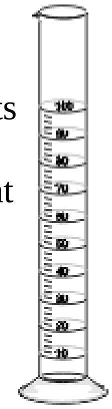
# Review of the SI System of Measurement

**The Structure of SI**



The International System of Weights and measures (SI or System Internationale) is built up from the definition of the units for seven fundamental quantities - length, mass, time, temperature, electric current, amount of matter and luminous intensity. Once these base units have been defined, they can be combined in various ways to yield a multitude of derived units for all other quantities. This is the way in which the system is made to be coherent, that is, the system has one and only one unit for each physical quantity, and in almost all cases the units are related to one another by the simple multiplication of the base units with no numerical conversions.

In addition, SI makes use of a system of prefixes to indicate decimal multiples and sub multiples of both the base and derived units. The function of these multiples is to provide numbers of a convenient size, neither very large, nor very small.

The symbols for the seven base units appear in Table 1 below:

**Symbols for the Base Units**

| Quantity Measured | Unit Name | Symbol for Unit |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Temperature | Kelvin or Celsius | K or $^{o}$C |
| Electric current | Ampere | I |
| Amount of matter | mole | mol |
| Luminous intensity | candela | cd |

There are two points to notice when using these symbols. First, no period is used after the symbol. Thus the correct way to write six meters is 6 m, not 6 m. Secondly, the same symbol is used for both the singular and the plural - no "s" is added.

**Multiples and sub multiples of the SI Units**

Another feature of SI as well as the traditional metric system is the use of prefixes to indicate multiples and sub multiples of the base and derived units. The function of these multiples is simply to provide numbers of a convenient size for the particular quantity being measured. For example, the distance between Calgary and Edmonton is about 300 000 metres, which can be more easily written as 300 kilometers. Literally, this means 300 units of 1000 m each.

The system of prefixes used appears in Table 2 below:

**Prefixes for Multiples and Sub multiples of the base units**

| Prefix | Symbol | Meaning | Example |
|---|---|---|---|
| Giga | G | 1 000 000 000 or $10^9$ | 1 Gm = $10^9$ m |
| Mega | M | 1 000 000 or $10^6$ m | 1 Mm = $10^6$ m |
| Kilo | k | 1 000 or $10^3$ | 1 km = 1000 m |
| Hecto | h | 100 or $10^2$ | 1 hm = 100 m |
| Deca | da | 10 or $10^1$ | 1 dam = 10 m |
| Base unit of your choice | 1m (or whatever) | 1 | 1 m = 1 m |
| Deci | d | 1/10 or $10^{-1}$ | 1 dm = 0.10 m |
| Centi | c | 1/100 or $10^{-2}$ | 1 cm = 0.010 m |
| Milli | m | 1/1000 or $10^{-3}$ | 1 mm = 0.0010 m |
| Micro | u | 1/1 000 000 or $10^{-6}$ | 1 um = $10^{-6}$ m |
| Nano | n | 1/1 000 000 000 or $10^{-9}$ | 1 nm = $10^{-9}$ m |
| Pico | p | 1/ 1 000 000 000 000 or $10^{-12}$ | 1 pm = $10^{-12}$ m |

**The Derived Units**

SI is a coherent system. That is, the units associated with other physical quantities are obtained by simple combinations of the base units. Some of the more commonly used derived units are listed in Table 3 below:

**Some Examples of Derived Units**

| Quantity Measured | Unit | Symbol |
|---|---|---|
| Area | square metre | $m^2$ |
| Volume | cubic metre | $m^3$ |
| Speed | metre per second | m/s or $ms^{-1}$ |
| Acceleration | metre per second per second | $m/s^2$ or $ms^{-2}$ |
| Density | kilogram per cubic metre | $kg/m^3$ or $kgm^{-3}$ |

**Some Examples of Derived Units With Special Names**

| Quantity Measured | Unit | Symbol | Definition |
|---|---|---|---|
| Frequency | Hertz | Hz | $s^{-1}$ |
| Force | Newton | N | $kgm/s^2$ |
| Pressure | Pascal | Pa | $N/m^2$ or $kgm^{-1}s^2$ |
| Energy, work or quantity of heat | Joule | J | N.m or $kgm^2/s^2$ |
| Power | Watt | W | J/s |