

GENERAL CHEMISTRY

STANDARD 1.4

1.4: Convert measurements among the metric units

METRIC SYSTEM

- SI System – System International
 - Also known as Metric System
- Base 10 System
 - Every unit is a factor of 10 different from every other unit
 - EX: kilogram is 10^3 grams ($10 \times 10 \times 10$)

FUNDAMENTAL SI UNITS

| SI Unit | Quantity Name | Current Definition |
|----------|---------------------|---|
| Meter | Length | The distance traveled by light in a vacuum in $1/299\,792\,458$ seconds |
| Kilogram | Mass | The mass of the international prototype kilogram |
| Second | Time | The duration of $9\,192\,631\,770$ periods of the radiation corresponding to the transition between two hyperfine levels of the ground state of the caesium 133 ion |
| Ampere | Electric Current | The constant current, which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1.0 m apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newtons per meter of length |
| Kelvin | Temperature | $1 / 273.13$ of the thermodynamic temperature of the triple point of water |
| Mole | Amount of Substance | The amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilograms of carbon-12 |
| Candela | Luminous Intensity | The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 5.4×10^{14} hertz and that has a radiant intensity in that direction of $1 / 683$ watt per steradian |

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METRIC CONVERSION

Kilo-

Hecto-

Deka-

Base Unit

grams
liters
meters

Deci-

Centi-

Milli-

Going up the staircase –
move decimal to left as units
are getting larger – once per
step (unit on exponent)

Going down the staircase –
move decimal to right as units
are getting smaller – once per
step (unit on exponent)

METRIC CONVERSION

| Metric Prefix | Value | Metric Prefix | Value |
|-----------------------|------------------------|---------------|----------------------|
| atto (a) | 10^{-18} | deca (da) | $10^1 = 10$ |
| femto (f) | 10^{-15} | hecto (h) | $10^2 = 100$ |
| pico (p) | 10^{-12} | kilo (k) | $10^3 = 1\ 000$ |
| nano (n) | 10^{-9} | mega (M) | $10^6 = 1\ 000\ 000$ |
| micro (μ) | $10^{-6} = 0.000\ 001$ | giga (G) | 10^9 |
| milli (m) | $10^{-3} = 0.001$ | tera (T) | 10^{12} |
| centi (c) | $10^{-2} = 0.01$ | peta (P) | 10^{15} |
| deci (d) | $10^{-1} = 0.1$ | exa (E) | 10^{18} |
| Base Unit (no prefix) | $10^0 = 1$ | | |

METRIC CONVERSION EXAMPLES

Convert 250 000 mm to km

Note that milli has an exponent of -3 and kilo has an exponent of +3. Also note we are moving up the staircase, so the decimal point will be moved six places to the left.

$$250\ 000\ \text{mm} = 0.25\ \text{km}$$

Convert 0.0025 hg to cg

Note that hecto has an exponent of +2 and centi has an exponent of -2. Also note we are moving down the staircase, so the decimal point will be moved four places to the right.

$$0.0025\ \text{hg} = 25\ \text{cg}$$