Significant Figures: A measurement that includes all the digits that are known, plus a last digit that is estimated

Significant figures are critical when reporting scientific data because they give the reader an idea of how well you could actually measure/report your data. Before looking at a few examples, let's summarize the rules for significant figures.

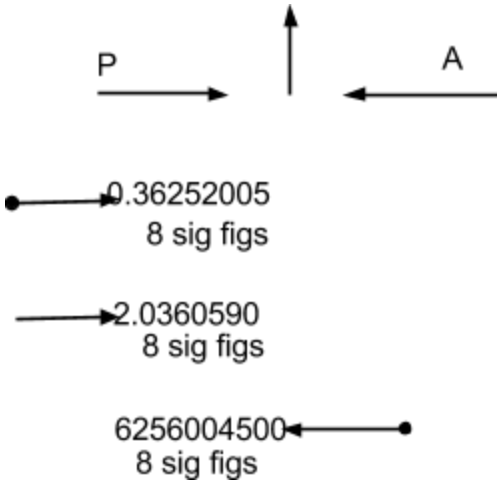
1. **ALL** non-zero numbers (1, 2, 3, 4, 5, 6, 7, 8, 9) are **ALWAYS** significant.
2. **ALL** zeros between non-zero numbers are **ALWAYS** significant.
3. **ALL** zeroes which are **SIMULTANEOUSLY** to the right of the decimal point **AND** at the end of the number are **ALWAYS** significant.
4. **ALL** zeroes which are to the left of a written decimal point and are in a number >= 10 are ALWAYS significant.
5. Place holding zeros are **NEVER** significant.

Examples: How many significant figures are present in the following numbers?

Number	**# Significant Figures**	**Rule(s)**
48,923	5	1
3.967	4	1
900.06	5	1,2,4
0.0004 (= 4 E-4)	1	1,5
8.1000	5	1,3
501.040	6	1,2,3,4
3,000,000 (= 3 E+6)	1	1
10.0 (= 1.00 E+1)	3	1,3,4

Alternate Rule for Scientific Notation

- If the number has a decimal point draw from the pacific ocean (Decimal point **P**resent = **P for Pacific**)
- if the number doesn't have a decimal point draw from the atlantic ocean (Decimal point **A**bsent = **A for Atlantic**)
- when the arrow hits a non zero digit then all the digits after it are significant



When Adding and Subtracting
Your answer can only show as many decimal places as the measurement having the fewest number of decimal places it has
Ex: When adding **63.21+75.2**, the answer can only have 3 significant figures in it because the number with the lowest amount of sig. figs. (75.2) has 3 sig. figs. **Ans: 138.4**
When Multiplying and Dividing
Your answer should only show the least amount of sig. figs. in the problem
Ex: When dividing 78.2/2.5 the answer can only have 2 significant figures in it because the number with the lowest amount of significant figures. **Ans: 31**
International System of Units: **S.I Units**

TABLE 1.4 SI Base Units

Physical Quantity	Name of Unit	Abbreviation
Mass	Kilogram	kg
Length	Meter	m
Time	Second	s[a]
Temperature	Kelvin	K
Amount of substance	Mole	mol
Electric current	Ampere	A
Luminous intensity	Candela	cd

[a]The abbreviation sec is frequently used.

Scientific Notation
- ➔ Coefficient raised to power of 10
  - ◆ 3420 is 3.42x10^3
- ➔ Multiply: Multiply the coefficient and add exponents.
- ➔ Division: Divide the coefficients and subtract exponents.
- ➔ After getting the answer, remember to follow the rules for adding/subtracting or multiplying/dividing the numbers!

Vocab
Accuracy: How close a measurement is to the true value.
Precision: How close the measurements are to each other.
Accepted value: Connect value based on reliable references.
Mass: A quantity of matter in an object.
Error: The difference between the experimental value and the accepted value is called the error.
Weight: Force of gravity on an object.
Quantitative: Something you can measure.
Qualitative: Characteristic.
Percent of error: $$\% \text{ error} = \frac{|\text{Accepted} - \text{Measured}|}{\text{Accepted}} \times 100$$
Density: Considered as a physical property. This is because mass and volume are also physical properties, making density a physical property as well. It is an intensive property that depends only on the competition of a substance, not on the size of the sample
Density: Mass/Volume

Celsius/Kelvin
**Base points on a celsius thermometer is 0 degrees celsius for freezing and 100 degrees celsius for boiling point.
**To convert celsius to kelvin use the following equation k=c+273, where c is the degrees in celsius.

Temperature Scales

- The Celsius scale uses the freezing point (0ºC) and boiling point (100ºC) of water as references. It is divided into 100 equal intervals, or degrees Celsius.
- The Kelvin scale, or absolute scale, is the SI Unit of temperature. The interval is the same. **K = ºC + 273**. At 0K, or absolute zero, it is -273ºC and atoms stop moving. This means everything is frozen solid.
- A change of one degree Kelvin is the same as the change of one degree Celsius
- Temperature of Absolute Zero is 0 degree Kelvin or -273.15 degrees Celsius

Dimensional Analysis: Way to analyze and solve problems using the units, dimensions, of the measurements. It is a powerful tool for solving conversion problems in which a measurement with one unit is changed to an equivalent measurement with another unit

Scientific Method: A logical question to the solution of a scientific problem.

Steps:

1. **Observation**: Noting and recording facts. This leads to a question.
2. **Hypothesis**: Proposed explanation from observation. Hypothesis is only useful if it is correct after experiment.
3. Experiment
    - There are only two possible outcomes: wrong or right. If hypothesis is wrong, hypothesis must be changed, and experiment must be done to get the correct hypothesis.

Hypothesis can be made into a **theory, a well-tested explanation based on observations.**

- Theories form mental pictures. You cannot prove a theory.

Scientific Law: An exact statement that summarises the results of many observations and experiments. Can be expressed in a simple, mathematical expression.