One Page Lesson: "Rules" for assessing the Significant Figures in a provided measurement

1. **All non-zero digits are significant.**

   12.1231 has *six* significant figures.

2. **All zeros *between* non-zero digits are significant.**

   1003.003 has *seven* significant figures.

3. **For numbers less than 1, the leading zeroes are *NOT* significant – they're simply holding the decimal place.**

   0.007 has *one* significant figure, and 0.00062014 has *five* significant figures.

   The number of significant figures is far more evident when these values are written in scientific notation:

   7×10^{-3} has *one* significant figure, and 6.2014×10^{-4} has *five* significant figures.

4. **Trailing zeros to the *RIGHT* of the decimal point *ARE* significant.**
   (However, for a large number with trailing zeroes, none of which are past the decimal point, the number of significant figures *cannot be determined.* But his ambiguity is easily resolved by expressing the number in scientific notation.)

   0.027600 has *five* significant figures.

   6430.00 has *six* significant figures.

   73500 It's unclear which digit contains the uncertainty; this value could have three, four, or five significant figures.

   For this last value, scientific notation *must* be used to indicate the digit that contains the uncertainty:

   7.3500×10^4 has *five* significant figures, and the uncertainty is in the "ones" place.

   7.350×10^4 has *four* significant figures, and the uncertainty is in the "tens" place.

   7.35×10^4 has *three* significant figures, and the uncertainty is in the "hundreds" place.

5. ***EXACT* Numbers (*Counted Numbers* or *Definitions of Units*):**

   Some numbers are *EXACT*; thus they can be treated as if they have an infinite number of significant figures. When used in a calculation, *exact numbers do NOT affect the number of significant figures in the final result.*

   Counted numbers are *NOT* measurements; they are *exact*. If you count three drops of water, *there is no uncertainty.* The value "3" is *exact*.

   Definitions of units (expressions of Unit Relationships) are also *exact*; they contain *no uncertainty.* 1 foot is *exactly* equal to 12 inches. 1 meter is equal to *exactly* 1000 millimeters. 1 hour contains *exactly* 60 seconds.

A Note on Scientific Notation: Sometimes measured values are so large or so small that it's difficult to express them without using scientific notation. For example, the speed of light expressed in conventional notation would be 300,000,000 meters/sec. As indicated by Rule #4 above, the number of significant figures in this value is ambiguous. However, in scientific notation this value is more clearly expressed as: 3.00×10^8 m/s (*three* significant figures).

Remember that in scientific notation, a value is written with *only **one** digit to the left of the decimal,* followed by the *appropriate number of significant figures to the right of the decimal.* The value is then multiplied by power of 10 that indicates the order of magnitude.

For example, the value 3021.1 is equal to $3.0211 \times 10 \times 10 \times 10$; thus in scientific notation, the value is written as 3.0211×10^3 (*five* significant figures). You should remember that in expressing a *large* value (greater than 1), a *positive* exponent is used.

To express a *small* value (less than 1), a *negative* exponent must be used. Thus, 0.000000454 is written as 4.54×10^{-7} (*three* significant figures).

Note that the *number of significant figures is the **same*** whether the value is written in conventional or in scientific notation.