



Objectives (Copy into Notes.)

- ✳️ **Outline** the main steps in the scientific method.
- ✳️ **Summarize** how observations are used to form hypotheses.
- ✳️ **List** the elements of a controlled experiment.
- ✳️ **Describe** how scientists use data to draw conclusions.
- ✳️ **Compare** a scientific hypothesis and a scientific theory.
- ✳️ **State** how communication in science helps prevent dishonesty and bias.



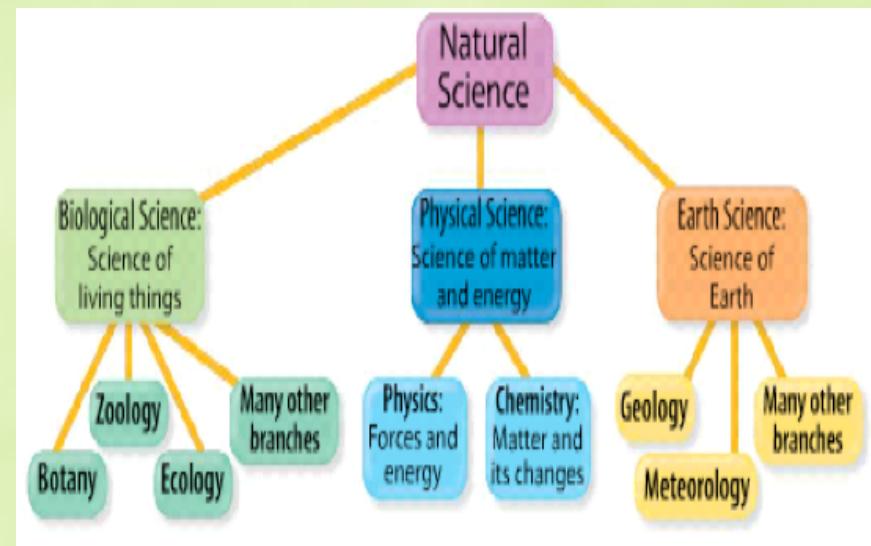
What is Science?

- ❖ Science is an organized way of using evidence to learn about the natural world.
- ❖ The goal of any science is use observations to make predictions.
- ❖ This means that scientific theories and hypotheses are only as good as the observations and data on which they are based.



The Branches of Science

- ✿ There are 3 main branches of science:
- ✿ Biological Science
 - ♣ Living things
- ✿ Physical Science
 - ♣ Matter & Energy
- ✿ Earth/Space Science
 - ♣ Duh!





The Scientific Method

- ➊ The **scientific method** is a step-by-step process used to solve a problem.
- ➋ It involves making observations, asking questions, forming hypotheses, making predictions, designing experiments, analyzing data, and drawing conclusions.
- ➌ Most other problem solving models originate with the scientific method.



Step 1: Define the Problem

- ❖ The first step to the scientific method is to identify the problem you are trying to solve.
- ❖ This is a most important step because it provides direction for the rest of the steps.
- ❖ It is impossible to solve a problem or find a solution for a problem that does not exist.



Step 2: Make Observations

- ✿ An observation is information that is gathered using your senses that is factual.
- ✿ Observations allow you to learn more about the different aspects of the problem.
- ✿ It is important not to confuse observation with judgment because judgments are not always based on fact.
- ✿ EXAMPLE:
 - ✿ “Mr. Doc’s shirt is ugly.” - Judgment
 - ✿ “Mr. Doc’s has flowers on it.” Observation



Step 3: Forming a Hypothesis

- ✿ A hypothesis is an educated guess.
- ✿ All hypotheses have 2 parts:
 - ✿ A guess: This is your thoughts on the subject and can include a prediction.
 - ✿ The “Educated” part: This is what lead to you the guess (observations.)
- ✿ In other words, a hypothesis is what you think and why you think that way.
- ✿ A hypothesis without reasons is just a guess.



Step 4: Testing Hypothesis

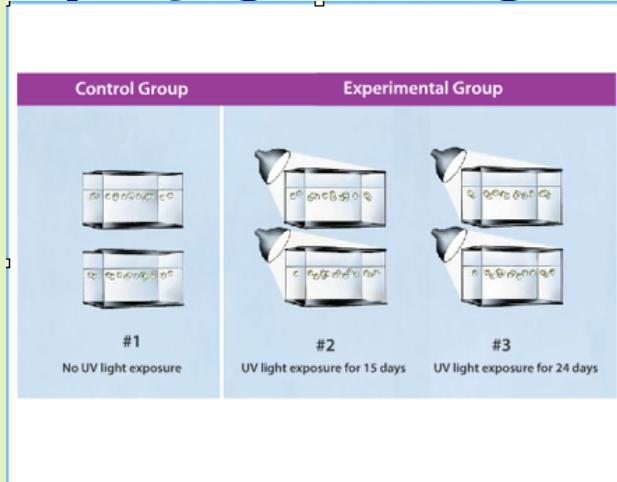
- ✳ Experimentation is often used to test a hypothesis.
- ✳ Experiments are models in which the conditions are controlled to produce a result.
- ✳ In an experiment there are 2 groups:
 - ✳ The Control Group: Under “normal” conditions.
 - ✳ The Experimental Group: Under “test” conditions.



Variables

- ✿ There are 3 types of variables in a controlled experiment:
 - ▣ Constant Variables: These are variables that are the same for both groups that are not being tested.
 - ▣ Independent Variable: This is the variable that is altered in the “experimental” group. It is the variable being tested.
 - ▣ Dependent Variable: This is the variable that changes as a result of the independent variable. It is used to measure the results of the experiment.

EXPERIMENT: The Effect of Light on Plant Growth



✳ Problem: What effect does UV light on the growth of plants.

- ✳ Control Group: No UV exposure.
- ✳ Experimental Group: Varying UV exposure.
- ✳ Constants: Soil type, plant type, amount of water, temperature, etc.
- ✳ Independent Variable: The amount of UV Light.
- ✳ Dependent Variable: The growth of the plants.



Step 5: Analyze Results

- ❖ The next step is to look at the information that you have generated and try to find meaning.
- ❖ This is the part of the experiment where the data is sorted and combined to see what if any trends appear.
- ❖ Graphs, tables, and charts are often used to organize data to make analyzing easier.



Step 6: Form a Conclusion

Step 7: Publish Results

- Once you have analyzed your results, you should be at the point where you can make a final conclusion.
- It is important to communicate results of experimentation to others who can attempt to recreate your experiment.
- If multiple people test a conclusion and find that it is correct, then a scientific theory can be made.
- If a theory is proven correct under all circumstances, then it can be established as a scientific law.



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