HONORS CHEMISTRY: SIGNIFICANT FIGURES

Background:

When reading the scale on a piece of laboratory equipment such a as a measuring cylinder or a burette, there is always a degree of uncertainty in the recorded measurement. The reading will often fall between two divisions on the scale and an estimate must be made in order to record the final digit. The estimated final digit is said to be uncertain and is reflected in the recording of the numbers by using a ± (just like in the measurement lab we completed!). All those digits that can be recorded with certainty are said to be certain. The certain and the uncertain numbers taken together are called **significant figures.**

Fill in the blank:

**The last digit of a measurement expression is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. That is because the last digit is usually an approximation.**

**Significant figures in a measurement expression comprise all digits that are known with \_\_\_\_\_\_\_\_\_\_\_\_, plus the first digit that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Rules for determining the number of significant figures present in a number:**

1. Any non-zero integers are always counted as significant figures.
2. Leading zeros are those that precede all of the non-zero digits and are never counted as significant figures.

Examples:

1. 43.8 L
2. 4567.98 g
3. 0.00876 kg
4. 0.0000876 g
5. Captive zeros are those that fall between non-zero digits and are always counted as significant figures.

Examples:

1. 43.08 L
2. 5678.09807 g
3. 3,400,008 mL
4. 0.080906 L
5. Trailing zeros are those at the end of a number and are only significant if the number is written with a decimal point.

Examples:

1. 345,000 g
2. 0.00090 mg
3. 987.00 cm
4. 90.0000 m
5. Exact numbers have an unlimited number of significant figures. Exact numbers are those which are as a result of counting (for example, 3 apples) or by definition (for example 1 kg = 2.205 lb.).
6. In scientific notation the 10x part of the number is never counted as significant.

\*\* The bar notation is used to “make” zeros significant by placing a bar over the number. Everything under the bar and to the left is counted as significant.

Example:

345,000 cm = 3 significant figures but 345,000 cm = 4 significant figures with the bar notation.

**Why is this “sig fig” stuff important?**

Calculators will often present answers to calculations with many more figures than the significant ones. As a result many of the figures shown are meaningless, and the answer, before it is presented, needs to be rounded off.

**Determining the correct number of significant figures to be shown as the result of a calculation:**

1. When multiplying or dividing – limit the answer to the fewest number of ***significant figures*** that appear in the original data.
2. When adding or subtracting – limit the answer to the fewest number of ***decimal places*** that appear in the original data.

DON’T RECORD A GREATER DEGREE OF SIGNIFICANT FIGURES OR DECIMAL PLACES IN THE CALCULATED ANSWER THAN THE WEAKEST DATA WILL ALLOW!!!

In a series of calculation always leave the rounding off to the end, i.e. leave all numbers on the calculator in the intermediate steps. \* Exception to this rule – if you are mixing types of calculation, you must round to the correct number of significant figures between types of calculations. For example, if your calculation requires you to multiply and\or divide several numbers and then to use the answer in an addition or subtraction, you must find the correct number of significant figures after each calculation because you are mixing types of calculations.

When rounding off, use the simple rule that if the digit directly to the right of the final significant figure is less than 5 then the preceding digit stays the same, if it is equal to or greater than 5 then the preceding digit should be increased by one.