

"Wet" Your Appetite!

Grades 6-12

Grade 6 Standards

Lesson Summary

Students will learn how much water is needed to produce food and will create a menu that helps conserve water.

Overview

In this lesson, students will:

- Analyze data sample sets of water consumption for a typical daily diet.
- Design a new menu that will cut water consumption by half.
- Write and solve algebraic expressions.
- Solve problems using fractions, ratios, and cross multiplication.

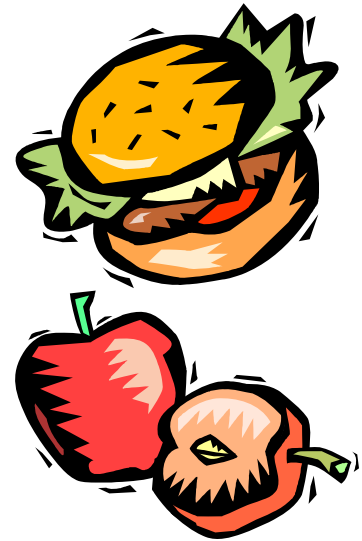
Time 🕒

Two 45- minute periods, one homework assignment

Background

Water is the most abundant substance on earth, covering three-fourths of its surface. Only a tiny amount of that water, however, is usable drinking water. Ninety-seven percent (97%) of all water on earth is salt water found in oceans and seas. Two percent (2%) of all water on earth is frozen in the form of ice caps, glaciers and icebergs and isn't usable. And the remaining 1% of all water on earth is in the form of fresh water found in lakes, streams, rivers, soil and underground reservoirs or aquifers. Since most of this water isn't readily available for us to use, that leaves less than 1% (about 0.34%) available for animals and humans to drink and use. That's like having \$100 dollars in the bank and only being able to use 34¢!

Over half of the water in California and the United States is used to grow crops to feed cattle and other livestock. These cattle become food items like steak, hamburgers, taco meat, hot dogs and other red meat items. Raising cattle for food uses a lot of water, because cattle eat tons of crops that need to be grown (using water) to feed them. It takes 25 gallons of water to grow one serving of rice, 63 gallons of water to produce one egg, and 625 gallons of water to make one quarter-pound hamburger. It takes up to 100 times more water to produce one pound of beef than one pound of wheat.



Vocabulary

- Outliers
- Rate
- Plant-based diet
- Agriculture
- Food chain

Materials

- *Water—The River of Life* Fact Sheet
- "Wet" Your Appetite Handout
- Calculator



Menu of a Typical American Diet

Breakfast

2 eggs-12 gal.
2 slices bacon-100 gal.
2 pc. toast w/butter-110 gal
1 glass orange juice-49 gal.



Lunch

1 burger on a bun-626 gal.
1 order French fries-15 gal.
1 serving carrots-6 gal.
1 cookie-55 gal.
1 glass milk-48 gal.



Dinner

1 beefsteak-1200 gal.
1 serving rice-25 gal.
1 tossed salad-15 gal.
1 soda-10 gal.
1 slice apple pie-90 gal.



The typical American diet includes a lot of beef. Most doctors agree that plant-based diets full of whole grains, fresh fruits, vegetables, legumes, nuts and seeds are much healthier for our bodies and can help prevent heart attacks, diabetes, cancer and obesity that are often associated with a high intake of beef and other animal products. Many different ethnic cuisines like Chinese, Indian, Thai, Mexican, Middle Eastern and Vietnamese foods offer a variety of healthy dishes that mostly contain plant-based foods. The lower we eat on the food chain (i.e. the more plant-based foods we eat versus animal based foods) the less water, energy and other natural resources we use. Eating less beef is better for the environment and better for our health.

Preparation

- Read *Background and Water—The River of Life* Fact Sheet
- Write the entire *Menu of a Typical American Diet* at left. Cover up the menu so that students can't see gallon amounts until later.
- Pass out *Water—The River of Life* Fact Sheet and have students read alone or take turns reading aloud. This can also be done earlier as a homework assignment.

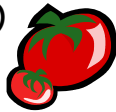
Pre-Activity Questions

Ask students:

1. What are two things water provides us with that we literally could not live without? (*drinking water; food*)
2. How much of all water on earth is found as salt water? (*97%*)
3. How much of all water on earth is found as fresh water? (*3%*)
4. How much fresh water is available for us to drink? (*0.34%*)
5. How much water does each student consume every day as drinking water and as water added to other drinks like juice and soda? (*Answers will vary, but generally it's 4-8 glasses of water a day per person.*)
6. Since much of our water is used by farmers to grow food and other crops, are there some foods that require more water than other foods to be produced? Why? (*Animal products, especially beef, use more water than plant products. To produce food from animals, water is needed to grow crops to feed these animals during their lifetime before they provide us with eggs, dairy or meat products. It takes up to 100 times more water to grow a pound of beef than it does to grow a pound of wheat.*)

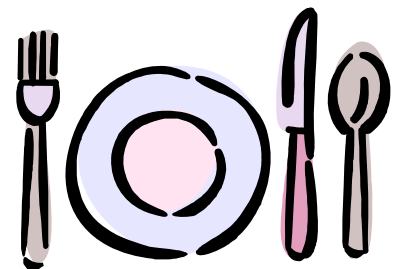
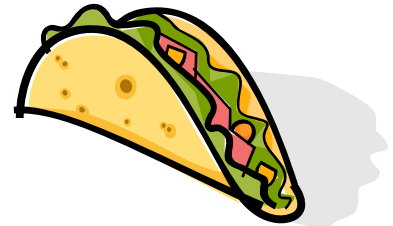
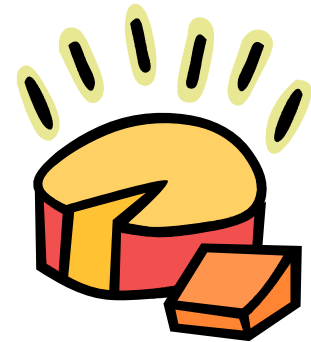
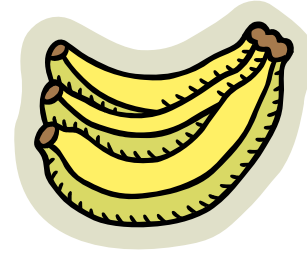
How much water does it take to produce...? (typical serving)

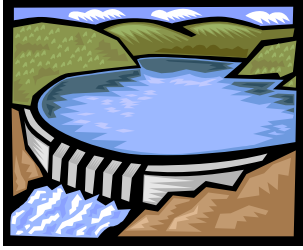
Lettuce -3 gallons
Tomato -8 gallons
Orange -14 gallons
French fries -15 gallons
2 slices bread -20 gallons
Rice -25 gallons
1 glass milk -48 gallons
Cheese -56 gallons
1 egg -62 gallons
Chicken -330 gallons
Pork -400 gallons
Beefsteak -1200 gallons



Procedure

1. Explain to students that most of the water we consume during our lifetime comes from producing the foods we eat every day. Uncover the menu on the board and explain that this resembles a typical American diet. Ask students if they eat any of the foods listed on the board. Ask students to find the sum for gallons of water needed to produce the food for each meal, and then calculate the total amount needed for all three meals. When ready, call on students for their answers.
2. Have students identify the **outliers**—or data values that stand out from the others—that use the most and the least water. Ask them why they require different amounts of water. (*Tossed salad, carrots, burger on a bun, beefsteak. Beef requires a lot of grain to be grown as feed, while lettuce and carrots grow year round, are adaptable, do not fruit and have shallow root systems.*)
3. Tell students they will now create a Water-Wise Menu that requires only half the amount of water. Put students into groups of four or five. Pass out the “Wet” Your Appetite handout to each group, or projected as an overhead for the entire class. Tell students to refer to the list of foods and the gallons needed to produce each food. Ask students to come up with a new daily menu that they will share with the class. The goal of this new menu is to reduce water use by approximately half. Since there are many ways to do this, their task is to create a menu that most closely represents what they would eat and that is balanced and nutritious. In other words, no substituting cookies for sandwiches, and no lettuce-only lunches!
4. When ready, have a student from each group share their group’s menu with the class. Write these new menus on the board including total water needed for the meal.
5. Discuss the findings by investigating the following:
 - Are the meals listed balanced and nutritious?
 - Do meals include animal products or are they plant-based?
 - Is it possible to eat meat and conserve water? (*Note: It is not necessary to be a vegetarian to reduce water use by half when consuming food. While a plant-based diet significantly reduces water consumption, it is important to teach that we can still eat meat and conserve water. This especially makes sense when looking at a weekly diet. If beef is eaten four times a week, it can be halved to twice a week for water conservation benefits.*)





- Pick one of the students' Water-Wise Menus. Tell students they will now find the **rate**, or amount of water needed over time, for this Water-Wise Menu and the *Typical American Diet Menu*. What is the weekly rate or how many gallons of water per week is used for each menu? What is the monthly (30 days) rate or how many gallons of water is used per month for each menu? (*Typical American Diet Menu: 17,304 gal/week; 74,160 gal/month*)
- Ask students to discuss their findings. How does food choice affect water consumption and conservation? Will this new information affect their food choices when they are allowed to choose what they eat? (*Note: Some students don't have much choice at home regarding what foods are served to them. If they mention this, explain that they usually have choice when ordering meals at a restaurant and that they will have freedom to choose what they eat when they are older. Whatever foods are served at home, it is important to be thankful to the family for providing that food. The goal is to raise awareness about the impact food choices have on our water supply and to empower students with knowledge they can use throughout their lives.*)
- Pass out the Math Worksheet, and have the students solve the problems on their own either in class or as homework. (*Note: Remember to collect the "Wet Your Appetite" handout at the end of the project, or before handing out the Math Worksheet.*)

Extensions

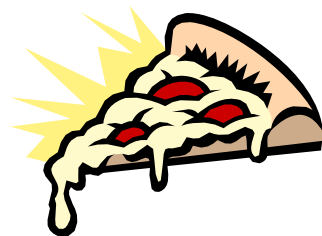
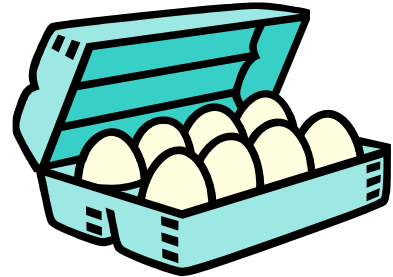
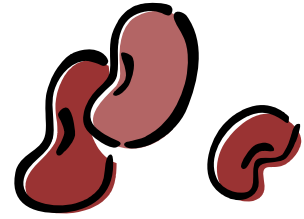
- Using either the Lunch Foods list, and/or the Dinner Foods list, plot the data values on a number line. Have the students answer the following questions:
 - Find the range, mean, median and mode.
 - What are the outliers?
 - If the upper outlier were excluded, how would this change the mean and median? (Students can calculate the exact number, and/or describe how this would affect the measures of central tendency.)
- Discuss ethnic cultures that mostly eat a plant-based diet. What foods do the traditional peoples of Mexico, Lebanon, India, Japan and China eat? Is meat the main part of their diet? Have students research the foods of these countries and hold an international potluck where students bring in plant-based foods from the country they've studied. Examples of foods include: chips and salsa, bean dip, guacamole, bean burritos, hummus and pita bread, falafel, vegetable curry, samosas, vegetable tempura, sushi rolls, seaweed salad, stir-fried veggies with tofu, vegetarian egg rolls, fried rice, vegetable chow mein, etc.

"Wet" Your Appetite!

Grades 6 Math Problems

Write and solve algebraic expressions for the given situations. Remember to show all work.

1. A serving of baked beans without pork (b) uses 200 gallons less water than baked beans with pork (p). Baked beans with pork use 265 gallons of water. How much water does baked beans without pork use?
2. A ham sandwich (h) uses as much water as a quesadilla (q) and a peanut butter sandwich (p) combined. A ham sandwich uses 240 gallons of water, and a quesadilla uses 100 gallons. How much water does a peanut-butter sandwich use?
3. An egg salad sandwich (e) uses 100 gallons of water. A bologna sandwich (b) uses as much water as three egg salad sandwiches. How much water does a bologna sandwich use?
4. 1 piece of bacon (p) uses as much water as two and a half bagels (b). 2 pieces of bacon use as much water as a slice of ham (h). A slice of ham uses 100 gallons of water. How much water does a piece of bacon use? How much water does a bagel use?
5. One serving of pepperoni pizza (p) uses 10 gallons less than a slice of cheese pizza (c) and a quesadilla (q) combined. A serving of pepperoni pizza uses 285 gallons of water. A quesadilla uses 140 gallons of water. How much water does it take to produce a serving of cheese pizza?
6. One serving of beef tamale (b) uses 10 more gallons of water than 3 servings of macaroni and cheese (m). One serving of beef tamale uses 340 gallons of water. How much water does a serving of macaroni and cheese use?





Solve the following problems using multiplication, conversions and ratios.

7. $\frac{69}{h} = \frac{\text{vegetable stir-fry w/ meat (v)}}{\text{hamburger (h)}}$

8. Find h if:

a. $\frac{345}{h}$

9. Write the following as a ratio: the ratio of water used for vegetable stir-fry with meat to hamburger.

10.

$\frac{11}{40} = \frac{\text{chicken (c)}}{\text{beefsteak (b)}}$

Find c if:

$\frac{11}{40} = \frac{c}{1200}$



11. Write the following as a ratio: the ratio of water used for a serving of chicken to beefsteak.

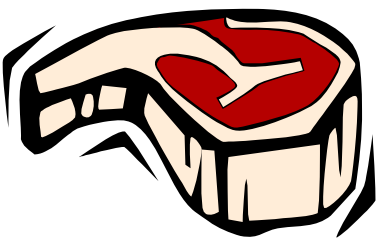
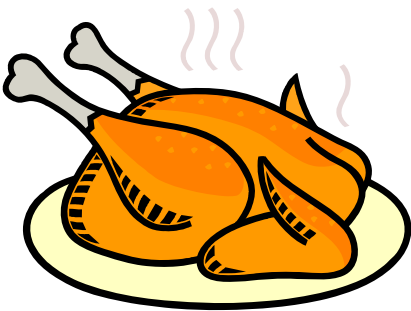
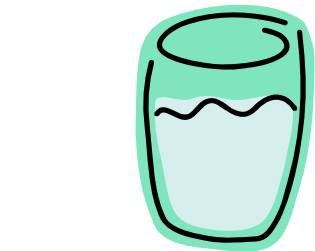
12. 1 gallon of water equals 231 cubic inches. How many cubic inches does a beefsteak use?

13. 1 cubic foot of water is equal to 7.5 gallons of water. How many cubic feet of water does a beefsteak use?

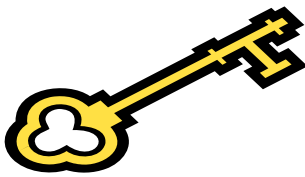
14. One serving of water uses 8 ounces of water, compared to serving a soda, which uses 10 gallons. There are 128 ounces of water in a gallon. How many ounces of water does a serving of soda use?

15. Write the following as a ratio: the ratio of water used in a serving of water to water used in a soda.

16. Convert the ratio of water to water used in a soda into a fraction, and find the reduced form.



Teachers Key



Write and solve algebraic expressions for the given situations. Remember to show all work.

1. A serving of baked beans without pork (b) uses 200 gallons less water than baked beans with pork (p). Baked beans with pork uses 265 gallons of water. How much water does baked beans without pork use?

$$\begin{aligned}b &= p - 200 \text{ OR} \\b &= -200 + p \\p &= 265 \\b &= ?\end{aligned}$$

$$\begin{aligned}b &= p - 200 \text{ OR} \\b &= -200 + 265 \\b &= 265 - 200 \\b &= 65\end{aligned}$$

2. A ham sandwich (h) uses as much water as a quesadilla (q) and a peanut butter sandwich (p) combined. A ham sandwich uses 240 gallons of water, and a quesadilla uses 100 gallons. How much water does a peanut-butter sandwich use?

$$\begin{aligned}h &= q + p \\h &= 240 \\q &= 100 \\240 &= 100 + p \\p &= ?\end{aligned}$$

$$\begin{aligned}p &= h - q \\p &= 240 - 100 \\p &= 140\end{aligned}$$

3. An egg salad sandwich (e) uses 100 gallons of water. A bologna sandwich (b) uses as much water as three egg salad sandwiches. How much water does a bologna sandwich use?

$$\begin{aligned}b &= 3e \\e &= 100 \\b &= ?\end{aligned}$$

$$\begin{aligned}b &= 3e \\b &= 3 \times 100 \\b &= 300\end{aligned}$$

4. 1 piece of bacon (p) uses as much water as two and a half bagels (b). 2 pieces of bacon use as much water as a slice of ham (h). A slice of ham uses 100 gallons of water. How much water does a piece of bacon use? How much water does a bagel use?

$$\begin{aligned}p &= 2.5b \\2p &= h \\h &= 100 \\p &= ? \\b &= ?\end{aligned}$$

$$\begin{aligned}2p &= h \\2p &= 100 \\p &= 50\end{aligned}$$

$$\begin{aligned}p &= 2.5b \\50 &= 2.5b \\b &= 20\end{aligned}$$

5. One serving of pepperoni pizza (p) uses 10 gallons less than a slice of cheese pizza (c) and a quesadilla (q) combined. A serving of pepperoni pizza uses 285 gallons of water. A quesadilla uses 140 gallons. How much water does it take to produce a serving of cheese pizza?

$$\begin{aligned}p &= (c + q) - 10 \\p &= 285 \\q &= 140 \\c &= ?\end{aligned}$$

$$\begin{aligned}285 &= (c + 140) - 10 \\285 + 10 &= (c + 140) \\295 &= c + 140 \\295 - 140 &= c \\c &= 155\end{aligned}$$

6. One serving of beef tamale (b) uses 10 more gallons of water than 3 servings of macaroni and cheese (m). One serving of beef tamale uses 340 gallons of water. How much water does a serving of macaroni and cheese use?

$$b = 10 + 3m$$

$$b = 340$$

$$m = ?$$

$$3m = b - 10$$

$$3m = 340 - 10$$

$$3m = 330$$

$$m = 110$$

Solve the following problems using multiplication, conversions and ratios.

7. $\frac{69}{125} = \frac{\text{vegetable stir-fry w/ meat } (v)}{\text{hamburger } (h)}$

Find h if:

$$\frac{69}{125} = \frac{345}{h}$$

$$h = 625$$

8. Write the following as a ratio: the ratio of water used for vegetable stir--fry with meat to hamburger.

$$69:125 \text{ or } 345:625$$

9. $\frac{11}{40} = \frac{\text{chicken } (c)}{\text{beefsteak } (b)}$

Find c if:

$$\frac{11}{40} = \frac{c}{1200}$$

$$c = 330$$

10. Write the following as a ratio: the ratio of water used for a serving of chicken to beefsteak.

$$330 : 1200 \text{ or } 11 : 40$$

11. 1 gallon of water equals 231 cubic inches. How many cubic inches does a beefsteak use?

$$277,200 \text{ cubic inches}$$

12. 1 cubic foot of water is equal to 7.5 gallons. How many cubic feet of water does a beefsteak use?

$$160 \text{ cubic feet}$$

13. One serving of water uses 8 ounces of water, compared to serving a soda, which uses 10 gallons. There are 128 ounces of water in a gallon. How many ounces of water does a serving of soda use?

$$1,280 \text{ oz.}$$

14. Write the following as a ratio: the ratio of water used in a serving of water to soda.

$$8 : 1,280$$

15. Convert the ratio of water to soda into a fraction, and find the reduced form.

$$8/1,280$$

$$1/160$$

Name _____

Date _____

“Wet” Your Appetite!

Using the list of foods provided, create a balanced and realistic daily menu that uses half (or less) of the amount of water needed for the *Typical American Diet*. (Note: Fish items are not included because it is not known how many gallons of water are needed to process fish items.)

Menu of a Typical American Diet

Breakfast



- 2 eggs-124 gal.
- 2 slices bacon-100 gal.
- 2 pc. toast w/butter-110 gal
- 1 glass orange juice-49 gal.

Lunch



- 1 burger on a bun-626 gal.
- 1 order French fries-15 gal.
- 1 serving carrots-6 gal.
- 1 cookie-55 gal.
- 1 glass milk-48 gal.

Dinner



- 1 beefsteak-1200 gal.
- 1 serving rice-25 gal.
- 1 tossed salad-15 gal.
- 1 soda-10 gal.
- 1 slice apple pie-90 gal.

Daily total: 2472 gallons

Breakfast Foods



- Bacon (1 slice)-50 gal.
- Bagel-20 gal.
- Butter (1 pat)-45 gal.
- Cereal (w/out milk)-20 gal.
- Cereal with milk - 68 gal.

- Cream cheese -56 gal.
- Egg (one)-62 gal.
- French toast (1 slice)-45 gal.
- Fruit salad-25 gal.
- Ham (1 slice)-100 gal.
- Hash brown potatoes -10 gal.
- Muffin- 45 gal.
- Pancakes (1 large)-45 gal.
- Sausage (1 link)-100 gal.
- Toast-(1 slice)-10 gal.
- Waffles (1 slice)-45 gal
- Yogurt (plain)-48 gal.
- Soy Yogurt (plain)-40 gal.

Lunch Foods

- Bologna sandwich-300 gal.
- Cheese sandwich-66 gal.
- Chicken sandwich-175 gal.
- Egg salad sandwich-100 gal.
- Ham sandwich-240 gal.
- Hamburger-625 gal.
- P-nut butter sandwich-100 gal.
- Pizza (pepperoni) -285 gal.
- Pizza (cheese)-155 gal.
- Quesadilla -140 gal.

Dinner Foods

- Baked beans (no pork)-65 gal.
- Baked beans w/pork-265 gal.
- Bean burrito-125 gal.
- Beef burrito-425 gal.
- Beef hot dog-325 gal.
- Beefsteak-1200 gal.
- Chicken -330 gal.
- Chicken burger-185 gal.
- Hamburger-625 gal.
- Lasagna w/cheese-135 gal.
- Lasagna w/beef-435 gal.
- Macaroni and cheese-110 gal.
- Pasta w/tomato sauce-55 gal.
- Pasta w/meatballs-670 gal.
- Rice-25 gal.
- Noodles-25 gal.
- Tamale w/beef-340 gal.
- Tamale w/chicken-195 gal.

- Tofu burger-80 gal.
- Tofu hot dog-80 gal.
- Turkey-330 gal.
- Veggie stir-fry-45 gal.
- Veg. stir-fry w/meat-345 gal.

Fruits and Vegetables

- Apple-10 gal.
- Broccoli-11 gal.
- Cantaloupe-40 gal.
- Carrots-6 gal.
- Corn-20 gal.
- French fries-15 gal.
- Fruit salad-25 gal.
- Mashed potatoes-15 gal.
- Orange-14 gal.
- Potato-6 gallons
- Tomato-8 gal.
- Tossed salad w/dressing 15 gal.
- Watermelon-100 gal.

Desserts

- Apple pie-90 gal.
- Cake-90 gal.
- Cookie-55 gal.
- Ice Cream-150 gal.
- Non-dairy ice cream-120 gal.

Snacks

- Almonds-80 gal.
- Corn chips- 40 gal
- Crackers-20 gal.
- Popcorn-20 gal.
- Potato chips-- .10 gal.

Beverages

- Apple juice-45 gal.
- Milk-48 gal.
- Soy Milk-40 gal.
- Milkshake-95 gal.
- Orange juice-49 gal.
- Soda-10 gal.
- Water-8 ounces

Breakfast-----Gallons

Lunch-----Gallons

Dinner-----Gallons

Total Gal. Used:

Total Gal. Used:

Total Gal. Used:

Daily Total Used:

"Wet" Your Appetite! CA Standards 6



Grade 6

<p>Math</p> <p>◆ NS 1.2</p> <p>◆ NS 1.3</p> <p>◆ NS 2.0</p> <p>◆ NS 2.4</p>	<p>Interpret and use ratios in different contexts to show the relative sizes of two quantities, using appropriate notations (a/b, a to b, $a:b$).</p> <p>Use proportions to solve problems. Use cross-multiplication as a method for solving such problems, understanding it as the multiplication of both sides of an equation by a multiplicative inverse.</p> <p>Students calculate and solve problems involving addition, subtraction, multiplication, and division.</p> <p>Determine the least common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator, add two fractions, or to find the reduced form for a fraction).</p>
<p>◆ AF 1.0</p> <p>◆ AF 1.1</p> <p>◆ AF 1.4</p> <p>◆ AF 2.2</p>	<p>Students write verbal expressions and sentences as algebraic expressions and equations; they evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results.</p> <p>Write and solve one-step linear equations in one variable.</p> <p>Solve problems manually by using the correct order of operations or by using a scientific calculator.</p> <p>Demonstrate an understanding that <i>rate</i> is a measure of one quantity per unit value of another quantity.</p>
<p>◆ S 1.0</p> <p>◆ S 1.1</p> <p>◆ S 1.3</p>	<p>Students compute and analyze statistical measurements for data sets</p> <p>Compute the range, mean, median, and mode of data sets.</p> <p>Understand how the inclusion or exclusion of outliers affects measures of central tendency.</p>

Abbreviations

Math: NS=Number Sense; AF=Algebra and Functions; S=Statistics/Data Analysis