The Metric System

The **International System of Units** -- the Metric System -- is usually referred to as the **SI**. The metric system is used by scientists throughout the world, and is based on units of **ten**. Each unit is ten times larger or ten times smaller than the next unit, and these units are specified by the use of **prefixes**.

*There are seven base units used in **all** Physics*

Measurement	Unit	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric current	Ampere	A
Temperature	Kelvin	K
Amount of substance	Mole	mol
Intensity of light	Candela	cd

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

Symbol	Unit	Quantity
ºK	degree Kelvin	absolute temperature
ha	hectare	area
ºC	degree Celsius	Celsius temperature
C	coulomb	electric charge
A	ampere	electric current
V	volt	electric potential energy
Ω	ohm	electric resistance
J	joule	energy, work
N	newton	force
Hz	hertz	frequency
m	metre (meter)	length
g	gram	mass
t	tonne, metric ton	mass
W	watt	power
Pa	pascal	pressure, stress
Gy	gray	radiation (absorbed dose)
Sv	sievert	radiation (dose equivalent)
Bq	becquerel	radioactivity
a	year	time
d	day	time
h	hour	time
min	minute	time
s	second	time
L	litre	volume

Some commonly used Metric Units

Prefix	Symbol	Mult. Factor	Example
exa	E	10^{18}	
peta	P	10^{15}	
tera	T	10^{12}	
giga	G	10^{9}	
mega	M	10^{6}	10^{6} m = 1 Mm
kilo	k	10^{3}	10^{3} g = 1 kg
hecto	h	10^{2}	
deca	da	10^{1}	
		10^{0}	m
deci	d	10^{-1}	
centi	c	10^{-2}	10^{-2} m = 1 cm
milli	m	10^{-3}	10^{-3} m = 1 mm
micro	μ	10^{-6}	10^{-6} m = 1 μm
nano	n	10^{-9}	
pico	p	10^{-12}	
femto	f	10^{-15}	
atto	a	10^{-18}	

Metric	English
2.54 cm	= 1 inch (in.)
1 m	= 39.37 inches (in.)
1 km	= 0.62 miles (mi)
1 L	= 1.06 quarts (qt)
250 mL	= 1 cup (c)
1 kg	= 2.2 pounds (lb)
28.3 g	= 1 ounce (oz)
ºC	= 5/9 x (ºF - 32)

Length: the distance from one point to another meter (m) A meter is slightly longer than a yard 1 meter = 1000 millimeters (cm) 1 meter = 100 centimeters (cm)	**Volume**: the amount of space an object takes up liter (L) A liter is slightly more than a quart 1 liter = 1000 millimeters (mL)
Mass: the amount of matter in an object gram (g) A gram has a mass equal to about one paper clip 1000 grams = 1 kilogram (kg)	**Temperature**: the measure of hotness or coldness degrees Celsius (ºC) 0ºC = freezing point of water 100ºC = boiling point of water Kelvin (ºK) -273ºC = 0ºK = (absolute zero -- the lowest temperature possible)

Exercise

1. Using the abbreviations for the base units (See previous page), write abbreviations for the following metric units:
   a. milligram mg
   b. centimeter cm
   c. kilometer km
   d. micrometer μm
2. Write the name of each metric unit abbreviated below:
   a. mm millimeter
   b. cg centimeter
   c. kg kilogram
   d. km kilometer
   e. cm centimeter
   f. dg decigram
   g. μg microgram
   h. Mm megameter
3. Calculate the equivalence between the following metric units:
   a. 100 cg = 1 g
   b. 100 cg = 1 g
   c. 10^{-3} km = 1 m
   d. 100 cm = 1 m
   e. 1 cg = 0.01 g
   f. 1 kg = 1000 g
   g. 1 km = 1000 m
   h. 1 cm = 0.01 m
   i. 10 dg = 1 g
   j. 10^{6} μg = 1 g
   k. 10^{-6} Mm = 1 m
   l. 1 dg = 0.1 g
   m. 1 μg = 10^{-6} g
   n. 1 Mm = 10^{6} m
   o. 1 am = 10^{-9} nm
   p. 1 MW = 10^{9} mW
4. 0.268 g = 268 mg
5. 0.0005 MΩ = 500 Ω
6. 247 000 m = 247 km
7. 2.5 cm = 0.025 m
8. 10^{38} aV = 100 EV
9. 0.15 μg = 0.000 000 15 g

10. What unit of measurement would you choose to measure:

a. the amount of juice you drank for breakfast?	mL
b. the amount of salt you put on French fries?	g
d. the amount of water your family uses in one year?	kL
f. the distance from here to the moon?	km
g. the amount of energy in a liter of gasoline?	MJ
h. the amount of farmland on a wheat farm?	m^2
i. the thickness of a piece of notepaper?	μm
j. the width of a piece of notepaper?	cm
l. the size of a single atom of Carbon?	am
m. the frequency of Z-95.3 on the FM radio?	MHz
n. the temperature on Pluto?	K

Science and Engineering Worksheet Don't forget about your Sig. Figs!!!

1. The formula C = 5/9 (F- 32) converts temperatures from Fahrenheit to Celsius. How many ºC is 167°F? 75 °C
2. Air temperature affects the speed of sound. The relationship is shown in the formula S = 331.5 + 0.61T, where T is measured in degrees Celsius, and S in meters/sec. Find the speed of sound when T = 10 °C, then convert your answer to km/hr (1 m/s = 3.6 km/hr). 1215 $\frac{km}{hr}$
3. In an electrical circuit, the total resistance of two separate, parallel resistors can be calculated using the formula:
   Find R_T, if R_1 = 1.5 ohms and R_2 = 4.5 ohms.

   1.1 Ω

   $$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

4. The current in an electrical circuit is given by the formula:

   $$I = \frac{V}{R + 2r}$$

   Where I is current (amperes), V is potential energy (volts), R is circuit resistance (ohms, Ω), and r is cell or battery resistance. Find I if V = 22V, R = 1.3Ω and r = 0.050 Ω.

   16 A