Unit 6: Measurement

Unit 6: Measurement

Lesson 1: U.S. Customary Units of Measurement

Topic 1: Length

Learning Objectives

- Define units of length and convert from one to another.
- Perform arithmetic calculations on units of length.
- Solve application problems involving units of length.

Topic 2: Weight

Learning Objectives

- Define units of weight and convert from one to another.
- Perform arithmetic calculations on units of weight.
- Solve application problems involving units of weight.

Topic 3: Capacity

Learning Objectives

- Define units of capacity and convert from one to another.
- Perform arithmetic calculations on units of capacity.
- Solve application problems involving units of capacity.

Lesson 2: Metric Units of Measurement

Topic 1: The Metric System

Learning Objectives

- Describe the general relationship between the U.S. customary units and metric units of length, weight/mass, and volume.
- Define the metric prefixes and use them to perform basic conversions among metric units.

Topic 2: Converting within the Metric System

Learning Objectives

- Perform arithmetic calculations on metric units of length, mass, and volume.

Topic 3: Using Metric Conversions to Solve Problems

Learning Objectives

- Solve application problems involving metric units of length, mass, and volume.

Lesson 3: Temperature

Topic 1: Temperature Scales

Learning Objectives

- State the freezing and boiling points of water on the Celsius and Fahrenheit temperature scales.
- Convert from one temperature scale to the other, using conversion formulas.

Unit 6: Measurement

Instructor Notes

The Mathematics of Measurement

All students come into Developmental Math with their own ideas about measurement—long and short, big and small, hot and cold—they all have a personal sense of what such terms mean. But as with earlier units on fractions, decimals, and percentages, many students aren't able to evaluate measurements in a consistent, mathematical way. Unit 6 will give them that ability.

After completing this unit, students will be able to express and manipulate length, weight, and capacity in both U.S. customary and metric units. They'll know how to convert between units within each system and also between Celsius and Fahrenheit temperatures. Students will have learned how to carry out arithmetic calculations on all types of measurements, and they'll have an appreciation for the usefulness of formal, accurate measuring systems.

Teaching Tips: Challenges and Approaches

Students educated in the United States are very familiar with the U.S. customary units of measurement, but are liable to be shaky on the metric system. Students educated outside of the United States will be in just the opposite frame of mind. U.S. students will benefit from examples where metric units are commonly used, as in 2-liter bottles of soda or 5K races. Those brought up with the metric system may need frequent reminders that units in the U.S. system are not related by powers of 10.

The biggest challenge for many students will be converting measurements between units within a measurement system. We recommend teaching them to use the factor label method with the U.S. customary system, and to move the decimal point in the metric system. Once students understand how to convert between units, arithmetic problems will be easier.

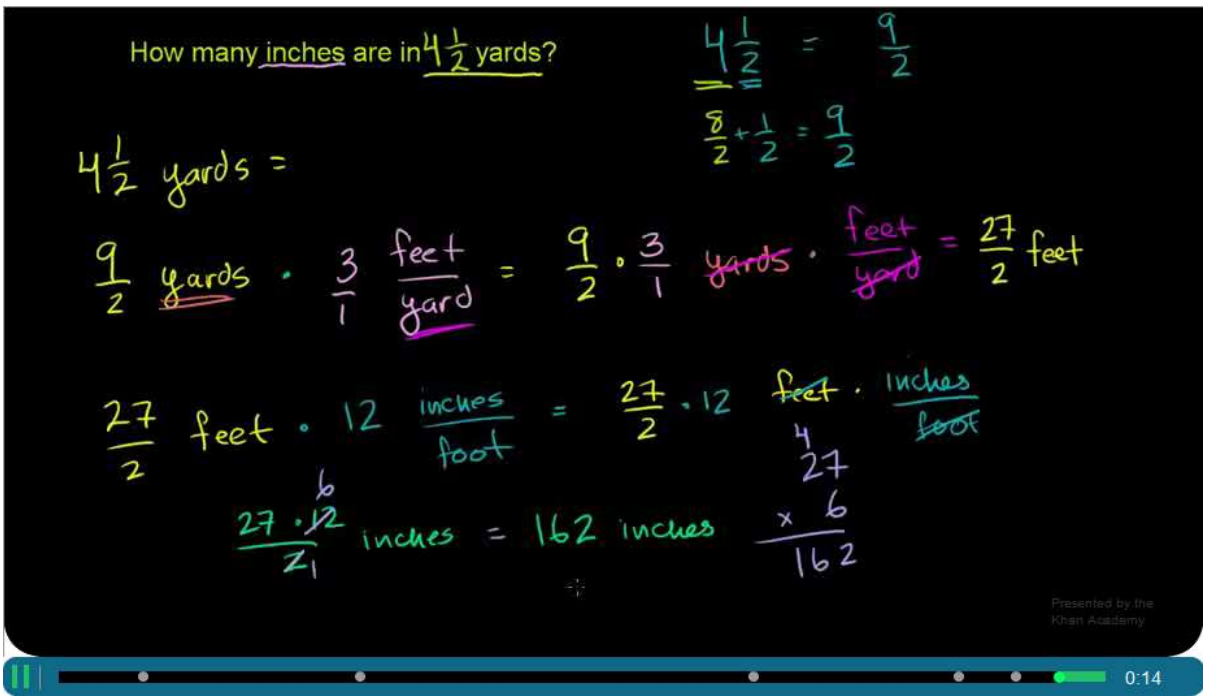
U.S. Customary Units of Measurement - Factor Label Method
Most students will be comfortable with the equivalent measures given in this unit because they have been using them most of their lives. Many can probably do some conversions in their head, for example figuring inches from feet or changing pounds into ounces. In general though, they should use the factor label technique, which employs conversion factors. The course material gives unit equivalent measures and two conversion factors. Point out how the conversion factors are obtained from the unit equivalents. Also be sure to note that the two conversion factors are reciprocals of each other, and both of them are equal to one. Thus,

when they multiply a measurement by a conversion factor, they aren't changing its value, just its units.

Unit Equivalents	Conversion Factors (longer to shorter units of measurement)	Conversion Factors (shorter to longer units of measurement)
1 foot = 12 inches	$\frac{12 \text{ inches}}{1 \text{ foot}}$	$\frac{1 \text{ foot}}{12 \text{ inches}}$
1 yard = 3 feet	$\frac{3 \text{ feet}}{1 \text{ yard}}$	$\frac{1 \text{ yard}}{3 \text{ feet}}$
1 mile = 5,280 feet	$\frac{5{,}280 \text{ feet}}{1 \text{ mile}}$	$\frac{1 \text{ mile}}{5{,}280 \text{ feet}}$

[From Lesson 1, Topic 1, Topic Text]

Once students understand what conversion factors are, give them examples and then lots of practice carrying out step-by-step conversions using first one and then multiple factors:



[From Lesson 1, Topic 1, Worked Example 1]

If students have trouble deciding which conversion factor to use, explain that the unit in the numerator of the proper conversion factor will match the unit they're trying to find.

As a check of their work, have students predict if the converted measure should be a larger or smaller number than the original. They'll soon realize that conversion to a bigger unit produces a smaller number, and vice versa.

Make sure that students can easily convert between different units before moving on to arithmetic calculations and application problems.

Metric System - Moving the Decimal Point

U.S. students will likely have trouble with the metric system because it isn't used much outside of scientific and technical circles. They may need more help and more practice problems. Be sure to describe metric prefixes and how they combine with measurements like liter, meter, and gram.

One way to overcome the resistance to metric units is to spend some time solving a few complicated conversion problems with U.S. customary units. That's a good lead in to explaining why the metric system is so popular with the rest of the world. Because the students already know how to use the factor label method, begin by using this method on a metric problem, such as the following:

Example

Problem **If you have a prescription for 5,000 mg of medicine, and upon getting it filled, the dosage reads 5 g of medicine, did the pharmacist make a mistake?**

5,000 mg = ___ g? Need to convert mg to g.

$$\frac{5{,}000\ mg}{1} \cdot \frac{1\ g}{1{,}000\ mg} = \_\_\_\ g$$

$$\frac{5{,}000\ \cancel{mg}}{1} \cdot \frac{1\ g}{1{,}000\ \cancel{mg}} = \_\_\_\ g$$

$$\frac{5{,}000 \cdot 1\ g}{1 \cdot 1{,}000} = \frac{5{,}000g}{1{,}000}$$

$$\frac{5{,}000g}{1{,}000} = 5\ g$$

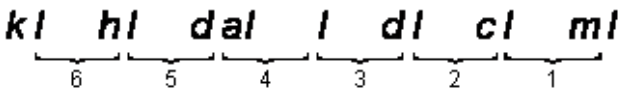
Answer 5 g = 5,000 mg, so the pharmacist did not make a mistake.

[From Lesson 2, Topic 2, Topic Text]

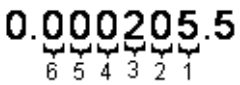
Then show students that there is an easier way to do this sort of problem—moving the decimal point:

Example

Problem **Convert 205.5 milliliters to kiloliters.**



Count six places from milliliters to kiloliters.



Milliliters is smaller than kiloliters, so you expect the number 205.5 to get smaller as you move up the metric chart.

In 205.5 ml, move the decimal point six places to the left.

$205.5\ ml = 0.0002055\ kl$

Answer 205.5 milliliters = 0.0002055 kiloliters

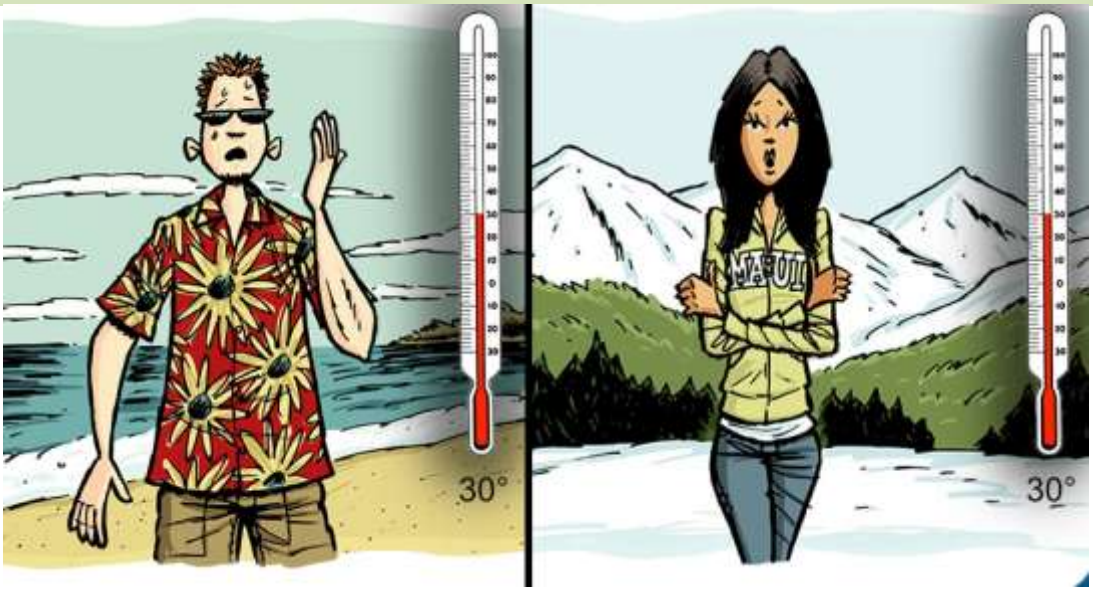
[From Lesson 2, Topic 2, Topic Text]

This skill will be relatively easy for students to pick up once they understand the naming structure of metric units. Encourage your students to solve all conversion problems in the metric system by moving the decimal point. After a number of these problems have been worked, explain that the ease of converting between different units is one of the reasons why the metric system is so popular.

Temperature

Temperature is the only measurement for which students are asked to convert between instead of within systems. This may be tricky for some, because the formulas are more complex than conversion factors or sliding a decimal point around. In addition, students may or may not be aware that there are two common temperature scales—Fahrenheit and Celsius—although those who have traveled outside the United States will at least have some sense of the Celsius scale. Most will need some touch points to help them relate to temperatures in Celsius.

The lesson begins with a graphic demonstration of the difference between 30° Celsius and Fahrenheit:



[From Lesson 3, Topic 1, Presentation]

It will also help to make sure students know the common comparison points:

- 0°C and 32°F – water freezes
- 100°C and 212°F – water boils
- 22°C and 72°F – room temperature

Students may find it easier to remember the conversion formulas if you run through the development of these equations, which is also covered briefly in the lesson:

> How were these formulas developed? They came from comparing the two scales. Since the freezing point is 0° in the Celsius scale and 32° on the Fahrenheit scale, we subtract 32 when converting from Fahrenheit to Celsius, and add 32 when converting from Celsius to Fahrenheit.
>
> There is a reason for the fractions $\frac{5}{9}$ and $\frac{9}{5}$, also. There are 100 degrees between the freezing (0°) and boiling points (100°) of water on the Celsius scale and 180 degrees between the similar points (32° and 212°) on the Fahrenheit scale. Writing these two scales as a ratio, $\frac{F°}{C°}$, gives $\frac{180°}{100°} = \frac{180° \div 20}{100° \div 20} = \frac{9}{5}$. If you flip the ratio to be $\frac{C°}{F°}$, you get $\frac{100°}{180°} = \frac{100° \div 20}{180° \div 20} = \frac{5}{9}$. Notice how these fractions are used in the conversion formulas.

[From Lesson 3, Topic 1, Topic Text]

Keep in Mind

Students may become so used to working with different units when converting measurements that they forget that units must match when doing arithmetic calculations. Be alert for this common mistake.

This unit doesn't cover conversions between metric and the U.S. customary units of measurement. In the past, conversion between the two systems was routinely taught, especially in the 1970s when there was an attempt to have the United States "go metric." Today these conversions are not emphasized because they are rarely required. However, it does help a student to have some idea of how the customary and metric systems relate:

	Common Measurements in Customary and Metric Systems
Length	1 centimeter is a little less than half an inch.
	1.6 kilometers is about 1 mile.
	1 meter is about 3 inches longer than 1 yard.
Mass	1 kilogram is a little more than 2 pounds.
	28 grams is about the same as 1 ounce.
Volume	1 liter is a little more than 1 quart.
	4 liters is a little more than 1 gallon.

[From Lesson 2, Topic 1, Topic Text]

Working with the metric system is easier if the measurements have some meaning. You might also mention that they'll need to know this system well if they intend to go into any of the scientific fields.

Additional Resources

In all mathematics, the best way to really learn new skills and ideas is repetition. Problem solving is woven into every aspect of this course—each topic includes warm-up, practice, and review problems for students to solve on their own. The presentations, worked examples, and topic texts demonstrate how to tackle even more problems. But practice makes perfect, and some students will benefit from additional work.

Measurement systems and conversions can be reviewed and practiced at the website http://www.321know.com/mea.htm.

Summary

After studying this unit, students will understand the U.S. customary and metric systems of measurement, and the Fahrenheit and Celsius temperature scales. They'll know how to convert between units of length, weight, mass, and volume within the systems, and between Celsius

and Fahrenheit readings. Students will also be able to perform arithmetic calculations and solve application problems dealing with length, weight, capacity, and temperature.

Unit 6: Measurement

Instructor Overview
Tutor Simulation: Converting Measurements between Different Measurement Systems

Purpose

This simulation allows students to demonstrate their understanding of systems of measurement. Students will be asked to apply what they have learned to solve a problem involving:

- U.S. Customary and Metric Length Measurements
- U.S. Customary and Metric Weight Measurements
- U.S. Customary and Metric Capacity Measurements
- Fahrenheit and Celsius Temperature Measurements
- Converting Measurements within one Measurement System

Problem

Students are presented with the following problem:

> You were chosen for a summer internship at the National Space Agency to assist with a satellite project. While looking over the satellite specifications, you notice that numbers are given in different measurement units than what the engineers need--something that could cause problems and confusion. When you told your boss about it, he said, "Convert them as needed."

Recommendations

Tutor simulations are designed to give students a chance to assess their understanding of unit material in a personal, risk-free situation. Before directing students to the simulation,

- Make sure they have completed all other unit material.
- Explain the mechanics of tutor simulations.
    - Students will be given a problem and then guided through its solution by a video tutor;
    - After each answer is chosen, students should wait for tutor feedback before continuing;
    - After the simulation is completed, students will be given an assessment of their efforts. If areas of concern are found, the students should review unit materials or seek help from their instructor.
- Emphasize that this is an exploration, not an exam.

Unit 6: Measurement

Instructor Overview
Puzzle: Measure 4 Measure

Objectives

Measure 4 Measure challenges a player's ability to convert between units of measurement. In order to solve the puzzles, students will have to apply conversion factors to U.S. customary units, solve Celsius - Fahrenheit formulas, and recognize the decimal value of metric system prefixes.

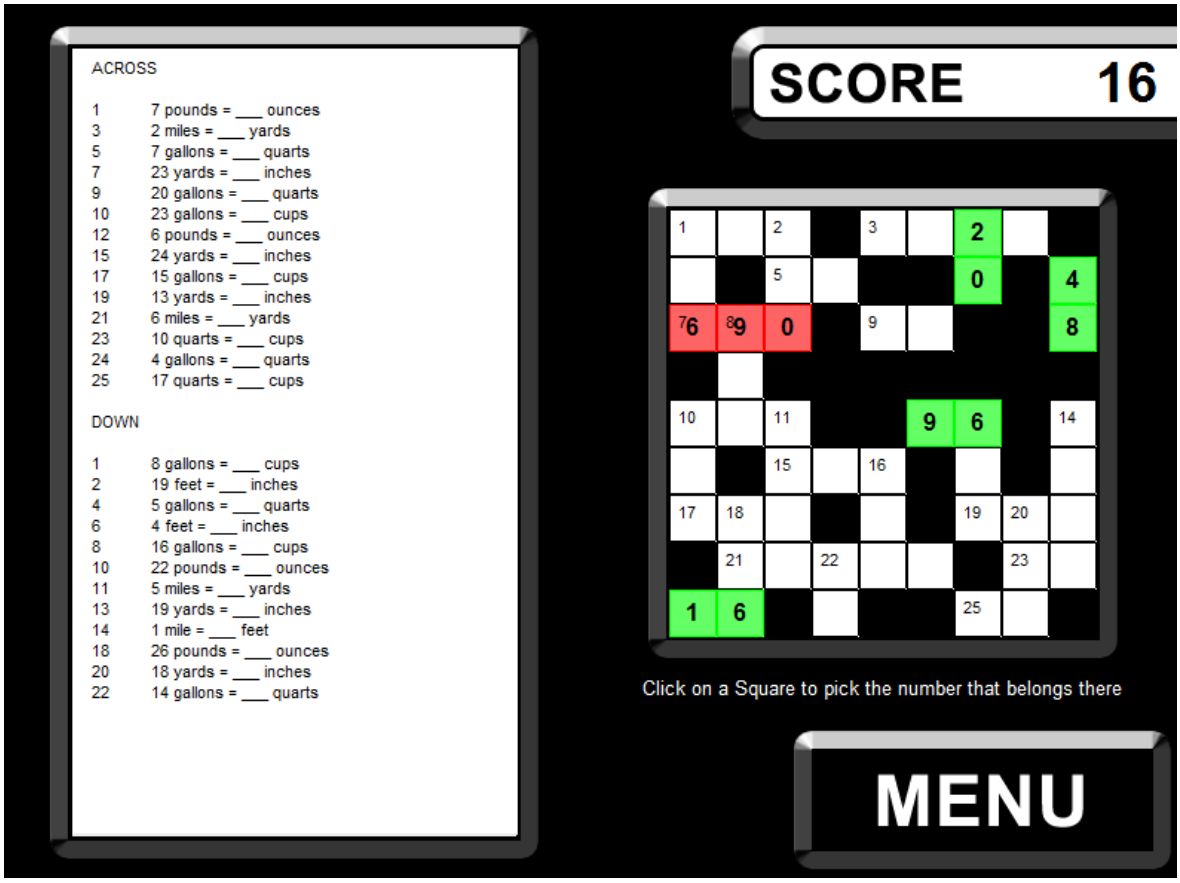


Figure 1. Players fill in the empty squares with numbers obtained by converting units of measurement.

Description

The game has three levels, each consisting of a single crossword-type puzzle. Players convert the given measurements into new units in order to determine the values that belong in the empty boxes. When they fill in the correct numbers, the boxes turn green and the player earns points. If they make a mistake, the box turns red. In Level 1, all the conversions are within the U.S. customary system. In Level 2, the problems are all metric. Level 3 includes a mixture of U.S customary system, metric system, and Fahrenheit/Celsius conversions.

Measure 4 Measure is suitable for both individual and team play. It would also work well in a classroom setting with students taking turns or shouting out answers.

Unit 6: Measurement

Instructor Overview
Project: Six of One, Half-Dozen of the Other

Student Instructions

Introduction

Length, weight, and capacity can be expressed in terms of various units. Feeling comfortable with multiple units in mathematics allows you to quickly make comparisons and thoughtful decisions even when the given units vary.

Task

Working together with your group, you will first convert given units of length, weight, and capacity to new units of your choice. Then you will research additional common items to add to your tables. Finally, your group will use your skills at conversion to solve a real-world problem.

Instructions

Complete each problem in order keeping careful notes along the way. The answers to the problems will be used to create a final project.

1. Working together with your group, your first problem is to place 6 well-known items into the appropriate table. Begin by making three tables similar to the one below on your own paper. You will need one for length, one for weight, and one for capacity. Label each table as Length, Weight, or Capacity.

    - Hint: Leave plenty of room in the third column to show your work and be sure to save the tables, as you will need them for your final project.

Item	Given unit	(Show work here to convert to new unit)	New Unit

Now take the six items below and fill them into the appropriate table.

- Hint: Is the first item given as length, weight, or capacity? Write each item and the given unit into the appropriate table. You should have 2 items in each table when you are finished.

18-wheeler tractor-trailer 80,000 lbs.	One lap of a track 400 m
Milk Jug 1 gallon	Ford F-150 pick up 3 tons
Large bottle of Coke 2 Liters	Empire State Building 1250 feet

2. Now that you have each of the six items placed in the correct table, work with your group to convert the given unit to a new unit. For instance, weight in tons could be converted to weight in pounds and height in feet could be converted to height in inches, etc. Be sure to show all of your work within the table. When finished, you should have two completed rows on each of your three tables.

3. Now work with your group to choose 3 new common items to research, one weight, one length, and one capacity. Research the size of each. For example: weight of a 4 door passenger car, capacity of an Olympic size swimming pool, length of a city block in the nearest city. Your research may be done in customary or metric units. Use the Internet to research. A quick Google search should give you the necessary information. Record the item and the given unit within the appropriate table. Then, convert the length, weight, or capacity to a new unit. Again, be sure to show all of your work within the table.

- Hint: Before moving on to the next problem, check to be sure that you have three completed rows in each of your three tables. It would also be helpful to double check your work and be sure that your conversions are correct.

Now that your group has practiced conversions, it is time to apply the knowledge to solving a real-world problem. You are planning a camping trip with a friend, but need to make some

decisions about what type of food to bring and which location to choose. Work together to solve the problems. Remember to save your work to include in your final project.

4. You are going on a camping trip and need to stock up on trail mix for the outing. Your local warehouse store is selling a 5-pound bag of trail mix for $26.00. The same trail mix is sold in the local grocery store in 10-ounce bags. The smaller bags cost $3.79 each. Which store has the better price on the trail mix? How much money would you save by buying the trail mix at the cheaper store?

5. Now that you have the food purchased, you need to pick a location. You and your friend both like hot weather and would prefer to camp in the warmer location. You have found that the average summer high in Baja, Mexico is 32 degrees Celsius. Your friend would prefer Yosemite, where the average summer high is 88 degrees Fahrenheit. She argues that 88°F has to be much warmer than 32°C. Who is correct? How much warmer is the hotter destination? Which location would you choose and why?

6. When you check in at the ranger station, the park ranger offers you two campsites. The campsites are remote and will require a hike to reach. You would both prefer the closer campsite in order to save your strength for day hikes. The first site is located $1\frac{1}{2}$ miles from the station. The second is 1800 yards away. Which campsite is closer? How many yards closer is the nearest site? If your stride is 2 steps per yard, how many steps would you save by choosing the closer site?

Collaboration

Compare your tables from problems 1 - 3 with a neighboring group. The first two rows of each table should be similar. Which new unit did the other group choose? Is it the same unit or a different unit? If it is the same, make sure that the units match. If the units are different, work together to check each other's work.

Discuss the new items that were researched and added to the table. Check the conversions to ensure that the math is done correctly and that work is shown clearly.

Finally, compare answers to problems 4 - 6. Do both groups' answers to all three problems match? If not, carefully examine the work of each and determine which group is correct. Make the appropriate corrections before beginning the final project.

Conclusion

You have two options for your final project. You will need to include the answers to each of the six problems no matter which project you choose. You will also need to include all of your mathematical calculations. The math can either be neatly hand-written or typed. Work together to create a project that represents your group's individual interests and strengths. You may choose between a written report or an oral presentation with handouts.

Written Report

Work together with your group to create professional looking, finalized versions of the three tables from problems 1 - 3. Then either neatly hand write or type the worked out mathematic solutions to problems 4 - 6. Be sure to show all of your work clearly and answer each of the questions asked.

Oral Presentation

Rather than creating a written document, your group may choose an oral presentation. You will need to show your finalized tables from problems 1 - 3 by either creating a poster, using the blackboard, or creating a handout for your classmates. You will also need to discuss the solutions to problems 4 - 6. Consider the following: Who will discuss each problem? What handouts will you need to prepare in order to help the audience follow along?

Instructor Notes

Assignment Procedures

Problem 4
To purchase 5 pounds, 8 small bags would need to be purchased for $30.32. The large 5-pound bag saves $4.32.

Problem 5
32 degrees Celsius converts to 89.6 degrees Fahrenheit. The average high in Baja is 1.6 degrees Fahrenheit warmer than Yosemite.

Problem 6
$1\frac{1}{2}$ miles converts to 2640 yards. The second site is 840 yards closer. By selecting the closer site, you will save 1680 steps.

Recommendations

- Have students work in teams to encourage brainstorming and cooperative learning.
- Assign a specific timeline for completion of the project that includes milestone dates.
- Provide students feedback as they complete each milestone.
- Ensure that each member of student groups has a specific job.

Technology Integration
This project provides abundant opportunities for technology integration, and gives students the chance to research and collaborate using online technology. The students' instructions list several websites that provide information on numbering systems, game design, and graphics.

The following are other examples of free Internet resources that can be used to support this project:

http://www.moodle.org

An Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). Moodle has become very popular among educators around the world as a tool for creating online dynamic websites for their students.

http://www.wikispaces.com/site/for/teachers or http://pbworks.com/content/edu+overview

Allows you to create a secure online Wiki workspace in about 60 seconds. Encourage classroom participation with interactive Wiki pages that students can view and edit from any computer. Share class resources and completed student work.

http://www.docs.google.com

Allows you to collaborate in real-time from any computer. Google Docs provides free access and storage for word processing, spreadsheets, presentations, and surveys. This is ideal for group projects.

http://why.openoffice.org/

The leading open-source office software suite for word processing, spreadsheets, presentations, graphics, databases and more. It can read and write files from other common office software packages like Microsoft Word or Excel and MacWorks. It can be downloaded and used completely free of charge for any purpose.

Rubric

Score	Content	Presentation/Communication
4	• The solution shows a deep understanding of the problem including the ability to identify the appropriate mathematical concepts and the information necessary for its solution. • The solution completely addresses all mathematical components presented in the task. • The solution puts to use the underlying mathematical concepts upon which the task is designed and applies procedures accurately to correctly solve the problem and verify the results. • Mathematically relevant observations and/or connections are made.	• There is a clear, effective explanation detailing how the problem is solved. All of the steps are included so that the reader does not need to infer how and why decisions were made. • Mathematical representation is actively used as a means of communicating ideas related to the solution of the problem. • There is precise and appropriate use of mathematical terminology and notation. • Your project is professional looking with graphics and effective use of color.

3	• The solution shows that the student has a broad understanding of the problem and the major concepts necessary for its solution. • The solution addresses all of the mathematical components presented in the task. • The student uses a strategy that includes mathematical procedures and some mathematical reasoning that leads to a solution of the problem. • Most parts of the project are correct with only minor mathematical errors.	• There is a clear explanation. • There is appropriate use of accurate mathematical representation. • There is effective use of mathematical terminology and notation. • Your project is neat with graphics and effective use of color.
2	• The solution is not complete indicating that parts of the problem are not understood. • The solution addresses some, but not all of the mathematical components presented in the task. • The student uses a strategy that is partially useful, and demonstrates some evidence of mathematical reasoning. • Some parts of the project may be correct, but major errors are noted and the student could not completely carry out mathematical procedures.	• Your project is hard to follow because the material is presented in a manner that jumps around between unconnected topics. • There is some use of appropriate mathematical representation. • There is some use of mathematical terminology and notation appropriate to the problem. • Your project contains low quality graphics and colors that do not add interest to the project.
1	• There is no solution, or the solution has no relationship to the task. • No evidence of a strategy, procedure, or mathematical reasoning and/or uses a strategy that does not help solve the problem. • The solution addresses none of the mathematical components presented in the task. • There were so many errors in mathematical procedures that the problem could not be solved.	• There is no explanation of the solution, the explanation cannot be understood or it is unrelated to the problem. • There is no use or inappropriate use of mathematical representations (e.g. figures, diagrams, graphs, tables, etc.). • There is no use, or mostly inappropriate use, of mathematical terminology and notation. • Your project is missing graphics and uses little to no color.

Unit 6: Measurement

Common Core Standards

Unit 6, Lesson 1, Topic 1: Length

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.
STRAND / DOMAIN	**CC.N.**	Number and Quantity
CATEGORY / CLUSTER	**N-Q.**	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	**N-Q.1.**	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Unit 6, Lesson 1, Topic 2: Weight

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.
STRAND / DOMAIN	**CC.N.**	Number and Quantity
CATEGORY / CLUSTER	**N-Q.**	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	**N-Q.1.**	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Unit 6, Lesson 1, Topic 3: Capacity

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.
STRAND / DOMAIN	**CC.N.**	Number and Quantity
CATEGORY / CLUSTER	**N-Q.**	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	**N-Q.1.**	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Unit 6, Lesson 2, Topic 1: The Metric System

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.
STRAND / DOMAIN	**CC.N.**	Number and Quantity
CATEGORY / CLUSTER	**N-Q.**	Quantities
STANDARD		Reason quantitatively and use units to solve problems.
EXPECTATION	**N-Q.1.**	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Unit 6, Lesson 2, Topic 2: Converting within the Metric System

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.

Unit 6, Lesson 2, Topic 3: Using Metric Conversions to Solve Problems

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP.8.5.**	Use appropriate tools strategically.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.
CATEGORY / CLUSTER	**MP-5.**	Use appropriate tools strategically.

Unit 6, Lesson 3, Topic 1: Temperature Scales

Grade: **8** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.8.**	Mathematical Practices
CATEGORY / CLUSTER	**MP.8.3.**	Construct viable arguments and critique the reasoning of others.

Grade: **9-12** - Adopted **2010**

STRAND / DOMAIN	**CC.MP.**	Mathematical Practices
CATEGORY / CLUSTER	**MP-3.**	Construct viable arguments and critique the reasoning of others.