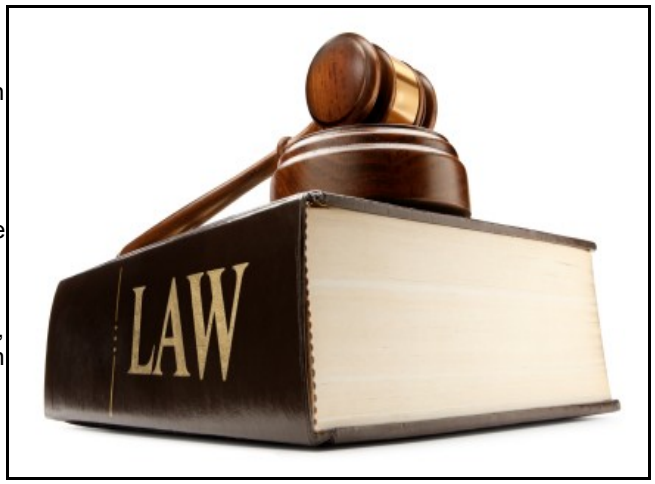


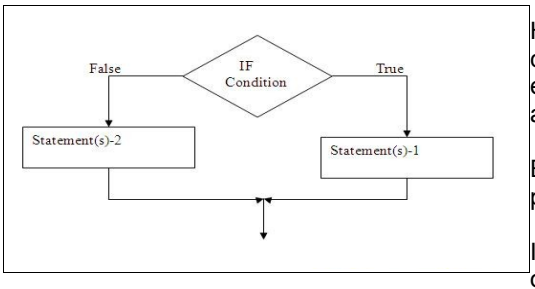
Scientific Law: This is a statement of fact meant to describe, in concise terms, an action or set of actions. It is accepted to be **true** and **universal**, and can sometimes be expressed in terms of a single mathematical equation. Scientific laws are similar to mathematical postulates. They don't really need any complex external proofs; they are accepted at face value based upon the fact that they have **always been observed to be true.**

Specifically, scientific laws must be simple, true, universal, and absolute. They represent the cornerstone of scientific discovery, because if a law ever did not apply, then all science based upon that law would collapse.

Some scientific laws, or laws of nature, include the law of gravity, Newton's laws of motion, the laws of thermodynamics, Boyle's law of gases, the law of conservation of mass and energy, and Hook's law of elasticity.

Law is a summary. Law must be obeyed. Laws do not explain. Laws are often mathematical.

Hypothesis: This is an **educated guess** based upon **observation**. It is an attempt to explain a single event or phenomenon based upon what is observed, but which has not been proved. Most hypotheses can be **supported or refuted by experimentation or continued observation.** This is often the starting point of an experiment.



Hypotheses can usually be written as **IF/THEN** statements. **If** […] is correct, **then** we will see […] happen in the laboratory. The point of an experiment is to **accept or reject** the hypothesis based on what was actually seen or measured in the lab.

Example: **If** diet soda has a lower density than water, **then** it will float when put in a bucket of room temperature water.

In the above example **if** we see the can bobbing to the surface of a bucket of water, **then** we accept the hypothesis and have proven that diet soda has a density less than water.
If we see the can sink, **then** we must reject the hypothesis. We conclude the opposite (but we really should test this new hypothesis as well).

Theory: A theory is an **attempt to explain why** a bunch of related hypotheses have been proven to be true. A theory is an explanation of a set of related observations or events based upon tested hypotheses and verified multiple times by detached groups of researchers. Theories are based on a mountain of experiments that different workers have shown to be true.

A theory represents our best explanation of our state of knowledge. **Theories are constantly modified** as new experiments give us better and better information.

Atomic Theory:

In the 1800's John Dalton said that chemical reactions made more sense if atoms existed. That would explain the similarities and differences between carbon monoxide and carbon dioxide. Atoms must be indestructible.

In the 1940's Enrico Fermi and others split the atom and recognized that radioactivity was fragments of atoms being released. Atoms existed, but they had parts (protons, neutrons, electrons) **Theory modified**.

Today: The Large Hadron Collider and other accelerators are proving that the protons and neutrons are made of quarks and energy carriers. The parts have more parts, but atoms still exist.

The theory is changing, but each new theory is compatible with older versions. Kind of like with software.