Name: _____

Date: _____   Per.: ____

Calculating With Sig Figs And Scientific Notation

We all need to be able to use significant figures (sig figs) and scientific notation (sci not) in our calculations in physics and chemistry. The first thing you need to do is to put your calculator in the "SCI" mode. If you can't do that ask someone for help-this mode is necessary for you to get your answers in the correct form. This can normally be accomplished by pressing 2nd followed by the number "5" key, which shows "SCI" above the key. This turns out to be 3rd/"6" in the TI36, SCI mode for most Casio calculators is most often mode 8. Not all calculators will perform in exactly the same way as outlined in this paper. The Texas Instruments 30X series will perform, as described, and all for less than $12.

When you enter expanded numbers, numbers not written in sci not, into your calculator using the "SCI" mode, your calculator will convert these into scientific notation when you push the "=" button. This works for almost every number. What happens in this mode is your calculator converts the number into scientific notation with the correct number of sig figs shown. There is a very important but simple rule: scientific notation is always written in the correct number of sig figs. With a single exception, your TI 30 calculator will always do this for you. The single exception is decimal fractions that end with zero(s). Your calculator will truncate, cut off, these ending zeros. Thus, the your calculator will never have the correct answer for in scientific notation and thus, sig figs for decimal fractions that end with a zero(s). You need to remember to add these zeros back into your scientific notation and count them as sig figs.

CALCULATOR: Mode "SCI" $1234 = 1.234 \times 10^3$ 4 sig figs (1.234)

$0.123 = 1.23 \times 10^{-1}$ 3 sig figs (1.23)

$0.00123 = 1.23 \times 10^{-3}$ 3 sig figs (1.23)

$0.01230 = 1.23 \times 10^{-2}$ 4 sig figs (1.230)*

*The last example shows where the calculator does, as always, give you the answer in scientific notation but not the sig figs because it doesn't know how to handle a decimal fraction ending with a zero.

Rules for Significant Figures

1. **Nonzero digits are always significant**

2. **Zeros between two other significant figures are always significant**

3. **Zeros used solely for spacing the decimal point are <u>not</u> significant**
   Example: 30 meters has only 1 significant figure (the 3)
                0.03 meters has only 1 significant figure (the 3)

4. **All final zeros used after the decimal point are significant.**
   Example: 200.0 cm has 4 significant figures
                200 meters has only 1 significant figure (the 2)

5. **If the number to be rounded is an <u>exact five</u>, then round so that the number preceding the exact five is even.**
        If the number is odd round up and if the number is even round down.

   Example: Round 2.45 cm to two significant figures.
                Answer = 2.4 cm because of the exact five rule

Write the following numbers in scientific notation and indicate the number of sig figs.

17,891   _____ (   )   2306   _____ (   )

5100   _____ (   )   0.00589   _____ (   )

121.0   _____ (   )   0.00120   _____ (   )

Numbers written in scientific notation (1.234×10^2) are written into your calculator in the following manner. First, enter the number as shown (1.234). Second, push the "EE" or "EXP" key and enter the exponent (2). Do not enter x 10!!! The calculator already knows this part because everything we do in counting is based on tens. If you need to change the sign on your exponent to a negative, your calculator has a +/- key that will do this. You can push this key just before or just after, you enter the exponent.

Operations Using Significant Figures

1. Be sure to use the expanded number for all calculations. Only round off the **final answer**.

2. For numbers in scientific notation, display only significant figures.

3. For addition and subtraction, round to the **decimal place** of the **least precise measurement**.

4. For multiplication and division, round the answer so that it has the **same number** of significant figures as the **least precise measurement**.

5. Always state the final answer in significant figures and circle or box-in the answer.

Solve the following problems, write your answers in scientific notation and sig figs:

$375 \times 0.0217 =$ _____ $375 \div 0.0217 =$ _____

$(3.641 \times 10^2)(1.7832 \times 10^4) =$ _____ $(4.56 \times 10^{-8}) \div (1.892 \times 10^{-8}) =$ _____

$\dfrac{(2.000 \times 10^4)(1.380 \times 10^7)}{(1.100 \times 10^3)(8.640 \times 10^5)} =$ _____ $\dfrac{(1.65 \times 10^{23})(2.784 \times 10^{16})}{(5.781 \times 10^{-10})(8.63 \times 10^{-9})} =$ _____

$\dfrac{(125)(3481)(14,564)}{(241)(4199)(5566)} =$ _____ $\dfrac{(9.985 \times 10^{-23})(3.4563 \times 10^{15})}{(6.441 \times 10^{15})(5.783 \times 10^{21})} =$ _____

You ran 25 meters in 3.16 s. What was your average speed in m/s? _____

You have a box that is 10 m x 8 m x 18 m. What is the volume of the box in m^3? _____

You measure a line segment at 1.230 m. What is the length of this segment in centimeters? ___

You weigh 1.3×10^2 Newtons (N) and your friend 8.4×10^1 N. What is the combined weight? _____

You have a box that is 10 m x 8 m x 18 m. What is the volume of the box in cm^3? _____

You ran 25 meters in 3.16 s. What is your average speed in km/h? _____

You lift a 2.3×10^2 N box to a height 0f 0.13 m. How much work in N m did you do? _____