

Introduction to Fundamental Concepts of Chemistry

Chemistry

Chemistry is the branch of science which deals with the properties, composition and structure of matter. The study of chemistry also includes the laws and principles related to the structure and inter-relations of elements and compound.

Chemistry has the task of investigating the materials of which our universe is made. Chemistry investigates chemical changes, conditions under which chemical changes occur. Chemistry also deals with the way in which similar changes can be brought about in laboratory and on a large scale in industries.

Chemistry is a very vast field. Chemistry is divided into a number of branches such as Organic chemistry, Inorganic chemistry, Physical chemistry, biochemistry, Applied chemistry, Nuclear chemistry etc. The four main branches we talk about are Organic, Inorganic, Physical, and Analytical.

Significant Figures

Significant figures are the reliable digits in a number or measurement which are known with certainty. Significant figures show the accuracy in measurements. We can understand the precision of a measurement if we know exactly the significant figures in the measurement. A measurement that contains more number of significant figures is more accurate than a measurement that contains less number of significant figures.

Measurements are reported using the digits we know for certain plus one more digit that is uncertain or the best estimate. It is all of these digits that are reported for a measurement and the determination of what is significant or not. Sometimes this will depend upon the instrument used to make the measurement.

For example: Radius of one bob is 3.3679 cm and that of another bob is 3.36 cm. In this situation the first measurement is the most accurate as it has more number of significant figures.

Rules Of Significant Figures

In order to determine significant figures in a number we must follow the following rules:

- (1) All the non-zero digits are significant figures.
For Example:
3.456 has four significant figures.
12.3456 has six significant figures.
0.34 has two significant figures.
- (2) Zeros between non-zero digits are significant.
For Example:
2306 has four significant figures.
20,0894 has six significant figures.
- (3) Zeros locating the position of decimal in numbers of magnitude less than one are not significant.
For Example:
0.2224 has only one significant figures.
0.0000034 has two significant figures.

(4) Final zeros to the right of the decimal point are significant.

For Example:

3.0000 has five significant figures.

1002.00 has six significant figures.

(5) Zeros that locate decimal point in numbers greater than one are not significant.

For Example:

30000 has only one significant figure.

120000 has two significant figures.

However, if a decimal point is used at the end of a number like these, then all numbers up to the decimal point become significant, so that "30000." has five significant figures, and "120000." has six.

Rules For Rounding Off Data

Rule # 1:

If the digit to be dropped is 5 or greater, then add "1" to the last digit to be retained and drop all digits farther to the right.

For example:

3.677 is rounded off to 3.68 if we need three significant figures in measurement.

3.677 is rounded off to 3.7 if we need two significant figures in measurement.

Rule # 2:

If the digit to be dropped is less than 5, then simply drop it without adding any number to the last digit.

For example:

6.632 is rounded off to 6.63 if we need three significant figures in measurement.

6.632 is rounded off to 6.6 if we need two significant figures in measurement.

Use of significant figures in addition and subtraction

In addition and subtraction we consider the significant figures on the right side of decimal point. This means that only as many digits are to be retained to the right side of decimal point as the number with fewest digits to the right of the decimal point.

For example:

$4.345 + 23.5 = 27.845$ (actual answer by using calculator)

Answer after rounding off: 27.8 (This is because 23.5 only has one digit to the right of the decimal point.)

Use of significant figures in multiplication and division

In multiplication and division, the number obtained after calculation of two or more numbers must have no more significant figure than that number used in multiplication or division.

For example:

$4.3458 \times 2.7 = 11.73366$ (actual answer by using calculator)

Answer after rounding off: 12 (because 2.7 has only two significant figures)