

09/04/2020

Metric System

Units for Mass/Weight

Units for Length (Area and Volume)

Units for Volume

Units for Time and Temperature

Mass/Weight

English units: pound, or ounces, 16 ounces in a pound for weight

Metric units: mass=grams or kilograms

Conversion: 2.2 pound is about 1 kilogram

150 pounds to kilograms ... 68 kilograms

Depend on being on Earth!

Weight changes in different gravity (different planets, etc.), mass stays the same

Mass in English units is in slugs or stones

Length

Metric units: meter (3.3 feet), 2.54 cm = inch

English: inches, feet, yards, miles... 12 inches=1 ft, 3 ft = yard, 5280 feet=mile

Kilometer = 0.6 miles

Volume

English: quarts, gallons, cups, pints, teaspoons, tablespoon

Metric: liters

Wine bottles are typically 0.75 liter

Quart is approximately a liter

Gallon is about 4 liters

Cubic centimeters cc's = milliliter

1 kilogram of water = 1 liter at sea level

Time and Temperature

Second is a second

60 seconds in a minute

60 minutes in a hour

And 24 hours in a day

Etc.

Fahrenheit : water freezes at 32-degrees, and boils at 212-degrees, and human bodies are 98.6, room temperature is about 72-degrees.

Celsius : water freezes at 0-degrees, and boils at 100-degrees, and body temp is about 37-degrees and room temperature is about 20-degrees.

Mercury freezes around -40-degrees in both scales

Kelvin where absolute zero is measured as zero, but all the units are otherwise Celsius. Absolute zero is about -273-degrees Celsius = 0 Kelvin

Metric prefixes

All are powers of 10

Scaling up: deka- and hecto- multiples of 10 and 100 respectively

10 meters = 1 dekameter Dm, or dam

100 meters = hectometer, hm

Kilo- 1000

Kilometer = 1000 meters km

Million = mega- Mm

Megameter = 1,000,000 meters, or 1000 kilometers

Giga – billion G

Gigabyte = 1,000,000,000 bytes Gb

Tera- 1000 giga's, : terabyte is 10^{12} bytes Tb

Peta- petabyte is 10^{15} bytes Pb

Yottabyte of memory

Scale down:

1/10 scale = deci- dm

Decimeter is 1/10 of meter, 10 decimeters = 1 meter

1/100 scales = centi- cm

Centimeter = 1/100 of meter, 100 centimeters = 1 meter

1/1000 is milli- mm

Millimeter is 1/1000 of meter, 1000 millimeters = 1 meter

1/1,000,000 = micro- μm

Micrometer = 1/1000 of a millimeter or 1/1,000,000 of a meter

1 billionth of meter = nanometer (atomic scales) 10^{-9} nm

Femto - 10^{-15}

Pico- 10^{-12}

Conversion sheet

<https://www.mcckc.edu/tutoring/docs/br/math/basic/Measures-English, Metric, and Equivalentents.pdf>

Liters = L

7.3 meters = 730 cm

$$7.3 m \times \frac{100 cm}{m} = 7.3 \times 100 cm = 730 cm$$

Measured area and volume

Area = m^2, cm^2, mi^2

Volume = m^3, cm^3, ft^3

1 ft = 12 inches

1 square-foot = 12 inches times 12 inches = 144 inches-squared

1 yd = 3 ft

1 square-yard = 9 square-feet

1 square mile = 5280² square-feet

100 centimeters = 1 meter

1 square-meter = 100 times 100 square centimeter = 10,000 cm^2

1 cubic-meter = 100 times 100 times x100 cubic centimeters = 1,000,000 cm^3

13,950 s to h min s

60 seconds in a minute

$$\frac{13950}{60} = 232.5 = 232 \text{ minutes } 30 \text{ second}$$

$$\frac{232}{60} = 3 \text{ hours } 52 \text{ minutes } 30 \text{ seconds}$$

Convert 86-degrees F to Celsius.

$$C = \frac{5}{9}(F - 32)$$

86-32 = 54

$$C = \frac{5}{9}(54) = 30$$

86-degrees F = 30-degrees C.

$$F = \frac{9}{5}C + 32$$

Measurement

Exact measurements vs. approximate measurements

Exact tends to be things that are counted

Approximate measurements tend to be continuous values

The greatest possible error of a measurement is = $\frac{1}{2}$ its precision.

Precision = 1 mm

Greatest possible error = 0.5 mm

How accurate is the measurement (what is the last unit that is reliable), and then divide that unit by 2

4560

Accurate to the 10's position, precision = 10, maximum error is 5

Fraction: $45\frac{7}{8}$: precision = $\frac{1}{8}$, maximum error = $\frac{1}{16}$

Operations on measurement – rely on significant digits

Significant digits of an answer cannot be greater than the smallest number of significant digits of the measurements being added.

Suppose I have a measurement with 1 sig fig, and two others with 3 sig figs and 4 sig figs respectively
The final measurement can only contain one sig fig

$0.6 \text{ m} \times 1.45 \text{ m} \times 1.781 \text{ m} = 1.54947 \text{ m}$ approximately 2 m

Relative error:

$$\frac{\textit{greatest possible error}}{\textit{measurement}}$$

4560

Greatest possible error = 5

Relative error = $\frac{5}{4560} = 0.001096 \dots$

Percentage error: relative error x 100 = 0.1096%