Lesson 21: Getting the Job Done—Speed, Work, and Measurement Units

Student Outcomes

- Students use rates between measurements to convert measurement in one unit to measurement in another unit. They manipulate and transform units appropriately when multiplying or dividing quantities.

Lesson Notes

Prior to this lesson, a measurement center should be made available to students. By allowing all students to handle all the various items, they gain a real sense of each measure and its relationship to the others.

Measurement Center Materials: rulers (centimeter and inches), meter sticks, yard sticks, measuring tapes; kilogram, gram, and milligram masses; liter box, liter bottle, or liter graduated cylinder, eyedropper (for milliliter); ounce and pound weights; cup, pint, quart, and gallon containers

Materials: copies of conversion charts, calculators

Vocabulary: Length, Mass, Weight, Capacity, Metric System, U.S. Customary System, kilo-, deci-, centi-, milli-

Conversion tables contain ratios that can be used to convert units of length, weight, or capacity. You must multiply the given number by the ratio that compares the two units.

Classwork

It may be helpful to copy the vocabulary terms on one side of a handout and the conversion charts on the other. Distribute these to each student. Pair the students for the first two examples.

Opening Exercise (5 minutes)

Opening Exercise

Identify the ratios that are associated with conversions between feet, inches, and yards.

12 inches $=$ ___1___ foot; the ratio of inches to feet is ___$12:1$___.

1 foot $=$ ___12___ inches; the ratio of feet to inches is ___$1:12$___.

3 feet $=$ ___1___ yard; the ratio of feet to yards is ___$3:1$___.

1 yard $=$ ___3___ feet; the ratio of yards to feet is ___$1:3$___.

Example 1 (10 minutes)

- Conversion tables are really ratio tables that can be used to convert units of length, weight, or capacity (and other units, too). You must multiply the given number by the ratio that compares the two units.
- Work with your partner to find out how many feet are in 48 inches. Make a ratio table that compares feet and inches. Use the conversion rate of 12 inches per foot or $\frac{1}{12}$ foot per inch.

Allow students to solve the problem using the conversion chart. When all groups finish, make clear that they can multiply 48 by $\frac{1}{12}$ or divide 48 by 12. The result is 4 feet either way.

Example 1

Work with your partner to find out how many feet are in 48 inches. Make a ratio table that compares feet and inches. Use the conversion rate of 12 inches per foot or $\frac{1}{12}$ foot per inch.

$$\frac{1\ \textit{foot}}{12\ \cancel{\textit{inches}}} \times \frac{48\ \cancel{\textit{inches}}}{1} = \frac{1\ \textit{foot} \times 48}{12 \times 1} = \frac{48}{12} = 4\ \textit{feet}$$

48 inches equals 4 feet.

Example 2 (10 minutes)

Example 2

How many grams are in 6 kilograms? Again, make a record of your work before using the calculator. The rate would be $1,000$ grams per kg. The unit rate would be $1,000$.

$$\frac{6}{1} \times \frac{1,000}{1} = \frac{6 \times 1,000}{1 \times 1} = 6,000$$

$$\frac{6\ \cancel{\textit{kilograms}}}{1} \times \frac{1,000\ \textit{grams}}{1\ \cancel{\textit{kilogram}}} = \frac{6 \times 1,000\ \textit{grams}}{1 \times 1} = 6,000\ \textit{grams}$$

There are $6,000$ grams in 6 kilograms.

Exercises (10 minutes)

Exercise 1

How many cups are in 5 quarts? As always, make a record of your work before using the calculator. The rate would be 4 cups per quart. The unit rate would be 4.

$$\frac{5}{1} \times \frac{4}{1} = \frac{5 \times 4}{1 \times 1} = 20$$

$$\frac{5\ \cancel{\textit{quarts}}}{1} \times \frac{4\ \textit{cups}}{1\ \cancel{\textit{quart}}} = \frac{5 \times 4\ \textit{cups}}{1 \times 1} = 20\ \textit{cups}$$

There are 20 cups in 5 quarts.

Exercise 2

How many quarts are in 10 cups?

$10\ \cancel{cups} \bullet \frac{1\ quart}{4\ \cancel{cups}} = \frac{10}{4} quarts = \frac{5}{2}\ quarts = 2\frac{1}{2}\ quarts$

Closing (5 minutes)

- In Exercise 2, what if it was set up this way: $10 \text{ cups} \times \left(\frac{4 \text{ cups}}{1 \text{ quart}}\right) = 40$ quarts. What is wrong with that set up?
  - *If the conversion factor is flipped upside down, the units will not cancel and the number won't make sense.*

Lesson Summary

Conversion tables contain ratios that can be used to convert units of length, weight, or capacity. You must multiply the given number by the ratio that compares the two units.

Exit Ticket (5 minutes)

Name ____ Date____________________

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Exit Ticket

Jill and Erika made 4 gallons of lemonade for their lemonade stand. How many quarts did they make? If they charge $\$2.00$ per quart, how much money will they make if they sell it all?

Exit Ticket Sample Solutions

Jill and Erika made 4 gallons of lemonade for their lemonade stand. How many quarts did they make? If they charge $\$2.00$ per quart, how much money will they make if they sell it all?

The conversion rate is 4 quarts per gallon.

$$\frac{4 \text{ quarts}}{1 \cancel{\text{ gallon}}} \bullet \frac{4 \cancel{\text{ gallons}}}{1} = \frac{4 \text{ quarts } \bullet 4}{1 \bullet 1} = 16 \text{ quarts}$$

$$16 \cancel{\text{ quarts}} \times \frac{\$2.00}{\cancel{\text{quart}}} = \$32 \text{ in sales}$$

Problem Set Sample Solutions

1. 7 ft. $=$ __84__ in.
2. 100 yd. $=$ __300__ ft.
3. 25 m $=$ __$2,500$__ cm
4. 5 km $=$ __$5,000$__ m
5. 96 oz. $=$ __6__ lb.
6. 2 mi. $=$ __$10,560$__ ft.
7. 2 mi. $=$ __$3,520$__ yd.
8. 32 fl. oz. $=$ __4__ c.
9. $1,500$ mL $=$ __1.5__ L
10. 6 g $=$ __$6,000$__ mg
11. **Beau buys a 3-pound bag of trail mix for a hike. He wants to make one-ounce bags for his friends with whom he is hiking. How many one-ounce bags can he make?**

    48 bags

12. **The maximum weight for a truck on the New York State Thruway is 40 tons. How many pounds is this?**

    $80,000$ lb.

13. **Claudia's skis are 150 centimeters long. How many meters is this?**

    1.5 m

14. **Claudia's skis are 150 centimeters long. How many millimeters is this?**

    $1,500$ mm

15. **Write your own problem and solve it. Be ready to share the question tomorrow.**

    Answers will vary.

U.S. Customary Length	Conversion
Inch (in.)	1 in. $= \frac{1}{12}$ ft.
Foot (ft.)	1 ft. = 12 in.
Yard (yd.)	1 yd. = 3 ft. 1 yd. = 36 in.
Mile (mi.)	1 mi. = 1,760 yd. 1 mi. = 5,280 ft.

Metric Length	Conversion
Centimeter (cm)	1 cm = 10 mm
Meter (m)	1 m = 100 cm 1 m = 1,000 mm
Kilometer (km)	1 km = 1,000 m

U.S. Customary Weight	Conversion
Pound (lb.)	1 lb. = 16 oz.
Ton (T.)	1 T. = 2,000 lb.

Metric Capacity	Conversion
Liter (L)	1 L = 1,000 ml
Kiloliter (kL)	1 kL = 1,000 L

U.S. Customary Capacity	Conversion
Cup (c.)	1 c. = 8 fluid ounces
Pint (pt.)	1 pt. = 2 c.
Quart (qt.)	1 qt. = 4 c. 1 qt. = 2 pt. 1 qt. = 32 fluid ounces
Gallon (gal.)	1 gal. = 4 qt. 1 gal. = 8 pt. 1 gal. = 16 c. 1 gal. = 128 fluid ounces

Metric Mass	Conversion
Gram (g)	1 g = 1,000 mg
Kilogram (kg)	1 kg = 1,000 g