Simple Unit Conversion Problems

Recently we have learned how to set up unit conversion factors. Today we will use them to complete simple problems. Sometimes we would like to present measurements in different units than those we measured in. We can use unit conversion factors to *convert* from one unit to another. The only requirement is that the both the unit converted from and unit converted to must be measuring the same thing. For instance we can convert from millimeters to centimeters because both of them measure length. Likewise, you can convert hours to minutes because both of them measure time. You could not convert seconds into inches because they measure different things: seconds measures time and inches measures length. Follow along below to learn how to calculate unit conversion problems.

Introduction

1. In your own words, what does the word *convert* mean? _____

_____

2. Let's practice setting up a couple of unit conversion factors to refresh our memory. Complete those below:

     a) What are the two unit conversion factors between miles and feet if 1 mile equals 5280 feet.

     b) What are the two unit conversion factors between inches and feet if 1 foot equals 12 inches.

3. If you divide anything by itself, then you will get one. In another way of saying this, is that if you have a number of items and break it into groups in which eat group has that number of items, the number of groups you make will be one. For example, if you have 7 items and break these into groups of 7, then you will have one group. Knowing this, calculate the following problems:

    a) $\dfrac{3}{3} =$
                 c) $\dfrac{278}{278} =$

    b) $\dfrac{3.14}{3.14} =$
              d) $\dfrac{998873}{998873} =$

4. Did you know that a unit conversion factor is equal to one? This is because the value on the top (numerator) of the unit conversion factor is the same as the value on the bottom (denominator) of the unit conversion factor. This means that a unit conversion factor is equal to 1! Knowing this, calculate the following:

    a) If 5280 feet are equal to 1 mile then calculate: $\dfrac{5280 \text{ feet}}{1 \text{ mile}} =$

    b) If 3600 seconds are equal to 1 hour then calculate: $\dfrac{3600 \text{ seconds}}{1 \text{ hour}} =$

5. As you know if you multiply anything by one you will get the same number you started with. Knowing this, please calculate the following math problems:

a) 3 x 1 =

d) 2 miles x 1 =

b) 1 x 322 =

e) 3 feet x 1 =

c) 3.14159265 x 1 =

f) 33 seconds x 1 =

Putting it Together

To complete a simple unit conversion problem we will use the following steps:

Conversion Problem Steps

STEP 1 – Create both unit conversion factors between the unit you are converting between. Circle the factor with the unit you are converting *from* in the denominator.

STEP 2 – Begin the equation with the starting measurement (the value you are converting *from*) divide by 1.

STEP 3 – Multiply the starting measurement (from step 2) by the conversion factor circled in step 1.

STEP 4 – Cancel everything that appears both on the top and the bottom in the equation (both numbers and units).

STEP 5 – Solve the problem by multiplying across the top and bottom and then calculate the resulting quotient (including units!).

Problem: Convert 45 millimeters to centimeters. There are 10 millimeters in 1 centimeter.

Step 1: Create both unit conversion factors between the unit you are converting between. Circle the factor with the unit you are converting *from* in the denominator.

The conversion factor is just a ratio of two equivalent measurements. The two equivalent measurements in this problem are 10 millimeters and 1 centimeter. We are converting *from* millimeters so we circle factor #1 because it has mm in the denominator:

Factor #1: $\dfrac{1 \text{ cm}}{10 \text{ mm}}$ Factor #2: $\dfrac{10 \text{ mm}}{1 \text{ cm}}$

Step 2: Begin the equation with the starting measurement (the value you are converting *from*) divided by 1.

The starting measurement in this case is 45 mm. Dividing it by 1 results in:

$$\frac{45 \text{ mm}}{1}$$

Step 3: Multiply the starting measurement (from step 2) by the conversion factor circled in step 1.

The starting unit is "mm". Factor #1 has mm unit in the denominator, thus we will use this one:

Factor #1 circled in step 1

$$\frac{45 \text{ mm}}{1} \times \frac{1 \text{ cm}}{10 \text{ mm}} =$$

Measurement from Step 2

Step 4: Cancel everything that appears both on the top and the bottom in the equation (both numbers and units).

Because "mm" appears both on the top and the bottom, this unit will cancel.

$$\frac{45 \; \cancel{mm}}{1} \times \frac{1 \; cm}{10 \; \cancel{mm}} =$$

Step 5: Solve the problem by multiplying across the top and bottom and then calculating the resulting quotient (including units!).

If we multiply across the top we get 45 times 1 cm. If we multiply across the bottom we get 1 times 10. The result is shown below. Solving the resulting quotient results in 45 cm divided by 10 and gives the final result of 4.5 cm.

$$\frac{45 \; \cancel{mm}}{1} \times \frac{1 \; cm}{10 \; \cancel{mm}} = \frac{45 \times 1 \; cm}{1 \times 10} = \frac{45 cm}{10} = 4.5 \; cm$$

This means 45 mm is the same as 4.5 cm! We just converted it!

Practice

Now you will practice completing unit conversions problems yourself. Please follow the steps each time you do a problem.

9. Convert 36 inches to feet. There are 12 inches in one foot.	Conversion factors between inches and feet

10. Convert 4 cups to gallons. There are 16 cups in one gallon.	Conversion factors between cups and gallons

11. Convert 3 miles to feet. There are 5280 feet in one mile.	Conversion factors between feet and miles

12. Convert 5 inches to centimeters. There are 2.54 centimeters in one inch.	Conversion factors between centimeters and inches

13. Convert 53.2 miles to marathons. There are 26.2 miles in one marathon.	Conversion factors between miles and marathons
14. Convert 40 miles to kilometers. There are 1.6 kilometers in one mile.	Conversion factors between kilometers and miles
15. Convert 50 miles to races. There are 500 miles in one race.	Conversion factors between miles and races