SIGNIFICANT DIGITS / SIGNIFICANT FIGURES

Accuracy – correct

Precision – consistent

The precision of any measurement depends upon the precision of the instrument used. The digits in an answer which imply more accuracy or precision than the measurements justify are not significant and should dropped so that those digits which remain truly imply the precision of the original measurements. The remaining digits are called significant digits or significant figures. Significant digits or significant figures consist of :

A QUANTITY contains both a number and a unit.

Measured numbers - used a device

Exact numbers - counted, definition, conversion (infinite sig figs)

Determining which zeros are significant -- because zeros must be written both as placeholders and as indicators of the precision of the measurement, we must learn how to distinguish between them. The following rules are used to determine the number of significant digits:

RULES FOR SIGNIFICANT FIGURES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Zeros to the right of all non-zero digits are only significant if a decimal point is shown.
4. For values written in scientific notation, the digits in the coefficient are significant.
5. In a common logarithm, there are as many digits after the decimal point as there are significant figures in the original number.

Leading? NO! Captive? YES! Trailing? Yes, if Decimal!

Rules for Rounding:

1. If the eliminated digit is less than 5, leave alone.
2. If the eliminated digit is 5 or greater, round up.

Determine the number of significant digits in each of the following:

1.	0.02	1	11.	142	3
2.	0.020	2	12.	0.073	2
3.	501	3	13.	1.071	4
4.	501.0	4	14.	10810	4
5.	5000	1	15.	5.00	3
6.	5000.	4	16.	55.320	5
7.	6051.00	6	17.	1.010	4
8.	0.0005	1	18.	154	3
9.	0.1020	4	19.	8710	3
10.	10001	5	20.	1.0004	5

Round each of the following to three significant digits.

1.	88.473	88.5	6.	69.95	70.0

2.	8505	8510	7.	0.000056794	0.0000568
3.	976450	976000	8.	67.048	67.0
4.	699.5	700.	9.	3.002	3.00
5.	123.98	124	10.	0.0300	0.0300
11.	0.00086321	0.000863	14.	90100	90100
12.	12.17	12.2	15.	54.009	54.0
13.	8040	8040			

SCIENTIFIC (EXPONENTIAL) NOTATION

Putting Ordinary Numbers into Scientific Notation:
Scientists (and those studying science) frequently must deal with numbers that are very large or very small.

Have you met Avogadro's number (6.02×10^{23})?

Or have you calculated the wavelength of red light (6.10×10^{-7} m)?

If those numbers weren't written the way they are, all of us who must deal with them would be spending much of our time just counting the zeros that separate the figures from the decimal point. To avoid that kind of time wasting, a method of writing very large and very small numbers was invented.

The rules for writing numbers in scientific notation are

1. The first figure is a number from 1 to less than 10.
2. The first figure is followed by a decimal point and then the rest of the figures.
3. Then multiply by the appropriate power of 10.

Write each of these numbers in scientific notation:

17 =	1.7×10^{1}	0.000000614 =	6.14×10^{-7}
3 =	3×10^{0}	0.0037004 =	3.7004×10^{-3}
5.000 =	5.000×10^{0}	0.00000038 =	3.8×10^{-7}
215 =	2.15×10^{2}	0.01010 =	1.010×10^{-2}
7,000,631 =	7.000631×10^{6}	0.00000000001 =	1×10^{-11}

Putting Scientific Notation into Ordinary Numbers:
If the number ends with a positive exponent, move the decimal point to the right. If the number ends with a negative exponent, move the decimal point to the left.

Write each of the following as ordinary numbers.

$2.926847212 \times 10^{9}$ =	2926847212	4.000×10^{-2} =	0.04000
4.29×10^{6} =	4290000	4.92×10^{-5} =	0.0000492
3.286×10^{4} =	32860	8.429×10^{-1} =	0.8429
5.92000×10^{2} =	592.000	5.376×10^{-2} =	0.05376
4.37521×10^{3} =	4375.21	2.986×10^{-4} =	0.0002986