3rd

Topic 15: Liquid Volume and Mass

Lessons 1-5

MDIS:

15-1 D40
15-2 D41
15-3 D43
15-4 D42
15-5 D29, D30, D31, D32, D33, D34

Guided Practice

- Provide students with hands-on practice with mass. Give students gram and kilogram masses. Ask students to find classroom objects that have a mass of about 1 kilogram. Then have them find objects that have a mass of about 1 gram.
- Have students look through magazines to find pictures of objects that can be measured in grams and kilograms. Have them create a chart of measures.

Reinforce

Envision Math Games:

Topic Game: NA

envision Online Games
Measurement
Customary units of capacity

Symbaloo

Assessments

3rd

Topic 15: Liquid Volume and Mass

Lesson 15-1

Customary Units of Capacity

Quick and Easy **Lesson Overview**

Objective	Essential Understanding	Vocabulary	Materials
Students will choose an appropriate unit and tool, estimate, and measure in cups, pints, quarts, and gallons. Students will identify objects which hold about a cup, a pint, a quart, or a gallon.	Capacity is a measure of the amount of liquid a container can hold.	**capacity** **cup** **pint** **quart** **gallon**	Teaching Tool 47

PROFESSIONAL DEVELOPMENT

Math Background

Research says ... whatever the attribute being measured students learn to measure through a sequence that starts with recognizing that there is a measurable property, moves through making direct physical comparisons among objects that have that property, and then progresses to determining an appropriate unit for measuring the property (Wilson & Rowland, 1993; Hiebert, 1984).

In this lesson, students learn that the **capacity** of a container is the amount it can hold. Volume and capacity are related attributes. They both measure the space inside a container. Capacity is usually associated with how much liquid is needed to fill this space and is described with units such as cups or quarts rather than with cubic units.

Students are given the relationships between the customary units of capacity—1 pint equals 2 cups, 1 quart equals 2 pints, 1 gallon equals 4 quarts—so they can better understand the relative sizes of the units. However, they are not expected to change measurements from one unit to another.

2 Guided Practice

MATHEMATICAL PRACTICES

Remind students that they can estimate capacity by comparing an object to familiar objects whose capacities they know, like the containers pictured at the top of the page.

Exercise 2

Error Intervention

If students are having difficulty choosing the better estimate,

then suggest that they try to decide if one estimate is unreasonable. *Think about 1 gallon of milk. Now think about 3 gallons of milk. Do you think you could pour 3 gallons of milk into the pan?* [No, the pan is not big enough for that much milk.] *So an estimate of 3 gallons must be unreasonable.*

Reteaching Show students a small container, such as an individual-serving juice carton. Give them two estimates for its capacity, 1 cup and 1 quart. Guide them to choose the better estimate. For another example and more practice, assign **Reteaching** Set A on p. 384.

Common Core

Domain

Measurement and Data

Cluster

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standard

3.MD.2 Measure and estimate liquid volumes ... using standard units of ... liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving ... volumes that are given in the same units, ...

Mathematical Practices

- ✔ Make sense of problems and persevere in solving them.
- ✔ Reason abstractly and quantitatively.
- ✔ Construct viable arguments and critique the reasoning of others.
- ○ Model with mathematics.
- ○ Use appropriate tools strategically.
- ○ Attend to precision.
- ○ Look for and make use of structure.
- ✔ Look for and express regularity in repeated reasoning.

3rd

Topic 15: Liquid Volume and Mass

Lesson 15-2

Metric Units of Capacity

Quick and Easy **Lesson Overview**

Objective	Essential Understanding	Vocabulary	Materials
Students will choose an appropriate unit and tool, estimate, and measure in milliliters and liters. Students identify objects that hold about a liter or a milliliter.	Capacity is a measure of the amount of liquid a container can hold. Different units can be used to estimate or measure capacity. The most appropriate unit to use is often the one with which the measurement can be expressed using the least whole number.	**milliliter (mL)** **liter (L)**	Liter containers Water Sand Rice

PROFESSIONAL DEVELOPMENT

Math Background

Like the meter, the **liter** came into being as part of the simplified measurement system developed by the French Academy of Sciences at the end of the 18th century. Over the years there has been some disagreement as to how the liter should be defined. Today it is recognized as being equivalent to one cubic decimeter. In relation to customary units, a liter is a little more than a quart.

The word *liter* was derived from an old French unit of capacity, the *litron*, which was one-sixteenth of a bushel. *Litron* in turn was derived from a Greek unit of weight called the *litra*.

Internationally, both the lowercase letter *l* and the uppercase letter *L* are recognized as abbreviations for the liter. However, the United States Department of Commerce has stipulated that the preferred abbreviation for use in the United States is *L*, in order to avoid confusion between the lowercase *l* and the numeral 1.

A **milliliter** is one thousandth of a liter. In this text, students are given this relationship in the form of 1,000 milliliters = 1 liter so they can better understand the relative sizes of the units. However, they are not expected to change measurements from one unit to the other.

2 Guided Practice

MATHEMATICAL PRACTICES

Remind students that they can estimate capacity by comparing an object to familiar objects whose capacities they know, such as an eyedropper and water bottle as pictured at the top of the page.

Exercise 3

Error Intervention

If students are having difficulty answering the question,

then ask: ***Is a milliliter smaller than a liter or larger than a liter?*** [Smaller than a liter] ***Suppose you could fill a container with liters of water, or you could fill it with milliliters of water. Would you be able to pour in more liters or more milliliters?*** [More milliliters]

Reteaching Show students an object with a very small capacity, such as a teaspoon. Give them two estimates for its capacity, 5 milliliters and 5 liters. Guide them to choose the better estimate. For another example and more practice, assign **Reteaching** Set B on p. 384.

Common Core

Domain

Measurement and Data

Cluster

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standard

3.MD.2 Measure and estimate liquid volumes ... using standard units of ... liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving ... volumes that are given in the same units, ...

Mathematical Practices

- ☐ Make sense of problems and persevere in solving them.
- ☑ Reason abstractly and quantitatively.
- ☑ Construct viable arguments and critique the reasoning of others.
- ☐ Model with mathematics.
- ☐ Use appropriate tools strategically.
- ☐ Attend to precision.
- ☐ Look for and make use of structure.
- ☑ Look for and express regularity in repeated reasoning.

3rd

Topic 15: Liquid Volume and Mass

Lesson 15-3

Units of Mass

Quick and Easy **Lesson Overview**

Objective	Essential Understanding	Vocabulary	Materials
Students choose an appropriate unit and tool, estimate, and measure in grams and kilograms. Students identify objects with a mass of about one gram or one kilogram.	Mass is a measure of the quantity of matter in an object. Weight and mass are different.	**mass** **gram (g)** **kilogram (kg)**	Pan balance Dollar bill Stapler

PROFESSIONAL DEVELOPMENT

Math Background

The **gram**, like the meter and the liter, is a basic unit of the measurement system developed in France at the end of the 18th century. At that time, the gram was defined to be the mass of one cubic centimeter of pure water.

Over time, the need arose for a more precise definition of a gram. Today it is defined in terms of the kilogram. The **kilogram** has been standardized as the mass of a platinum-iridium cylinder kept in a vault at Sèvres, France. The gram is considered to be one thousandth of that mass.

A gram is a very small mass. In relation to customary units, it is equivalent to about thirty-five thousandths of an ounce. A kilogram, on the other hand, is equivalent to about 2.2 pounds.

The name *gram* comes from the old Greek word *gramma*, which referred to a small weight. The original French spelling is *gramme*, and it is sometimes used today.

Note that grams and kilograms are measures of *mass*, not measures of weight. **Mass** can be considered as the amount of matter in an object. The mass of an object is constant, whereas weight is affected by the amount of gravitational pull.

2 Guided Practice

MATHEMATICAL PRACTICES

Remind students that they can estimate mass by comparing an object to familiar objects whose masses they know, like the grape and the cantaloupe pictured at the top of the page.

Exercise 1

Error Intervention

If students are having difficulty choosing the better estimate,

then suggest that they try to decide if one estimate is unreasonable. ***Think about 1 cantaloupe. Now think about 5 cantaloupes. Do you think a nickel has the same mass as 5 cantaloupes?*** [No, 5 cantaloupes have a much greater mass than a nickel.] ***So an estimate of 5 kilograms must be unreasonable.***

Reteaching Show students a pencil or crayon. Give them two estimates for its mass, 8 grams and 8 kilograms. Guide them to choose the better estimate. For another example and more practice, assign **Reteaching** Set C on p. 385.

Common Core

Domain

Measurement and Data

Cluster

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standard

3.MD.2 Measure and estimate … masses of objects using standard units of grams (g), kilograms (kg) …. Add, subtract, multiply, or divide to solve one-step word problems involving masses … that are given in the same units, …

Mathematical Practices

- ○ Make sense of problems and persevere in solving them.
- ✔ Reason abstractly and quantitatively.
- ✔ Construct viable arguments and critique the reasoning of others.
- ○ Model with mathematics.
- ✔ Use appropriate tools strategically.
- ○ Attend to precision.
- ✔ Look for and make use of structure.
- ✔ Look for and express regularity in repeated reasoning.

3rd

Topic 15: Liquid Volume and Mass

Lesson 15-4

Units of Weight

Quick and Easy Lesson Overview

Objective	Essential Understanding	Vocabulary	Materials
Students will choose an appropriate unit and tool, estimate, and measure in ounces, pounds, and tons. Students identify objects that weigh about an ounce, a pound, or a ton.	The weight of an object is a measure of how heavy an object is.	**weight** **ounce** **pound** **ton**	Pan balance

PROFESSIONAL DEVELOPMENT

Math Background

In this lesson, students learn to choose an appropriate customary unit—ounce, pound, or ton—for measuring the weight of an object. They also determine which of two given measurements is the better estimate for the weight of an object.

The word **pound** has its origins in the Latin word *pondus*, meaning "a weight." The abbreviation for pound, *lb*, is derived from a specific weight, called the *libra*, which was used by the ancient Romans.

One-twelfth of the Roman libra was called an *uncia*, and it is from this term that **ounce** is derived. In the customary system of measurement, the ounce eventually evolved into one-sixteenth of a pound. However, in the system of *troy weights*, which is used to weigh precious metals, a pound is still divided into twelve ounces. The abbreviation for ounce, *oz*, is taken from the old Italian word *onza*, meaning "ounce".

The **ton** has been a customary unit of weight since approximately the 15th century. Prior to that time, the word was used to describe the capacity of a *tun*, which was a vat used for storing liquids in the hold of a ship. The size of a tun was fairly standard, and so the word *ton* also came to represent the weight of the vat when full.

2 Guided Practice

MATHEMATICAL PRACTICES

Remind students that they can estimate weight by comparing an object to familiar objects whose weight they know, such as a cube of cheese, a cheese wedge, and a bison as pictured at the top of the page.

Exercise 1

Error Intervention

If students are having difficulty choosing the better estimate,

then say: *Look at the cube of cheese at the top of the page. How do you think the weight of a cube of cheese compares to the weight of a loaf of bread?* [The cheese is much lighter.] *How do you think the weight of a wedge of cheese compares to the weight of a loaf of bread?* [The weights probably are about the same.] *So the better estimate is 1 pound.*

Reteaching Show students a copy of their math textbook. Give them two estimates for its weight, 3 pounds and 3 tons. Guide them to choose the better estimate. For another example and more practice, assign **Reteaching** Set D on p. 385.

Common Core

Domain

Measurement and Data

Cluster

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standard

3.MD.2 Measure and estimate … masses of objects using standard units of grams (g), kilograms (kg). … Add, subtract, multiply, or divide to solve one-step word problems involving masses … that are given in the same units, …

Mathematical Practices

- ○ Make sense of problems and persevere in solving them.
- ✔ Reason abstractly and quantitatively.
- ✔ Construct viable arguments and critique the reasoning of others.
- ○ Model with mathematics.
- ✔ Use appropriate tools strategically.
- ○ Attend to precision.
- ○ Look for and make use of structure.
- ✔ Look for and express regularity in repeated reasoning.

3rd

Topic 15: Liquid Volume and Mass

Lesson 15-5

Problem Solving: Draw a Picture

Quick and Easy **Lesson Overview**

Objective	Essential Understanding	Vocabulary	Materials
Students draw a picture to solve a problem involving units of capacity and mass.	Information in a problem can often be shown using a picture or diagram and used to understand and solve the problem. Some problems can be solved by writing and completing a number sentence or equation.		

PROFESSIONAL DEVELOPMENT

Math Background

Students have learned about measuring capacity, weight, and mass with customary and metric units. In this lesson, students add, subtract, multiply, and divide measurements with those units to solve problems using the problem-solving strategy **Draw a Picture**.

Students learn that measurements can be represented with drawings in many different ways. For example, capacity can be represented by a vertical scale on the side of a container. Mass in metric units can be represented by groups of hundreds of units, tens of units, and single units, as in place-value block representations. By using pictures to represent operations with these measurements, students can then write number sentences to solve the problems.

2 Guided Practice

MATHEMATICAL PRACTICES

The problem-solving strategy ***Draw a Picture*** can be helpful in finding which operation can help solve a problem. To review this strategy, refer students to the Problem-Solving Handbook.

Exercise 1

Error Intervention

If students are having difficulty understanding the diagram and its parts,

then help students think through what information is given. *What does 100 g represent in the picture?* [The mass of the box of pudding mix] *What part of the picture shows the mass of the box of pudding mix and the box of cocoa in all?* [The line segment above the boxes] *What operation should be used to solve the problem?* [Subtraction]

Reteaching For another example and more practice, assign **Reteaching** Set E on p. 385.

Common Core

Domain

Measurement and Data

Cluster

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

Standard

3.MD.2 ... 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 ... to represent the problem.

Mathematical Practices

- ✔ Make sense of problems and persevere in solving them.
- ○ Reason abstractly and quantitatively.
- ✔ Construct viable arguments and critique the reasoning of others.
- ✔ Model with mathematics.
- ✔ Use appropriate tools strategically.
- ✔ Attend to precision.
- ○ Look for and make use of structure.
- ○ Look for and express regularity in repeated reasoning.