Conversions by Cancelling Units

Cancelling units is a handy way to convert one unit to another, such as miles to inches, seconds to weeks, or grams to kilograms. It’s based on the principle that multiplying or dividing both the numerator and denominator of a fraction by the same value doesn’t change the fraction’s value.

Example: Change 80 miles per hour into feet per second.

x x x 🡨 We multiply by 3 different **conversion factors**. Notice that the fraction for each conversion factor is equal to “1”.

x x x 🡨 Next, we cancel the units

= = 117 feet/second 🡨 Then, we multiply the numerators & denominators, and simplify the result

One common mistake is choosing the correct conversion factor, but writing it upside down.

Example: Change 43 gallons into quarts.

|  |  |
| --- | --- |
| ***Incorrect:***  x = = ?!?! | ***Correct:***  x = = 172 quarts |

Canceling of units is part of what is called **unit analysis**, or **dimensional analysis**. So if your parents ask about your Math Club homework this week, you can tell them it’s all about dimensional analysis. They’ll be impressed.

Metric System of Measurement:

|  |  |  |
| --- | --- | --- |
| Basic Unit of Length | **meter (m)** | 1 m = 100 cm = 1000 mm = .001 km |
| Basic Unit of Mass (weight) | **gram (g)** | 1 g = 1000 mg = .001 kg |
| Basic Unit of Capacity (liquid measurement) | **liter (L)** | 1 L = 1000 ml = .001 kl |

Important Metric System Prefixes:

|  |  |  |  |
| --- | --- | --- | --- |
| **Prefix** | **Symbol** | **Meaning** | **Order of Magnitude** |
| *giga-* | G | 1,000,000,000 |  |
| *mega-* | M | 1,000,000 |  |
| *kilo-* | k | 1,000 |  |
| *hecto-* | h | 100 |  |
| *deka-* | da | 10 |  |
|  | base unit | 1 |  |
| *deci-* | d | 0.1 |  |
| *centi-* | c | 0.01 |  |
| *milli-* | m | 0.001 |  |
| *micro-* | µ | 0.0000001 |  |
| *nano-* | n | 0.000000001 |  |

Some Common Metric Conversions

|  |  |
| --- | --- |
| **Length** | |
| 1 meter (m) = 100 centimeters (cm)  1 cm = 0.01 m  1 m = 1000 millimeters (mm)  1 mm = 0.001 m  1 kilometer (km) = 1000 m  1 m = 0.001 km | 1 megameter = 1,000,000 m  1 hectometer = 100 m  1 dekameter = 10 m  1 decimeter = 1/10 m  1 micrometer = 1/1,000,000 m  1 nanometer = 1/1,000,000,000 m |
|  |  |
| **Weight** | **Capacity** |
| 1 gram (g) = 1000 milligrams  1 kilogram (kg) = 1000 grams  1 milligram (mg) = 0.001 g  1 g = 0.001 kg | 1 liter (L) = 1000 mL  1 milliliter (mL) = 0.001 L  1 kiloliter (kL) = 1000 L |

U.S. System of Measurement

Some common U.S. Measurement Conversions:

|  |  |  |  |
| --- | --- | --- | --- |
| **Length** | **Weight** | **Capacity** | **Area** |
| 1 foot = 12 inches  1 yard = 3 feet  1 yard = 36 inches  1 mile = 5,280 feet | 1 lb. = 16 oz.  1 ton = 2,000 lbs. | 1 cup = 8 fl. oz.  1 pint = 2 cups  1 quart = 2 pints  1 gallon = 4 quarts | 1 = 144  1 = 9  1 acre = 43,560  1 = 640 acres |

Conversions between Systems

Some Common Conversions between U.S. & Metric Systems:

|  |  |  |
| --- | --- | --- |
| **Length** | **Weight** | **Capacity** |
| 1 inch = 2.54 cm.  1 meter = 3.28 feet  1 meter = 1.09 yards  1 mile = 1.61 km. | 1 ounce (oz.) = 28.35 grams  1 pound (lb.) = 454 grams  1 kilogram = 2.2 pounds | 1 liter (L) = 1.06 quarts  1 gallon = 3.79 L |

Temperature Conversions:

|  |  |
| --- | --- |
| **To Convert Fahrenheit to Celsius:**   1. Subtract 32 2. Multiply by 5 3. Divide by 9   Example: 75˚F = \_\_ degrees Celsius?  75 – 32 = 43  43 x 5 = 215  215 9 = 23.9  75˚F = 23.9˚C | **To Convert Celsius to Fahrenheit:**   1. Multiply by 9 2. Divide by 5 3. Add 32   Example: 32˚C = \_\_ degrees Fahrenheit?  32 x 9 = 288  288 5 = 57.6  57.6 + 32 = 89.6  32˚C = 89.6˚F |