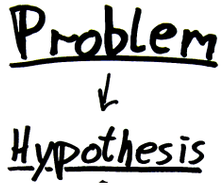
The Scientific Method

To raise new questions, new possibilities, and to regard old problems from a new angle, requires creative imagination and marks real advance in science. - Albert Einstein

Scientific Method

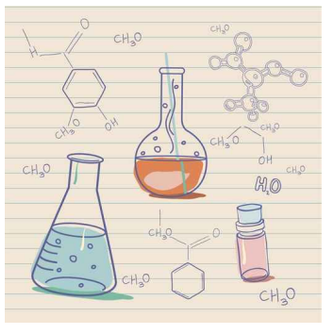
Question or Observation

Step 1. Ask a question, make an observation or identify a problem.



Hypothesis

Step 2. Formulate hypothesis (a statement).



Experiment

Step 3. Test the hypothesis with experimentation.

Analyze Data

Step 4. Collect and analyze the data.

Accept | **Reject**

Step 5. Make conclusions, was hypothesis correct, i.e. do you accept or reject hypothesis.

Scientific Hypothesis & Theory

- **Scientific hypothesis:**
  - An educated guess used as a explanation of an observation, but which has not yet been fully tested.
  - Used in the scientific method to predict the results of further experiments, which will be used either to confirm or disprove it.
  - A scientific hypothesis that survives extensive experimental testing may achieve the status of a scientific theory.

- **Scientific theory:**
  - A scientific hypothesis that survives extensive experimental testing may achieve the status of a scientific theory.
  - An explanation of why and how a specific natural phenomenon may occur.

Nature of Science
"Discovering Scientific Knowledge"

The nature of science consists of discovering knowledge about the natural world. The scientific discovery process (i.e. scientific method) can be characterized such that scientific knowledge is:

1. Empirically Based: testable, derived from experimentation or observation (direct or indirect)
2. Tentative: subject to change
3. Subjective: biasness from personal experience, research training, individual creativity, employment and etc.
4. Based on creativity, imagination and inference: creativity and imagination are often required to create hypotheses, design experiments, analyze data, develop theories as well as make inferences - inference is the process of reasoning or drawing conclusions from direct or indirect observations.
5. Influenced by society and culture: interpretation of the same data may be influenced by the different social or cultural backgrounds of scientists.

Scientific Method	Peer Review Research Publications	Bloom's Taxonomy	Research Simulation Case Study
	Abstract - Summary		
1. Identify Problem 2. Formulate Hypothesis	Introduction	Knowledge Understanding	Introduction Observation Background **Knowledge, Understanding**
3. Test Hypothesis	Materials and Methods	Apply Analyze	Materials and Methods (Experimental Protocols) **Apply & Analyze**
4. Collect & Analyze Data	Results	Analyze Evaluate	Interpret Results **Analyze, Evaluate**
5. Make Conclusions	Discussion	Evaluate Create	Make Conclusions **Create**