

## Teacher’s Guide: Unit Conversion: Water Use

Recommended Grade Level: 5-8

*(also applicable to grades 9-12 for students requiring significant support in learning)*

Suggested Time: About 50-60 minutes spread over one or more class periods, plus additional time to complete a writing assignment

### Goals

Following are the big ideas that students should take away after completing this lesson:

- Measurements can be converted from one unit to another.
- Unit conversions can be represented as ratios.

### Vocabulary

(See definitions on page 6.)

- calculate
- conserve
- convert
- equivalent
- ratio
- unit of measurement

### Key Literacy Strategies

Following are the primary literacy strategies students will use to complete this activity:

- Making inferences (screen 4; final assignments 2 and 3)
- Determining important information (screens 4, 5, 7, 8, and 11; final assignments 2 and 3)
- Constructing summaries (final assignment 1)

Note: In addition to the key literacy strategies listed above, students will also use each of these strategies to complete this lesson:

- Monitoring comprehension
- Synthesizing
- Making predictions
- Developing vocabulary
- Connecting prior knowledge to new learning
- Developing a topic in writing
- Identifying and using text features (photographs, captions, diagrams, and/or maps)

### Overview

*Unit Conversion: Water Use* is a student-directed learning experience. However, while students are expected to work through the lesson on their own, teachers should be available to keep the lesson on track, organize groupings, facilitate discussions, answer questions, and ensure that students meet all learning goals.

The following is a summary of the lesson screens:

- Screen 1: Students consider the idea that overuse of water could lead to eventual shortages and are invited to think about how math can help us make decisions about protecting this important resource.
- Screen 2: Students read about the amount of water they use in daily activities. The importance of converting a measurement into another unit is introduced.
- Screen 3: Students learn what the goals are for the lesson, which strategies they will be using to complete the lesson, and the important vocabulary words they will use during the lesson.
- Screen 4: Students watch a video that shows a teenager, Noreen, estimating the amount of water used during a 10-minute shower. Students learn that if they gather data about the water flow for 30 seconds, they can calculate how much water would be used over a longer period of time (10 minutes).
- Screen 5: Students watch another video clip of Noreen performing a unit conversion from cups to gallons. The idea of equivalence—that 16 cups and 1 gallon have the same capacity—is introduced, and a mathematical reasoning for determining this equivalence is presented. Students explain how many gallons 240 cups is equivalent to. They must include the word “convert” in their answer.
- Screen 6: Students read and learn about the ratio method for converting measurement units.
- Screen 7: Students read about procedures for converting measurements and see more examples of measurement conversions using ratios. Some common ratios, such as 4 quarts = 1 gallon and 1 foot = 12 inches, are presented.
- Screen 8: Students read a description of different ways to conserve water at home and see a calculation of how much water could be saved by switching to a high-efficiency washing machine.
- Screen 9: Students answer three multiple-choice questions to show their comprehension of unit conversions and proportional reasoning.
- Screen 10: Students complete an interactive vocabulary activity, and then choose two words from the vocabulary list and write a new sentence for each word. These tasks demonstrate their understanding of the meanings of the words.
- Screen 11: Students use an interactive activity to create the steps in unit conversions. Given a brief scenario, they will drag the appropriate ratio and the converted measurement onto the screen.
- Final  
Assignment: Students select and complete a writing assignment about the lesson topic.

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## Before the Lesson

- ❑ Go through each screen of the lesson, including all the interactive activities, so that you can experience ahead of time what students will be doing. As you go through each screen, jot down your own expectations for students' responses.
- ❑ Determine if students will be working individually or in pairs on the lesson. Some students may be able to work independently with little or no support. Students who are less familiar with the subject area or who struggle with literacy skills may benefit from working with another student. An effective way to do this is to pair a stronger student with a less able reader. You can also have students work individually on certain tasks and in pairs on others, depending on their experience and needs. If students will be working in pairs on any portion of the lesson, let them know if they will be expected to type in their notes individually or together.
- ❑ Provide instruction on key vocabulary (vocabulary words are defined in the lesson on screen 3, and on page 6 of this guide).
- ❑ Determine what students already know about unit conversions, estimation, and conservation. Record their ideas on a chart. You may want to ask students to consider their water use during the day and then display answers in a chart with three columns: "What I use water for," "How long I use it for," and "How much I think I use." When students are filling in the "How much I think I use" column, ask them how they measure water and whether they think cup, quart, or gallon is the best unit to use. This can lead to a discussion of the uses of water and also provides teachers with an early chance to talk about measurement units and unit conversion based on students' responses to the "How much I use" column. This will give you a sense of the background knowledge and possible misconceptions that students have before beginning this lesson. If time allows, return to the chart after students have completed the lesson to add new ideas and data—and to perhaps convert some of the measurements to different units. Note: You may want to record their new learning in a different-colored ink so they can see how much they've learned.
- ❑ Arrange computers with Internet access so students can work individually or in pairs.
- ❑ Before students begin, suggest a timeline for completing the lesson, mention the different types of media they will encounter, and let them know how you expect them to submit their work. You may want to provide an outline of this information on a chart, chalkboard, or whiteboard, or as a handout.

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## Lesson Assessments

The following are descriptions of the lesson features that will be part of the packet of materials that students will submit. Students will use the packet for reference when writing their final assignment. It also serves as a formative assessment tool to monitor students' work as they are progressing through the lesson.

- **Notes** - Students take notes on screens 4, 5, 7, and 8. If time allows, review their notes before students begin their writing assignment.

- **Multiple-choice questions** - Students complete the three questions on screen 9. Walk around to make sure students answer all three questions before they continue. If students click to go to the next page before they finish, their work will not be saved.
- **Match It!** - Students complete an interactive vocabulary activity on screen 10. They begin by dragging the vocabulary terms into the correct sentences. After they finish and save their work, they will be able to check their answers against an answer key. When they are done, they will be asked to choose two vocabulary words and write a new sentence for each word. Sentences should demonstrate a clear understanding of the meaning of each word. An inappropriate response would be “Jo converted it to the right answer.” An appropriate response would be “Using equivalent units, Jo converted 24 inches to 2 feet.”
- **Arrange It!** - Students complete the concept map activity Arrange It! on screen 11. Students will create and then solve some simple equations in order to convert measurements. Students will not be able to check their answers online, so you will need to provide them with correct answers when they are finished with the lesson. You can choose to review the answers as a class or return the corrected packet of materials to students before they begin the final assignment.

The proper distribution of answers (information in bold will be provided) is as follows:

**How many hours is 8 days?**

$$8 \text{ days} \times 24 \text{ hours/day} = 192 \text{ hours}$$

**How many days is 264 hours?**

$$264 \text{ hours} \times 1 \text{ day/24 hours} = 11 \text{ days}$$

**How many gallons is 800 quarts?**

$$800 \text{ quarts} \times 1 \text{ gallon/16 quart} = 50 \text{ gallons}$$

**How many quarts is 32 gallons?**

$$32 \text{ gallons} \times 16 \text{ quarts/1 gallon} = 512 \text{ quarts}$$

- **Final Assignment** - Students complete one final writing assignment. You can choose to let students make their own selection or assign one according to your goals for the lesson. Use the rubric on pages 7 and 8 to assess the writing assignments.

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### Lesson Aids and Extensions

Use the following suggestions to help students if they are stuck on a particular screen, to prepare students for completing their writing assignments, or as follow-up discussions to reinforce learning.

- **Watching Videos** - Encourage students to watch the videos more than once. After the initial viewing, provide students with a specific content focus to frame their next viewing(s) of the video. This will help them draw connections between the main topic and the information that the videos have to offer.
- **Participating in Discussions** - Organize class discussions or encourage students to talk about their questions in pairs. You may want to use the following discussion starters:

- o What units do we use for measuring water?
- o Why would it not be practical to measure shower water in teaspoons?
- o How can you measure water in a way that gives you more meaningful information?
- o How many cups is 10 gallons? How many hours is 480 minutes?
- o Could you convert 5 miles to inches? How?
- o What are the best units of measurement when measuring:
  - Use of water in the shower
  - Number of glasses of water you drink each day
  - The distance you walk from home to school
- o What are some ways we can conserve water?
- **Reading the PDF Text** - Before they read the PDF text on screen 8, ask students to estimate how much water is used when they brush their teeth, flush a toilet, take a shower, or do a load of laundry. Then ask what experiments they could do to find out. The reading provides some facts and figures about water usage. After they read the text, try to calculate (as a group) how much water the class spends on brushing teeth each year.
- **Sharing Student Work** - It may be motivational, and a further learning opportunity, for students to post their final essays so that their classmates, peers, and/or parents can see them. This may also provide an opportunity for students to comment on and discuss each other's essays.

If you do not already have access to an online writing community, Teaching Matters™ provides TeXT, free classroom publishing tools that allow teachers and students to create and publish their own online eZine. More information and a free signup are available at Teaching Matters: TeXT (<http://text.teachingmatters.org>).

- **Reflection and Self-Assessment** - After students have turned in their writing assignments, you can choose to have them assess their learning. Bring students together as a whole class or in small groups to discuss the questions below. You may want to return to the chart of their ideas developed before the lesson and record their new learning. You may also have students respond individually to the questions and then convene the class to discuss the chart.
  - o What did you learn?
  - o What was surprising?
  - o What questions do you still have?
  - o What was the easiest for you to understand and do?
  - o What was the most difficult?

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## Vocabulary Definitions

### **calculate**

To perform a mathematical operation, such as addition, subtraction, multiplication, and division.

### **conserve**

To save or use less of something. You can conserve water by taking shorter showers and shutting off the faucet while you brush your teeth.

### **convert**

To change into something equal. You can convert 1 gallon into 4 quarts; they both represent the same amount of liquid.

### **equivalent**

An equal amount.

### **ratio**

A comparison of two related numbers. For example, if a recipe uses 1 cup of flour and 2 cups of oats, the ratio of flour to oats is 1 to 2. The ratio also can be written as 1:2 or  $1/2$ .

### **unit of measurement**

A term (such as cup, inch, hour, etc.) that defines a certain amount, distance, or time.

## Final Assignment Rubric (page 1 of 2) Unit Conversion: Water Use

- You have learned how to convert cups to gallons, miles to feet, and hours to days. Think about the unit conversions shown in the lesson, and then answer the following questions:
  - Why do we need to learn how to convert units of measurement?
  - What rules do we use to do this?
  - List one example of when you might need to convert units of measurement in your daily life.
- Do you know how much water you use every day? Look at the list of activities (refer to list in the final assignment document). Choose three or four activities that you do every day. Then answer the following questions:
  - Based on the numbers above, how much water do you use every day? Explain how you calculated this number.
  - What changes could you make in your routines to conserve at least 50 cups of water each day? (Remember: 16 cups = 1 gallon.)
  - Would it be easy or hard to make these changes? Explain your opinion and write about how these changes would affect your daily routine.

4	3	2	1
<p>Provides a clear and accurate response to the question. Ideas are elaborated, with three or more relevant supporting details from the reading passage, video, and other materials in the lesson.</p>	<p>Provides an adequate response to the question. Topic and ideas are generally well organized, with two relevant supporting details from the reading passage, video, and other materials in the lesson.</p>	<p>Provides a generally accurate response, with one supporting detail from the reading passage, video, and other materials in the lesson.</p>	<p>Provides an inaccurate response to the question or fails to address the question. May include misinterpretations. Understanding of the topic is not apparent.</p>
<p>Uses at least three vocabulary words (or a form of the vocabulary words) from the lesson, and uses them all correctly.</p>	<p>Uses two vocabulary words (or a form of the vocabulary words) from the lesson, and uses them both correctly.</p>	<p>Uses one vocabulary word (or a form of the vocabulary word) from the lesson, and uses it correctly.</p>	<p>Does not use any vocabulary words, or uses vocabulary words incorrectly.</p>

## Final Assignment Rubric (page 2 of 2)

### Unit Conversion: Water Use

3. Some old washing machines use up to 35 gallons of water per load. But new, high-efficiency washers use only about 15 gallons of water—and clean clothes just as well.

Imagine that a new laundromat, a place where people can go to wash and dry their clothes, is being built in your neighborhood. This laundromat will have 20 washers. Write a letter that persuades the owner of the laundromat to use newer, high-efficiency washing machines instead of regular washers.

In your letter, include:

- An estimate of how much water he could save if each machine does 5 loads of laundry each day for a year.
- Information about why conserving water is important.
- A suggestion for a grand opening celebration, with water conservation as a theme.

4	3	2	1
<p>Provides a clear and accurate response to the question. Ideas are elaborated, with three or more relevant supporting details from the reading passage, video, and other materials in the lesson.</p>	<p>Provides an adequate response to the question. Topic and ideas are generally well organized, with two relevant supporting details from the reading passage, video, and other materials in the lesson.</p>	<p>Provides a generally accurate response, with one supporting detail from the reading passage, video, and other materials in the lesson.</p>	<p>Provides an inaccurate response to the question or fails to address the question. May include misinterpretations. Understanding of the topic is not apparent.</p>
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## Scoring the Rubric

Here are two suggestions for scoring the final assignment rubric. Select the option that best meets your needs or develop your own grading system.

**Option 1:** This option provides one score for each submitted assignment.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric), for a total maximum score of 8. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
7-8	A	Excellent
5-6	B	Good
4	C	Adequate (Fair)
3 or below	D	Minimal

**Option 2:** This option provides two scores for each submitted assignment: one for written content and one for the use of key vocabulary. An advantage of separate scores is that you can weight students' comprehension and composition differently than you do their knowledge of vocabulary. It can also help you identify specific needs for future instruction.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric) and then score them separately. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
4	A	Excellent
3	B	Good
2	C	Adequate (Fair)
1	D	Minimal

The final grade may look like this: A/B (A for content and B for vocabulary use).