METRIC SYSTEM

"I got you ten roses. I believe strong relationships are based on the metric system."

Measurements are central to science. Scientists are often uncomfortable when they cannot measure something because it is hard to communicate how much we have of something if we cannot measure it.

The units of measure used in science and engineering around the world is the SI system. The basic units of the SI system (French for Systeme International) are shown below.

Unit name	Unit symbol	Quantity name
meter	m	length
kilogram	kg	mass
second	s	time
ampere	A	electric current
kelvin	K	temperature
mole	mol	amount of matter
candela	cd	luminous intensity

(source: Wikipedia)

These units are given in amounts based on the metric system. The metric system is based on a logical series of prefixes based on multiples of ten and 1000. These are shown in the following table. You should memorize the prefixes in the left column the numerical multiple they represent, and their scientific notation. For example, mega has the symbol M and it represents a million (1 000 000) and a million is the same as 10^6 in scientific notation. Milli has the symbol m and represents one thousandth (1/1 000), and 1/1000 is 10^{-3} in scientific notation. A megameter is a million meters or 10^6 meters. A millimeter is one thousandth of a meter or 10^{-3} meters.

Prefix	Symbol for Prefix		Scientific Notation
exa	E	1 000 000 000 000 000 000	10^{18}
peta	P	1 000 000 000 000 000	10^{15}
tera	T	1 000 000 000 000	10^{12}
giga	G	1 000 000 000	10^9
mega	M	1 000 000	10^6
kilo	k	1 000	10^3
hecto	h	100	10^2
deka	da	10	10^1
----	--	1	10^0
deci	d	0.1	10^{-1}
centi	c	0.01	10^{-2}
milli	m	0.001	10^{-3}
micro	µ	0.000 001	10^{-6}
nano	n	0.000 000 001	10^{-9}
pico	p	0.000 000 000 001	10^{-12}
femto	f	0.000 000 000 000 001	10^{-15}
atto	a	0.000 000 000 000 000 001	10^{-18}

For example a kilometer is 10^3 meters or 1000 meters (10^3 = 10 x 10 x 10)
Note that we are using negative exponents. A negative exponent works as follows: 10^3 = 10 x 10 x 10 and 10^{-3} = 1/10 x 10 x 10. A millimeter is 10^{-3} meter = 1/10 x 10 x 10 or one thousandth of a meter. A centimeter is 10^{-2} meters or one hundredth of a meter. You can see this in both the above and below tables.

Prefix	Symbol	Power of Ten
giga	G	9
mega	M	6
kilo	k	3
Base unit (meter)	---	0
centi	c	-2
mili	m	-3
micro	µ	-6
nano	n	-9

It is good to know how the metric system matches up with the odd system used in the USA. Here are some common ones to know from the table that follows: there are ~2.5 centimeters in an inch; there are about 1.6 kilometers in a mile; there are 0.95 liters in a quart (a liter   is just a little larger than a quart); there are 2.2 pounds in a kilogram;

CONVERSION BETWEEN METRIC AND US CUSTOMARY SYSTEMS					
FROM US CUSTOMARY TO METRIC			FROM METRIC TO US CUSTOMARY		
When you know	multiply by	to find	When you know	multiply by	to find
inches	25.4	millimeters	millimeters	0.04	inches
	2.54	centimeters	centimeters	0.39	inches
feet	30.48	centimeters	meters	3.28	feet
yards	0.91	meters		1.09	yards
miles	1.61	kilometers	kilometers	0.62	miles
fluid ounces	29.57	milliliters	milliliters (liquid)	0.03	fluid ounces
pints (liquid)	0.47	liters (liquid)	liters (liquid)	1.06	quarts (liquid)
quarts (liquid)	0.95	liters (liquid)		0.26	gallons
gallons	3.79	liters (liquid)		2.12	pints (liquid)
pints (dry)	0.55	liters (dry)	liters (dry)	1.82	pints (dry)
quarts (dry)	1.10	liters (dry)		0.90	quarts (dry)
ounces	28.35	grams	grams	0.035	ounces
pounds	0.45	kilograms	kilograms	2.20	pounds
short tons (2,000 lbs)	0.91	metric tons	metric tons (1,000 kg)	1.10	short tons
square inches	6.45	square centimeters	square centimeters	0.155	square inches
square feet	0.09	square meters	square meters	1.20	square yards
square yards	0.84	square meters	square kilometers	0.39	square miles
square miles	2.59	square kilometers	hectares	2.47	acres
acres	0.40	hectares			

A Ruler
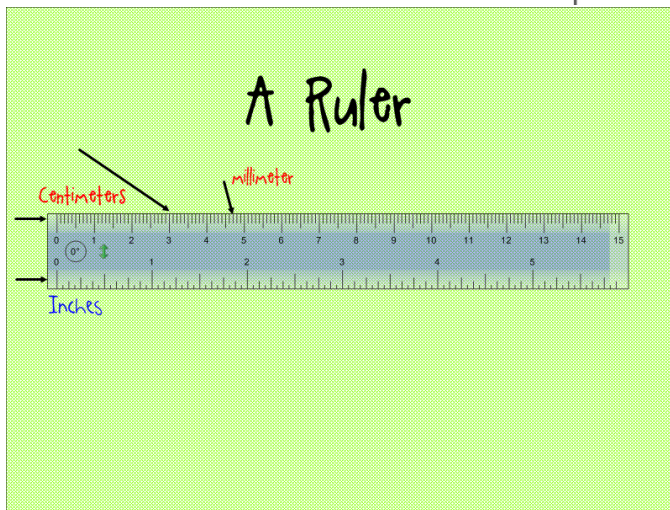
The image to the left illustrates the comparison between metric and standard lengths.