science generation

SO WHAT EXACTLY IS A UNIT?

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Overview
Unit 7.1

This unit introduces students to some of the important scientific terminology used for measurement and aims to clarify some of the misunderstandings that students have around this important vocabulary.

Additionally, the unit reinforces the need for students to use this language when recording data or writing lab reports.

Students practice using this scientific language and learn to distinguish it from some of the other uses that they may encounter in school.

The word chart on the last page of the unit should be used as a resource for students.

Reader's Theater

The Importance of Units

Setting: Emon, Markus, Yesinia, and Kaitlyn meet Haitham at his locker. He's been upset since second period.

Emon: Why are you so frustrated with Ms. Phan in science class, Haitham?

Haitham: She keeps telling me, "Don't forget your **units**!" "It's wrong without **units**!" I lost points on my last lab report. She thinks I know what she means, but I don't. I looked "**unit**" up in my dictionary and there are 17 different definitions! For one stupid word!

Markus: You carry that dictionary in your backpack? How heavy is that thing?

Haitham: Not the point.

Kaitlyn: Seventeen entries? That's interesting. It's a pretty simple word, I would say.

Haitham: *(glaring)* I would respectfully disagree.

Yesinia: Haitham, is one of the definitions "book chapter"? My science text has a **unit** on evolution, a **units** on microorganisms, a **unit** on—

Markus: (*interrupting*) Hey, and my cousin at UMass gets three or four **units** for each of her college courses.

Emon: And Ms. Schultz says our marching band performs like a single **unit**. I think she means the band is a group that marches in step like one person.

Haitham: Whoa! I know you're trying to help, but all I need to know is what my science teacher means by ***unit***.

Kaitlyn: Well, I think we're on the right track—a ***unit*** probably means one of something, because *uni* means one. A unicycle is like a bicycle, but it just has one wheel.

Haitham: What? So Ms. Phan wants me to write one of something all over my papers? One of WHAT?

Kaitlyn: No, no. Think about it. A **unit** is more like a thing you use when you measure.

Haitham: Are you talking about measuring things in pounds or inches?

Kaitlyn: You got it now. A **unit** can be a **weight** or a **distance** or time. We measure lots of quantities. And to make sense to everyone, every measurement needs a **unit**. It doesn't make sense to say the **length** of the field is 200. You have to say 200 feet, meters, or whatever **unit** you are using.

Haitham: Oh, that's all? Okay, now I get it. I've been writing ratios on my paper like 60 per 1. The numbers needed **units**: 60 miles per 1 hour.

Markus: Right, if you don't write the **units**, nobody knows what you're talking about. *(thinking)* Say I told you that I drank two sodas at lunch.

Yesinia: Your teeth are gonna rot.

Markus: Not the point. What I'm saying is that you don't know if I drank two liters, two 12-ounce cans, or two tiny cups! It really doesn't mean anything unless you know the **units**.

Emon: The **volume** of a two-liter bottle is way more than two soda cans.

Markus: You're right about that, Emon, but wrong about something else. What I think you mean is **capacity**. The **capacity** of a two-liter bottle is more than two soda cans because the bottle can hold more.

Emon: Whatever.

Haitham: That reminds me that Coach Frassetto said the other day that the **length** of the football field was 100 yards. And then he said the **distance** to the goalpost was 25 yards. I was wondering, why did he say **length** and then say **distance** when both are yards?

Kaitlyn: Good catch. The **length** often means the longest side of an object. The football field has a long side, the **length**, and a width, the short side. A **distance** is the measurement between two things or points.

Emon: We totally use **length** and **distance** for each other all the time. Probably doesn't matter that much.

Markus: There are lots of ways these words get used, like the **length** of time to finish your report or going the **distance** for the team.

Kaitlyn: All right, here is a challenge. Another pair of **units** that are really similar is **weight** and **mass**. Most people think they are the same. Any of you guys know the difference?

Yesinia: Okay, I think I know this. Every night after eating a bowl of ice cream my dad weighs himself. He's measuring how heavy he is, like last night he was 210 pounds. But our science book never says ***weight***, it says ***mass***. **Mass** is the quantity of material, or matter, like my dad and his bowl of spumoni.

Kaitlyn: That's right. **Weight** also has to do with quantity of matter, but **weight** changes according to the strength of gravity. **Mass** doesn't.

continued...

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Teacher Directions, Session 1

pages 2-3

Reader's Theater

You may want to assign students parts so they can read the Reader's Theater aloud.

The story begins with a frustrated student who has been told by his science teacher that he must include the units in his lab reports. However, he's not sure what the word means and complains to his friends about the multiple definitions for the word in the dictionary.

Throughout the Reader's Theater, the characters reveal their misunderstandings of the terminology and seek clarification from their more informed peers.

Review the focus words of the week. Use the word chart at the end of the unit to review definitions and sample sentences.

Reader's Theater

Comprehension Questions

Markus: Nice. The gravity on the moon is about one-sixth of the earth. So if your father moves to the moon, he'd weigh 35 pounds.

Emon: That's pretty funny. But this time, you're the one who is only half right. Technically speaking, pound is a **unit** used for **mass**, not **weight**.

Haitham: For real? When I say that I weigh 103 pounds, I should really be saying my **mass** is 103 pounds?

Emon: That's right. But it does sound kind of nerdy.

Markus: Then what is the right **unit** for **weight**?

Emon: Newton.

Markus: You're totally making that up.

Emon: No, Isaac Newton "discovered" gravity, and since **weight units** have to do with gravity, they are named after him.

Kaitlyn: People can just name **units** after themselves?

Emon: Well, it helps if you are a king or something. Last year in Ancient Civilization class, I read that the Egyptian pyramids were measured by a royal cubit that was equal to the forearm of an Egyptian pharaoh. So the pharaoh could just establish the **standard** measurement.

Yesinia: Hey, if a king can name a **length unit** after his arm, so can we. I hereby declare one "schnoz" to equal the **length** of Markus' nose.

Respond in writing to the questions, then compare and discuss your answers with someone else.

Can you complete this sentence to summarize why **units** are important? Ms. Phan wants Haitham to write the units for the numbers on his paper because

_____

_____ .

List several situations in which the word ***unit*** is used in different ways.

_____

_____

_____

_____ .

Emon said that a pharaoh established a **standard** measurement called a royal cubit. What does Emon mean by the word ***standard***?

A) A **unit** equal to the **length** of a pharaoh's forearm

B) A flag that is often carried by soldiers into a battle

C) A **unit** used to measure something or someone that is standing up

D) A **unit** that many people agree should be used to compare or measure things

Discuss the following questions with a partner, and come to an agreement on an answer.

Yesinia's father weighs 210 pounds. Markus said that because the moon's gravity is one-sixth as strong as on earth, his **weight** on the moon would be one-sixth as much as on earth. But his **mass** would stay the same. The gravity on Saturn is about double the gravity of the Earth. What would Yesinia's father weigh on Saturn? What would his **mass** equal?

Mr. Aristotle, a substitute teacher, told Emon's class to "use the beakers with a **volume** of 500 milliliters." Did Mr. Aristotle use the word ***volume*** correctly? Why or why not?

Make up two different sentences: one with the word ***length*** and the other with the word ***distance***. Then swap the two words and see if the sentences still make sense.

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Reader's Theater, cont.

When finished with the Reader's Theater, ask students to answer the three questions on the right side of the page.

1. **Sample response:** *Ms. Phan wants Haitham to write the units for the numbers on his paper because his reports are not correct without the proper units.*

2. **Sample responses:**

   We read a science fiction unit in English class.

   The unit next to our apartment is for rent.

   My brother was short a unit to graduate this year.

   The emergency doctor on TV is always calling for several units of something or other.

3. **Correct response:** (D) A unit that many people agree should be used to compare or measure things

The three questions in the grey box: Have students discuss the question with a partner and try to reach an agreement. This is an opportunity for students to practice using scientific language as they discuss the questions.

Question 1: Yesinia's father would weigh 420 pounds due to the force of gravity. His mass would still be 210 pounds since mass isn't affected by gravity.

Question 2: Mr. Aristotle is not using the word volume correctly. The correct word is capacity.

Question 3: Sample responses:

The length of our swimming pool is 25 yards. I swam a total distance of 2,000 yards yesterday.

The distance of our swimming pool is 25 yards. I swam a total length of 2,000 yards yesterday.

While the second sample sentence may make sense, and someone might understand what we mean, it doesn't sound as accurate or precise as the first sentence.

Speaking Scientifically

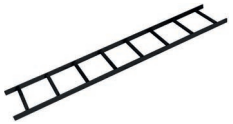
Concept Cousins

Have you ever mixed up the names of two people, like classmates at school? It seems to happen most often when two people are similar in some ways. The same happens in science. It's easy to mix up terms that *sort of* mean the same thing, but not exactly.

Check out these examples. (Ignore the blank lines below the pictures for now.)

MASS	WEIGHT	So, what's the difference?
		Mass and **weight** are similar ideas. They both tell about how much matter is in an item. The difference is that mass does not change due to gravity, but weight is measured using gravity (like the apple on the scale). Think about it: You would weigh less on the moon, but your mass would be the same.

VOLUME	CAPACITY	So, what's the difference?
		Volume and **capacity** are similar ideas. Volume describes the amount of space that something takes up, whereas capacity describes the space in a container that can contain (hold) a substance.

LENGTH	DISTANCE	So, what's the difference?
		**Length** and **distance** are similar ideas. Length is usually used when referring to the long side of something, and it implies straightness. Distance simply means how far two points are from each other.

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Teacher Directions, Session 2

pages 4-8

Speaking Scientifically

Many people often confuse terms used for measurement. This chart includes a picture to help students visualize each term. It also has an explanation that compares and contrasts these similar and often confused terms.

You may want to point out to your students the language used to compare and contrast these terms:

- *both tell*
- *the difference is*
- *but*
- *whereas*

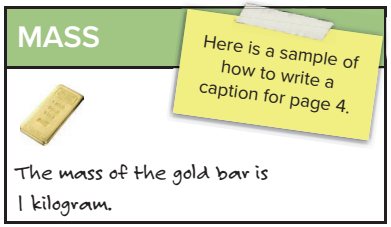
These discourse connectors may be unfamiliar to some of your English language learners and underused by your students in both speaking and writing.

Below each picture are blank lines that will be used for the activity on the next page.

Speaking Scientifically

Caption Confusion

What a mess! If you read the first row of this table horizontally, it says, "The **mass** of San Francisco to Philadelphia is 12 feet." That makes no sense at all. With a partner, please cut out these 18 sentence parts, then rearrange them so they make sense. If you succeed, your new sentences will work as captions for the images on **page 4**. When you and your partner are confident that you have the correct sentence to be an image's caption, rewrite the sentence into the blank lines below the image.



The mass of	San Francisco to Philadelphia	is 12 feet.
The volume of	the measuring cup	is 1 kilogram.
The length of	the gold bar	is about 150 milligrams.
The weight of	the ladder	is 1 pint.
The distance from	the puzzle cube	is 2,875 miles.
The capacity of	the apple	is 27 cubic inches.

Speaking Scientifically, continued

Have students work in pairs to create sentences that are accurate and that make sense given their new understanding of this terminology.

Ask students to assemble sentences about measurements using the word strips they have cut up. Remind them they can use the pictures on the previous page as a reference. Students may need some additional guidance and modeling.

Once partners have agreed on the sentences, have each student write the sentence on the blank lines beneath each image on the previous page.

Here are the correct sentences:

- *The mass of the gold bar is 1 kilogram.*
- *The weight of the apple is about 150 milligrams.*
- *The volume of the puzzle cube is 27 cubic inches.*
- *The capacity of the measuring cup is 1 pint.*
- *The length of the ladder is 12 feet.*
- *The distance from San Francisco to Philadelphia is 2,875 miles.*

This page has been intentionally left blank for printing purposes.

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Speaking Scientifically

Comparing Items Beyond "Bigger" and "Smaller"

Younger students compare objects by looking at them and saying something like, "The dog is bigger than the cat." While there is nothing wrong with this, students must be capable of making comparisons that provide more information before they enter high school.

"The potato is bigger than the beet."

"The mass of the potato is 5.1 ounces greater than the mass of the beet."

Tori, 2nd Grade

Charlie, 7th Grade

"The milk jug holds more than the soda can."

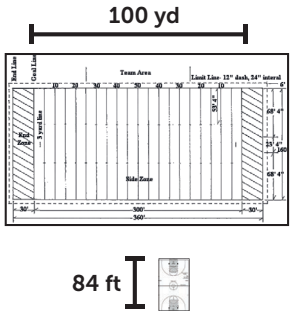
"The milk jug's capacity is 64 fluid ounces. It holds much more than the soda can, which holds 12 fluid ounces."

Adonis, 2nd Grade

Rafael, 7th Grade

Try filling in these blanks:

"The football field is _____ than the basketball court."



"Playing areas are different in football and basketball. A football field has a _____ of 100 yards, and a basketball court is only 84 feet long."

Cherise, 2nd Grade

Ivana, 7th Grade

Speaking Scientifically, continued

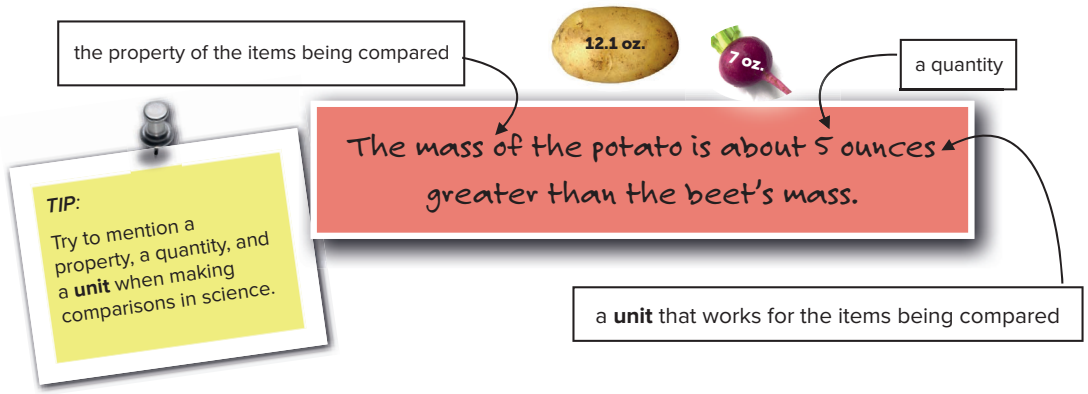
This section shows students how to "upgrade" their language to more precise and formal scientific language. The last example on the page asks that students fill in the blanks.

"The football field is longer than the basketball court."

"Playing areas are different in football and basketball. A football field has a length of 100 yards, and a basketball court is only 84 feet long."

Speaking Scientifically

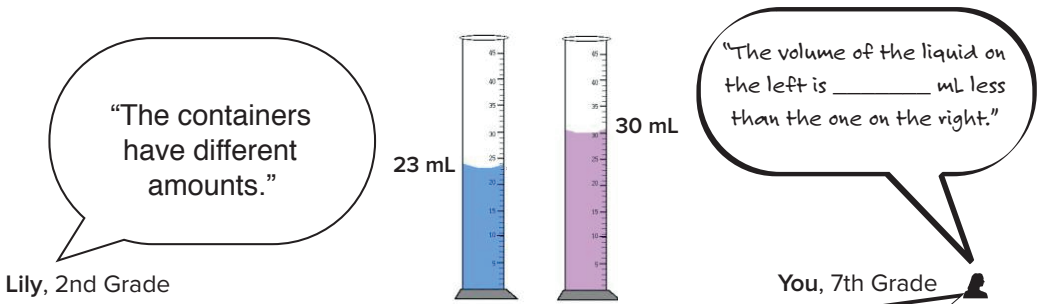
Making Simple and Complex Comparisons



Now it's your turn to do the same type of exercise that you read on the previous page. Analyze the image on each line. On the left is a comparison as a young child might say it. On the right, fill in the blanks to create a more complex comparison that would be appropriate for a student who is near high school age.

Franklin, 2nd Grade

You, 7th Grade



Lily, 2nd Grade

You, 7th Grade

Bonus! Both cylinders have the same _____ .

Speaking Scientifically, continued

Students may need a mini-lesson on how to write more precise sentences when comparing items for measurement. The graphic at the top of the page can be used as a simple checklist for students.

Below, are two comparisons. Have students write the informal, less-precise comparison sentences as well as the more scientifically accurate sentences.

It is longer to El Paso than to Texarkana. / The distance to El Paso from Austin is 200 miles greater than the distance to Texarkana.

The containers have different amounts / The volume of the liquid on the left is 7 ml less than the one on the right.

Bonus:

Both cylinders have the same capacity.

Design Challenge

Units in the Marketplace

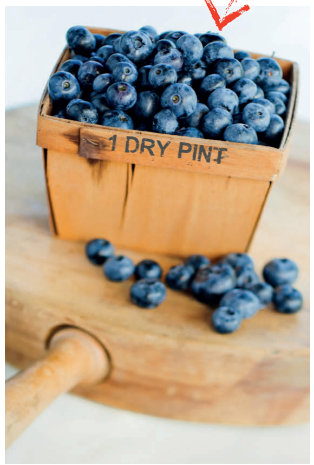
Blueberry Farmer Embraces Standard Units of Measurements Thanks to Studious Daughter

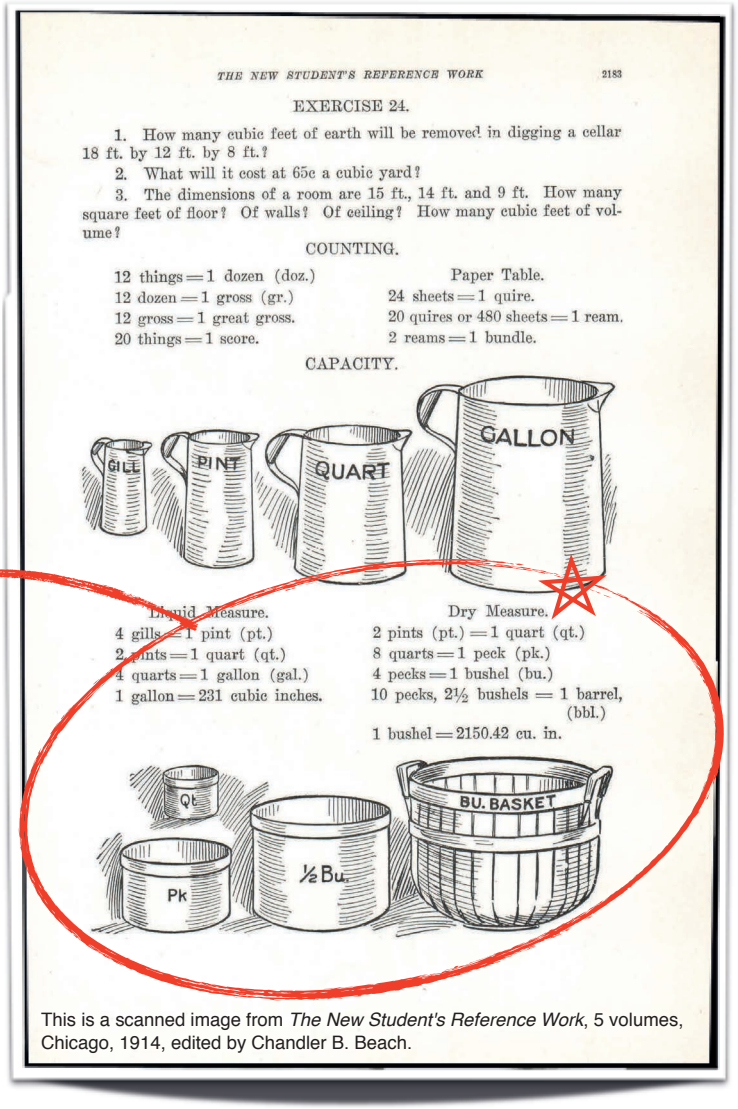
Back in 1916, there was was a blueberry farmer who sold his blueberries by the blueberry. This turned out very badly for him. He spent more time counting out blueberries for his customers than he spent growing them!

One day, exhausted, he sat down next to his daughter who was doing her homework (see right). He watched her work through a section in her lesson book called "Dry Measure" and got very excited.

He knew what a pint was because his beer came in pints. He learned from the diagram that a dry pint was a box or basket that would hold the same amount of blueberries each time he filled it up. He could sell pints instead of single berries!!Maybe he could even try selling quarts during the peak of the growing season!

Not only that, he noticed that there were other dry measures. His daughter told him that everyone in the city was already familiar with these **units**.





THE NEW STUDENT'S REFERENCE WORK 2183

EXERCISE 24.

1. How many cubic feet of earth will be removed in digging a cellar 18 ft. by 12 ft. by 8 ft.?
2. What will it cost at 65c a cubic yard?
3. The dimensions of a room are 15 ft., 14 ft. and 9 ft. How many square feet of floor? Of walls? Of ceiling? How many cubic feet of volume?

COUNTING.

12 things = 1 dozen (doz.)
12 dozen = 1 gross (gr.)
12 gross = 1 great gross.
20 things = 1 score.

Paper Table.

24 sheets = 1 quire.
20 quires or 480 sheets = 1 ream.
2 reams = 1 bundle.

CAPACITY.

Liquid Measure.

4 gills = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
1 gallon = 231 cubic inches.

Dry Measure.

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)
10 pecks, 2½ bushels = 1 barrel, (bbl.)
1 bushel = 2150.42 cu. in.

This is a scanned image from *The New Student's Reference Work*, 5 volumes, Chicago, 1914, edited by Chandler B. Beach.

Teacher Directions, Session 3

pages 9-12

Design Challenge

The fictional story of the blueberry farmer illustrates the efficiency of having standardized units of measurement.

Discuss the standards for liquid and dry measurements. Many students will not have seen examples of a peck, bushel, or barrel.

Ask students to think about why this terminology is no longer widely used. *Why would these terms of measurement be included in a textbook in 1914 but not today?*

You may also want to talk about the seemingly arbitrary nature of selecting units for measurement. This may be helpful for students when they get to the design activity.

Design Challenge

Invent a System of Measurement!

As a test to see if you understand what makes a system of measurement work, your team is now going to work on a challenging yet creative task. You are going to invent a brand new system of measurement!

Remember earlier when you read this?

> **Yesinia**: Hey, if a king can name a **length unit** after his arm, so can we. I hereby declare 1 "schnoz" to equal the **length** of Markus' nose.

Now we are going to do what Yesinia joked about (but you do not have to use the schnoz as your base **unit**).

Step 1: Select one property from the list that your invented system will measure (your teacher may add more choices).

- ☐ **length** or **distance**
- ☐ **volume**
- ☐ **capacity**
- ☐ **mass**

Step 2: Create the base **unit** for your system and compare it to a familiar item. For example, Yesinia decided that the schnoz was a base **unit** and was equal to the **length** of Markus' nose.

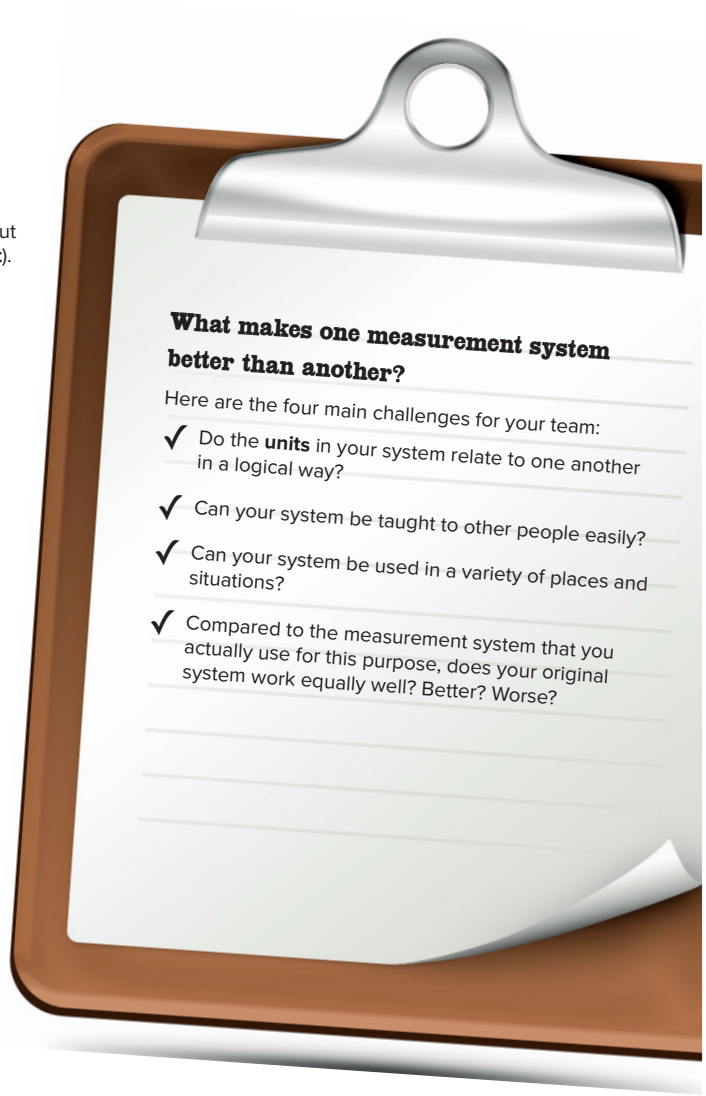
Step 3: Once you have your base **unit**, build off of it and make larger and smaller **units**. For example, with dry measures (the blueberry farmer's new favorite system), 2 pints equals 1 quart, 8 quarts equals 1 peck, etc. (see previous page). And Yesinia might decide that a "schnozette" is half the **length** of a schnoz. You get the idea.

Step 4: Design a textbook page or a small poster that teaches your system to other people.

Step 5: Present your system to the class.

Step 6: Respond to challenges others have about how sensible your system is.

Step 7: To the right is the list of challenges your classmates will use to evaluate your measurement system. How does your system measure up?



Design Challenge, continued

In this activity, student groups design a new system of measurement. This activity is designed for groups of four students and may be completed quickly if all students participate.

Explain to students that the criteria for developing an effective system of measurement are on the clipboard image.

Emphasize that they should keep these in mind as they create their measurement systems. Their systems will be evaluated on these criteria during their presentations.

Have groups use the space on the next page as a workspace for developing their systems.

Additional examples include:

Property	Base unit	Scaled Units
Length or distance	The mano	manito, mano, manisimo
volume	The brick	brack, bricky, brick, and the brick-crick
capacity	The gulp	minigulp, gulp, big gulp
mass	The skittle	skittette, skittle, skitanic

Design Challenge

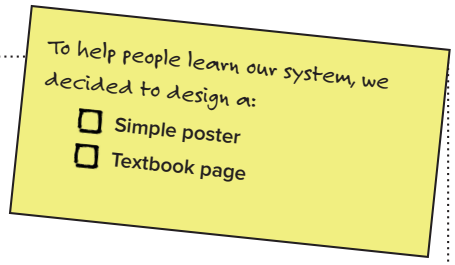
Workspace for planning your original measurement system

We decided to develop a new system for:

- ☐ **length** or **distance**
- ☐ **volume**
- ☐ **capacity**
- ☐ **mass**

Design Challenge

Design of poster or textbook page



→ Tomorrow, your team will present your system to the class so other teams can rate it. Are you ready?

Design Challenge, continued

You may want to provide groups with a larger piece of paper so that more than one student can work on the poster or textbook page simultaneously.

After they have completed their posters or textbook pages, have students practice their presentations.

Presenting and Rating the Invented Systems

Your team will listen to the presentations given by the other teams. Then you will ask clarifying questions and complete an evaluation card for each system that was presented.

Team 1

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 1** a total score of _____ out of a possible 20 points.*

Team 2

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 2** a total score of _____ out of a possible 20 points.*

Team 3

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 3** a total score of _____ out of a possible 20 points.*

Team 4

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 4** a total score of _____ out of a possible 20 points.*

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Teacher Directions, Session 4

pages 13-14

Presenting and Rating the Invented Systems

Ask each team to present their system to the class.

Have the remaining teams sit together while listening to the presentations.

Encourage presenters to answer a few questions from the class.

After each presentation, all teams should discuss the system, evaluate it according to the criteria, and tally the score. Ask one member of each team to record the score.

Extension:

After the presentations, ask teams to determine the most effective system.

Have all students write why the highest-rated group earned its high ratings.

Presenting and Rating the Invented Systems

Team 5

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 5** a total score of _____ out of a possible 20 points.*

Team 6

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 6** a total score of _____ out of a possible 20 points.*

Team 7

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 7** a total score of _____ out of a possible 20 points.*

Team 8

Name of the system:

System is used to measure: (circle one)

length or distance | volume | capacity | mass

Notes on the presentation:

Your team's evaluation of the system:

	less effective more effective
Do **units** within the system relate to one another in a logical way?	1 - 2 - 3 - 4 - 5
Is the system one that you could learn easily?	1 - 2 - 3 - 4 - 5
Can the system be used in a variety of places and situations?	1 - 2 - 3 - 4 - 5
Compared to the measurement system that you actually use for this purpose, does this system work equally well? Better? Worse?	1 - 2 - 3 - 4 - 5

*Our team gives **Team 8** a total score of _____ out of a possible 20 points.*

Which system did your team rate the highest? Please summarize what led you to your decision:

_____

_____

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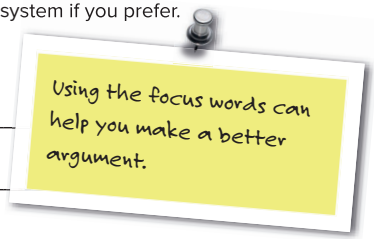
Writing

Imagine that every country on Earth uses its own measurement systems. However, there has been some talk recently of trying to develop one system that everyone could share. But this new movement has no leader—until now. YOU are responsible for delivering a speech to the United Nations about the benefits of a unified **standard** system. Describe examples of how countries could better cooperate in science, enjoy sports, trade goods, etc.

Alternatively, you may choose to write a speech against the idea of a unified **standard** system if you prefer.



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Teacher Directions, Session 5

pages 15-16

Writing

The writing prompt asks students to make the argument for or against a standardized, worldwide system of measurement. Students should include examples of how this system would benefit (or have a negative impact on) science, sports, and business.

Remind students to use the focus words at the top of the page.

Note to teacher: It may be useful to refer to this essay during Unit 7.2 (the next unit).

Writing

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Shades of Meaning

Sometimes words in English can be spelled the same and pronounced the same, but have two completely different meanings. Consider the word ***tire***. Write a definition for each of the meanings of ***tire*** in the following sentences.

I never **tire** of learning new words.

Definition: _____

_____

_____

Our bus got a flat **tire** on the way to school this morning.

Definition: _____

_____

_____

Words that are spelled the same but have completely different meanings are called **homographs** (from *homo* = same and *graph* = write). Other homographs include *bear*, *type,* and *lean*.

Can you think of other examples of homographs?

There are other words that have several definitions in the dictionary. However, these definitions are not as different from each other. Consider the word ***unit***. Below are seven different ways we use the word ***unit***.

Unit (n.)

1. A single thing or person
2. A group of people who work together
3. An amount of something used as a **standard** of measurement (inches, pounds, feet, decibels, etc.)
4. A part of an organization that performs a specific function
5. Several chapters or sections of a book that go together
6. The quantity of a vaccine or drug that is used for medical purposes
7. An amount of credit earned by attending and passing a class in a college or university. *In order to graduate, a student must earn a specific number of* ***units***.

What do these seven definitions have in common?

_____

_____

_____

_____

_____

_____

The many different definitions of these words are not as obvious as a homograph, such as ***tire***. Words like ***unit*** have different shades of meaning, but the different meanings have a clear relationship. When your English teacher says, "Today we are going to work on our poetry **unit**," the word ***unit*** means something different than when your coach says, "We need to work together as a **unit**." However, both uses have something to do with *a part* and *a whole*.

Consider the word ***length***. Can you think of two different ways that we use the word **length**? How about ***weight***?

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Teacher Directions, Supplementary Activities

pages 17-19

ELA Activity

In their science class, students have been learning about the need to include units of measurement (length, mass, volume, capacity, etc.) when writing about scientific processes. They have also learned that many people tend to misuse terms that are related, such as volume and capacity.

This week's ELA activity reinforces the idea that a word can have multiple, related meanings as well as completely different meanings. The word unit is one example of such a word.

Answers:

Other examples of homographs:

- *bass, bow, digest, lead, produce, tear*

Writing prompt:

Unlike the word tire, which has two completely different meanings, all seven of the definitions for unit are related. They all have to do with being a part of something larger or being made of different parts.

Discussion question sample responses:

- *Length: My teacher went to great lengths to teach us the difference between weight and mass.*
- *Weight: The teacher felt the weight of the students' disappointment when he had to cancel the field trip*

How much paint will it take to cover...?

All of the focus words this week are important in math, but there is another important type of measurement that has not been mentioned yet. That is the measurement of area. Area measurements are used for describing the sizes of surfaces.

Capacity measurements and area measurements can be related, such as when you are buying paint. When you go to a paint store in the United States, you see that they sell paint in many different container sizes. Of course, when you buy a larger container, you get more paint. And when you buy more paint, you can paint a larger area. The industry **standard** is 350 square feet of coverage per gallon of paint.

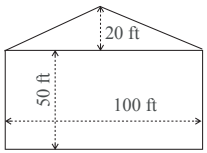
Step 1: Complete the chart so it shows the coverage you will get with containers of various **capacities**.

container capacity	expected area of coverage
8 ounces	_____ square feet
1 pint	_____ square feet
1 quart	_____ square feet
1 gallon	_____ square feet
2 gallons	_____ square feet
5 gallons	_____ square feet

Step 2: Imagine that your math class has been asked to determine how much paint is needed to paint one of the exterior walls of your school, which has been covered with graffiti. Diagram 1 shows the **length** and the height of the wall.

Diagram 1

Bonus: The wall above is a rectangle. However, a different side of your school has the shape shown here. Determine the area of this wall. Then calculate how much paint you would need to buy to paint it.



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Math Activity

In their science class, students have been learning about the need to include units of measurement (length, mass, volume, capacity, etc) when writing about scientific processes. They have also learned that many people tend to misuse terms that are related, such as volume and capacity. In this math activity, students will practice scaling the property of capacity.

Step 1:

8 ounces: 21.875 square feet

1 pint: 43.75 square feet

1 quart: 87.5 square feet

1 gallon: 350 square feet

2 gallons: 700 square feet

5 gallons: 1,750 square feet

Step 2:

area of a rectangle = length x width

50 ft x 150 ft = 7,500 sq ft

7,500 sq ft / 350 sq ft = 21.428 gallons of paint (should buy 22 gallons)

Bonus:

area of a triangle = ½(base x height)

1. Find area of triangle portion: (100 ft x 20 ft) / 2 = 1,000 sq ft
2. Find area of rectangle portion: 50 ft x 100 ft = 5,000 ft
3. Add areas of both portions:

   1,000 sq ft + 5,000 sq ft = 6,000 sq ft

   6,000 sq ft / 350 sq ft = 17.14 gallons needed (buy 18)

Social Studies

mass • weight • volume • capacity • length • distance • standard • unit

Rai stones? Really?

The dollar is the **unit** of currency used in the United States, but other countries have different currency **standards**, such as the peso, the yen, the Euro, and the shekel. When American kids go to other countries they realize that money from other countries might have a different shape, texture, or color, but it basically works the same way.

However, money works very differently on the tiny island of Yap in Micronesia.

In Yap, **massive** stones with a donut-like hole sit in front of homes or are displayed in what appear to be public parks. These stones, known as the rai stones, are part of the money system on this small island in the South Pacific. The stones range from a few inches in diameter to over 10 feet. The largest rai stone weighs 8,000 pounds.

Hundreds of years ago, explorers from Yap traveled 250 miles in their small canoes to the island of Palau. There, they discovered limestone and cut a piece that resembled the shape of a whale and brought it back to home. The Yapese word for whale is *rai*, which is how the stone got its name. Because the Yapese didn't have limestone, they saw the stone as rare and beautiful and decided to make it the currency for their little island.

However unlike gold and silver, the Yap didn't use size and **weight** as a way to determine the value of each rai stone. Instead, the stone received its value based on the difficulty of obtaining the particular stone. Since the Yap explorers had to travel great **distances** and took huge risks to obtain the stones, many men died in the process. A journey for a stone that resulted in many deaths made the stone much more valuable.

In the late 1800s, an American explorer with the **capacity** to transport many more stones in his large sailing vessel decided to trade with the Yapese people. He was able to transport several very large stones from Palau to Yap as part of his trade. However, even though many of these stones were larger than the others, they were not as valuable because there was not as much risk involved in the journey.

Today, the rai stones are still used as part of the money system in Yap. Most of the stones are too big to move, so people just leave them in the same spot; however, everyone knows who they belong to. While the Yapese people use the stones less than they did in the past, the stones are still an important part of their economy.

Why do you think the Yapese people assigned value based on risk and loss of life? What does this suggest about their personal values?

Map and photograph courtesy of the Yap Visitors Board

Social Studies Activity

In their science class, students have been learning about the need to include units of measurement (length, mass, volume, capacity, etc) when writing about scientific processes. They have also learned that many people tend to misuse terms that are related, such as *volume* and *capacity*.

This week's social studies passage uses some of the other meanings of the scientific vocabulary that they may encounter in other academic classes. Read the passage aloud to the class. The Yap currency introduced in this passage is assigned a value in a unique way. Students are asked to discuss what this suggests about the values of the Yap people.

Possible responses:

The Yap people value human life. Because people lost their lives when they traveled to get these stones, they see these stones as being valuable. People from other places might not see why a stone is so important; however, the people on Yap always know that people may have died or risked their lives trying to get the stone. They know that life is more precious than anything else.

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Focus Words

mass • weight • volume • capacity • length • distance • standard • unit

Examining the Focus Words Closely

SciGen Unit 7.1

→ Scientific or * Everyday Use		Definition	Try using the word...
→	**mass** *noun*	a measure of the quantity of matter in an object	*Imagine you take a trip to the moon on a new spaceship. Would your **mass** change when you leave Earth?*
*	**massive** *adjective*	very large	*Is there a **massive** difference between the work in sixth grade and the work in seventh grade?*
→	**weight** *noun*	a measure of mass by using an object's downward force	*Does your **weight** change during a roller coaster ride?*
*	**weight** *noun*	importance and influence	*Whose advice carries a lot of **weight** when you are trying to decide something important?*
→	**volume** *noun*	the amount of space taken up by an object	*Is it easier to determine the **volume** of a brick or a stone?*
*	**volume** *noun*	a quantity or amount	*How do you handle the **volume** of projects, essays, and presentations assigned in middle school?*
→	**capacity** *noun*	the amount an object can contain	*The **capacity** of soda bottles is how much liquid they can contain. But the **capacity** of elevators is how much weight they can hold. What's the difference?*
*	**capacity** *noun*	the ability to do or understand something	*Are there any activities for which you believe you have a tremendous **capacity**?*
→	**length** *noun*	a measure of the longer side of an object; a measure of an object from end to end	*A football field is 100 yards long. What do you estimate is the **length** of your schoolyard?*
*	**go to great lengths** *verb phrase*	to try very hard or try many things to achieve something	*Do you **go to great lengths** to get good grades? What is another goal you would **go to great lengths** to achieve?*
→	**distance** *noun*	the measurement between two points	*What do you think is the greatest **distance** you could run without needing to stop and catch your breath?*
*	**distant** *adjective*	far away in space or time; a disconnected attitude	*Where is the most **distant** place you have traveled?*
→	**standard** *noun*	an idea or thing used to measure	*If there were no **standard** weights, how would we buy food at the grocery store?*
*	**standard** *adjective*	usual or normal	*What is a **standard** behavior in your home, school, or community?*
→	**unit** *noun*	a particular quantity that is used to count or measure other quantities	*In the U.S. we purchase gasoline using the gallon as the **unit** of measurement, but most other countries use the liter. What are some other examples of U.S. **units** that are not used in other countries?*
*	**unit** *noun*	something that is single or complete, but can also be part of larger whole	*What was your favorite **unit** in sixth grade Social Studies? Why?*

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Teacher Directions, Focus Words

page 20

Examining the Focus Words Closely

The chart includes the scientific definitions that are reinforced throughout the unit. Each of these words has an arrow next to it. Additionally, there are other forms of the words or polysemous meanings that sometimes cause confusion for students. These words are marked with an asterisk.

Have students discuss the questions next to each word to help them learn these distinctions. Make sure students answer the questions using the focus word.