Unit 1: Nature of Chemistry
Content Outline: Math – The Language of Science (1.4) – Part 2

I. **Scientific Notation**
   A. This is essentially a way of writing numbers with large amounts of digits in a *condensed* form.
   B. Only significant figures are written when using Scientific Notation.
   C. It is *also based on the powers of 10*; but as exponents.
      1. **Exponents** are whole numbers written in *superscript* to represent a specific *number of places* the decimal point has moved.
         a. If the exponent is a *positive whole number*, the decimal point has been moved to the *left. This would be a larger than 1 number.*
         b. If the exponent is a *negative whole number*, the decimal point has been moved to the *right. This would be a smaller than 1 number.*
   D. Numbers written in scientific notation have a basic format:

      $M.N \times 10^{Z}$; M = First Significant digit in the number (always followed by the decimal point)
      N = Second Significant digit in the number
      Z = a whole number representing the *number of places* the decimal point has moved.

      For example: $1{,}000{,}000.0\ g = 1.0 \times 10^{6}\ g$
      $250.0\ L = 2.5 \times 10^{2}\ L$
      $0.000465\ m = 4.65 \times 10^{-4}\ m$

   E. *Addition* and *subtraction* using Scientific Notation:
      1. These mathematical *operations* can only be performed if they possess the *same exponent value.* For example:

         $2.4 \times 10^{6} + 5.3 \times 10^{6} = 7.7 \times 10^{6}$ OR $5.3 \times 10^{6} - 2.4 \times 10^{6} = 2.9 \times 10^{6}$

         a. If they do not have the same exponent, then one of the numbers will need to be *converted* so that they do match.

            $2.4 \times 10^{5} + 3.1 \times 10^{3} = 2.4 \times 10^{5} + 0.031 \times 10^{5} = 2.431 \times 10^{5}$

            OR

            $2.4 \times 10^{5} + 3.1 \times 10^{3} = 240.0 \times 10^{3} + 3.1 \times 10^{3} = 243.1 \times 10^{3}$

   F. *Multiplication* using Scientific Notation:
      1. The significant digits, of each number, are *multiplied first.*
      2. Then the *exponents are added together.*
         For example:

         $(2.4 \times 10^{5}) \times (3.6 \times 10^{3}) = 8.64 \times 10^{8}$

   G. *Division* using Scientific Notation:
      1. The significant digits are *divided first.*
      2. Then the *exponents are subtracted.*
         For example:
         $\frac{2.45 \times 10^{23}}{5.65 \times 10^{12}} = 4.3 \times 10^{10}$

         Step one: 2.45 /5.65 = 0.433 (round to 0.43)
         Step two: 23 – 12 = 11
         Step three: Move the decimal to the right to turn 0.43 into 4.3

Step four: Since you had to move the decimal to the right, you need to correct your exponent number to reflect that → 11 becomes 10

*If you move the decimal to the *right*; then *subtract* that number of moves to the exponent.

* If you move the decimal to the *left*; the *add* that number of moves to the exponent