

Introduction to Science and the Scientific Method

I. What is Science?

A. The goal of science is to investigate and understand the natural world, to explain events in the natural world, and to use those explanations to make useful predictions.

B. Science:

1. Science deals only with the natural world.
2. Scientists:
3. Scientists propose _____ that can be _____ by examining evidence.
4. Science is an organized way of using evidence to learn about the natural world.

C. How is science done?

1. Science begins with an _____. This is the process of gathering information about events or processes in a careful, orderly way.
2. _____ is the information gathered from making observations.
3. Hypothesis
 - a) A hypothesis is a _____.
 - b) A hypothesis must be stated in a way that makes it “testable”. The hypothesis is just a possible answer to a question, and it must be thoroughly tested.

III. Scientific Methods

A. The scientific method is:

B. The Steps to the Scientific Method

Step 1: Observation / Asking a Question

1. A problem or a question must first be identified.
2. Examples: How much water can a root hair absorb? Why does a plant stem bend toward the light? What effect does temperature have on heart rate?

Step 2: Form a Hypothesis

1. Hypothesis:

It is simply a prediction and has not yet been _____.

2. It must be stated in a way that is testable. A statement is considered “testable” if evidence can be collected that either does or does not support it.

Step 3: Designing a Controlled Experiment

1. The factors in an experiment that can be changed are called _____. Some example of variables would be: changing the temperature, the amount of light present, time, concentration of solutions used.
2. A controlled experiment works with _____. If several variables were changed at the same time, the scientist would not know which variable was responsible for the observed results.

3. In a _____ only one variable is changed at a time. All other variables should be unchanged or “controlled”.
4. An experiment is based on the comparison between a _____ with an _____.
 - a) These two groups are identical except for one factor.
 - b) The control group serves as the comparison. It is the same as the experiment group, except that the one variable that is being tested is removed.
 - c) The experimental group shows the effect of the variable that is being tested.
5. Example: In order to test the effectiveness of a new vaccine, 50 volunteers are selected and divided into two groups. One group will be the control group and the other will be the experimental group. Both groups are given a pill to take that is identical in size, shape, color and texture.

Describe the control group:

Describe the experimental group:

What variables are kept constant?

What variable is being changed?

6. There are two variables in an experiment:
 - a) The independent variable is the variable that is:
 - b) The dependent variable is the one:

The dependent variable is the data we collect during the experiment. This data is collected as a result of changing the independent variable.
 - c) In the above example, what is the independent variable?
 - d) In the above example, what is the dependent variable?

Step 4: Recording and Analyzing Results

1. The data that has been collected must be organized and analyzed to determine whether the data are reliable.
2. Does the data support or not support the hypothesis?

Step 5: Drawing Conclusions

1. The evidence from the experiment is used to determine if the hypothesis is _____.
2. Experiments must be repeated over and over. When repeated, the results should always be the same before a valid conclusion can be reached.

III. Forming a Theory

- A. A theory may be formed after the hypothesis has been tested many times and is supported by much evidence.
- B. Theory:
- C. A theory is supported by considerable evidence.