

NOTES: THE SCIENTIFIC METHOD

How do scientists investigate? As scientists seek knowledge about their environment, they carry out investigations in a logical manner. This organized approach to problem solving is called the **SCIENTIFIC METHOD**. It is comprised of a series of logical and systematic steps.

Step 1 **PROBLEM** - Defining the question

The first step in problem solving is a careful study of the situation. The scientist must find a single question. Frequently, the failure of an investigation comes from not having a clearly stated question.

Step 2 **RESEARCH** - Gathering evidence

Scientific discoveries begin with a basic idea. A scientist must read through reference materials to determine what has been previously done to solve the problem.

Step 3 **HYPOTHESIS** - Making a trial solution

A trial solution to the problem is called the hypothesis. It is often called an "educated guess" because it is based on the evidence the scientist gathers about the problem. Several Hypotheses may be tested and rejected before the problem is solved.

Step 4 **EXPERIMENT** - Testing the hypothesis

Scientists establish a set of procedures to test the hypothesis. This set of procedures is called an experiment. Accurate, up-to-date records are kept so that the results can be communicated to others. One must be able to repeat the experiment to check the results.

Step 5 **OBSERVATIONS** - Recording the data

Up-to date records of all observations and results of the experiment should be kept. This prevents leaving out any important data and facts.

Step 6 ANALYSIS - Studying the data

Scientists must organize their data into graphs to be able to observe trends and patterns. Then scientists are able to make decisions about their experiment.

Step 7 CONCLUSIONS

Based upon the evidence that was gathered, observations and the analyzed results of the experiment, scientists try to draw meaningful conclusions. Sometimes the conclusions will support the ideas and the hypothesis of the experiment and the hypothesis has been proved.

Conclusions from experiments have been classified into three main categories:

Scientific Theory

Scientists develop possible explanations or models of various phenomena. Theories cannot be proven either "true or false". They serve as models for investigation.

Scientific Fact

If a theory is proven to the satisfaction of most scientists, it is often called a fact. Even facts are subject to change when new information becomes available which makes the original fact invalid.

Scientific Law

A scientific law is established when the same results are consistently observed without exception, although no satisfactory explanation may be available.

Often, however, if the problem was not solved by the experiment, scientists make new questions and start over again. The experiment should never be considered a failure.