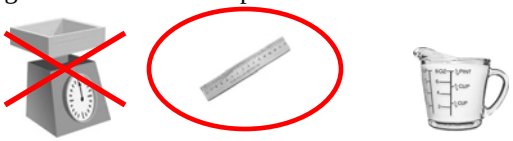
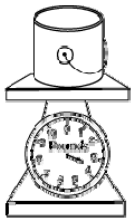
5. Put a square around the tool that measures mass.
6. Put an "X" on the tool that is called a scale.



7. Circle the unit that is used to measures length: kg mL lbs in °F oz
8. Circle the unit that is used to measure mass: mL °F lbs ft km in
9. Circle the unit that is used to measure weight: mL km mi in °F kg
10. Using the appropriate tool, measure the mass of an eraser. Record your answer with metric units: _____28 g_____ U.S. customary units: ____1 oz_____
    Which tool did you use? Pan balance (3 points)
11. Using the appropriate tool, measure the length of an eraser. Record your answer with metric units: ____7.5 cm___ U.S. customary units: ____ 3 in_____
    Which tool did you use? Ruler (3 points)
12. Using the appropriate tool, measure the weight of an eraser. Record your answer with metric units: ____28 g____ U.S. customary units: _____1 oz_____
    Which tool did you use? Kitchen scale (3 points)
13. What does the can shown in the diagram weigh? Circle the correct answer. $2\frac{3}{4}$ pounds $1\frac{3}{4}$ pounds $3\frac{1}{2}$ pounds $4\frac{1}{4}$ pounds



14. What measurement does the ruler indicate? Circle the correct answer.

    1.9 cm 5.1 in 6.2 cm 5.1 cm

Grading for 4th Grade Science Measurement Summative Assessment: The summative assessment has a total of 20 points. Mastery is 80% and above (16 points or greater)

Grade	Number of Answers correct
A	18 - 20
B	16 - 17
C	14 - 15
D	12 - 13
F	11 and below