

## Grade 8 Mathematics

### Measurement: Lesson 3

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol ( $\Rightarrow$ ) by them.

#### *Purpose of Lesson 3:*

- In this lesson, the tutor and the students will
  - ✓ select the best unit to measure weight/mass and capacity;
  - ✓ read weight/mass and capacity measurements;
  - ✓ estimate weight/mass and capacity measurement; and
  - ✓ convert from one unit of measurement to another.

#### *Equipment/Materials Needed:*

- Paper and pencils
- Copies of Student Sheets 24 – 26, and the Mathematics Reference Sheet (Student Sheet 27)
- An object that weighs about one pound, an object that weighs about one ounce, an object that weighs about one kilogram, and an object that weighs about one gram

#### *Preparations before beginning Lesson 3:*

- Run off one copy of Student Sheets 24 – 26 for each student and the Mathematics Reference Sheet (Student Sheet 17 in Measurement 4.)
- Have paper and pencils available.
- Measure some objects around the room. You need objects that weigh one pound, one ounce, one kilogram, and one gram. Find a few objects that weigh more and less than these objects do.

### Lesson 3: Measurement

Say:

**Let's talk about weight. When might you need to measure weight?** (when buying fruits and vegetables, to make a sports team, to ship something by mail) **What kind of tool would you use to measure weight?** (scales) **You will see both the terms *weight* and *mass*. *Mass* is the amount of matter in an object. *Weight* is a measure of how heavy an object is. Customary units are used to measure weight. Metric units are used to measure mass. Do not make a big deal of this difference. What units do you use to measure weight/mass?** (pound, ounce, ton, gram, kilogram, milligram) There are others, but these are the most common ones.

⇒ Write *customary* and *metric* on a piece of paper or on the board. Divide the units into customary and metric units.

**Customary**

Pound, ounce, ton

**Metric**

gram, kilogram, milligram

Say:

**Let's put the units in order from the smallest to the largest in each system. Write the symbol next to the unit.**

**Customary**

ounce (oz)

pound (lb)

ton (T)

**Metric**

milligram (mg)

gram (g)

kilogram (kg)

Say:

**Let's start with the customary system. Can you think of something that weighs about a ounce?** (a slice of bread); **Something that weighs about a pound?** (a loaf of bread); **About a ton?** (a small car.)

**What units would you use to measure the following items?**

**A. The weight of a grown dog** (pounds)

**B. The weight of an elephant** (tons)

**C. The weight of a computer** (pounds)

**D. The weight of a potato** (ounces)

**E. The weight of a sack of potatoes** (pounds)

**F. The weight of a paper clip** (ounces)

⇒ Find an object that weighs about one pound and some other objects that weigh more or less than a pound. (You need to weigh these objects ahead of

time.) Have several students hold the one pound object in one hand and another object in the other hand.

Say:

**Does the other object weigh more or less than one pound?** Don't use objects that are similar in weight. Keep trying objects around the room. Do the same activity with ounces.

Say:

**Remember, in our lesson on length, we said that the bigger the unit, the fewer that we would need. Which is the larger unit, pound or ounce? (pound) If I tell you that I have an object that weighs 10 pounds, and I want to know how many ounces, would I multiply or divide by 16? Remember that 16 ounces is one pound. (multiply) Why? (Pounds are bigger, so I would have fewer pounds. Therefore, I multiply.)**

⇒ Give Student Sheet 24. Have the students work independently. Come back and talk about each problem. Answers:

- |             |             |   |
|-------------|-------------|---|
| 1) A        | 2) C        | 3) less   |
| 4) less     | 5) <        | 6) >  |
| 7) multiply | 8) multiply | 9) 4 ounces (The students may have trouble with this problem. A quarter pound is $\frac{1}{4}$ of a pound. So they should multiply $\frac{1}{4} \times 16$ .) |
- 10) D. They have to find out how much protein each day. 12 ounces. Multiply 12 times 7 to find out how much per week. Then divide 84 ounces by 16 ounces to find out how many pounds.
- 11) B.  $2\frac{1}{2}$  lbs. is equal to 40 ounces. Divide 40 ounces by 5 ounces to get 8 burgers.
- |           |           |         |           |
|-----------|-----------|---------|-----------|
| 12) ounce | 13) pound | 14) ton | 15) ounce |
|-----------|-----------|---------|-----------|

Say:

**The Mathematics Reference Sheet has this customary weight conversion on it, 16 ounces = 1 pound.**

**You need to know that there are 2000 pounds in 1 ton.**

Say:

**Let's look at the idea of weight or mass in the metric system. Can you think of something that has the mass of one (1) gram?** (a small grape, a shoelace); **About 1 kilogram?** (a textbook; or since a kilogram is about 2 pounds, 2 loaves of bread); **About one milligram?** (a small seed)

Say:

**What unit would you use to measure the mass of the following items?**

- A. The weight of a grown dog** (kilograms)
- B. The weight of a elephant** (kilograms)
- C. The weight of a computer** (kilograms)
- D. The weight of a potato** (grams)
- E. The weight of a sack of potatoes** (kilograms)
- F. The weight of a paper clip** (gram)
- G. The weight of an eyelash** (milligram)

⇒ Find an object that weighs about one kilogram and some other objects that weigh more or less than a kilogram. (You need to weigh these objects ahead of time.) Have several students hold the one-kilogram object in one hand and another object in the other hand.

Say:

**Does the other object weigh more or less than one kilogram?** Don't use objects that are similar in weight. Keep trying objects around the room. Do the same activity with grams.

Say:

**There are no metric mass conversions on the Reference Table. Remember that the prefixes are the same for weight as for length. The reference sheet shows 1 kilometer = 1,000 m, so how many grams in 1 kilogram? (1000 grams) The reference sheet shows 1 millimeter = 0.001 meters, so how many grams does 1 milligram equal? (0.001 grams)**

⇒ Give Student Sheet 25 to the students. Talk about each problem.

Answers:

- |            |       |             |
|------------|-------|-------------|
| 1) D       | 2) C  | 3) more     |
| 4) less    | 5) g  | 6) g        |
| 7) kg      | 8) mg | 9) multiply |
| 10) divide | 11) < | 12) >       |
| 13) D      | 14) A |             |

⇒ In this part, you will focus on capacity.

Say:

**Capacity is the measure of how much will fit into a container. When might you need to find the capacity of a container.** (when buying milk or sodas, when taking cough syrup, when measuring vanilla to make a cake)

**What kind of tools would you use to measure capacity?** (measuring cups or other measuring containers) **What units do you use to measure capacity?** (cup, quart, gallon, pint, milliliter, liter) There are others, but these are the most important ones. Divide the units into customary and metric units.

**Customary**  
cup, quart, gallon, pint

**Metric**  
milliliter, liter, kiloliter

Say:

**Let's put the units in order from the smallest to the largest in each system. Write the symbol next to the unit.**

**Customary**  
cup (c)  
pint (pt)  
quart (qt)  
gallon (gal)

**Metric**  
milliliter (ml)  
liter (L)

Say:

**Which units would you use to measure the capacity of the following items?**

- A. The amount of water used to fill a swimming pool (gallons)**
- B. The amount of milk in a cookie recipe (cups)**
- C. The amount of gasoline in your car (gallons)**

Say:

**The following capacity conversions are found on the Mathematics Reference Sheet. There are no other ones to memorize.**

**8 fluid ounces = 1 cup**  
**2 cups = 1 pint**  
**2 pints = 1 quart**  
**4 quarts = 1 gallon**

Say:

**Let's talk about the metric system. A milliliter is about 10 drops of medicine. A liter is a little more than a quart. Which units would you use to measure the capacity of the following items?**

- A. The amount of water used to fill a swimming pool (kiloliters)**
- B. The amount of milk in a cookie recipe (milliliters)**
- C. The amount of gasoline in your car (liters)**
- D. The amount of cough medicine you take (milliliters)**

Say:

**There are no metric capacity conversions on the Reference Table. Remember that the prefixes are the same for weight as for length. The reference sheet shows 1 kilometer = 1,000 m, so how many liters in 1 kiloliter? (1000 liters) The reference sheet shows 1 millimeter = 0.001 meters, so how many liters does 1 milliliter equal? (0.001 liters)**

⇒ Give Student Sheet 26 to the students. Have the students discuss the problems. Answers:

- |        |           |          |          |
|--------|-----------|----------|----------|
| 1) C   | 2) A      | 3) less  | 4) more  |
| 5) cup | 6) gallon | 7) <     | 8) >     |
| 9) C   | 10) B     | 11) more | 12) less |
| 13) <  | 14) <     |          |          |

⇒ Have one student summarize today's lesson.

## Student Sheet 24 (Measurement: Lesson 3)

### Choose the best answer.

1. What is the best estimate of the weight of a key?  
A. 1 oz  
B. 6 oz  
C. 4 lbs  
D. 6 lbs
2. What is the best estimate of the weight of a person's brain?  
A. 1 oz  
B. 3 oz  
C. 3 lbs  
D. 20 lbs
3. Is the weight of a bicycle more or less than a ton? \_\_\_\_\_
4. Is the weight of a potato chip more or less than an ounce? \_\_\_\_\_

### For 5 and 6, fill in each circle with the symbol (>, <, or =) to make the statements true.

5. 10 oz  2 lbs
6. 4500 lbs  2 tons

### For 7 and 8, fill in the blanks.

7. To change from pounds to ounces, \_\_\_\_\_ by 16.
8. To change from tons to lbs, \_\_\_\_\_ by 2000.
9. How many ounces does a quarter-pounder weigh? \_\_\_\_\_
10. Ted is on a diet and must weigh all the food that he eats each day. He is allowed three 4-ounce servings of protein each day. About how many pounds of protein is this allowance for one week?  
A. 84 pounds      B. 28 pounds      C. 12 pounds      D. 5 pounds
11. Mr. Julius bought  $2\frac{1}{2}$  pounds of ground turkey to make hamburgers. He wants to put approximately 5 ounces in each burger. How many burgers can he make?  
A.  $7\frac{1}{2}$  burgers    B. 8 burgers      C. 10 burgers      D.  $12\frac{1}{2}$  burgers

### In 12–15, choose the best unit to measure the weight of each object. (ounce, pound, or ton)

12. A shoelace \_\_\_\_\_
13. A 8<sup>th</sup> grade student \_\_\_\_\_
14. A streetcar \_\_\_\_\_
15. A handheld calculator \_\_\_\_\_

## Student Sheet 25 (Measurement: Lesson 3)

### Choose the best answer.

1. What is the best estimate for the mass of an average adult woman?  
A. 20 g  
B. 2 kg  
C. 60 g  
D. 60 kg
2. What is the best estimate for the weight/mass of a handful of peanuts?  
A. 1 g  
B. 1 kg  
C. 20 g  
D. 20 kg
3. Is the weight/mass of a TV more or less than a gram? \_\_\_\_\_
4. Is the weight/mass of shoelace more or less than a kilogram? \_\_\_\_\_

### In 5–8, choose the best unit to measure the weight/mass of each object.

5. A pen \_\_\_\_\_
6. A handful of paperclips \_\_\_\_\_
7. A bowling ball \_\_\_\_\_
9. A flea \_\_\_\_\_

### For 9 and 10, fill in the blanks.

9. To change from kilograms to grams, \_\_\_\_\_ by 1000.
10. To change from milligrams to grams, \_\_\_\_\_ by 1000.

### For 5 and 6, fill in each circle with the symbol (>, <, or =) to make the statements true.

11. 105 g  1 kg
12. 4500 mg  4 g
13. The weight of a box of crackers is approximately 270 grams. If a truck was carrying 2000 boxes of crackers, how much did the cargo of crackers weigh in kilograms?  
A. 540,000 kg      B. 54,000 kg      C. 5,400 kg      D. 540 kg
14. In that same box of crackers, one serving contains approximately 170 mg of sodium (salt.) If there were 9 servings in the entire box, approximately how much sodium would you get, in grams, if you ate the entire box?  
A. 1.5 g      B. 15 g      C. 150 g      D. 1500 g

**Student Sheet 26 (Measurement: Lesson 3)**

1. What is the best estimate of the amount of gasoline an average car gas tank holds?  
A. 1.6 quarts  
B. 1.6 gallons  
C. 16 gallons  
D. 16 cups
2. What is the best estimate of the amount of milk in a small milk carton?  
A. 2 cups  
B. 20 cups  
C. 20 pints  
D. 20 gallons
3. Does a can of soda hold more or less than a pint? \_\_\_\_\_
4. Does a bowl of chili hold more or less than a cup? \_\_\_\_\_

**Which unit would you use to measure the capacity of the following objects? (cup, pint, quart, or gallon)**

5. the amount of milk to add to a cookie recipe \_\_\_\_\_
6. the amount of water in a bath tub \_\_\_\_\_

**For 7 and 8, fill in each circle with the symbol (>, <, or =) to make the statements true.**

7. 2.5 quarts  1 gallon      8. 5 cups  2 pints

**Choose the best answer.**

9. What is the best estimate of the amount of water in a 2-gallon bucket?  
A. 1 milliliter   B. 10 milliliters   C. 10 liters   D. 100 liters
10. What is the best estimate of the amount of shampoo in a bottle?  
A. 1 milliliter   B. 100 milliliters   C. 1 liter   D. 100 liters
11. Does a gallon of milk hold more or less than a liter? \_\_\_\_\_
12. Does a bottle of hot sauce hold more or less than liter? \_\_\_\_\_

**For 13 and 14, fill in each circle with the symbol (>, <, or =) to make the statements true.**

13. 10 ml  1 L      14. 4 L  4321 ml