**Significant Figures, Rounding and Scientific Notation**  
**Worksheet**

**Significant Figures:**
- Use significant figures to deal with uncertainty in numbers and calculations.

**Rules:**
(a) All non-zero integers are considered significant. (5.56 ----> 3 sig figs)
(b) Zero integers depend on the position within the number:
   (1) **Leading Zero:** Not significant (only positions the decimal point). (0.0041 ----> 2 sf)
   (2) **Captive Zero:** Significant (14.301 ----> 5 sf).
   (3) **Trailing Zero:** Significant only if decimal is present.
      (250.40 ----> 5 sf, 3750 ----> 3 sf)
(c) Exact Numbers: contain unlimited significant figures by definition.
   (i.e.: 3 vipers, 21 students, etc.)

**Rounding**
- Need to round the final answer in calculations to reflect the proper # of sig figs.

**Rules:** If the number following the last significant digit allowed in the answer is:
   (1) less than 5 ----> keep the last sf digit the same and do not round up.
   (2) greater than 5 ----> round the last sf digit up.
   (3) exactly equal to 5 ----> make the last sf digit even (leave alone or round up)

**Calculations using Significant Figures**
* The rules for carrying uncertainty through mathematical calculations involve significant figures and depend on the type of calculation being performed:

**Multiplication or Division:**
- The final answer is limited to the same # of sig figs as the value with the fewest # of sig figs used in the calculation.

**Addition, Subtraction and Averages:**
- The final answer is limited to the same # of decimal places as the value with the fewest # of decimal places used in the calculation.
- When doing calculations, it's most accurate to round only the final answer (but can be trickier to follow sf's).
  It is always a good idea to indicate more than the correct number of significant figures in an intermediate result, before you round off the number. To do so, you draw a vertical dashed line separating the significant digits from the extra non-significant digits.

  i.e.: To represent 3 sig figs, 1.06¦77 g

**Scientific Notation**
- Used for ease in dealing with very large or small numbers. Converts it into a number between 1 and 10 times a power of ten:  
  i.e.: value x 10^n
  * All non-significant digits are removed from the value when converted to scientific notation

  57,000,000,000,000 = 5.7 x 10,000,000,000,000 = 5.7 x 10^{13}
  
  0.000035 = 3.5 x 10^{-5} 
  5000 = 5 x 10^3 
- If decimal is moved to the left ----> + exponent of 10
- If decimal is moved to the right ----> – exponent of 10
Problems:

1) Determine the number of significant figures in the following values:
   a) 140.74 mL -------->  
   f) 4 aardvarks -------->
   b) 0.0041 g -------->  
   g) 3.70 x 10^{14} pg -------->
   c) 31.00 mm -------->  
   h) 1.05 x 10^{12} -------->
   d) 1300 nm -------->  
   i) 7.0400 x 10^{3} m -------->
   e) 847.040 lb -------->  
   j) 2495 miles -------->

2) Round the following values to 3 significant figures:
   a) 3.76411 -------->  
   f) 0.0411984 -------->
   b) 3.76811 -------->  
   g) 150.6142 -------->
   c) 3.76511 -------->  
   h) 0.013877 -------->
   d) 11.048176 -------->  
   i) 4.88223 x 10^{9} -------->
   e) 8.75510 -------->  
   j) 2.0097 x 10^{-12} -------->

3) Perform the following unitless calculations and round the final answer to the proper number of sig figs:
   a) 18.7644 − 3.472 + 0.4101 =  
   f) 0.87 + 4.061 + 10.4 =
   b) 17.441 ÷ 3 =  
   g) 16 x 841.4 ÷ 16.300 =
   c) 14.044 + 8.11 + 3.4 =  
   h) 21.01 x 2.0 =
   d) 3.41 − 0.086652 =
   e) Calculate the average of the following set of values: 18.4, 12.99, 13.772 and 9.704

4) Convert the following values into scientific notation, or if given in scientific notation, convert back to a regular number:
   a) 47,000 -------->  
   b) 0.0008 -------->  
   c) 675,000,000 -------->
   d) 157,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 -------->  
   e) 0.0000003407 -------->
   d) 7.66 x 10^{-2} -------->  
   e) 7.8 x 10^{5} -------->  
   h) 4.75 x 10^{-4} -------->
   f) 6 x 10^{-3} -------->  
   g) 9 x 10^{8} -------->
   j) 6.022 x 10^{23} (a mole) -------->