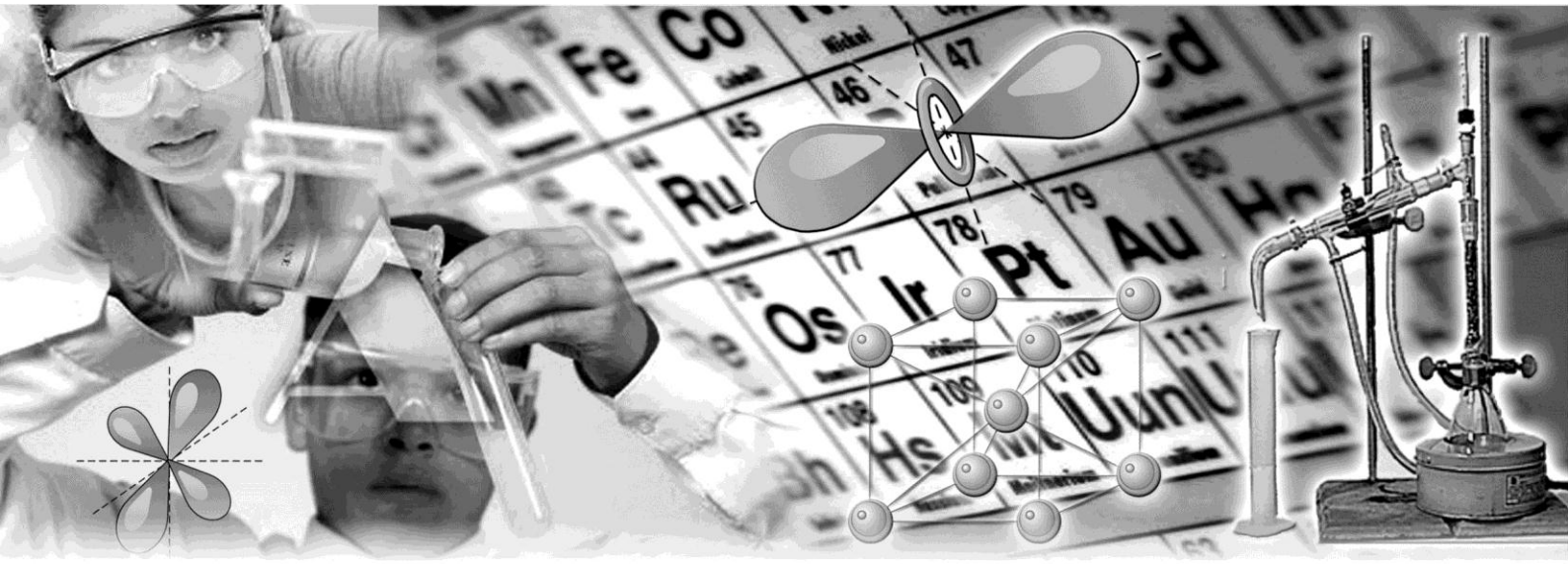

Chapter 1

Chemical Arithmetic

Chemistry is basically an experimental science. In it we study physical and chemical properties of substance and measure it upto possibility. The results of measurement can we reported in two steps,

(a) Arithmetic number, (b) Unit of measurement.

Every experimental measurement vary slightly from one another and involves some error or uncertainty depending upon the skill of person making the measurements and measuring instrument. The closeness of the set of values obtained from identical measurement called ***precision*** and a related term, refers to the closeness of a single measurement to its true value called ***accuracy***.

Significant figures

In the measured value of a physical quantity, the digits about the correctness of which we are sure plus the last digit which is doubtful are called the significant figures. Number of significant figures in a physical quantity depends upon the least count of the instrument used for its measurement.

(1) **Common rules for counting significant figures** Following are some of the common rules for counting significant figures in a given expression

Rule 1. All non zero digits are significant.

Example : $x = 1234$ has four significant figures. Again $x = 189$ has only three significant figures.

Rule 2. All zeros occurring between two non zero digits are significant.

Example : $x = 1007$ has four significant figures. Again $x = 1.0809$ has five significant figures.

Rule 3. In a number less than one, all zeros to the right of decimal point and to the left of a non zero digit are not significant.

Example : $x = 0.0084$ has only two significant digits. Again, $x = 1.0084$ has five significant figures. This is on account of rule 2.

Rule 4. All zeros on the right of the last non zero digit in the decimal part are significant.

Example : $x = 0.00800$ has three significant figures 8, 0, 0. The zeros before 8 are not significant again 1.00 has three significant figures.

Rule 5. All zeros on the right of the non zero digit are not significant.

Example : $x = 1000$ has only one significant figure. Again $x = 378000$ has three significant figures.

Rule 6. All zeros on the right of the last non zero digit become significant, when they come from a measurement.

Example : Suppose distance between two stations is measured to be 0.800 *m*. It has four significant figures. The same distance can be expressed as 3.050 *km* or 3.050×10^5 *cm*. In all these expressions, number of significant figures continues to be four. Thus we conclude that change in the units of measurement of a quantity does not change the number of significant figures. By changing the position of the decimal point, the number of significant digits in the results does not change. Larger the number of significant figures obtained in a measurement, greater is the accuracy of the measurement. The reverse is also true.

(2) **Rounding off :** While rounding off measurements, we use the following rules by convention

Rule 1. If the digit to be dropped is less than 5, then the preceding digit is left unchanged.

Example : $x = 7.82$ is rounded off to 7.8, again $x = 3.94$ is rounded off to 3.9.

Rule 2. If the digit to be dropped is more than 5, then the preceding digit is raised by one.

Example : $x = 6.87$ is rounded off to 6.9, again $x = 12.78$ is rounded off to 12.8.

Rule 3. If the digit to be dropped is 5 followed by digits other than zero, then the preceding digit is raised by one.

Example : $x = 16.351$ is rounded off to 16.4, again $x = 6.758$ is rounded off to 6.8.

Rule 4. If digit to be dropped is 5 or 5 followed by zeros, then preceding digit is left unchanged, if it is even.

Example : $x = 3.250$ becomes 3.2 on rounding off, again $x = 12.650$ becomes 12.6 on rounding off.