## **ChemQuest 1: Numbers in Chemistry**

#### Information: Scientific Notation

“**Scientific notation**” is used to make very large or very small numbers easier to handle. For example the number 45,000,000,000,000,000 can be written as “4.5 x 1016 ”. The “16” tells you that there are sixteen decimal places between the right side of the four and the end of the number.

Another example: 2.641 x 1012 = 2,641,000,000,000 🡪 the “12” tells you that there are 12 decimal places between the right side of the 2 and the end of the number.

Very small numbers are written with negative exponents. For example, 0.00000000000000378 can be written as 3.78 x 10-15. The “-15” tells you that there are 15 decimal places between the right side of the 3 and the end of the number.

Another example: 7.45 x 10-8 = 0.0000000745 🡪 the “-8” tells you that there are 8 decimal places between the right side of the 7 and the end of the number.

In both very large and very small numbers, the exponent tells you how many decimal points are between the right side of the first digit and the end of the number. If the exponent is positive, the decimal places are to the right of the number. If the exponent is negative, the decimal places are to the left of the number.

#### Critical Thinking Questions

1. Two of the following six numbers are written incorrectly. Circle the two that are incorrect.

a) 3.57 x 10-8 b) 4.23 x 10-2 c) 75.3 x 102 d) 2.92 x 109 e) 0.000354 x 104 f) 9.1 x 104

What do you think is wrong about the two numbers you circled?

1. Write the following numbers in scientific notation:

a) 25,310,000,000,000,000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b) 0.000000003018 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the following scientific numbers in regular notation:

a) 8.41 x 10-7 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b) 3.215 x 108 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Information**: Multiplying and Dividing Using Scientific Notation

When you multiply two numbers in scientific notation, you must add their exponents. Here are two examples. Make sure you understand each step:

(4.5x1012) x (3.2x1036) = (4.5)(3.2) x 1012+36 = 14.4x1048 🡪 1.44x1049

 (5.9x109) x (6.3x10-5) = (5.9)(6.3) x 109+(-5) = 37.17x104 🡪 3.717x105

When you divide two numbers, you must subtract denominator’s exponent from the numerator’s exponent. Here are two examples. Make sure you understand each step:



**Critical Thinking Questions**

1. Solve the following problems.
2. (4.6x1034)(7.9x10-21) =
3. (1.24x1012)(3.31x1020) =
4. Solve the following problems.

a) 

 b) 

**Information**: Adding and Subtracting Using Scientific Notation

Whenever you add or subtract two numbers in scientific notation, you must make sure that they have the same exponents. Your answer will them have the same exponent as the numbers you add or subtract. Here are some examples. Make sure you understand each step:

4.2x106 + 3.1x105 🡪 make exponents the same, either a 5 or 6 🡪 42x105 + 3.1x105 = 45.1x105 = 4.51x106

7.3x10-7 - 2.0x10-8 🡪 make exponents the same, either -7 or -8 🡪 73x10-8 – 2.0x10-8 = 71x10-8 = 7.1x10-7