

1.4: SI and Metric Units

Within the sciences, we use the system of weights and measures that are defined by the International System of Units which are generally referred to as **SI Units**. At the heart of the SI system is a short list of base units defined in an absolute way without referring to any other units. The base units that we will use in this text, and later in General Chemistry include the meter (m) for distance, the kilogram (kg) for mass and the second (s) for time. The volume of a substance is a derived unit based on the meter, and a cubic meter (m^3) is defined as the volume of a cube that is exactly 1 meter on all edges.

Because most laboratory work that takes place in chemistry is on a relatively small scale, the mass of a kilogram (about 2.2 pounds) is too large to be convenient and the gram is generally utilized, where a gram (g) is defined as 1/1000 kilograms. Likewise, a volume of one cubic meter is too large to be practical in the laboratory and it is common to use the cubic centimeter to describe volume. A cubic centimeter is a cube that is 1/100 meter on each edge, a teaspoon holds approximately 5 cubic centimeters. For liquids and gasses, chemists will usually describe volume using the liter, where a liter (L) is defined as 1000 cubic centimeters.

SI base units are typically represented using the abbreviation for the unit itself, preceded by a metric prefix, where the metric prefix represents the power of 10 that the base unit is multiplied by. The set of common metric prefixes are shown in Table 1.4.1.

Table 1.4.1: Common Metric Prefixes

Factor	Name	Symbol
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
1		none
10^3	kilo	k
10^6	mega	M
10^9	giga	G

Using this Table as a reference, we see the metric symbol “c” represents the factor 10^{-2} ; thus writing “cm” is equivalent to writing ($10^{-2} \times m$). Likewise, we could describe 1/1000 of a meter as mm, where the metric symbol “m” represents the factor 10^{-3} . The set of metric prefixes and their symbols that are shown in Table 1.3 are widely used in chemistry and it is important that you memorize them and become adept at relating the prefix (and its’ symbol) to the corresponding factor of 10.

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