1.2 Using a Scientific Approach

Suppose you want to find a cure for the common cold....what steps would you take?

You use the scientific method to organize your problem-solving approach.

1.2 Using a Scientific Approach

Scientific Methods

An organized plan for gathering, organizing, and communicating information is called a scientific method.

- You can use a scientific method to search for the answer to a question.
- Scientific methods can vary from case to case, depending on the question and how the researcher decides to look for an answer.
1.2 Using a Scientific Approach

Scientific Methods

What is the goal of a scientific method?

The goal of any scientific method is to solve a problem or to better understand an observed event.

Scientific Methods

Here is an example of a scientific method. Each step uses specific skills. The order of steps can vary. Sometimes you will use all of the steps and other times only some of them.
1.2 Using a Scientific Approach

Scientific Methods

Making Observations
• Scientific investigations often begin with observations. An **observation** is information that you or someone else obtained through your senses.
• In science, many times observations and questions come from:
  – The literature (information published by other scientists)
  – Critical global questions

• Forming a Hypothesis
• A **hypothesis** is a proposed answer to a question.
• It is a statement of your expected outcome to the experiment.
• Testing a Hypothesis
  • In an experiment, any factor that can change is called a variable.
    – The **manipulated variable** causes a change.
    – The **responding variable** changes in response to the manipulated variable.
    – A **controlled experiment** is an experiment in which only one variable, the manipulated variable, is deliberately changed at a time.
1.2 Using a Scientific Approach

Scientific Methods

1. Make an observation.
2. Ask a question.
3. Develop a hypothesis.
4. Test the hypothesis with an experiment.
5. Analyze data and draw conclusions.
6. Revise the hypothesis based on results.
7. Test hypothesis with further experiments.
8. Conclusion: hypothesis is supported or not supported.
Observation (typically a need or topic and solution):
1.) Each cold experienced by a working adult caused an average of 8.7 lost work hours.


2.) You are aware of a compound (compound A) isolated from a marine plant that has potential to cure the common cold.

Question: Is there a medicine that will cure the common cold?

Hypothesis: Compound A will cure the common cold.
1.2 Using a Scientific Approach

Scientific Methods

Experiment:
1. Obtain quantities of Compound A.
2. Provide group 1 of test subjects with common cold compound A.
3. Provide group 2 of test subjects with common cold a placebo (a blank or a pill with no medicine).
4. Obtain data related to symptoms in both groups.
5. Compare data taken from two groups.
   - Statistical analysis

Variables

Variable: quantity subject to variations or changes

Manipulated variable: Compound A

Responding variable: Symptoms of group treated with compound A

Controlled variable: Symptoms of group treated with no medicine
Using a Scientific Approach

**Scientific Methods**

75% of the subjects in the group given compound A showed a decrease in symptoms 12h sooner than the placebo group.

**Draw a Conclusion:** Compound A is effective in curing the common cold.

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**Scientific Laws**

After repeated observations or experiments, scientists may arrive at a scientific law.

- A **scientific law** is a statement that summarizes a pattern found in nature.
- For example, Newton’s law of gravity is a scientific law that has been verified over and over. Scientists have yet to agree on a theory that explains how gravity works.
### Scientific Laws

How does a scientific law differ from a scientific theory?

A scientific law describes an observed pattern in nature without attempting to explain it. The explanation of such a pattern is provided by a scientific theory.

### Scientific Models

Why are scientific models useful?

A **model** is a representation of an object or event. A street map is a model of a city.

**Scientific models** make it easier to understand things that might be too difficult to observe directly.
**Scientific Models**

This is a computer model of the common cold virus. It helps scientists analyze the structure to see important functions.

Models help you visualize things that are too small to see, such as atoms, or things that are large, such as the solar system.

As new data are collected, models can be changed or be replaced by new models.

[http://staff.science.uva.nl/~rhd/r14_icv.gif](http://staff.science.uva.nl/~rhd/r14_icv.gif)

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**Working Safely in Science**

Safety plays an important role in science. Laboratory work may involve flames or hot plates, electricity, chemicals, hot liquids, sharp instruments, and breakable glassware.

Always follow your teacher’s instructions and the textbook directions exactly.

Remove gloves and/or wash hands when you leave the laboratory.