Name _____ Date _____ Section _____

Chem Activity 02-11 Scientific Notation Review - Addison Wesley Reteach 2.3

Scientific notation is used in many fields of science in order to make very large or small numbers easier to use. In scientific notation, a number is written as the product of two numbers; a coefficient and a power of ten to indicate the location of the decimal point. The first number, represented by M, must be one or greater and less than ten. Units are placed at the end of the number.

$M \times 10^{exponent}$ measurement unit 3.596×10^{15} grams

In scientific notation when the coefficient is multiplied by a positive power of 10, the decimal point of the original number was moved to the left. The exponent of 10 indicates the number of places that the decimal was moved. For example:

1.8×10^{3} meters = 1 800 meters
1.8×10^{6} meters = 1 800 000 meters

In scientific notation when the coefficient is multiplied by a negative power of 10, the decimal point of the original number was moved to the right. For example:

2.33×10^{-3} Liters = 0.00233 Liters
2.33×10^{-7} Liters = 0.000 000 233 Liters

To multiply numbers written in scientific notation, multiply the coefficients and add the exponents. To divide numbers written in scientific notation, divide the coefficients and subtract the exponent in the denominator (bottom) from the exponent in the numerator (top). The answer is then adjusted to standard scientific notation. These rules can be stated algebraically:

$\underline{M \times 10^{a}} \mid \underline{N \times 10^{b}} = MN \times 10^{a+b}$ and $\dfrac{M \times 10^{a}}{N \times 10^{b}} = \dfrac{M}{N} \times 10^{a-b}$

For example:

$\underline{1.20 \times 10^{6} \text{ meters}} \mid \underline{3.30 \times 10^{8} \text{ meters}} = \underline{(1.20 \times 3.30)} \mid \underline{(10^{6} \times 10^{8})}$ meters

$= 3.96 \times 10^{14}$ meters^2

$\dfrac{8.40 \times 10^{6} \text{ g}}{2.10 \times 10^{-3} \text{ mL}} = (4.00 \times 10^{6-(-3)}) \dfrac{\text{g}}{\text{mL}} = 4.00 \times 10^{9} \dfrac{\text{g}}{\text{mL}}$

When adding or subtracting numbers in scientific notation, the exponents must be changed to the same power and the decimal points adjusted as needed. The final solution is then rewritten in standard scientific notation.

For example:

Addition:

5.23×10^{3} g + 3.71×10^{4} g = 0.523×10^{4} g + 3.71×10^{4} g = 4.23×10^{4} g

0.523×10^{4} g
+ $\underline{3.71 \times 10^{4} \text{ g}}$
4.233×10^{4} g

significant digits 4.23×10^{4} g

Subtraction:

6.88×10^3 mL - 3.22×10^5 mL = 0.688×10^5 mL - 3.22×10^5 mL

$= -3.1512 \times 10^5$ mL

significant digits $= -3.15 \times 10^5$ mL

0.688×10^5 mL

$- 3.22 \times 10^5$ mL

-3.15×10^5 mL

Practice Problems

1. Express the following numbers in scientific notation.
   a. 0.01036 g
   b. 1 000 396 g
   c. 1534.13 g
   d. 0.3235 g
   e. 0.000 550 g
   f. 10 030.010 g
   g. 0.56 g
   h. 13 g
   i. 15 000 g

2. Change the following numbers from scientific notation expression into conventional numbers.
   a. 1.22×10^{-2} mL
   b. 154.6×10^4 mL
   c. 0.003×10^3 mL
   d. 3.0×10^3 mL
   e. 25.0×10^{-6} mL
   f. 1.00×10^{-3} mL
   g. 17.5×10^{-4} mL
   h. 274.0×10^5 mL
   i. 1.7×10^4 mL

3. Solve the following problems and express the answers in scientific notation. Round your answers to the correct number of significant digits.

   a. $\dfrac{7.0 \times 10^{-13}\ \text{m}}{3.0 \times 10^7\ \text{m}} =$

   b. $1.23 \times 10^7\ \text{m} + 1.54 \times 10^5\ \text{m} =$

   c. $3.21 \times 10^{-1}\ \text{m} - 5.84 \times 10^{-3}\ \text{m} =$

   d. $\dfrac{0.033\ \text{m}}{2.20 \times 10^{-3}\ \text{m}} =$

   e. $\dfrac{4.50 \times 10^3\ \text{m}}{2.10 \times 10^6\ \text{s}} \div \dfrac{2.10 \times 10^2\ \text{m}}{1.50 \times 10^2\ \text{s}} =$