# Math-in-CTE Lesson Plan Template

| Lesson Title: Unit Conversion | | Lesson # 3 |
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| Occupational Area: Engineering Technology | | |
| CTE Concept(s): Metric/US Customary Measurement | | |
| Math Concepts: Algebra 1 CBC<br><br>II 5 – Proportionality, II 6 – Solve real world problems involving rated measure, II 8 – Problems of standard and non-standard measurements | | |
| Lesson Objective: | Teach students how to convert between metric units and betw metric and US Customary measurement systems. | |
| Supplies Needed: | Calculator, standard ruler, metric tape measure | |

| THE "7 ELEMENTS" | TEACHER NOTES (and answer key) |
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| **1. Introduce the CTE lesson.**<br><br>**You've been asked to design a bridge with a 20 meter long span for a small local canal. As you prepare to begin working on your design you realize that the construction company that will be performing the work requires all measurements to be in millimeters. How long do you tell the company the bridge will be?**<br><br>**What would the bridge's span be in feet?**<br><br>**Vocabulary:**<br>**Metric, US Customary, unit rate, dimensional analysis, prefixes** | Metric System: A system of measurement developed in 1790 by the French Academy of Sciences. The basic units in the metric system are the following: for length- the meter; for mass-the gram, for capacity-the liter. Other units in the metric system are related to the basic units in terms of powers of 10; therefore, it is a decimal system. For example, 1 kilometer=100 meters or $10^3$ meters.<br><br>US Customary: A system of measurement used in the United States.<br><br>Unit rate: A ratio in which the denominator is 1 unit.<br><br>Dimensional Analysis: Dimensional Analysis is a fancy way of saying "converting units."<br><br>Prefixes: |

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| **2. Assess students' math awareness as it relates to the CTE lesson.**<br><br>Ask students:<br>1. What are some of the units used in US Customary? Where are these used?<br>2. What are some of the units used in the metric system? Where are these used?<br>3. How many centimeters are there in a meter?<br>4. How many millimeters are there in a centimeters?<br>5. How many centimeters are there in 1 ft?<br>6. How would you convert from feet to meters?<br>7. What is the difference between a rate and a ratio?<br>8. What is a unit rate? | Answers:<br>1. Miles, feet, inches, yard sticks, ounces and lbs are all US Customary forms of measurement. These are used in the grocery store, doctors office and mall.<br>2. Meters, Kilometers, centimeters and grams are all metric units. Kilometers are used in track and field for example.<br>3. There are 100 centimeters in a meter.<br>4. There are 10 millimeters in a centimeter.<br>5. There are 30.48 centimeters in a ft (use a ruler for a visual).<br>6. To convert from ft to meters you must first convert from ft to centimeters and from centimeters to meters.<br>7. A rate has different units in the numerator and denominator for example, $\frac{60.96\ cm}{2\ ft}$ while a ratio has no units (ie. $\frac{3}{2}$).<br>8. A unit rate has a unit with a quantitity of 1 in the denominator (ie. $\frac{4\ mi}{1\ hr}$) |
| **3. Work through the math example *embedded* in the CTE lesson.**<br><br>If in a 40 ft suspension bridge tension cables are necessary every 15 in, how many tension cables are needed to support the bridge?<br><br>How many tension cables would be needed to support the bridge if they had to be placed every .46 meters? | First we're going to convert the ft to inches. We will then divide the new total in inches by 15 and round down to the nearest whole number. We round down because you can't have a part of a cable.<br><br>First we're going to convert the ft to centimeters and from centimeter to meter. We will then divide the new total in meters by .46 and round down to the nearest whole number. We round down because you can't |

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| | have a part of a cable. |
| **4. Work through *related, contextual* math-in-CTE examples.**<br><br>Length of bridge in inches:<br>$\frac{40 \text{ ft}}{1} \times \frac{12 \text{ in}}{1 \text{ ft}} = 480 \text{ in}$<br><br>Number of tension cables needed:<br>$\frac{480 \text{ in}}{15 \text{ in}} = 32$<br><br>Length of bridge in meters?<br>$\frac{40 \text{ ft}}{1} \times \frac{30.48 \text{ cm}}{1 \text{ ft}} \times \frac{1 \text{ m}}{100 \text{ cm}} = \frac{1219.2 \text{ m}}{100} = 12.192 \text{ m}$<br><br>Number of tension cables needed?<br>$\frac{12.192 \text{ m}}{.46 \text{ m}} = 26.50435$<br><br>Rounded down: 26.50435 is 26 | Explain to students that in the metric system prefixes are used to describe smaller and larger quantities of a particular type. For example, a millimeter is a unit of length just as a meter is. The prefix milli- however tells us that 1000 millimeters would fit inside 1 meter. Present students with the following table.<br><br>King Henry Died drinking chocolate milk<br><br>Prefix<br># in unit<br>Kilo<br>.001<br>Hecta (H)<br>.01<br>Deca<br>.1<br>Unit (ie. gram, meter)<br>1<br>deci<br>10<br>centi<br>100<br>milli<br>1000<br><br>To convert between metric and US Customary students will need to know that there are 30.48 cm in 1 ft.<br><br>Remind students about place values and rounding. |
| **5. Work through *traditional math* examples.**<br><br>12.3 cm equals _____ m<br><br>82.1 m equals _____ ft | $\frac{12.3 \text{ cm}}{1} \times \frac{1 \text{ m}}{100 \text{ cm}} = .123 \text{ m}$<br><br>$\frac{82.1 \text{ m}}{} \times \frac{100 \text{ cm}}{} \times \frac{1 \text{ ft}}{} = 269.35 \text{ ft}$ |

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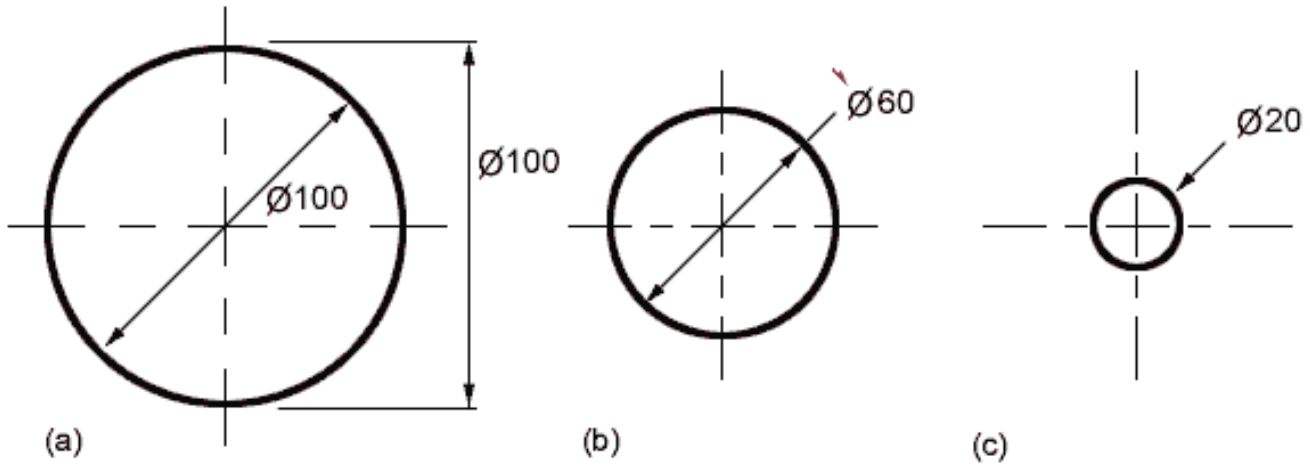
| | 1 1 m 30.48 cm |
| 22 ounces equals _____ cups<br>(HINT: There are 8 ounces in a cup) | 22 ounces X 1 cup = 2.75 cups<br>1 8 ounces |
| **6. Students demonstrate their understanding.**<br>Students will get into groups of four or five and select five objects from around the classroom. The student teams will then measure the object using a standard ruler and convert the measurements to cm, ft, m and km on their own paper. Students will then use metric tape measures to check their answer. | |
| **7. Formal assessment.**<br>Students will be given a drawing dimensioned in inches and will be asked to dimension it in mm. | |

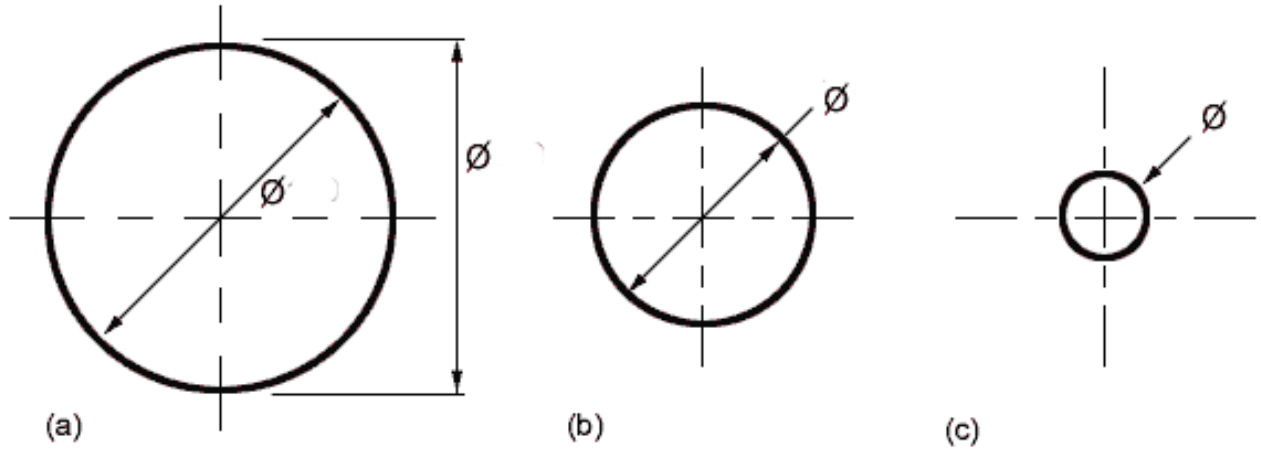
Name: _____ Course Title: _____

Date: _____ Period: _____

Directions: Consider the following drawings, the circles have been dimensioned using inches. Calculate the circle's dimensions in mm and re-dimension.




Write your answers below:



Name: _____ Course Title: _____

Date: _____ Period: _____

Team Members: 1. _____ 2. _____

3. _____ 4. _____

5. _____

Object # 1

| | Measurement | Calculation | Check your answer! |
|---|---|---|---|
| Inches (in) | | | |
| Feet (ft) | | | |
| Centimeter (cm) | | | |
| Meter (m) | | | |
| Kilometer (km) | | | |

Object # 2

| | Measurement | Calculation | Check your answer! |
|---|---|---|---|
| Inches (in) | | | |
| Feet (ft) | | | |
| Centimeter (cm) | | | |
| Meter (m) | | | |
| Kilometer (km) | | | |

Object # 3

| | Measurement | Calculation | Check your answer! |
|---|---|---|---|
| Inches (in) | | | |
| Feet (ft) | | | |
| Centimeter (cm) | | | |
| Meter (m) | | | |

| | | | |
|---|---|---|---|
| Kilometer (km) | | | |

Object # 4

| | Measurement | Calculation | Check your answer! |
|---|---|---|---|
| Inches (in) | | | |
| Feet (ft) | | | |
| Centimeter (cm) | | | |
| Meter (m) | | | |
| Kilometer (km) | | | |

Object # 5

| | Measurement | Calculation | Check your answer! |
|---|---|---|---|
| Inches (in) | | | |
| Feet (ft) | | | |
| Centimeter (cm) | | | |
| Meter (m) | | | |
| Kilometer (km) | | | |