Nasco Education

LESSON PLAN

Math

Developed with Kristin Hotter

Conversion of units

Volume 27 | Gr. 5

Activity 1: 40 mins.
Activity 2: 30 mins.
Activity 3: 20 mins.

Content

This lesson includes three activities that will help students master the conversion of units within the metric system. The first activity is teacher-guided and allows students to make foundational connections between measurements within the metric system. The second activity extends on the connections made from the first activity by asking students to convert between measurements other than the base unit. The final activity is a centers activity. There are 20 total task cards for students to solve. Cards 1-10 reinforce the skills learned in Activities 1 and 2. Cards 11-20 extend upon the skills learned.

Objectives

Students will...

- Convert metric measurements within a given unit
- Analyze the connection between related metric measurements
- Solve single- and multi-step problems that convert metric measurements

Materials

Materials for Activity 1: Conversion chart and Worksheet #1 with answer key

Materials for Activity 2: Bag with seven slips (one for each prefix: kilo-, hecto-, deca-, unit, deci-, centi-, and milli-), bag with three slips (one for each unit; gram, meter, and liter), conversion chart from previous activity, and Worksheet #2 with answer key

Materials for Activity 3: Conversion chart from previous activity, task cards, and Task Cards Worksheet with answer key

Common core state standards

CCSS.Math.Content.5.MD.A.1 — Convert like measurement units within a given measurement system.

Introduction

The introduction may be conducted as a whole group activity or in small collaborative groups. Begin by asking students the following questions. The answers should be used to either create a class list on the board or on chart paper, or students should be working together in their groups to come up with a list that answers each question.

- What are some tools we use to measure? (ruler, yardstick, meterstick, thermometer, measuring cups, stopwatch, etc.)
- What units do we use when we measure? (inches, feet, liters, gallons, miles, seconds, etc.)

For the next part, if you are conducting the introduction as a whole group activity, make the markings where appropriate on the lists. If students are working in small groups, prompt them to make the symbols on their lists. Ask the following questions:

- Which of the tools on the list are used to measure length? (choose a symbol and put it next to each of those tools)
- Which of the units on the list are measurements of length? (put the same symbol next to each appropriate unit)
- Which of the tools on the list are used to measure weight? (choose a second symbol and put it next to each of those tools)
- Which of the units on the list are measurements of weight or mass? (put the second symbol next to each appropriate unit)
- Which of the tools on the list are used to measure volume/liquids? (choose a third symbol and put it next to each of those tools)
- Which of the units on the list are measurements of volume/liquids? (put the third symbol next to each appropriate unit)

When this is done, there may be some tools, such as a thermometer, that measure something other than the other three categories. There may also be some leftover units of measurement, such as degrees, that do not fit into the three categories. Tell students that there are many measuring tools that measure many different units, but for now, they will be focusing on tools and units that measure length, weight/mass, and volume.

Activity 1

1. Give each student a copy of the conversion chart. Explain that now they are going to learn how different units relate to one another. Prompt them to look at the conversion chart, point out that there are seven columns in the chart, then have them focus on the middle column.
2. The middle column has the words *measurement*, *mass*, and *volume* in it. Explain that there is a universal unit used by scientists and mathematicians to measure length, and that is the *meter*, which is abbreviated as *m*. Have students write *meter = m* on the blank under *measurement*.
3. Follow the same procedure for *mass* and *volume*. For *mass*, the universal unit is the *gram* and its abbreviation is *g*; so for *mass*, students should write *gram = g* on the blank. For *volume*, the universal unit is the *liter* and its abbreviation is *l*; so students should write *liter = l* on the blank for *volume*.
4. Explain to students that when these units are converted or changed to different units, they all use the same prefixes. Remind students that a prefix is something added to the beginning of a word that changes the word's meaning. Also explain that all of these units are based on the number 10. When students move from column to column on the chart, they will be multiplying and dividing by powers of 10.
5. Tell students they will begin filling in the measurements on the chart that are located to the left of the Unit column. Each of these measurements is larger than the unit. Students should be filling in the chart as you progress through the activity. Ask students what the D at the top of the column to the left of the Unit column stands for *(deca-)*. Explain that the prefix *deca-* means 10, and that a *decameter* is 10 meters. A *decagram* is 10 grams. A *decaliter* is 10 liters. One of each of these measurements is ten times as large as a unit.
6. Move left to the next column. Ask what the H stands for *(hecto-)*. If each column is based on the number 10, and a decameter is 10 times as large as a meter, how many meters would fit in a hectometer? *(100)* Explain that the prefix *hecto-* means 100 and that a *hectometer* is 100 meters, a *hectogram* is 100 grams, and a *hectoliter* is 100 liters. One of each of these measurements is one hundred or 10 x 10 times larger than a unit.
7. Move left to the final column with a K at the top. Ask what the K stands for *(kilo-)*, then ask how many meters fit in a kilometer *(1,000)*. Explain that the prefix *kilo-* means 1,000. A *kilometer* is 1,000 meters. A *kilogram* is 1,000 grams. A *kiloliter* is 1,000 liters. One of each of these measurements is one thousand or 10 x 10 x 10 times larger than a unit.
8. Now direct students to the column directly to the right of the Unit column, which has a D on top. Tell them that each column to the right of the Unit column will be smaller than the unit. Ask what this D stands for *(deci-)*. Explain that the prefix *deci-* means 1/10 or 0.1. A *decimeter* is 0.1 meters. A *decigram* is 0.1 grams. A *deciliter* is 0.1 liters. One of each of these measurements is one tenth or 10 times smaller than a unit.
9. Move right to the next column, the one with a C at the top. Ask what the C stands for *(centi-)*. Ask if a decimeter is 0.1 meters, how many meters is a centimeter? *(0.01 or 1/100 meters)* Explain that the prefix *centi-* means 1/100 or 0.01. A *centimeter* is 0.01 meters. A *centigram* is 0.01 grams. A *centiliter* is 0.01 liters. One of each of these measurements is one hundredth or 10 x 10 times smaller than a unit.
10. Direct students to the final column, the one with an M at the top. Ask what the M stands for *(milli-)*. Ask how many meters are in a millimeter if a centimeter is 1/100 or 0.01 meters *(0.001 or 1/1000 meters)*. Explain that the prefix *milli-* means 1/1000 or 0.001. A *millimeter* is 0.001 meters. A *milligram* is 0.001 grams. A *milliliter* is 0.001 liters. One of each of these measurements is one thousandth or 10 x 10 x 10 times smaller than a unit.
11. Now that students have the terminology down, it's time for them to begin understanding how these terms apply to actual measurements. Direct their attention to the bottom of the conversion chart and to the number 18. Tell students they will use a unit of length for this measurement. Ask what the unit of length is *(meters)*. Say that they have an object that measures 18 meters in length. Ask where the decimal point is in the number 18 *(after the 8)*. Explain that when writing whole numbers, the decimal point isn't written because it is understood to always come after the last digit in the number. Ask where the decimal point is in the number 364 *(after the 4)*. What about after 7,853? *(after the 3)*
12. Return to the 18 meters on the conversion chart. Say that students will convert that number to decimeters, then ask if they need to move left or right on the conversion chart *(right)*. Ask students what operation needs to be performed when they move to the right *(multiplication)*. Ask what 18 x 10 is *(180)*. Say that 18 meters is the same as 180 decimeters, then have students write that in the space provided. Demonstrate for students that this is the same as moving the decimal point one spot to the right in the number.
13. Now have students convert the 18 meters into centimeters. Ask what 18 x 100 is *(1,800)*. Say that 18 meters is the same as 1,800 centimeters. Have them write that in the space provided. Demonstrate for students that this is the same as moving the decimal point two spots to the right in the number.
14. Now have students convert 18 meters to millimeters. Ask what 18 x 1,000 is *(18,000)*. Say that 18 meters is the same as 18,000 millimeters. Have them write that in the space provided. Demonstrate for students that this is the same as moving the decimal point three spots to the right in the number.

15. Students will now convert 18 meters to decameters. Ask which direction they need to move on the conversion chart to do this *(left)*. Ask what operation needs to be performed when moving to the left *(division)*. Explain that when dividing by 10, the decimal point needs to move one spot to the left in the number. Ask what 18 ÷ 10 is *(1.8)*. Explain that 18 meters is the same as 1.8 decameters, then have students write that in the space provided.
16. Guide students in converting 18 meters to hectometers. Ask which measurement they should convert to next *(hectometers)*, then how many meters are in one hectometer *(100)*. Remind students that since they've moved left, they need to divide. When dividing by 100, the decimal point moves two spots to the left in the number. Ask what 18 ÷ 100 is *(0.18)*. Explain that 18 meters is the same as 0.18 hectometers, then have students write that in the space provided.
17. Move on to converting 18 meters to kilometers. Ask how many meters are in a kilometer *(1,000)*. Say that they moved one spot left for decameters and two spots left for hectometers, then ask how many spots to the left they will need to move for kilometers *(three spots)*. Ask what 18 ÷ 1,000 is *(0.018)*. Explain that 18 meters is the same as 0.018 kilometers, then have students write that in the space provided.
18. Direct students to the number 223 at the bottom of the conversion chart. Say that they will use the unit of mass for this measurement, then ask what the unit of mass is *(grams)*. Ask where the decimal point is in the number 223 *(after the 3)*. Say that they will convert 223 grams to decigrams, then ask if they need to multiply or divide for this conversion *(multiply)*, which direction the decimal point will move *(to the right)*, what they need to multiply 223 by to determine the decigram conversion *(10)*, and how many spots to the right the decimal point will move *(one spot)*. Explain that when they multiply 223 x 10, it is the same as moving the decimal point one spot to the left, then ask what the number of decagrams is that is equivalent to 223 grams *(22.3 decagrams)*. Have them write this in the space provided.
19. Have students work independently or with a partner to determine the remaining conversions for 223 grams. After they have had some time to work, ask the following questions:

- When you convert 223 grams to centigrams, do you multiply or divide? *(multiply)*
- Which direction will the decimal point move? *(to the right)*
- What do you multiply 223 by to determine the centigram conversion? *(100)*
- How many spots to the right will the decimal point move? *(two spots)*
- When you multiply 223 by 100, which is the same as moving the decimal point two spots to the right, what is the number of centigrams that is equivalent to 223 grams? *(22,300 centigrams)*
- Use the same line of questioning for milligrams, hectograms, and kilograms. 223 grams = 223,000 milligrams, 2.23 hectograms, and 0.223 kilograms.

20. Move on to the final number of the chart, 6.82. Make this measurement liters. Guide students through the initial conversion from 6.82 liters to deciliters.

- Where is the decimal point in 6.82 liters? *(between the 6 and the 8)*
- When you convert 6.82 liters to deciliters, do you multiply or divide? *(multiply)*
- Which direction will the decimal point move? *(to the right)*
- What do you multiply 6.82 by to determine the deciliter conversion? *(10)*
- How many spots to the right will the decimal point move? *(one spot)*
- When you multiply 6.82 by 10, which is the same as moving the decimal point one spot to the right, what is the number of deciliters that is equivalent to 6.82 liters? (*68.2 deciliters*)

Have students determine the rest of the conversions independently or with a partner. Use the same line of questioning upon completion of the activity. 6.82 liters = 682 centiliters, 6,820 milliliters, 0.682 decaliters, 0.0682 hectoliters, and 0.00682 kiloliters.

21. For additional independent practice, have students complete Worksheet 1.

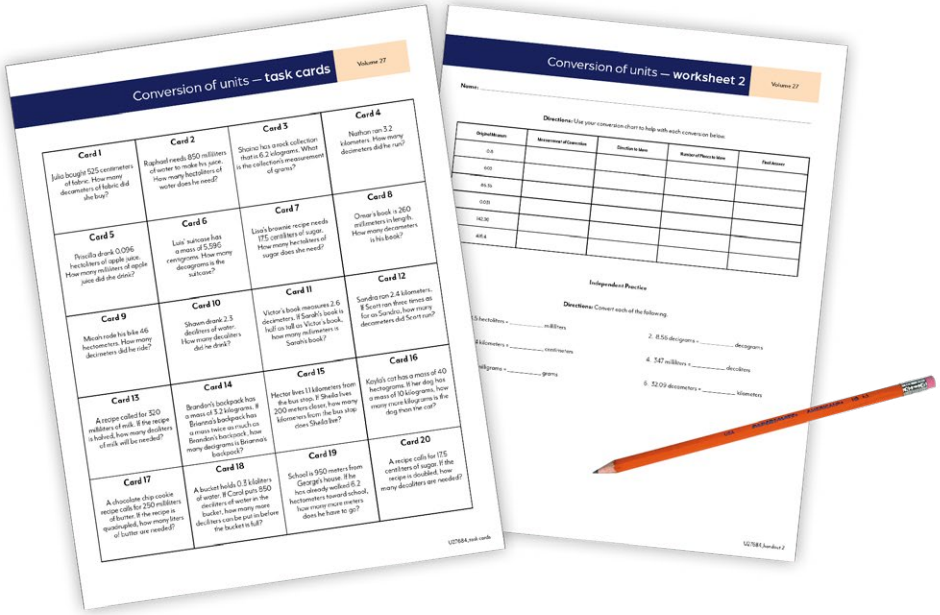
Activity 2

In the previous activity, each conversion started at the unit. With this lesson, students will learn to convert from any measurement to any other measurement from the chart. Example: Convert 2.56 hectograms to centigrams. You will also need two bags, one with the seven prefixes and one with the three different units of measurement.

1. Distribute Worksheet 2 to each student and have them take out their conversion charts from the previous activity. Tell students that they have been converting measurements by starting with the unit measurement, but now they will take their knowledge of conversions one step further and start with different measurements. For example, they may start with hectometers or milligrams, and convert those measurements to other measurements, such as centimeters or kilograms.
2. Hold up the two bags and say what is in the bags. Explain that the first bag holds all of the prefixes they discussed in the previous activity, along with a slip for unit. Tell them that unit means that they will use meter, liter, or gram. Go through each prefix and ask students to remind you what they mean *(kilo = 1,000; hecto = 100; deca = 10; deci = 0.1; centi = 0.01; milli = 0.001)*. Explain that the second bag holds the three units of measurement discussed yesterday: meter, liter, and gram. Ask what each of them measures *(meter = length; liter = volume; gram = mass)*.
3. Direct students to look at the chart on the worksheet and the number in the first column, 0.8. Draw a slip out of the first bag to determine the beginning measurement. Draw a second slip out of the first bag to determine the measurement they will be converting to. Draw a slip out of the second bag to determine the unit of measurement. For example, let's say you drew out *hecto-* for the first measurement, *milli-* for the second measurement, and *grams* for the unit of measurement. On the worksheet, students would fill in 0.8 hectograms in the first column and record milligrams in the second column.
4. Students should use their conversion charts to help convert from the original measurement to the measurement of conversion. For instance, in the example presented above, students would put their pencil on *hecto-* on the conversion chart, then determine if *milli-*, the measurement they're converting to, is to the left or the right of *hecto-* on the chart *(right)*. They would record *right* in the third column of their chart. Have them count how many spaces are between *hecto-* and *milli-* on the conversion chart. They should count five spaces. Record that number in the fourth column of the chart on the worksheet. In this case, since they moved to the right five spaces, they are multiplying the original number by 100,000, which has five zeroes in it. Have them take their pencil on the decimal point of the original number, 0.8, and move the decimal point five places to the right. They should get 80,000 milligrams, which they will record in the final column on their worksheet.
5. The next row on the worksheet has the number 603 written in the first column. Select students to draw the three slips to determine the starting measurement, measurement of conversion, and the unit that they will work with. Let's say that students drew *centi-*, *deca-*, and *meter*. Students would fill in the original measure with the first slip *(centimeter)* and the measurement of conversion with the second slip *(decameter)*. Students will then place their pencils on the original measure on their conversion charts, then determine if they need to move left or right and how many spots the decimal point needs to be moved. In this example, since they moved left three spots, they need to divide the original number by 1,000, which has three zeroes. Ask students where the decimal point is in the number 603 *(after the 3)*. So in this example, if they move the decimal point to the left three spaces, they would get 0.603 decameters.
6. Go through the remaining rows of the chart in the same manner. Give students more responsibility with answering the problems as you work your way down the chart. Use the same line of questioning as above to check for student understanding of the problems.
7. Have students complete the Independent Practice portion of the worksheet as a further check for understanding either in class or for homework.

Activity 3

This activity is designed to be a centers activity. There are 20 cards that students work with. Cards 1-10 reinforce the skills learned in Activities 1 and 2. Cards 11-20 extend the skills learned in Activities 1 and 2. Each student will need Task Cards worksheet to complete the activity.



Conversion Chart

K	H	D	U	D	C	M
_____	_____	_____	**Unit**	_____	_____	_____
It means _____ units. _____ times larger than a unit.	It means _____ units. _____ times larger than a unit.	It means _____ units. _____ times larger than a unit.	Measurement: _____ Mass: _____ Volume: _____	It means _____ units. _____ times smaller than a unit.	It means _____ units. _____ times smaller than a unit.	It means _____ units. _____ times smaller than a unit.
			18 _____			
			223 _____			
			6.82 _____			

Conversion of units — worksheet 1

U27684_handout 1

Directions: Complete the chart using the necessary conversions.

Name: _____

Kilo- (1,000)	Hecto- (100)	Deca- (10)	Unit	Deci- (0.1)	Centi- (0.01)	Milli- (0.001)
			7.8 meters			
			64 liters			
			83.6 grams			
			423 meters			

Conversion of units — answer key 1

U27684_answer key 1

Directions: Complete the chart using the necessary conversions.

Name: _____

Kilo- (1,000)	Hecto- (100)	Deca- (10)	Unit	Deci- (0.1)	Centi- (0.01)	Milli- (0.001)
0.0078 kilometers	0.078 hectometers	0.78 decameters	7.8 meters	78 decimeters	780 centimeters	7,800 millimeters
0.064 kiloliters	0.64 hectoliters	6.4 decaliters	64 liters	640 deciliters	6,400 centiliters	64,000 milliliters
0.0836 kilograms	0.836 hectograms	8.36 decagrams	83.6 grams	836 decigrams	8,360 centigrams	83,600 milligrams
0.423 kilometers	4.23 hectometers	42.3 decameters	423 meters	4,230 decimeters	42,300 centimeters	423,000 millimeters

Conversion of units — **worksheet 2**

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Name: _____

Directions: Use your conversion chart to help with each conversion below.

Original Measure	Measurement of Conversion	Direction to Move	Number of Places to Move	Final Answer
0.8				
603				
86.35				
0.031				
142.98				
416.4				

Independent Practice

Directions: Convert each of the following.

1. 78.5 hectoliters = _____ milliliters
2. 8.56 decigrams = _____ decagrams
3. 0.04 kilometers = _____ centimeters
4. 347 milliliters = _____ decaliters
5. 44.5 milligrams = _____ grams
6. 32.09 decameters = _____ kilometers

Name: _____

Conversion of Units Worksheet #2 Answer Key

Directions: Use your conversion chart to help with each conversion below.

The answers in this chart will vary based on what slips were drawn in class during Activity 2.

Original Measure	Measurement of Conversion	Direction to Move	Number of Places to Move	Final Answer
0.8				
603				
86.35				
0.031				
142.98				
416.4				

Independent Practice

Directions: Convert each of the following.

1. 78.5 hectoliters = 7,850,000 milliliters
2. 8.56 decigrams = 0.0856 decagrams
3. 0.04 kilometers = 4,000 centimeters
4. 347 milliliters = 0.0347 decaliters
5. 44.5 milligrams = 0.0445 grams
6. 32.09 decameters = 0.3209 kilometers

Card 1 Julia bought 525 centimeters of fabric. How many decameters of fabric did she buy?	**Card 2** Raphael needs 850 milliliters of water to make his juice. How many hectoliters of water does he need?	**Card 3** Shaina has a rock collection that is 6.2 kilograms. What is the collection's measurement in grams?	**Card 4** Nathan ran 3.2 kilometers. How many decimeters did he run?
Card 5 Priscilla drank 0.096 hectoliters of apple juice. How many milliliters of apple juice did she drink?	**Card 6** Luis' suitcase has a mass of 5,596 centigrams. How many decagrams is the suitcase?	**Card 7** Lisa's brownie recipe needs 17.5 centiliters of sugar. How many hectoliters of sugar does she need?	**Card 8** Omar's book is 260 millimeters in length. How many decameters is his book?
Card 9 Micah rode his bike 46 hectometers. How many decimeters did he ride?	**Card 10** Shawn drank 2.3 deciliters of water. How many decaliters did he drink?	**Card 11** Victor's book measures 2.6 decimeters. If Sarah's book is half as tall as Victor's book, how many millimeters is Sarah's book?	**Card 12** Sandra ran 2.4 kilometers. If Scott ran three times as far as Sandra, how many decameters did Scott run?
Card 13 A recipe called for 320 milliliters of milk. If the recipe is halved, how many deciliters of milk will be needed?	**Card 14** Brandon's backpack has a mass of 3.2 kilograms. If Brianna's backpack has a mass twice as much as Brandon's backpack, how many decigrams is Brianna's backpack?	**Card 15** Hector lives 1.1 kilometers from the bus stop. If Sheila lives 200 meters closer, how many kilometers from the bus stop does Sheila live?	**Card 16** Kayla's cat has a mass of 40 hectograms. If her dog has a mass of 10 kilograms, how many more kilograms is the dog than the cat?
Card 17 A chocolate chip cookie recipe calls for 250 milliliters of butter. If the recipe is quadrupled, how many liters of butter are needed?	**Card 18** A bucket holds 0.3 kiloliters of water. If Carol puts 850 deciliters of water in the bucket, how many more deciliters can be put in before the bucket is full?	**Card 19** School is 950 meters from George's house. If he has already walked 6.2 hectometers toward school, how many more meters does he have to go?	**Card 20** A recipe calls for 17.5 centiliters of sugar. If the recipe is doubled, how many decaliters are needed?

Conversion of units — **task cards worksheet**

Volume 27

Name: _____

Directions: Find the box that corresponds with your task card. Write the original measurement as well as the converted measurement for that card in the corresponding box below.

Card 1	**Card 2**	**Card 3**	**Card 4**
Card 5	**Card 6**	**Card 7**	**Card 8**
Card 9	**Card 10**	**Card 11**	**Card 12**
Card 13	**Card 14**	**Card 15**	**Card 16**
Card 17	**Card 18**	**Card 19**	**Card 20**

Conversion of units — **task cards answer key**

Card 1 525 centimeters = 0.525 decameters	**Card 2** 850 milliliters = 0.0085 hectoliters	**Card 3** 6.2 kilograms = 6,200 grams	**Card 4** 3.2 kilometers = 32,000 decimeters
Card 5 0.096 hectoliters = 9,600 milliliters	**Card 6** 5,596 centigrams = 5.596 decagrams	**Card 7** 17.5 centiliters = 0.00175 hectoliters	**Card 8** 260 millimeters = 0.026 decameters
Card 9 46 hectometers = 46,000 decimeters	**Card 10** 2.3 deciliters = 0.023 decaliters	**Card 11** 2.6 ÷ 2 = 1.3 decimeters 1.3 decimeters = 130 millimeters	**Card 12** 2.4 kilometers x 3 = 7.2 kilometers 7.2 kilometers = 720 decameters
Card 13 320 ÷ 2 = 160 milliliters 160 milliliters = 1.6 deciliters	**Card 14** 3.2 x 2 = 6.4 kilograms 6.4 kilograms = 64,000 decigrams	**Card 15** 1.1 kilometers = 1,100 meters 1,100 – 200 = 900 meters 900 meters = 0.9 kilometers	**Card 16** 40 hectograms = 4 kilograms 10 – 4 = 6 kilograms
Card 17 250 x 4 = 1,000 milliliters 1,000 milliliters = 1 liter	**Card 18** 0.3 kiloliters = 3,000 deciliters 3,000 – 850 = 2,150 deciliters	**Card 19** 950 meters = 9.5 hectometers 9.5 – 6.2 = 3.3 hectometers 3.3 hectometers = 330 meters	**Card 20** 17.5 x 2 = 35 centiliters 35 centiliters = 0.035 decaliters