Chemistry Basics Boot Camp

SCIENTIFIC NOTATION

Name _____

Scientists very often deal with very small and very large numbers, which can lead to a lot of confusion when counting zeros! We have learned to express these numbers as powers of 10.

Scientific notation takes the form of $M \times 10^n$ where $1 \leq M < 10$ and "n" represents the number of decimal places to be moved. Positive n indicates the standard form is a large number. Negative n indicates a number between zero and one.

Example 1: Convert 1,500,000 to scientific notation.

We move the decimal point so that there is only one digit to its left, a total of 6 places.

$1{,}500{,}000 = 1.5 \times 10^6$

Example 2: Convert 0.000025 to scientific notation.

For this, we move the decimal point 5 places to the right.

$0.000025 = 2.5 \times 10^{-5}$

(Note that when a number starts out less than one, the exponent is always negative.)

Convert the following to scientific notation.

1. 0.005 = _____
2. 5,050 = _____
3. 0.0008 = _____
4. 1,000 = _____
5. 1,000,000 = _____
6. 0.25 = _____
7. 0.025 = _____
8. 0.0025 = _____
9. 500 = _____
10. 5,000 = _____

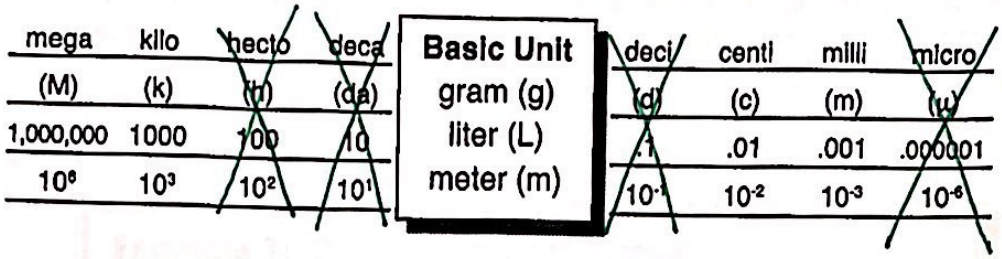
Convert the following to standard notation.

1. 1.5×10^3 = _____
2. 1.5×10^{-3} = _____
3. 3.75×10^{-2} = _____
4. 3.75×10^2 = _____
5. 2.2×10^5 = _____
6. 3.35×10^{-1} = _____
7. 1.2×10^{-4} = _____
8. 1×10^4 = _____
9. 1×10^{-1} = _____
10. 4×10^0 = _____

METRICS AND MEASUREMENT

Name _____

In the chemistry classroom and lab, the metric system of measurement is used, so it is important to be able to convert from one unit to another.



Factor Label Method

1. Write the given number and unit.
2. Set up a conversion factor (fraction used to convert one unit to another).
   a. Place the given unit as denominator of conversion factor.
   b. Place desired unit as numerator.
   c. Place a "1" in front of the larger unit.
   d. Determine the number of smaller units needed to make "1" of the larger unit.
3. Cancel units. Solve the problem.

Example 1: 55 mm = _____ m

$$\frac{55\ \text{mm}}{} \left| \frac{1\ \text{m}}{1000\ \text{mm}} \right. = 0.055\ \text{m}$$

Example 2: 88 km = _____ m

$$\frac{88\ \text{km}}{} \left| \frac{1000\ \text{m}}{1\ \text{km}} \right. = 88{,}000\ \text{m}$$

Example 3: 7000 cm = _____ hm

$$\frac{7000\ \text{cm}}{} \left| \frac{1\ \text{m}}{100\ \text{cm}} \right| \frac{1\ \text{hm}}{100\ \text{m}} = 0.7\ \text{hm}$$

Example 4: 8 daL = _____ dL

$$\frac{8\ \text{daL}}{} \left| \frac{10\ \text{L}}{1\ \text{daL}} \right| \frac{10\ \text{dL}}{1\ \text{L}} = 800\ \text{dL}$$

The factor label method can be used to solve virtually any problem including changes in units. It is especially useful in making complex conversions dealing with concentrations and derived units.

Convert the following.

1. 35 mL = _____ dL
2. 950 g = _____ kg
3. 275 mm = _____ cm
4. 1,000 L = _____ kL
5. 1,000 mL = _____ L
6. 4,500 mg = _____ g
7. 25 cm = _____ mm
8. 0.005 kg = _____ dag
9. 0.075 m = _____ cm
10. 15 g = _____ mg

DIMENSIONAL ANALYSIS (FACTOR LABEL METHOD)

Name _____

Using this method, it is possible to solve many problems by using the relationship of one unit to another. For example, 12 inches = one foot. Since these two numbers represent the same value, the fractions 12 in/1 ft and 1 ft/12 in are both equal to one. When you multiply another number by the number one, you do not change its value. However, you may change its unit.

Example 1: Convert 2 miles to inches.

$$2 \text{ miles} \times \frac{5{,}280 \text{ ft}}{1 \text{ mile}} \times \frac{12 \text{ inches}}{1 \text{ ft}} = 126{,}720 \text{ in}$$

Example 2: How many seconds are in 4 days?

$$4 \text{ days} \times \frac{24 \text{ hrs}}{1 \text{ day}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 345{,}600 \text{ sec}$$

Solve the following problems.

1. 3 hrs = _____ sec
2. 0.035 mg = _____ cg
3. 5.5 kg = _____ lbs
4. 2.5 yds = _____ in
5. 1.3 yrs = _____ hr (1 yr = 365 days)
6. 3 moles = _____ molecules (1 mole = 6.02×10^{23} molecules)
7. 2.5×10^{24} molecules = _____ moles
8. 5 moles = _____ liters (1 mole = 22.4 liters)
9. 100. liters = _____ moles
10. 50. liters = _____ molecules
11. 5.0×10^{24} molecules = _____ liters
12. 7.5×10^{3} mL = _____ liters

PERCENTAGE ERROR

Name _____

Percentage error is a way for scientists to express how far off a laboratory value is from the commonly accepted value.

The formula is:

$$\% \text{ error} = \left| \frac{\text{Accepted Value} - \text{Experimental Value}}{\text{Accepted Value}} \right| \times 100$$

absolute value

Determine the percentage error in the following problems.

1. Experimental Value = 1.24 g
   Accepted Value = 1.30 g

   Answer: _____

2. Experimental Value = 1.24×10^{-2} g
   Accepted Value = 9.98×10^{-3} g

   Answer: _____

3. Experimental Value = 252 mL
   Accepted Value = 225 mL

   Answer: _____

4. Experimental Value = 22.2 L
   Accepted Value = 22.4 L

   Answer: _____

5. Experimental Value = 125.2 mg
   Accepted Value = 124.8 mg

   Answer: _____