Name _____ Date _____ Class _____

SCIENTIFIC MEASUREMENT AND CONVERSION

SI Units and Conversions Between Them

SI, or *Système Internationale*, is the system for measuring that is used by scientists throughout the world. The six basic SI units that your textbook uses are listed in **Table 1.**

Table 1 SI Units

Basic unit	Abbreviation	Quantity measured
second	s	time
meter	m	length and distance
kilogram	kg	mass
kelvin	K	absolute temperature
mole	mol	quantity of matter
ampere	A	electric current

Other units can be derived as combinations of SI units. Some derived units that are used in the textbook are given in **Table 2.**

Table 2 Units Derived from SI

Derived unit	Definition	Quantity measured
newton (N)	$kg \bullet m/s^2$	force
joule (J)	$N \bullet m = kg \bullet m^2/s^2$	energy
watt (W)	$J/s = kg \bullet m^2/s^3$	power
hertz (Hz)	1/s	frequency

SI Conversion

One advantage of SI is that units are scaled by factors of 10. For instance, if you are measuring small amounts of mass in grams, you can express this quantity in the much larger units of kilograms because 1000 g make up a kilogram. In these simple conversions, the prefixes shown in **Table 3** are added to a given unit. For example, a frequency of 5 million Hz can be expressed more simply as 5 MHz. The letter M stands for the prefix "mega," which comes from the Greek word for "mighty."

SI Units and Conversions Between Them *continued*

Table 3 Prefixes for Units of Measurement

Symbol	Prefix	Is equal to
n	nano-	10^{-9} (a billionth)
μ	micro-	10^{-6} (a millionth)
m	milli-	10^{-3} (a thousandth)
c	centi-	10^{-2} (a hundredth)
k	kilo-	103 (a thousand)
M	mega-	106 (a million)
G	giga-	109 (a billion)

Math Skills

Convert 745 mm to meters.

Solution

1. Determine the possible conversion factors. The two units in this problem are millimeters and meters. You can see in Table 3 that the prefix "milli-" means 10^{-3} (a thousandth). This means that 1 mm = 10^{-3} m. So,

$$\frac{1\text{ mm}}{10^{-3}\text{ m}} = 1 \qquad \text{and} \qquad \frac{10^{-3}\text{ m}}{1\text{ mm}} = 1$$

2. Decide which conversion factor will give you the correct unit for the answer. The answer needs to be in meters. To get meters, use the conversion factor that multiplies by meters and divides by millimeters (to cancel millimeters in the number from the problem).

$$\frac{10^{-3}\text{ m}}{1\text{ mm}} = 1$$

3. Write down the number from the problem, and multiply it by the conversion factor.

$$745\text{ mm} \times \frac{10^{-3}\text{ m}}{1\text{ mm}} = 0.745\text{ m}$$

Practice

1. Convert 100 m, the length of a well-known track event, to kilometers.

SI Units and Conversions Between Them *continued*

2. Convert 5.98×10^{24} kg, the mass of Earth, to milligrams, mg.

3. If you reported how quickly energy was used, measuring energy in joules, J, and time in seconds, s, which unit would you use?

4. Convert a force of 4.448 N to units of g • cm/s^2.

5. Convert the gravitation constant 6.67×10^{-11} N • m^2/kg^2 to units of N • km^2/g^2.