Significant Digits

In an attempt to get away from the mathematical burden of uncertainties, scientists have gone to the use of *established rules for significant digits* that have greatly simplified calculations.

1. Significant numbers are always measurements and thus should always be accompanied by the measurement's unit. For simplicity, units are not included in the following examples.

2. Any numbers (that are measurements) other than zero are significant. (Many times, the zeros are also significant as you will see below.) Thus **123.45** contain five significant digits.

3. Any zeros between numbers are significant, thus **1002.05** contains six significant digits.

4. Unless told differently, all zeros to the left of an understood decimal point (a decimal that is not printed) but to the right of the last number are not significant. The number **921000** contains three significant digits but the number **921000.** has six significant digits.

5. Any zeros to the left of a number but to the right of a decimal point are not significant. These zeros are present merely to indicate the presence of a decimal point (they are used as place holders), (these zeros are not part of the measurement). The number **0.00123** has three significant digits. The reason that these zeros are not significant is that the measurement **0.00123 g** is equal in magnitude to the measurement **1.23 mg**. **1.23** has three significant digits, thus **0.0123** must also have three significant digits.

6. Any zeros to the right of a number and the right of a decimal point are significant. The value **0.012300** and **25.000** both contain five significant digits. The reason for this is that significant figures indicate to what place a measurement is made. Thus, the measurement 25.0 grams tells us that the measurement was made to the tenths place. (The accuracy of the scale is to the tenths place.)

Significant figures in derived quantities (Calculations)

In all calculations, the answer must be governed by the least significant figure employed.

ADDITION AND SUBTRACTION: The answer should be rounded off so as to contain the same number of decimal places as the number with the *least number of decimal places*. In other words, *an answer can be only as accurate as the number with the least accuracy*.

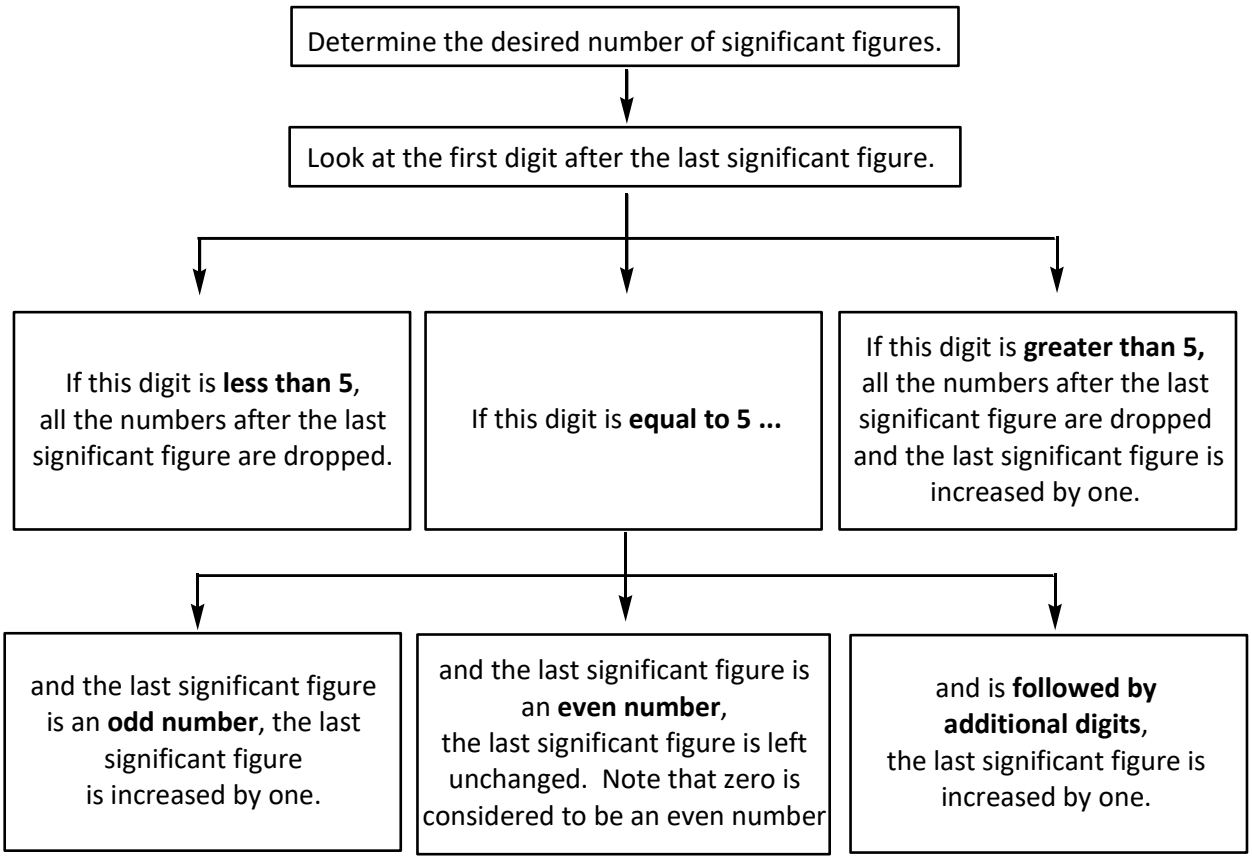
e.g. **11.31 + 33.264 + 4.1 = 48.674** **rounded off to 48.7**

MULTIPLICATION AND DIVISION: The answer should be rounded off to contain the same number of digits as found in the **LEAST** accurate of the values.

e.g. **5.282 x 3.42 = 18.06444** **rounded off to 18.1**

Rounding Off

As can be seen from the preceding calculations, it is usually necessary to round off the final answer so that it has the proper number of significant figures. To round off a number, follow the procedure below.



The rounding off process is exemplified in the table below.

Number	Desired Number of Significant Figures	Rounded Off Number
3.732473	5	3.7325
1.483	3	1.48
8765	3	8760
8775	3	8780
11.637	4	11.64
1.6753	3	1.68