Significant Figures, Rounding and Temperature Conversion

Uncertainty in Measurement
- Depends on the precision of the measuring device
  - For example a measurement of 1.682956 grams is a more precise measurement than 1.7 grams
- Reliability in Measurements
  - Accuracy – the closeness to the actual scientific value
  - Precision – getting repeated measurements in repeated trials
- Types of Errors
  - Random: error in measurement has equal probability of being high or low
  - Systematic: errors all occur in the same direction

General Rules for determining if a Number is Significant
1. Draw a box around all nonzero digits beginning with the leftmost nonzero digit and ending with the rightmost nonzero digit in the number.
2. If a decimal is present, draw a box around any trailing zeros
3. Consider any all boxed digits significant.

Example 1: 20406: 5 significant digits   Example 2: 0.0045: 2 significant digits
Example 3: 4000:   1 significant digit   Example 4: 4000. : 4 significant digits
Example 5: 0.002500: 4 significant digits   Example 6: 3.00: 3 significant digits

Addition or Subtraction using Significant Figures:
The answer can only be as precise as your least precise measurement.

     Example: 2.87   (precise 2 places to the right of the decimal)
                     3.5673   (precise 4 places to the right of the decimal)
             + 301.2   (precise 1 place to the right of the decimal)
               307.6373--> rounds off to 307.6   (our answer can only have one digit after the decimal)

Multiplication or Division using Significant Figures:
The answer can have no more significant figures that there are in the measurement with the fewest number of significant figures.

     Example: 12.257   (5 total significant figures)
               x   1.162   (4 total significant figures)
            14.2426 --> rounds off to 14.24   (4 total significant figures)

As a rule, when performing a series of calculations, wait until the very end to round off to the proper number of significant figures instead of rounding off each intermediate result.

General Rules for Rounding Numbers in Chemistry:
Rule 1. If the digit following the last significant figure is less than 5, the last significant figure remains unchanged. The digits after the last significant figure are dropped.

     <u>Example</u>: Round 23.437 to three significant figures.
     <u>Answer</u>: 23.4
     <u>Explanation</u>: 4 is the last significant figure. The next number is 3. 3 is less than 5. Thus, 4 remains unchanged and 37 is dropped.

Rule 2. If the digit following the last significant figure is 5 or greater, then 1 is added to the last significant figure. The digits after the last significant figure are dropped.

     <u>Example</u>: Round 5.383 to two significant figures.
     <u>Answer</u>: 5.4
     <u>Explanation</u>: 3 is the last significant figure. The next number is 8. 8 is greater than 5. Thus, 1 is added to 3 making it 4. The 83 is dropped.

Rule 3: When rounding numbers it is of absolute importance to maintain the magnitude of a number. This is done by adding zeros to the end of a number.

   <u>Example</u>: Round 86753.09 to two significant figures.

   <u>Answer</u>: 87000

   <u>Explanation</u>: Zeros have to be added to maintain the magnitude of the number. If you round the number to 87 you
      will have the correct number of significant figures but it will not be of the same magnitude. Your
      rounded number should always be approximately the same as the original number.

Temperature Conversion:

In Chemistry temperature is only measured in Celsius and Kelvin.

C: Celsius or Centigrade   K: Kelvin (named for Lord Kelvin, aka William Thomson)

K = °C + 273   **°C = K – 273**

°C =5/9(°F – 32)   **°F = 9/5(°C) + 32**   **You will not need to do conversions using °F on the test.**

Answer each of the following questions.

Part I: Determine the number of significant figures for the following:

1. 345	5. 39.5	9. 139.0	13. 1.95×10^{-8}
2. 0.93	6. 0.09305	10. 1.008	14. 89050
3. 340	7. 38.05	11. 10001	15. 3.9×10^{3}
4. 0.097	8. 0.00760	12. 160.	16. 3900.

Part II: Express the following calculations rounded to the proper number of significant figures.

1. 2.08 + 3.312 + 1.0032	7. 129/29.2
2. 3.745 + 9.1 + 15.0234	8. 30.8/45.0
3. 0.0097 + 5.623 + 3.33	9. 0.098/45.4
4. 17.65 - 4.337	10. 3.45/0.78
5. 1106.73 - 323.74	11. 1.551 x 3.260 x 4.9001
6. 15.24 - 2.2 - 3.338	12. 3.02 x 500. x 0.0023

Part III: Round each of the following numbers to requested number of significant figures:

1. 395 (1 significant figure)	6. 139.045 (5 significant figures)
2. 2.0098 (3 significant figures)	7. 78765.980 (4 significant figures)
3. 556.6552 (2 significant figures)	8. 1.999 (3 significant figures)
4. 374736.87 (3 significant figures)	9. 0.0098754 (3 significant figures)
5. 750 (1 significant figure)	10. 8.855 (3 significant figures)

Part IV: Convert the following temperatures.

1. 302°C to Kelvin	4. 177°C to Kelvin
2. 185 K to Celsius	5. 250 K to Celsius
3. 0°C to Kelvin	6. 0 K to Celsius

After completing this assignment you should take the following quizzes at: www.sartep.com/chem.

o convert to celsius quiz	o significant figures calculation quiz
o convert to fahrenheit quiz	o significant figures multiply divide quiz
o convert to kelvin quiz	o significant figures quiz
o hottest temperature quiz	o significant figures quiz 2
o rounding quiz 1	o temperature conversion quiz
o significant figures add subtract quiz	