

## Measurement in Science

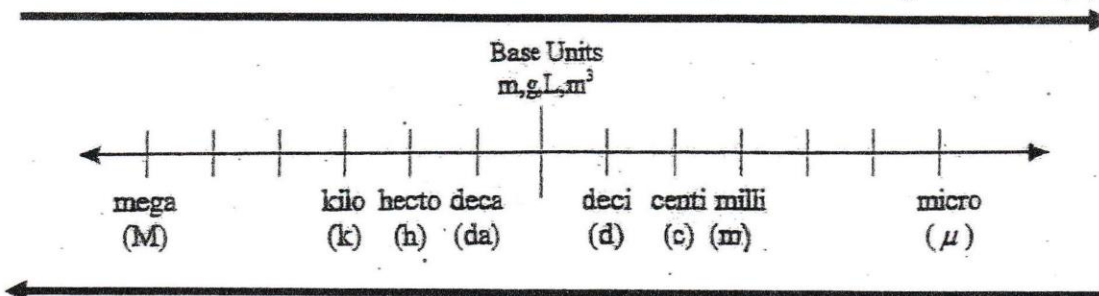
- For scientific observations to be meaningful around the world, we use a modernized version of the metric system which was originally developed in France "Systeme Internationale" = International System of Units
- The metric system uses base units for measurement
- Basic units are:
  - Length → meter
  - Mass → gram
  - Volume → Litre (or  $\text{dm}^3$ )
  - Time → seconds
  - Temp → °Celcius
- The units are **logarithmically** related to each other (based on 10)
- **Prefixes** are used to express larger or smaller quantities to reduce the ambiguity of the measurement

### A List of the Metric Prefixes

Prefix	Symbol	Multiplier Numerical	Exponential
yotta	Y	1,000,000,000,000,000,000,000,000	$10^{24}$
zetta	Z	1,000,000,000,000,000,000,000,000	$10^{21}$
exa	E	1,000,000,000,000,000,000,000	$10^{18}$
peta	P	1,000,000,000,000,000,000	$10^{15}$
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	$10^2$
deca	da	10	$10^1$
no prefix means: 1			$10^0$
deci	d	0.1	$10^{-1}$
centi	c	0.01	$10^{-2}$
milli	m	0.001	$10^{-3}$
micro	$\mu$	0.000001	$10^{-6}$
nano	n	0.000000001	$10^{-9}$
pico	p	0.000000000001	$10^{-12}$
femto	f	0.000000000000001	$10^{-15}$
atto	a	0.000000000000000001	$10^{-18}$
zepto	z	0.000000000000000000001	$10^{-21}$
yocto	y	0.000000000000000000000001	$10^{-24}$

### Metric Conversion Chart

To convert to a smaller unit, move the decimal point to the right or multiply



To convert to a larger unit, move decimal point to the left or divide

Eg. Convert:

- a)  $27.5\text{cm} = \underline{\hspace{2cm}} \text{mm}$     b)  $5.86\text{mm} = \underline{\hspace{2cm}} \text{hm}$     c)  $3\text{m} = \underline{\hspace{2cm}} \text{dm}$

#### Using Correct Units

For each of the following commonly used measurements, indicate its symbol. Use the symbols to complete the following.

- |                  |                   |                 |                  |
|------------------|-------------------|-----------------|------------------|
| _____ milliliter | _____ milligram   | _____ liter     | _____ centimeter |
| _____ kilogram   | _____ millimeter  | _____ kilometer | _____ gram       |
| _____ meter      | _____ millisecond | _____ microgram | _____ nanometer  |

**REMEMBER** →  $1.0 \text{ cm}^3 = 1.0 \text{ mL}$

Convert:

- |  |   |
|--|---|
| a. $9200 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$    | b. $2.0 \text{ ML} = \underline{\hspace{2cm}} \text{ kL}$     |
| c. $238 \text{ kg} = \underline{\hspace{2cm}} \text{ Mg}$    | d. $50.0 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$    |
| e. $706 \text{ dag} = \underline{\hspace{2cm}} \text{ dg}$   | f. $70.0 \text{ hm} = \underline{\hspace{2cm}} \text{ m}$     |
| g. $72 \text{ km} = \underline{\hspace{2cm}} \text{ m}$      | h. $0.67 \text{ kL} = \underline{\hspace{2cm}} \text{ mL}$    |
| i. $1500 \text{ m} = \underline{\hspace{2cm}} \text{ km}$    | j. $5800 \text{ mm} = \underline{\hspace{2cm}} \text{ km}$    |
| k. $0.042 \text{ km} = \underline{\hspace{2cm}} \text{ dm}$  | l. $12.0 \text{ dam} = \underline{\hspace{2cm}} \text{ dm}$   |
| m. $4.601 \text{ dam} = \underline{\hspace{2cm}} \text{ cm}$ | n. $0.020 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$    |
| o. $0.28 \text{ mL} = \underline{\hspace{2cm}} \text{ cm}^3$ | p. $7.50 \text{ μg} = \underline{\hspace{2cm}} \text{ mg}$    |
| q. $142 \text{ Mm} = \underline{\hspace{2cm}} \text{ km}$    | r. $60.0 \text{ ml} = \underline{\hspace{2cm}} \text{ cm}^3$  |
| s. $12.0 \text{ μm} = \underline{\hspace{2cm}} \text{ cm}$   | t. $65.0 \text{ g} = \underline{\hspace{2cm}} \text{ mg}$     |
| u. $750 \text{ ml} = \underline{\hspace{2cm}} \text{ L}$     | v. $81\,000 \text{ kg} = \underline{\hspace{2cm}} \text{ Mg}$ |