The Metric System

To establish a uniform set of units, the General Conference of Weights and Measurements in 1960 prescribed base units to be used for various quantities. The resulting system is called the *Systeme International d'Unitès* (International System of Units), abbreviated **SI** and is based on the metric system first developed in France towards the end of the 18th. century.

There are seven basic units in the metric system and all other units are derived from these seven basic units. Larger or smaller quantities are created by using prefixes with either the basic or derived units. In the English system of measurement, every quantity has its own unit which may or may not be directly related to a larger or smaller unit.

English system - inch, foot, yard, mile, furlong

Metric system - meter, kilometer, centimeter, millimeter, micrometer, etc.

The Seven Basic SI Units

Physical Quantity	Name of Unit	Abbreviation (symbol)
Mass	kilogram	kg
Length	meter	m
Time	second	s
Temperature	Kelvin	K
Amount of substance	mole	mol
Electric Current	ampere	A
Luminous intensity	candela	Cd

Some Commonly Used Units Derived from SI Basic Units

Quantity	Unit Name	Symbol	Definition
Area	square meter	m^2	
Volume	cubic meter	m^3	
Density	kilogram per cubic meter	Kg/m^3	
Force	Newton	N	$Kg \cdot m/s^2$
Pressure	Pascal	Pa	N/m^2
Energy	Joule	J	$Kg \cdot m^2/s^2$
Electric charge	Coulomb	C	$A \cdot s$
Electric potential difference	volt	V	$J/(A \cdot s)$
Power	Watt	W	J/s

Metric Measurements

Metric measurements usually consists of three parts, the number, the prefix, and the unit.

In the measurement, 100 cm, read "100 centimeter," the three parts are

The number - 100

The prefix - "c" (centi, meaning 10^{-2})

The unit - m (meter)

$$100 \text{ cm} = 100 \times 10^{-2} \text{ meter}$$

However, the measurement, 2.0 grams, has only the number and the unit.

What are the parts of the measurement?

$$200 \text{ kJ}$$

Number = 200, prefix = k (kilo), and the unit = J (joule).

Write 200 kJ in exponential form.

$$200 \text{ kJ} = 200 \times 10^{3} \text{ J (for joule)}$$

Write the measurement, 0.1 nV, in exponential form (V = volt)

$$0.1 \text{ nV} = 0.1 \times 10^{-9} \text{ volt}$$

What would be the symbol for the measurement, 6.0×10^{-3} watt (W)?

$$6.0 \times 10^{-3} \text{ watt} = 6.0 \text{ mW}$$

Supply the missing quantity, either the prefix, the exponential, or the unit as indicated.

â 500×10^{-6} A = 500 _____ A

ã 6 nm = 6 x $10^{?}$ m = 6 x 10 m

ä 70 : g = 70 : _____

å 0.5 mW = 0.5 x $10^{?}$ W = 0.5 x 10 W

æ 15 x 10^{6} mol = 15 _____ mol

Metric-Metric Conversions

Metric-metric conversions are easily performed by following these three steps:

- Convert the prefix into its exponential form (no prefix means x 10^0).

- Shift the decimal point in the number portion of the measurement to reflect the change in the exponent.

- Convert the measurement back into the prefix form. NOTE: If the exponent equals 10^0, there will be no prefix.

For example, convert the measurement

$$2.0 \text{ cm} = ? \text{ mm}$$

$$2 \times 10^{-2} \text{ m} = \_\_\_ \times 10^{-3} \text{ m}$$

$$2 \times 10^{-2} \text{ m} = 20 \times 10^{-3} \text{ m}$$

$$20 \text{ mm}$$

Convert 0.4 MN into 400 _?_ N

$$0.4 \times 10^{6} \text{ N} = 400 \times 10^{?} \text{ N}$$

$$0.4 \times 10^{6} \text{ N} = 400 \times 10^{3} \text{ N}$$

$$400 \text{ kN}$$

Perform the indicated metric-metric conversions:

â 500 kW = _____ MW

ã 0.01 :g = 10 _____ g

ä 4000 mC = _____ C

å 20,000,000 dR = _____ kR

æ 27 Cd = _____ cCd

ç 200 cA = 0.002 _____ A

METRIC (SI) PREFIXES

Prefix	Symbol	Exponential	Multiplication
mega*	M*	10^{6}	1,000,000
kilo*	k*	10^{3}	1,000
hecto	h	10^{2}	100
deka	da	10^{1}	10
units		10^{0}	1
deci*	d*	10^{-1}	0.1
centi*	c*	10^{-2}	0.01
milli*	m*	10^{-3}	0.001
micro*	:*	10^{-6}	0.000 001
nano*	n*	10^{-9}	0.000 000 001
pico*	p*	10^{-12}	0.000 000 000 001