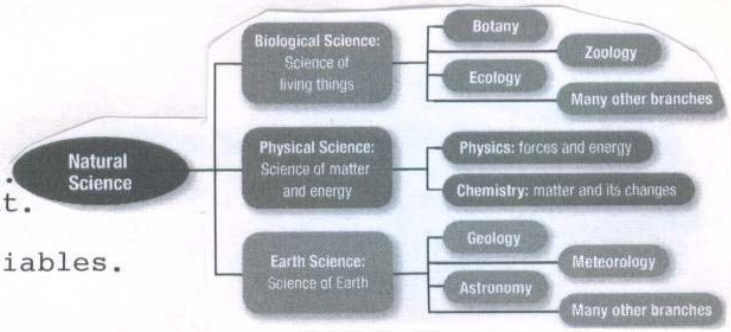
## Ch. 1-1 The Methods Of Science




**Objectives:**
1. Tlw Identify and use science skills.
2. Tlw Describe a controlled experiment.
3. Tlw Apply the scientific method.
4. Tlw Describe why scientists use variables.

**What Is Science**
- **Science** is a method for studying the natural world. It is a process that uses observations and investigations to gain knowledge about events in nature.

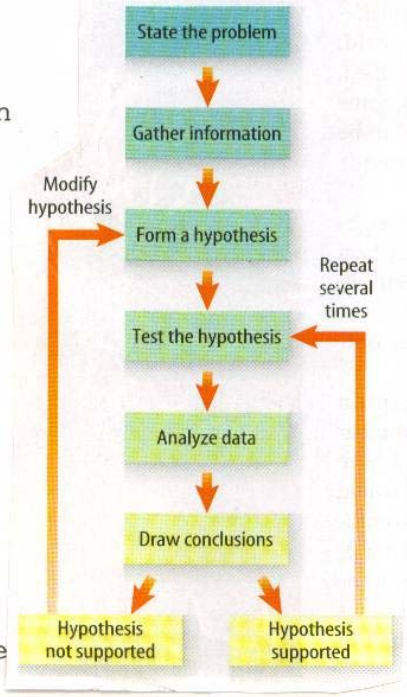
**-Major Categories In Science**
- Science covers many different topics that can be classified according to three main categories:
  1. **Life Science**- Deals with Living Things.
  2. **Earth Science**- Investigates Earth and Space.
  3. **Physical Science**- Deals with matter and energy. (Chemistry & Physics.

**-Science Explains Nature**
- Scientific explanations help you understand the natural world; which may change overtime.

**-Investigations**
- Scientists learn more about the natural world through investigations; which may involve observing, recording, setting up experiments, building a model representation, and testing.

**Science Skills**
- **Data**- Information we gather using science process skills.
- The most direct way to gain knowledge about something in nature is to **observe** it.
- We use our senses of sight, touch, taste, smell, and hearing to observe our surroundings everyday.
- An **Inference** is suggesting a possible explanation for an observation you make.
  **EX:** You drive up in your driveway and see a car that looks like your grandmothers, so you infer that your grandmother is at your house.
- **Estimating** is making a careful guess about something.
  **EX:** Speed, time, distance, size.
- **Measurements** are used to determine exact information about an observation; which includes a number and a unit.
  **EX:** Speed - 80 Km/hr. Height - 6 ft. 1 in. Weight - 125 lbs.
- Stating what you think might happen in the future is a **prediction**; which is based on past experiences and observations.
- **Classifying** is grouping things together based on how they are alike.
  **EX:** Size, color, shape, texture, weight, etc.
- **Hypothesizing** is suggesting a possible answer to a problem, an educated guess, or a proposed answer to a problem.
- **Recording And Organizing** involves writing down some sort of information you observed, predictions, or measurements and organizing them into groups and sub groups to show results.
  **EX:** Charts, graphs, tables, diagrams, flow charts, textbooks.
- **Analyzing** is looking for trends or patterns in data that has been recorded and organized.

## Scientific Methods




- The **Scientific Method** is an organized set of investigation procedures or an orderly systematic approach to problem solving.

1. Stating A Problem - What you want to find out or solve.
2. Researching And Gathering Information - Learning as much as possible about the background of the problem.
3. Form A Hypothesis - A possible explanation for a problem using what you know and what you observe.
4. Test The Hypothesis - Making observations, building a model, perform an **experiment**; which tests the effects of one thing on another using controlled conditions.

### -Variables

- A **variable** is a quantity that can have more than a single value, or is the one or two factors being tested.
- The **dependant variable** have values that change according to the changes in other variables.
- The **independant variable** is the variable you change to see how it will affect the dependant variable.
  **EX:** The freezing point of anti-freeze and water.

### -Constants And Controls

- The **constant** is a factor that does not change when other variables change.
  **EX:** The freezing point of water - 0 degrees **C**, or 32 degrees **F**.
- A **control** is the standard by which the test results can be compared or measured; which contains the constant.

5. Analyze The Data - Looking for trends or patterns in the data collected, recording and organizing and interpreting the data, or observations.
6. Drawing A Conclusion - Based on the analysis of the data, you decide whether or not your hypothesis is supported.

- For the hypothesis to be considered valid and widely accepted, the experiment must result in the exact same data every time it is repeated. If your experiment does not support your hypothesis, you must reconsider the hypothesis.

### -Being Objective

- Scientists must be careful to reduce **bias** in their experiments; which occurs when what the scientist expects changes how the results are viewed, and can be reduced by running as many trials as possible and by keeping accurate notes of each observation made.
- valid experiments also must have data that are measureable.
- Most importantly, the experiment must be repeatable.

### Visualizing With Models

- A **model** represents an idea, event, or object to help people better understand it.
- Today, we can use computers to create models we can not touch.
- **Models** are diagrams and maps or scale representations of a real object.

### Scientific Theories And Laws

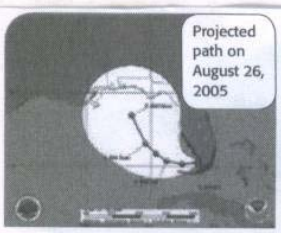
- A scientific **theory** is an explanation of things or events based on knowledge gained from many observations and investigations, and can change over time.
- If the results always support the hypothesis, it can be called a theory.
- A scientific **law** is a statement about what happens in nature and that seems to be true all the time; but can also change over time.
- **Laws** tell you what will happen under certain conditions; but they do not explain why or how something happens.
  **EX:** The law of gravity.
- A **theory** can explain a law.
- A **fact** is an agreement about many observations, based on repeated tests and studies and does not change over time.

## The Limitations Of Science

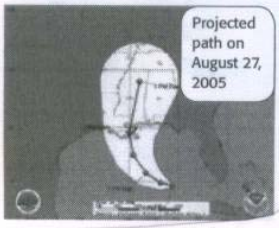
- Science can help you to explain many things about the world; but science can not explain or solve everything.
- Most questions about emotions and values are not scientific questions and can not be tested.

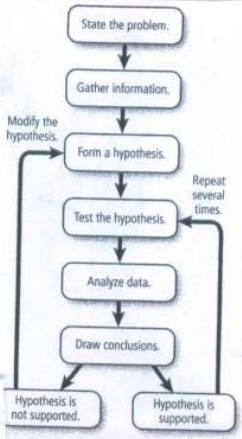
## Using Science Technology

- **Technology** is the application of science to help people, and vice-versa.







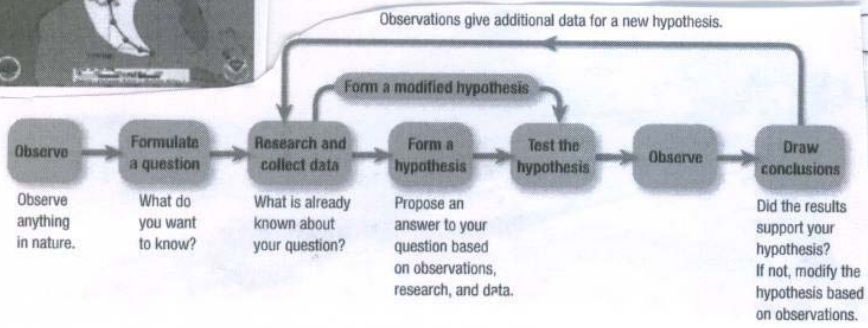




**Table 1 Types of Variables**

| | |
|---|---|
| Dependent Variable | changes according to the changes of the independent variable |
| Independent Variable | the variable that is changed to test the effect on the dependent variable |
| Constant | a factor that does not change when other variables change |
| Control | the standard by which the test results can be compared |

Figure 1.7 Decision Making ▼

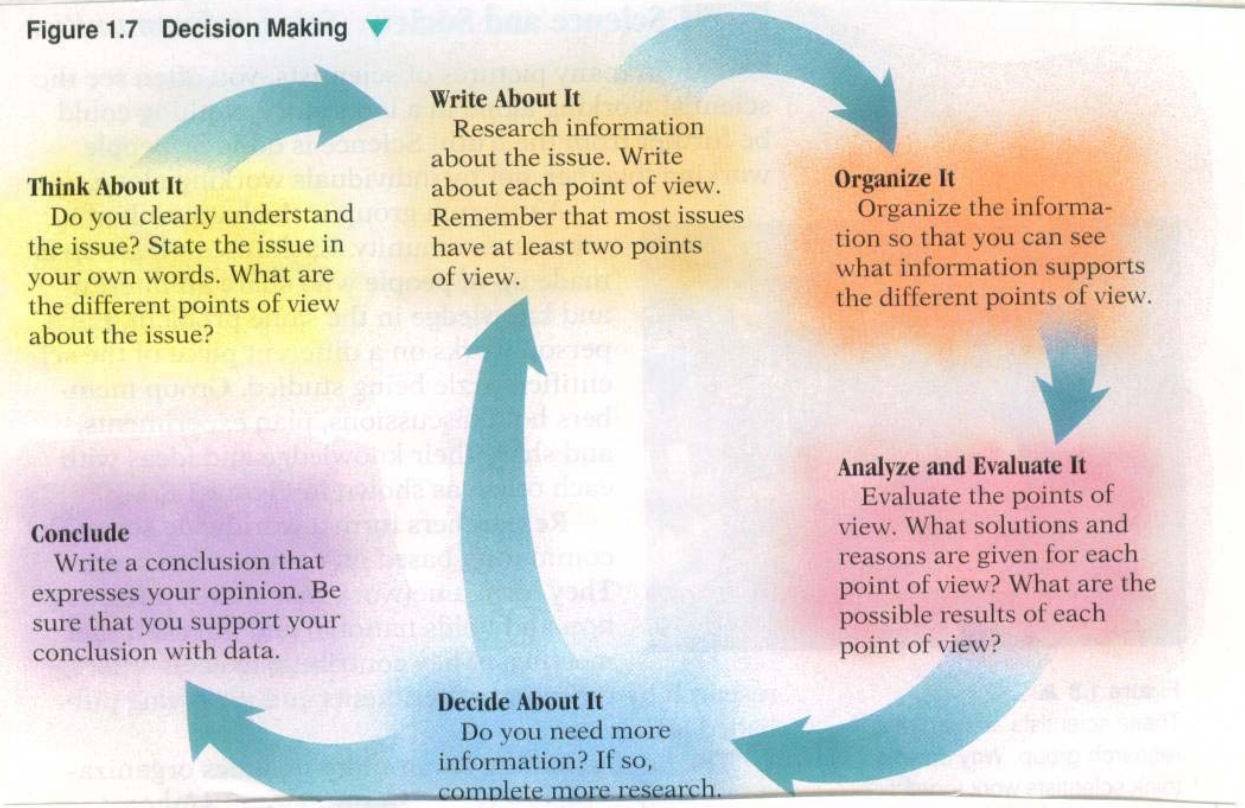



Figure 1.6 Designing and Planning an Experiment ▼