

Unit 1 Science Fundamentals

Chemistry - study of the composition of matter.

Scientific method

1. Observations- collecting data; results in a question.
2. Hypothesis- possible explanation for an observation that results in a prediction (must be testable).
3. Experiment- used to test a hypothesis.
variables - factors that change in an experiment; only one factor is changed.

Control- group has not been exposed to the variable suspected of causing an effect (uninfected or untreated).

Experimental- group that has been exposed to the variable suspected of causing an effect (infected or treated).

4. Conclusion

If the hypothesis is supported by repeated testing (repeatability), then it's **accepted**.

If it is not supported by testing, then it is **rejected**, and a new hypothesis may be formed.

Theory- a collection of related hypotheses that have been tested AND supported.

Scientific law- describes a natural phenomenon without explaining it.

Accuracy vs Precision

Accuracy refers to how close your values come to accepted values (hit the bull's eye).

Precision refers to how repeatable are your results (good groups).

Scientific Measurements

Quantity- property that can be measured and described by a number and a unit.

SI (Système Internationale d'Unités) units- uses decimals (powers of 10) and prefixes (same base units).

length	meter (m)
mass	kilogram (kg)
time	second (s)
temperature	kelvin (K)
amount of substance	mole (mol)
electric current	ampere (A)
volume	liter (L)

Prefixes:

mega	10^6	M
kilo	10^3	k
hecto	10^2	h
deka	10^1	da
deci	10^{-1}	d
centi	10^{-2}	c
milli	10^{-3}	m
micro	10^{-6}	μ
nano	10^{-9}	n
pico	10^{-12}	p

Area- length times width (L x W); e.g. square meters (feet), cm^2 .

Volume- length times width times height (L x W x H); cubic centimeters (cm^3), and liters.

Density- mass/volume $D = m/v$ water = 1g/ml or $1\text{g}/\text{cm}^3$

Temperature- a measure of the capability of matter to transfer heat.

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32^{\circ}\text{F})$$

$$^{\circ}\text{F} = 9/5^{\circ}\text{C} + 32^{\circ}\text{F}$$

Significant figures- an answer to a question can be no more precise than the least precise piece of information. Five rules:

Rule #1 every nonzero digit is significant.

Rule #2 zeroes between nonzero digits are significant.

Rule #3 leftmost zeroes in front of nonzero digit are not significant; they are placeholders.

<u>number</u>	<u>significant figures</u>
0.0071 m	2
0.42 m	2
0.000099 m	2

Rule #4 zeroes at the end of a number and to the right of a decimal point are significant.

<u>number</u>	<u>significant figures</u>
43.00	4
1.010	4
9.000	4

Rule #5 zeroes at the rightmost end of a measurement that lie to the left of an understood (but not shown) decimal point are not significant as they serve as placeholders.

<u>number</u>	<u>significant figures</u>
300 m	1
7000 m	1
27210 m	4

Add/Subtract- use the fewest number of decimal places

Multiply/Divide- use the least number of significant figures

For practice, go here (requires JAVA):

<http://lectureonline.cl.msu.edu/~mmp/applist/sigfig/sig.htm>