

Science and the Scientific Method

Introduction

Science is a continuous dynamic search for new knowledge. It has been a driving force of human development. The scientific method offers a means of testing ideas and solving problems.

Terminology Review

You should be familiar with the scientific method

If you do not understand how to use the words below you should review before continuing.
Observation, Hypothesis, Data, Experiment, Variable, Control, Analysis, Conclusion.

The Scientific Method: An Example

Many people were catching a communicable disease called "Ugo". Most of these people were very sick and took 7 to 9 days to recover.

Investigations directed by Dr. Kleinstein had revealed that Ugo was caused by a pathogenic bacteria, Ugot diarrha. Kleinstein had recently read in the 'Journal of Biochemistry' that an antibiotic called "noronium" was observed to kill the Ugo bacteria.

After receiving permission from the appropriate government agencies Kleinstein was ready to conduct an experiment on human subjects. Tablets were prepared containing the antibiotic noronium. A second batch of tablets containing none of this antibiotic were also prepared (tablets containing no medication are called 'placebos').

Volunteers of people who had just contracted the bacteria (as confirmed by a blood test) were divided into two groups of 25. One group (A) was given tablets containing the antibiotic, while the other group (B) received the placebo. The test subjects did not know which group they were in.

Kleinstein meticulously recorded the results. In group A, 20 people recovered within one day while the other 5 people recovered in the normal 7 to 9 day period. Group B results included only 1 recovery within 1 day while the rest recovered within the normal period.

After considering the example above, answer the following questions on a separate sheet of paper.

1. What observations and data were known before Kleinstein began his experiment?
2. What is Kleinstein's probable hypothesis?
3. What variable is being tested in this experiment?
4. What is the control in this experiment?
5. What are the data for this experiment? (construct a well organized data table)
6. What analysis do you think was made of the data? (Hint: consider using percentages)
7. What were the probable conclusions of this experiment?

Scientific Method: Exercise 1

1. Define each of the following:

a) Fact	
b) Data	
c) Hypothesis	
d) Experiment	
e) Control	
f) Theory	

2. What characteristics describe a good hypothesis?

3. True or false?

T	F	a) Scientific research is restricted to investigating what is already known
T	F	b) Scientists are trained to look for things and events that a non-scientist might not notice.
T	F	c) Scientists typically ask philosophical questions such as "should abortion be legalized?"
T	F	d) When investigating a problem, all evidence, whether factual or not, or relevant or not, must be taken into account.
T	F	e) In order for facts to be valid, observations or experiments must be repeated and verified under the same conditions.
T	F	f) An "if... then" statement is typically used in a hypothesis.
T	F	g) Experimental data can prove that a hypothesis is true.
T	F	h) Mathematical data may allow a scientist to find a relationship between variables in an experiment.
T	F	i) the more often a hypothesis is tested and supported, the more confidence scientists have in its validity.

4. Patty and Peter wanted to find out if temperature affects the growth of mould on bread. At lunch, they asked nine (9) of their friends to donate a piece of bread for this experiment.

They put nine pieces of bread in nine flasks as follows:

- a) Three of the flasks were kept in a refrigerator (temperature about 4C)
- b) Three of the flasks were kept at room temperature (about 20C)
- c) Three of the flasks were kept in a lab oven at 90C

The nine flasks were examined after four (4) days.

Questions:

1. Give a title for this experiment.
2. What was the purpose of the experiment?
3. Make a hypothesis.
4. What was the major difference between the nine flasks?
5. Name three (3) controls for Patty and Peter's experiment.
6. Would the flasks need to be closed on top? Explain.
7. The students made at least one error in performing the experiment described above. Suggest what this error is and explain how the error could be corrected.