The Scientific Method

Come in and get your notebooks out. We have notes today!
What is SCIENCE?

The study of natural phenomena that studies things that can be observed, measured, and tested by scientific methods.

Science is....
• The use of our scenes to observe and evaluate
• Based on a “testable” universe
• Used to predict natural events
• Based on computational (math) and conceptual models
• Classified into many different fields (or specializations)
• Always expanding and changing

Science is NOT....
• A ridged collection of facts
• Able to answer EVERY question – Some things are not scientifically testable...yet.
• Untestable or unrelated
• Based on things that cannot be observed.
• Only based on one field or topic
• Biased
Science Explanations: Hypothesis, Theory, and Laws

**Hypothesis**
- An Educated Guess based on Observations

**Theory**
- Summary of Hypothesis that predicts why something will happen, Supported by repeated testing

**Law**
- Generalizes observations that can describe or predict something that is universally understood in nature
A hypothesis can be given as an explanation for the occurrence of an event.

A hypothesis should...
- Be based on some knowledge or research (that is why they call it an educated guess)
- Be in the form of a statement... not a question
- Answer a scientific question.
- Must be TESTABLE (cannot be an opinion)

A HYPOTHESIS CAN BE PROVEN WRONG... AND THAT IS FINE! A WRONG HYPOTHESIS ONLY LEADS TO A NEW HYPOTHESIS
A theory is valid as long as there is no evidence to dispute it.

A theory can...
- Can be used to explain and predict WHAT can happen
- Theories are highly reliable and vastly tested
- Can be disproven, modified, or changed with new knowledge, observations, and technology.

Theories can eventually develop into a Law. However, as technology advances, some theories are disproved.
A law is a statement of fact.

A law is...
- Accepted as true and universal
- A summary of all the experimental results based on a hypothesis
- Laws don’t explain why something happens, only that it will happen without exception.

Newton’s Laws of Motion.
“An object in motion (or at rest) will stay in motion (or at rest) unless acted on by an outside force”
True Science vs Non-Science

Science is very specific. However, some ideas may be very logical and based on good reasoning.... They technically don’t fall into “true science”. We must be accurate when we discuss what true science is.

**TRUE SCIENCE NEEDS TO BE:**
- Consistent
- Observable
- Natural

**NON-SCIENCE IS:**
- Tentative
- Testable
- Predictable
- Philosophy
- Personal Opinion
- Ethics
- Beliefs
**Scientific Method:** An established method of research...a process to collect and evaluate information with objectivity.

Steps in the Scientific Method

1. Asking or defining a question
2. Researching the question
3. Forming a hypothesis
4. Developing and performing the experiment to gather data
5. Analyzing the data
6. Writing the conclusion and Communicating the results
1st step. Has to be testable

Ask the question or defining problem

Do Background Research
• Gathering information from books, asking other questions, using our scenes to observe, or seeking outside sources.

Forming a Hypothesis
• Your Educated Guess must be testable and based on background research.

Test with Experiment-Collecting Data
• The experiment should only have one variable. While experimenting, you should record data.

Analyze Results
• Crucial moment in the scientific method. IF your hypothesis is wrong, you must modify it! If you were correct, then you proceed.

Drawing Conclusions / Reporting
• The last step in the scientific method. Your conclusions should be clear and concise. This allows other scientists to replicate your experiment!
Designing an Experiment Checklist!

- The experiment must test the hypothesis
- Experiments need to have planned steps to follow.
- Should have only ONE variable that is tested.
- The experiment will either support or disprove hypothesis
- The experiment will be retested to validate the results.

Types of Variables

- **Independent Variable**
  The one thing you change in an experiment. Only one of these per experiment.

- **Dependent Variable**
  The thing you measure as a result of what you change.

- **Controlled Variable**
  These are the “constants” in an experiment. These will not change during the experiment.
Types of Variables Example

**Independent Variable**
Example: The liquid used to water each plant.

**Dependent Variable**
Example: The height or health of the plant.

**Controlled Variables**
Example: Type of plant used, pot size, amount of liquid, soil type, etc.
Science is the study of natural phenomena that studies things that can be observed, measured, and tested by scientific methods.

Science has developed many hypothesis, theories, and laws.

Scientists use the scientific method as a way to approach a question.

A hypothesis is an educated guess based on research. A hypothesis can be modified or thrown out if the experiment disproves it.

Experimentation involves changing a single variable and recording data pertaining to the response of other variables.

Science seeks to explain the world around use.

Scientific knowledge is the most reliable information we have.

The criminal justice system is influenced by the growing knowledge in the scientific community as new technology is introduced.