

UNIT CONVERSION / INSTRUCTOR INFO

Summary

This lesson includes vocabulary, content, and examples to help students learn and understand varying systems of measurement and how to convert both within and between measurement systems. Using classroom discussion and problem sets containing OCEARCH data, students will be able to apply principles of unit conversion to real life situations.

Part 1. Introduction

Part 2. The Customary System

Part 3. The Metric System

Part 4. Converting between Customary and Metric

Part 5. Review

Goals & Objectives

The students will:

- understand why different systems of measurement exist;
- understand basic principles of both the customary and metric systems of measurement;
- perform unit conversions both within and between measurement systems;
- solve unit conversion problems based on real scientific data;
- select appropriate representations of measurements based on real life situations.

// STANDARDS

This lesson aligns with the following TEKS:

6th Grade Math: RP.A.1, RP.A.2, RP.A.3, NS.A.1, EE.A.1 EE.B.6

7th Grade Math: RP.A.1, RP.A.2, RP.A.3

This lesson aligns with the following TEKS:

Grade 5 Math (Revised): 1A, 1B, 1C, 1D, 1E, 3E, 3G, 3L, 4H, 7

Grade 6 Math: 2C, 3A, 8A, 8B, 8D, 11A, 11B, 11D, 12A, 12B

Grade 6 Math (Revised): 1A, 1B, 1C, 1D, 1E, 3E, 4H, 5A

Grade 7 Math: 2A, 2B, 2D, 2F, 3B, 4A, 9A, 13A, 13B, 13D, 14A

Grade 7 Math (Revised): 1A, 1B, 1C, 1D, 1E, 2, 3A, 3B, 7D, 4E, 5A

Grade 8 Math: 1B, 2A, 2B, 2D, 3B, 14A, 14B, 14D, 15A

Grade 8 Math (Revised): 1A, 1B, 1C, 1D, 1E

Helpful Tips

- 1) The content in this lesson is based on the conservation work of OCEARCH™ and the Global Shark Tracker™. Spend a few minutes getting familiar with the website and the tracker if you have not done so already. The Global Shark Tracker™ is also available as an app for iPhone and Android.
- 2) This lesson plan is designed to be adaptable to suit your specific needs. Use the entire lesson plan or just parts of it. This material can be expanded to be an entire unit or condensed for just one day in the classroom.
- 3) Vocabulary words will be underlined as they first appear in the lesson plan. A complete list of vocabulary words is included as well.
- 4) Answers to questions and prompts for discussions will appear in *italics*.
- 5) Optional activities and content (side notes) will appear in a box. Use these to enhance your lesson and adapt it to suit your needs!
- 6) A unit conversion reference sheet is provided on the next page and can be given to the students to help with the lesson. Students can also create their own reference sheets as you work through the lesson.
- 7) Have questions for OCEARCH Expedition Leader, Chris Fischer? Email info@OCEARCH.org to schedule a Skype session and let your students/child talk directly to Chris and the OCEARCH crew!
- 8) Email all questions about this lesson to info@OCEARCH.org.

Unit Conversion Reference Sheet

Name: _____

Remember this basic rule for unit conversion:

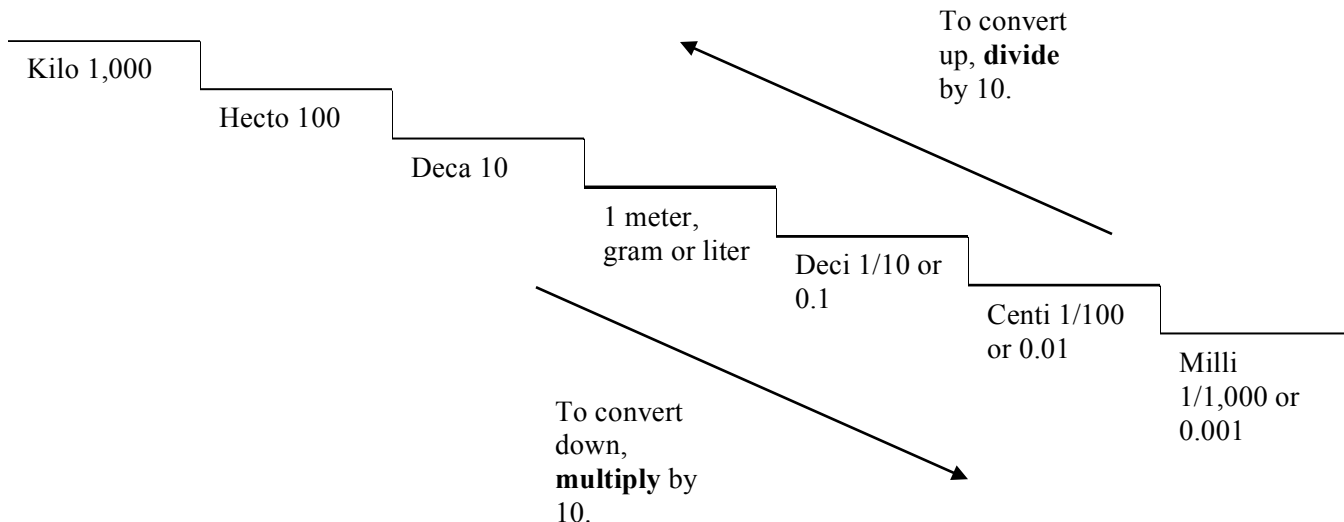
To convert from a LARGER unit to a SMALLER unit – MULTIPLY

To convert from a SMALLER unit to a LARGER unit – DIVIDE

Use the following conversion factors when converting within the CUSTOMARY system:

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
12 inches = 1 foot	16 ounces = 1 pound	8 ounces = 1 cup
3 feet = 1 yard	2,000 pounds = 1 ton	2 cups = 1 pint
1,760 yards = 1 mile		2 pints = 1 quart
5,280 feet = 1 mile		4 quarts = 1 gallon
		16 cups = 1 gallon

Use the following conversion factors when converting within the METRIC system:



For every step in the diagram, going up or down, add a zero to the number one and then multiply or divide by that number.

Use the following conversion factors when converting between CUSTOMARY and METRIC units:

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
2.54 centimeters = 1 inch	1 kilogram = 2.2 pounds	3.785 liters = 1 gallon
1.6 kilometers = 1 mile		

Vocabulary

Customary System –The system derived from the older English system of measurement and widely used in the United States today. Customary units include measurements that you are most familiar with like inches, gallons, and pounds.

Length – Any measured distance.

Metric System –A system of measurement based on liters (volume), meters (length), and grams (weight). It simplifies conversion by using a base-ten system using prefixes such as milli, deci, centi, deca, hecto and kilo. This is the standard system of measurement for most of the world.

Proportion – An equation that states that two ratios are equal.

Ratio – The quotient of two numbers or mathematical expressions.

Unit – A definite quantity used as a standard of measurement. For example, the dollar is a unit of U.S. money.

Unit Conversion – To change from one unit to another. For example, converting pounds to grams.

Volume – The amount of space as measured in cubic units.

Weight – The measure of how heavy an object is.

Vocabulary Game

Try this fun game to practice and review vocabulary words!

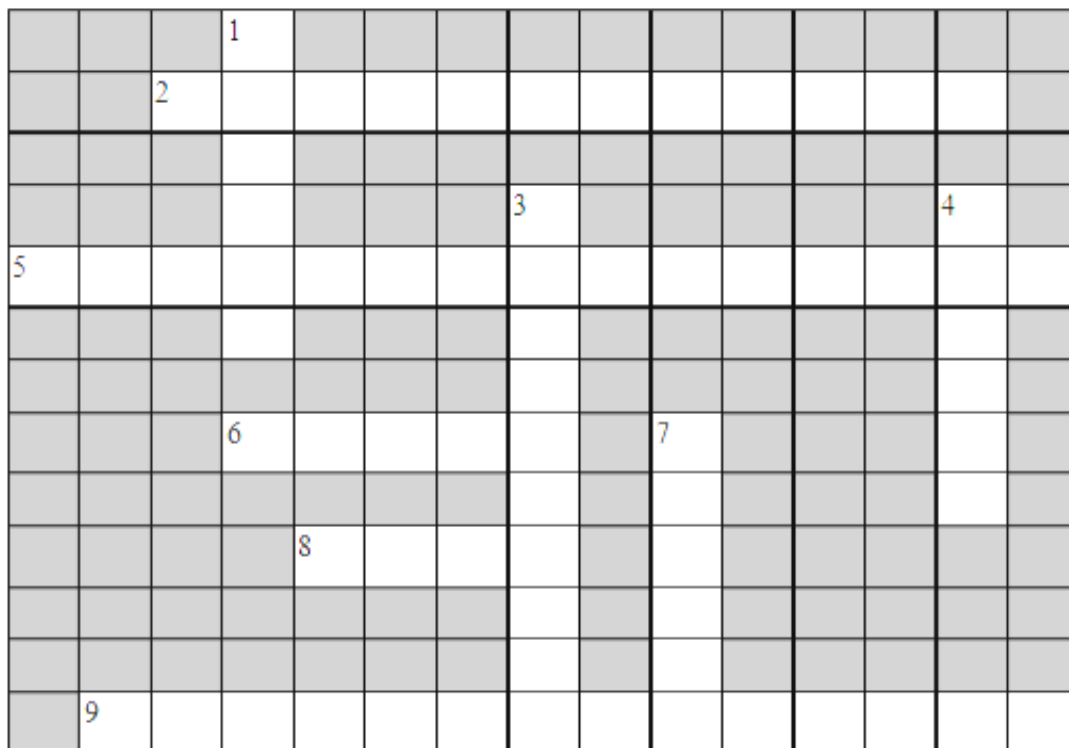
(10 – 20 minutes or take home)

Materials – Pencil and crossword handout (see next page).

Vocabulary Crossword Puzzle

Name: _____

Test your vocabulary skills by completing this puzzle:



ACROSS

2. The system of measurement that uses prefixes such as milli, centi, and kilo.
5. The system of measurement largely used in the United States.
6. The quotient of two numbers or mathematical expressions.
8. A definite quantity used as a standard of measurement.
9. To change from one unit to another.

DOWN

1. Any measured distance.
3. An equation that states that two ratios are equal.
4. The measure of how heavy an object is.
7. The amount of space as measured in cubic units.

UNIT CONVERSION / PRE-LESSON ASSESSMENT

Use the following short answer, multiple choice, and true/false questions as an introduction/warm-up to the lesson topics. You can do this in a verbal or written format, as a game, individually, or as a whole class! A handout is provided if you wish to hand the questions out in a quiz format.

The questions do not need to be graded. They are intended to give the students an idea of what they will be learning and to see what they already know.

1. What is the standard measurement system in the United States?

Answer: *Customary System*

2. What is the more common international measurement system?

Answer: *Metric System*

3. Name one difference between these two systems of measurement.

Answer: *Metric system units are represented with prefixes.*

4. Name three units of measurement from the customary system.

Answer: *Pound, inch, cup*

5. Which of the following are metric units? (Circle all that apply.)

- a. Meter
- b. Inch
- c. Gram
- d. Liter
- e. Pound

Answers: *a, c, d*

6. True or False A ratio is the quotient of two numbers or mathematical expressions.

Answer: *True*

7. True or False A proportion is an equation that states that two ratios are not equal.

Answer: *False*

Student handout provided on next page.

Name: _____ Date: _____

Unit Conversion

Select the correct answer(s) to each of the following questions.

1. What is the standard measurement system in the United States?
2. What is the more common international measurement system?
3. Name one difference between these two systems of measurement.
4. Name three units of measurement from the customary system.
5. Which of the following are metric units? (Circle all that apply.)
 - a. Meter
 - b. Inch
 - c. Gram
 - d. Liter
 - e. Pound
6. True or False A ratio is the quotient of two numbers or mathematical expressions.
7. True or False A proportion is an equation that states that two ratios are not equal.

Pre-Lesson Assessment

UNIT CONVERSION

/ LESSON PLAN

Part 1. Introduction (15-20 minutes)

Measurement is one of the most important and widely used applications of mathematics. What are some measurements that you use every day?

Measuring amounts of ingredients for a home cooked meal (cup, ounce, pound, liter etc.); measuring how much fuel your vehicle has so you know how far you can travel before refueling (gallon); measuring how far you ran for exercise (miles, kilometers).

Start a list based on the students answers. Separate units of length, weight and volume into different columns. Fill in any units that were left out. Your list should look similar to this:

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
Inch	Ounce	Ounce
Feet	Gram	Cup
Yard	Ton	Pint
Centimeter	Pound	Quart
Mile	Kilogram	Gallon
Meter		Liter
Kilometer		

We use different units of measurement to help us define the world around us. A unit is a definite quantity used as a standard of measurement. For example, the dollar is a unit of U.S. money. Each of the above units is used in one of two common systems of measurement – customary and metric. These measurement systems share similarities and have some differences, but both help you describe how long, heavy, or big something it.

Why are there so many different units of measurement? *Sometimes you need to measure small things and sometimes you need to measure large things.*

Which unit would you use to measure how far a great white shark swims in a day? Inches or miles? *Miles.* Miles is a large unit of measurement and is great for measuring long distances. Inches would be better for measuring something small, such as the length of a great white shark tooth!

Which unit would you use to measure how much fuel a ship's fuel tank can hold? Cups or gallons? *Gallons.*

What if the OCEARCH scientists have a tape measure marked with only inches to use for measuring great white sharks, but need the measurements to be recorded in feet? What would you do in this situation? *After measuring the length of the great white shark in inches, you would have to convert inches to feet.*

Any length can be described in inches or miles, any weight in ounces or pounds, and any volume in pints or gallons. But being able to convert from one unit to another is important because it allows you to express information in a way that makes the most sense.

Part 2. The Customary System (60-75 minutes)

The customary system is the system of measurement most commonly used in the United States. Look back at your list of units and highlight or circle the customary units (or erase/cover up the metric units). Your list should now look like this:

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
Inch	Ounce	Ounce
Feet	Pound	Cup
Yard	Ton	Pint
Mile		Quart
		Gallon

To convert from one unit of measurement to another, just remember this basic conversion rule:

To convert from a LARGER unit to a SMALLER unit – MULTIPLY
 To convert from a SMALLER unit to a LARGER unit - DIVIDE

For example, if you need to convert yards to miles, you will need to divide. If you need to convert gallons to cups, you will need to multiply.

To understand what you need to multiply and divide by to convert units, have the students make their own conversion chart on a blank piece of paper. Work as a class and see how much the students know already. How many inches are in a foot? How many quarts are in a gallon? It should look something like this:

Please note that the larger number is the smaller unit. For example, inches are smaller than

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
→ 12 inches = 1 foot	16 ounces = 1 pound	8 ounces = 1 cup
3 feet = 1 yard	2,000 pounds = 1 ton	2 cups = 1 pint
1,760 yards = 1 mile		2 pints = 1 quart
5,280 feet = 1 mile		4 quarts = 1 gallon
		16 cups = 1 gallon

The students should hold onto this chart. It will be helpful later on in the lesson.

Example 1. – A great white shark is measured to be four YARDS long but you need to know how long the shark is in FEET.

Step 1. What is the question? *How many feet are in four yards?*

$$4 \text{ yards} = X \text{ feet}$$

“X” represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from yards to feet? *You are converting from a larger unit (yards) to a smaller unit (feet), so you need to multiply!*

Step 3. How many feet are in just one yard? Refer to your chart if needed.

There are 3 feet in 1 yard!

This is the conversion factor.

→ 3 feet = 1 yard

This is your conversion factor and is what you need to multiply by to convert from yards to feet.

Step 4. Multiply the known value (4 yards) by the conversion factor to find out how many feet are equal to 4 yards.

$$4 \times 3 = 12$$

The great white shark is 12 feet in length!

Example 2. – Suppose the great white shark in the previous example was originally measured in feet, but you need to know how long it is in yards. The shark is 12 feet long.

Step 1. What is the question? *How many yards are in twelve feet?*

$$12 \text{ feet} = X \text{ yards}$$

“X” represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from feet to yards? *You are converting from a smaller unit (feet) to a larger unit (yards), so you need to divide!*

Step 3. What is the conversion factor used to convert between feet and yards? Refer to your chart if needed.

3 feet = 1 yard

Step 4. Divide the known value (12 feet) by the conversion factor to find out how many yards are equal to 12 feet.

$$\frac{12}{3} = 4 \text{ yards}$$

The great white shark is 4 yards in length!

Complete the following practice problems as a class. Remember the basic conversion rule of multiplying/dividing and the four steps to unit conversion.

Step 1. What is the question?

Step 2. Will you need to multiply or divide to convert?

Step 3. What is the conversion factor?

Step 4. Convert!

1. Great white sharks can travel at speeds of up to 184,800 feet per hour. If a shark travels at top speed for one hour, how many miles has the shark traveled?

Answer: *35 miles*

2. If Genie the great white shark weighs 36,672 ounces, how many pounds does she weigh?

Answer: *2,292 pounds*

3. The OCEARCH vessel can hold 8,000 gallons of fresh water. How many cups of water would the crew have to drink to empty their reserve?

Answer: *128,000 cups*

Students should complete the following practice problems individually in class or at home. An instructor answer key and a student handout have been provided below. Students should show their work and remember to record the correct unit for their answers.

Unit Conversion Practice
Problems – Customary System

Name: _____

Date: _____

Complete the following practice problems. Make sure to show your work and remember to write the correct unit for your answer. A number with no unit has no meaning!

1. Nico the great white shark was accidentally measured in inches, but OCEARCH scientists need to know how long he is in feet. If he is 108 inches long, what is his length in feet?
2. Great white sharks typically cruise through the water at about 5 miles per hour. If OCEARCH spotted a shark an hour ago swimming at the normal speed, how many feet in each direction around the ship do they need to search to find it?
3. The OCEARCH crew needs to pump 120 quarts of salt water over the gills of Jill, a great white shark, every minute while she is on the shark lift. However, their water pump only reads in gallons. How many gallons of salt water does the crew need to pump per minute?
4. If the length of a shark's tooth equals 1 inch, how many shark teeth long is Edna, a 14 foot and 2 inch great white shark?

5. The M/V OCEARCH anchor weighs $\frac{3}{4}$ of a ton. The crew needs to buy a second anchor that weighs the same, but the anchors are measured in pounds. How many pounds does the new anchor weigh?

6. A great white shark names Cyndi weighs 2,257 pounds, but the crew needs to find her weight in smaller units so that they can compare her weight with smaller species of sharks. What is Cyndi's weight in ounces?

7. Jill the great white shark displaces 7.8 gallons of water per cubic foot but the OCEARCH crew measures the water on their shark deck in quarts. How many quarts of water does Jill displace while on the shark deck?

Unit Conversion Practice Problems – Customary System

INSTRUCTOR ANSWER KEY

1. Nico the great white shark was accidentally measured in inches, but OCEARCH scientists need to know how long he is in feet. If he is 108 inches long, what is his length in feet?
Answer: *9 feet*
2. Great white sharks typically cruise through the water at about 5 miles per hour. If OCEARCH spotted a shark an hour ago swimming at the normal speed, how many feet in each direction around the ship do they need to search to find it?
Answer: *26,400 feet*
3. The OCEARCH crew needs to pump 120 quarts of salt water over the gills of Jill, a great white shark, every minute while she is on the shark lift. However, their water pump only reads in gallons. How many gallons of salt water does the crew need to pump per minute?
Answer: *30 gallons*
4. If the length of a shark's tooth equals 1 inch, how many shark teeth long is Edna, a 14 foot and 2 inch great white shark?
Answer: $14 \text{ feet} = 168 \text{ inches} + 2 \text{ inches} = 170 \text{ inches}$ or *170 teeth*
5. The M/V OCEARCH anchor weighs $\frac{3}{4}$ of a ton. The crew needs to buy a second anchor that weighs the same, but the anchors are measured in pounds. How many pounds does the new anchor weigh?
Answer: *1,500 pounds*
6. A great white shark names Cyndi weighs 2,257 pounds, but the crew needs to find her weight in smaller units so that they can compare her weight with smaller species of sharks. What is Cyndi's weight in ounces?
Answer: *36,112 ounces*
7. Jill the great white shark displaces 7.8 gallons of water per cubic foot but the OCEARCH crew measures the water on their shark deck in quarts. How many quarts of water does Jill displace while on the shark deck?
Answer: *31.2 quarts per cubic foot*

Part 3. The Metric System (60-75 minutes)

The metric system uses SI (*Système International*) units. SI units were invented as a standard form of measurement to be used by all countries. This system is so widely used, that the United States is one of only three countries in the world that does not use the metric system as its official measurement system. Liberia and Burma are the other two! The United States does use the metric system in science. This is why it is important to know how to convert between customary units and metric units.

See if the students can name any metric units – centimeters are a great example because standard rulers contain both centimeters and inches.

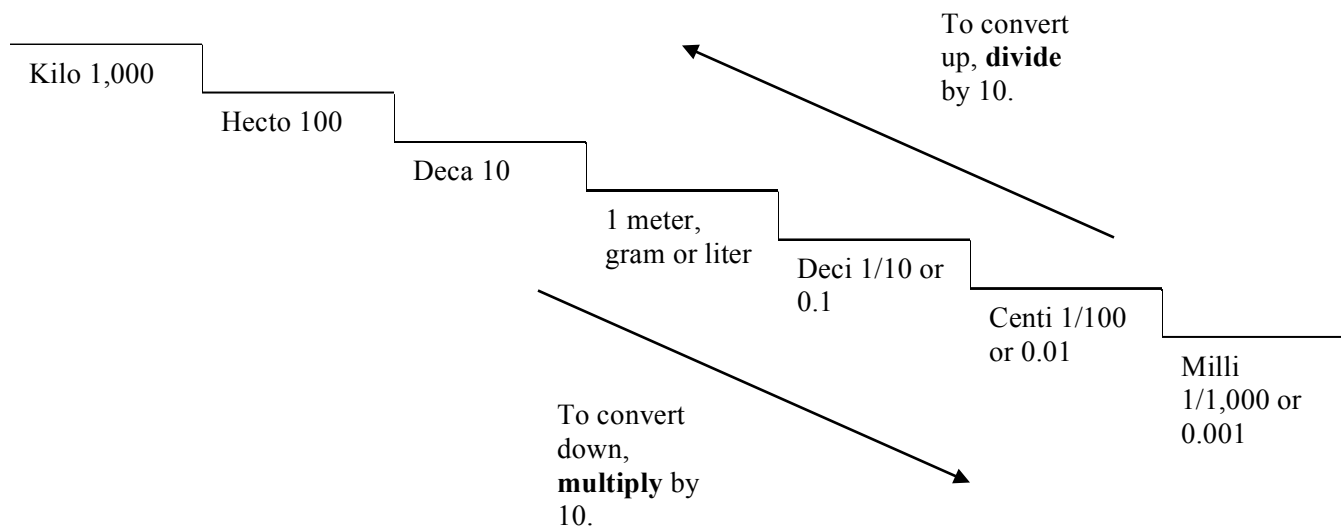
<u>Length</u>	<u>Weight</u>	<u>Volume</u>
Centimeter	Gram	Liter
Meter	Kilogram	
Kilometer		

The metric system uses meters to measure length, liters to measure volume, and grams to measure weight. Rather than switching to different units for different sized objects, these units are changed by powers of ten, denoted with prefixes such as milli-, centi-, deci-, deca-, hecto-, and kilo-.

One thing the customary system and the metric system have in common is the basic conversion rule:

To convert from a LARGER unit to a SMALLER unit – MULTIPLY
To convert from a SMALLER unit to a LARGER unit - DIVIDE

Have the students draw this staircase style diagram onto a blank piece of paper to help them with metric system conversions.



For every step in the diagram, going up or down, add a zero to the number one and then multiply or divide by that number.

Example 3. – A shark measures 5 METERS long, but you need to know its length in CENTIMETERS.

Step 1. What is the question? *How many centimeters are in 5 meters?*

5 meters = X centimeters
“X” represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from meters to centimeters? *You are converting from a larger unit (meters) to a smaller unit (centimeters), so you need to multiply!*

Step 3. How many centimeters are in one meter? Find meters on your chart and count how many steps it takes to get to centimeters. *Two steps!*
So now you know to add two zeroes to the number one.

1 meter = 100 centimeters

This is the conversion factor.

This is your conversion factor and is what you need to multiply by to convert from meters to centimeters.

Step 4. Multiply the known value (5 meters) by the conversion factor to find out how many centimeters are equal to 5 meters.

$$5 \times 100 = 500$$

The shark is 500 centimeters long!

Example 4. – Now suppose the shark in the previous example was originally measured in centimeters, but you need to know how long it is in meters. The shark is 500 centimeters long.

Step 1. What is the question? *How many meters are in 500 centimeters?*

500 centimeters = X meters
“X” represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from centimeters to meters? *You are converting from a smaller unit (centimeters) to a larger unit (meters), so you need to divide!*

Step 3. What is the conversion factor used to convert between centimeters and meters? Find centimeters on your chart and count how many steps it takes to get to meters. *Two steps!*

So now you know to add two zeroes to the number one.

1 meter = 100 centimeters

Step 4. Divide the known value (500 centimeters) by the conversion factor to find out how many meters are equal to 500 centimeters.

$$\frac{500}{100} = 5$$

The shark is 5 meters long!

Complete the following practice problems as a class. Remember the basic conversion rule of multiplying/dividing and the four steps to unit conversion.

Step 1. What is the question?

Step 2. Will you need to multiply or divide to convert?

Step 3. What is the conversion factor?

Step 4. Convert!

1. If the OCEARCH crew uses 15 liters of shark bait per day, but bait is only sold in milliliters, how much shark food will the crew need to buy?

Answer: 15,000 milliliters

2. The life rings aboard the OCEARCH vessel are 76 centimeters wide. If one of the crewmembers eats too much cake and ends up 8 decimeters wide, will he still fit into the life ring if he falls overboard?

Answer: No, he will be 80 centimeters wide – too large to fit in the life ring!

3. If the OCEARCH vessel weighs 527,074 kilograms, how many one gram pieces of shark bait would the crew need to equal the weight of the ship?

Answer: 527,074,000 pieces of shark bait

Class Discussion

Topic(s) – Measurement Systems and Unit Conversion

(10 – 20 minutes)

- Which system of measurement do you think is easier to measure with and convert? Why? *(Most would say the metric system is easiest because of the prefixes and multiples of 10's, but there's no wrong answer!)*
- Metric units are used quite often in the United States, even though it's not the standard system. Name examples where the metric system is used in everyday American life. *You may get answers such as students who run the 100 meter race or two liter bottles of soda. You also see metric units in science due to how easy it is to convert.*
- The United States government first approved the use of metric units in 1866, but never switched because changing the current measurement system would be expensive, time-consuming, and nearly impossible. What sort of things would we have to change if we stopped using customary units? *Street signs, food and drink packaging labels, sports, recipes, construction, etc.*

Students should complete the following practice problems individually in class or at home. An instructor answer key and a student handout have been provided below. Students should show their work and remember to record the correct unit for their answers.

Unit Conversion Practice Problems – Metric System

Name: _____

Date: _____

Complete the following practice problems. Make sure to show your work and remember to write the correct unit for your answer. A number with no unit has no meaning!

1. Great white sharks have been known to breach up to 304 centimeters above the water's surface. How many meters above the surface would this be?
2. Great white sharks have been found to dive deeper than 1,219 meters. If the tastiest types of fish live 1,000,000 millimeters below the surface of the water will the shark be able to catch and eat them?
3. If a great white shark traveled 96 kilometers in 24 hours, how many hectometers did it travel per hour on average?
4. Albert, a great white shark, weighs in at 220 kilograms. What is Albert's weight in milligrams?
5. The length of a great white shark's caudal fin (tail fin) is measured to be 1,372 millimeters. What is the length of the shark's

6. The crew needs to put new railing along the sides of the M/V OCEARCH. If the ship is 148 meters long but the railing they want is only sold in centimeters, how many centimeters of railing will they need for one side of the ship?

7. Suppose a great white shark's jaws weigh 250 kilograms, but a researcher needs to compare the size of great white jaws with those of smaller shark species. What is the weight of the great white shark's jaws in grams?

Unit Conversion Practice Problems – Metric System

INSTRUCTOR ANSWER KEY

1. Great white sharks have been known to breach up to 304 centimeters above the water's surface. How many meters above the surface would this be?
Answer: *3.04 meters*
2. Great white sharks have been found to dive deeper than 1,219 meters. If the tastiest types of fish live 1,000,000 millimeters below the surface of the water will the shark be able to catch and eat them?
Answer: *Yes! 1,219 meters = 1,219,000 millimeters.*
3. If a great white shark traveled 96 kilometers in 24 hours, how many hectometers did it travel per hour?
Answer: *4 kilometers per hour = 40 hectometers per hour.*
4. Albert, a great white shark, weighs in at 220 kilograms. What is Albert's weight in milligrams?
Answer: *220,000,000 milligrams*
5. The length of a great white shark's caudal fin (tail fin) is measured to be 1,372 millimeters. What is the length of the shark's caudal fin in decimeters?
Answer: *13.72 decimeters*
6. The crew needs to put new railing along the sides of the M/V OCEARCH. If the ship is 148 meters long but the railing they want is only sold in centimeters, how many centimeters of railing will they need for one side of the ship?
Answer: *14,800 centimeters*
7. Suppose a great white shark's jaws weigh 250 kilograms, but a researcher needs to compare the size of great white jaws with those of smaller shark species. What is the weight of the great white shark's jaws in grams?
Answer: *250,000 grams*

Part 4. Converting between Customary and Metric (60-75 minutes)

We often find ourselves needing to convert between these two systems of measurement due to the fact that the measurement system in the United States differs from the international standard.

For example, the OCEARCH crew uses feet to measure their sharks, but when the information is recorded for the official research papers the data needs to be converted to the metric system.

The same the basic conversion rule is used when converting between customary and metric units:

To convert from a LARGER unit to a SMALLER unit – MULTIPLY

To convert from a SMALLER unit to a LARGER unit - DIVIDE

Some common conversion factors are listed below:

<u>Length</u>	<u>Weight</u>	<u>Volume</u>
2.54 centimeters = 1 inch	1 kilogram = 2.2 pounds	3.785 liters = 1 gallon
1.6 kilometers = 1 mile		

Please note that the larger number is the smaller unit.
For example, pounds are smaller than kilograms.

Example 5. – The shark deck on the M/V OCEARCH can lift about 34,091 kilograms, but all of the sharks' weights are recorded in pounds. Will the shark deck be able to lift Mary Lee, a 3,456 pound great white shark? Explain your answer. Round to the nearest hundredth.

There are two ways to solve this problem.

- A. Convert Mary Lee's weight to kilograms and compare the answer to the amount of weight the shark deck can lift.

Step 1: What is the question? *What is Mary Lee's weight 3,456 pounds in kilograms?*

3,456 pounds = X kilograms

"X" represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from pounds to kilograms? *You are converting from a smaller unit (pounds) to a larger unit (kilograms), so you need to divide!*

Step 3. How many pounds are in one kilogram? Refer to your chart if needed.

There are 2.2 pounds in 1 kilogram.

This is the conversion factor.

→ 2.2 pounds = 1 kilograms

This is your conversion factor and is what you need to divide by to covert pounds to kilograms.

Step 4. Divide the known value (3,456 pounds) by the conversion factor to find out how many kilograms are equal to 3,456 pounds.

$$\frac{3,456}{2.2} = 1,570.91 \text{ kilograms}$$

The shark deck can hold 34,091 kilograms. Mary Lee weighs 1,570.91 kilograms. The OCEARCH team will be able to lift Mary Lee using the shark deck!

B. Convert the amount of weight the deck can lift to pounds and compare the answer to Mary Lee's body weight.

Step 1: What is the question? *How much weight in pounds can the deck lift at one time?*

$$34,091 \text{ kilograms} = X \text{ pounds}$$

"X" represents the answer you are solving for.

Step 2. Will you need to multiply or divide to convert from pounds to kilograms? *You are converting from a larger unit (kilograms) to a smaller unit (pounds), so you need to multiply!*

Step 3. What is the conversion factor used to convert between kilograms and pounds? Refer to your chart if needed.

$$2.2 \text{ pounds} = 1 \text{ kilograms}$$

Step 4. Multiply the known value (34,091 kilograms) by the conversion factor to find out how many pounds are equal to 34,091 kilograms.

$$34,091 \times 2.2 = 75,000.20 \text{ pounds}$$

The shark deck can lift 75,000.2 pounds. Mary Lee weighs 3,456 pounds. The shark deck will be able to lift Mary Lee!

Complete the following practice problems as a class. Remember the basic conversion rule of multiplying/dividing and the four steps to unit conversion.

Step 1. What is the question?

Step 2. Will you need to multiply or divide to convert?

Step 3. What is the conversion factor?

Step 4. Convert!

1. The M/V OCEARCH travels at 11 knots, which is about 13.2 miles per hour. How many kilometers could they travel in eight hours time? Round to the nearest hundredth.
Answer: $3.2 \text{ miles} \times 8 \text{ hours} = 105.6 \text{ miles} = 168.96 \text{ kilometers}$

2. One of the only great white sharks kept in captivity was kept in a 3,800,000 liter tank. How many gallons of water did this tank hold? Round to the nearest hundredth.

Answer: 1,003,963.01 gallons

Students should complete the following practice problems individually in class or at home. An instructor answer key and a student handout have been provided below. Students should show their work and remember to record the correct unit for their answers.

Unit Conversion Practice Problems – Customary & Metric

Name: _____

Date: _____

Complete the following practice problems. Make sure to show your work and remember to write the correct unit for your answer. A number with no unit has no meaning!

1. Andre the great white shark was measured to be 9 feet and 6 inches in length, but to include him in a research database his length needs to be recorded in meters. What is Andre's length in meters?
2. The OCEARCH vessel can filter up to 189 liters of fresh water per hour, but their fresh water holding tank is measured in gallons. How many gallons of fresh water are filtered per hour?
3. If a mature female great white shark can hold about 4 dekaliters of food in her stomach, how many gallons of food would she need to eat to fill up her stomach completely?
4. A great white shark named Maddox weighs 2,100 pounds. In order the researchers to compare his size to other mature sharks, they need his weight in metric units. How much does Maddox weigh in kilograms?
5. The heights of shark dorsal fins are recorded in a database using centimeters. If you measured a dorsal fin that is 14 inches tall, what is the height in centimeters?

- Practice Problems. Student Worksheet
-
- Page 2 of 2

Unit Conversion Practice Problems – Customary & Metric

INSTRUCTOR ANSWER KEY

1. Andre the great white shark was measured to be 9 feet and 6 inches in length, but to include him in a research database his length needs to be recorded in meters. What is Andre's length in meters?
Answer:
2. The OCEARCH vessel can filter up to 189 liters of fresh water per hour, but their fresh water holding tank is measured in gallons. How many gallons of fresh water are filtered per hour?
Answer:
3. If a mature female great white shark can hold about 4 dekaliters of food in her stomach, how many gallons of food would she need to eat to fill up her stomach completely?
Answer:
4. A great white shark named Maddox weighs 2,100 pounds. In order for the researchers to compare his size to other mature sharks, they need his weight in metric units. How much does Maddox weigh in kilograms?
Answer:
5. The heights of shark dorsal fins are recorded in a database using centimeters. If you measured a dorsal fin that is 14 inches tall, what is the height in centimeters.
Answer:
6. If a full grown great white shark has 1.8 tons of bite force and the OCEARCH crew's shark cage can withstand 2,000 kilograms of bite force, will the cage be able to protect the crew when they are in the water?
Answer:
7. The M/V OCEARCH vessel's main mast measures 914 centimeters tall. Knowing that a great white shark can jump 10 feet out of the water, the crew wants to know if a shark could jump as high as the mast. How high is the mast in feet?
Answer:

Part 5. Review (30 – 45 minutes or take home assignment)

Use one or both of the following activities as a review of the unit conversion lesson. Students should be able to explain the process of unit conversion.

- A. Success, the heaviest great white shark in the OCEARCH database, weighs 3,583 pounds. Have the students write step-by-step instructions explaining how they would convert his weight to dekagrams. Full sentences, drawings, charts, etc. are encouraged!
- B. Students can work individually or in groups. Each student/group should choose a shark from the OCEARCH website, www.ocearch.org. Access the Global Shark Tracker from the OCEARCH website to view the sharks' profiles and record one shark's weight in pounds or its length in feet. Write detailed instructions explaining how to convert the shark's weight or length to another unit (this can be assigned by the instructor). Students should present their findings to the class.

Unit Conversion

ACTIVITY Sharks at Great Lengths

(45 – 60 minutes)

Introduction

With this activity, students will solve unit conversion problems to determine the lengths of different species of sharks. After calculations, students will then compare the length of the sharks to everyday classroom objects.

Materials

- Ruler, yard stick or measuring tape
- Scratch paper
- Writing utensil
- Calculator
- Worksheet (provided below)

Instructions

Students may work in pairs or teams depending on the size of the class. Collaborating as a whole class would be fun as well!

Each group should be assigned one of the listed sharks below. (You may print and cut out the sharks listed on the last few pages of the lesson plan and hand the slips out to the students.) Each group will also have a unit conversion problem to solve pertaining to their assigned shark. The students will solve the problem to find the shark's length in *feet or meters*.

(Optional – Have the students do research on their assigned sharks to discover interesting facts, conservation status, diet, etc.)

An everyday classroom object is also listed with each shark. The students will measure this object with a ruler, yard stick, or measuring tape using what they believe to be the most fitting unit of measurement. They will then find out how many of these items will make up the total length of the shark. Students should share their results with the class!

For more fun, use sidewalk chalk, masking tape, yarn, or even the everyday classroom objects to create a life size representation of each shark species!

Example

Name: _____

Date: _____

Complete this worksheet using what you have learned about unit conversions!

My shark: Lemon shark

Length of my shark: 1,584.96 millimeters

You have been asked to convert your shark's length into another unit...

What unit are you converting your shark's length into? feet

Use the space below to convert the shark's length. Show your work!

1,584.96 millimeters → centimeters → inches → feet

1,584.96 mm = X cm 1 cm = 10 mm 1,584.96 mm =
158.496 cm

10

158.496 cm = X in 1 in = 2.54 cm 158.496 cm =
62.4 in

2.54

62.4 in = X ft 1 ft = 12 in 62.4 in = 5.2 feet

You have also been assigned an everyday item. What is it? water bottle

Measure this item with a ruler, yard stick, or measuring tape using any unit.

How long is your item? 7 inches

Use the space below to calculate how many of your item lined up will equal the length of your shark. Show your work!

$$5.2 \text{ ft} = X \text{ in} \qquad 1 \text{ ft} = 12 \text{ in} \qquad 5.2 \times 12 = 62.4 \text{ in}$$

$$\begin{array}{c} \bigcirc \\ 62.4 \text{ in} = 8.91 \text{ rounded up to a whole number} = 9 \\ 7 \text{ in (length of water bottle)} \end{array}$$

It will take 9 water bottles to equal the length of a

number everyday item

lemon shark!

type of shark

Sharks at Great Lengths

Name: _____

Date: _____

Complete this worksheet using what you have learned about unit conversions!

My shark: _____

Length of my shark: _____

You have been asked to convert your shark's length into another unit...

What unit are you converting your shark's length into? _____

Use the space below to convert the shark's length. Show your work!

You have also been assigned an everyday item. What is it? _____

Measure this item with a ruler, yard stick, or measuring tape using any unit.

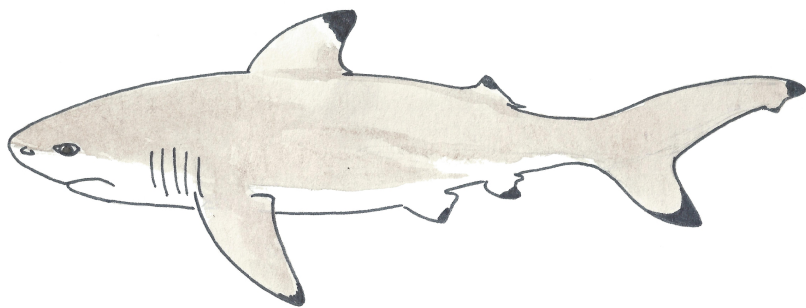
How long is your item? _____

Use the space below to calculate how many of your item lined up will equal the length of your shark. Show your work!

It will take _____ to equal the length of a
number *everyday item*

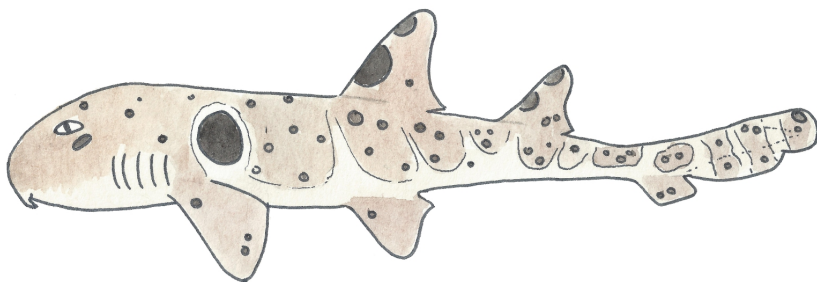
type of shark !

1. Blacktip Reef Shark



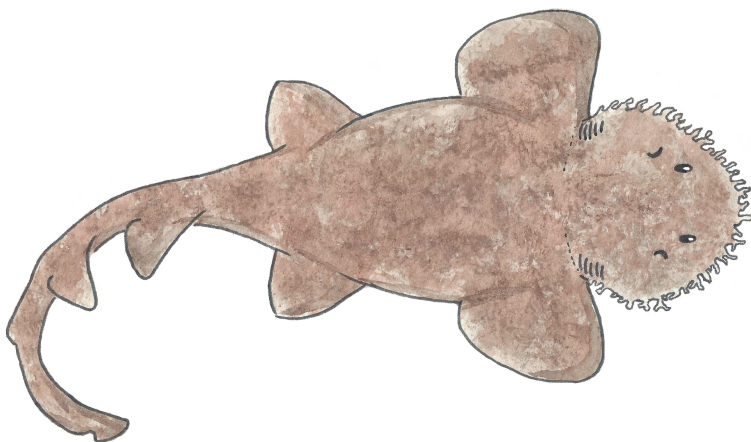
- A. If a blacktip reef shark measures 1584.96 millimeters, how long is the shark in feet?
b. Measure and draw the blacktip reef shark using the length of a **key**.

2. Epaulette Shark



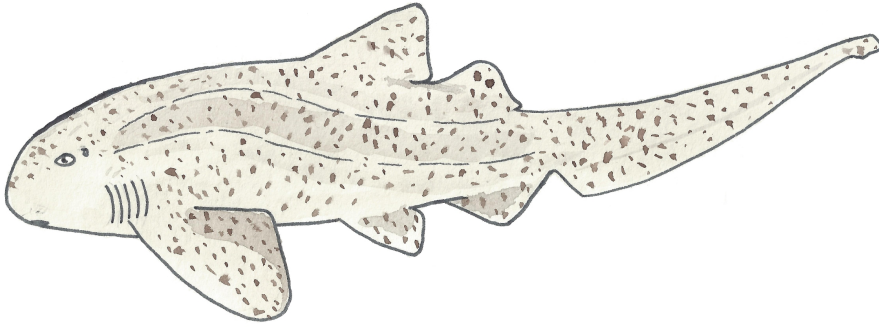
- a. If an epaulette shark measures 107 centimeters, how long is the shark in meters?
b. Measure and draw the epaulette shark using the length of a **penny**.

3. Tasseled Wobbegong



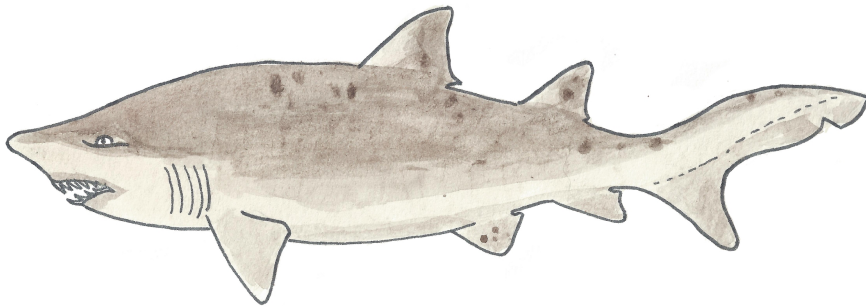
- a. If a tasseled wobbegong shark measures 70.8 inches, how long is the shark in feet?
b. Measure and draw the tasseled wobbegong shark using the length of a **paper clip**.

4. Zebra Shark



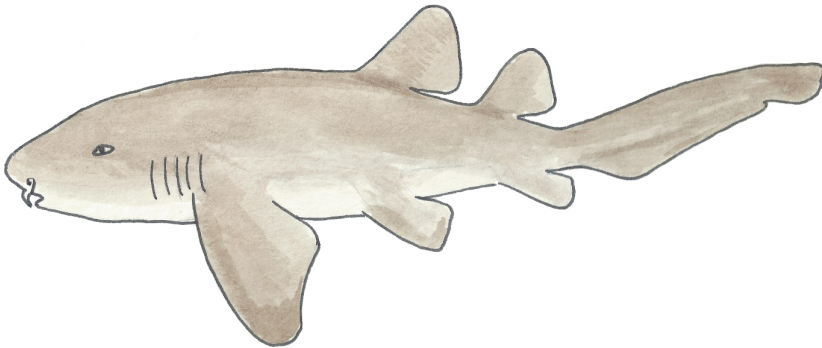
- a. If a zebra shark measures 8 feet, how long is the shark in meters?
- b. Measure and draw the zebra shark using the length of a **soda can**.

5. Sand Tiger Shark



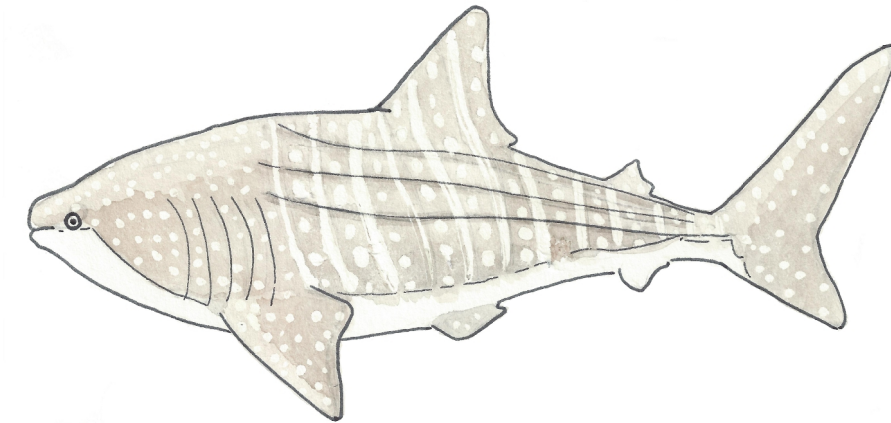
- a. If a sand tiger shark measures 3.5 yards, how long is the shark in feet?
- b. Measure and draw the sand tiger shark using the length of a **traced image of your hand**.

6. Nurse Shark



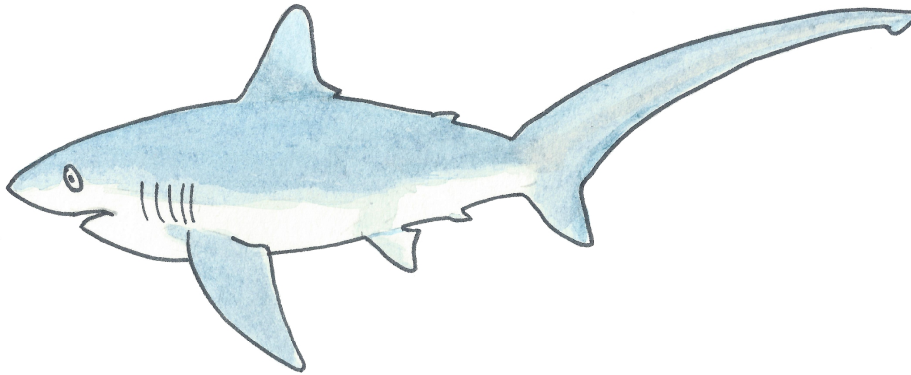
- a. If a nurse shark measures 0.427 dekameters, how long is the shark in feet?
- b. Measure and draw the nurse shark using the length of a **sheet of paper**.

7. Whale Shark



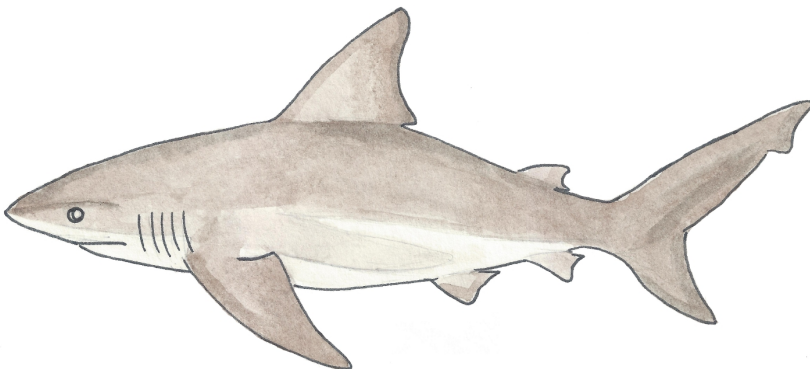
- If a whale shark measures 20 yards, how long is the shark in meters?
- Measure and draw the whale shark using the length of the **classroom door**.

8. Thresher Shark



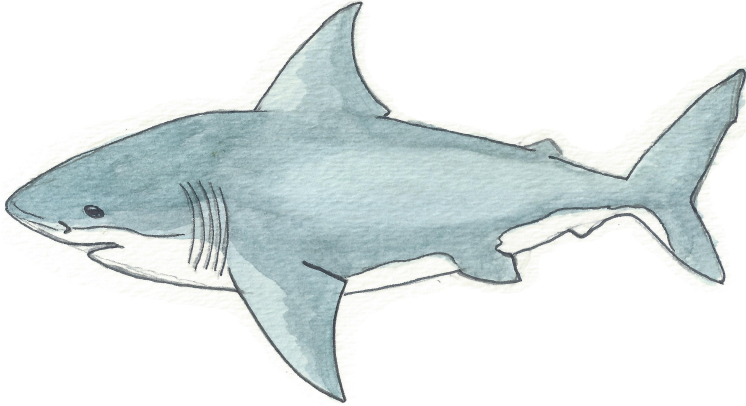
- If a thresher shark measures 49 decimeters, how long is the shark in meters?
- Measure and draw the thresher shark using the length of your **desk**.

9. Bull Shark



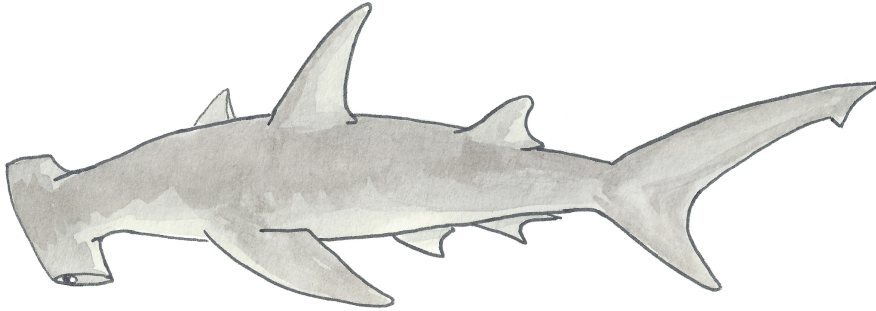
- If a bull shark measures 240.79 centimeters, how long is the shark in feet?
- Measure and draw the bull shark using the length of a **stapler**.

10. Great White Shark



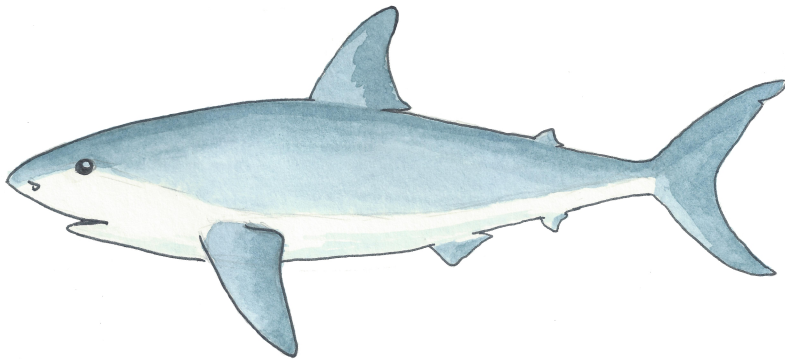
- If a great white shark measures 0.6 decameters, how long is the shark in meters?
- Measure and draw the great white shark using the length of a **textbook**.

11. Great Hammerhead Shark



- If a great hammerhead shark measures 240 inches, how long is the shark in feet?
- Measure and draw the great hammerhead shark using the length of a **poster**.

12. Shortfin Mako Shark



- If a shortfin mako shark measures 320 centimeters, how long is the shark in meters?
- Measure and draw the shortfin mako shark using the length of a **pencil**.

Illustrations by Sarah Rich – Landry's Downtown Aquarium

