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 larger than zero whereas negative n would indicate a number smaller than zero.

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 = _____

Scientific Notation

A. Do the worksheet on scientific notation on the back of this sheet.

B. Read Section 2.2 (Tro) and do these problems for practice: #3, 27-35 (odd).

C. Scientific Notation is usually written in a certain form. For instance, in this number

$$6.022 \times 10^{23} \text{ molecules}$$

the 6.022 is called a coefficient (or "decimal", as Tro says). This coefficient is usually between 1 and 10. Sometimes, the coefficient is not between 1 and 10.

$$450 \times 10^{-9} \text{ nm}$$

In the number above, 450 is not between 1 and 10. To put it into the "standard" scientific notation, the decimal is moved from 450**.** to 4**.**50 (or 4.5) to make the number between 1 and 10. This is in effect dividing 450 by 100 (to get 4.5). However, we cannot simply write 4.5×10^{-9} nm (this is not the same as the number above—write it out in "decimal" form and check for yourself). To compensate for the ***division*** by 100, you must ***multiply*** the exponent part (10^{-9}) by 100. 100 is 2 powers of 10 (it is 10×10). Therefore, you can add 2 powers of 10 to negative 9 powers of ten ($10^{(-9+2)}=10^{-7}$). Therefore,

$$450 \times 10^{-9} \text{ nm} = 4.5 \times 10^{-7} \text{ nm}$$

(both are in scientific notation, but the latter is in "standard" scientific notation).

1. Express the two numbers below in decimal form. Verify that they are the same.

450×10^{-9} _____

4.5×10^{-7} _____

2. Practice converting these to "standard" scientific notation:

39×10^{-1} _____

3859×10^{7} _____

0.01×10^{2} _____

423×10^{1} _____

0.000078×10^{-9} _____

53.498×10^{-34} _____

$10000000 \times 10^{-100}$ _____