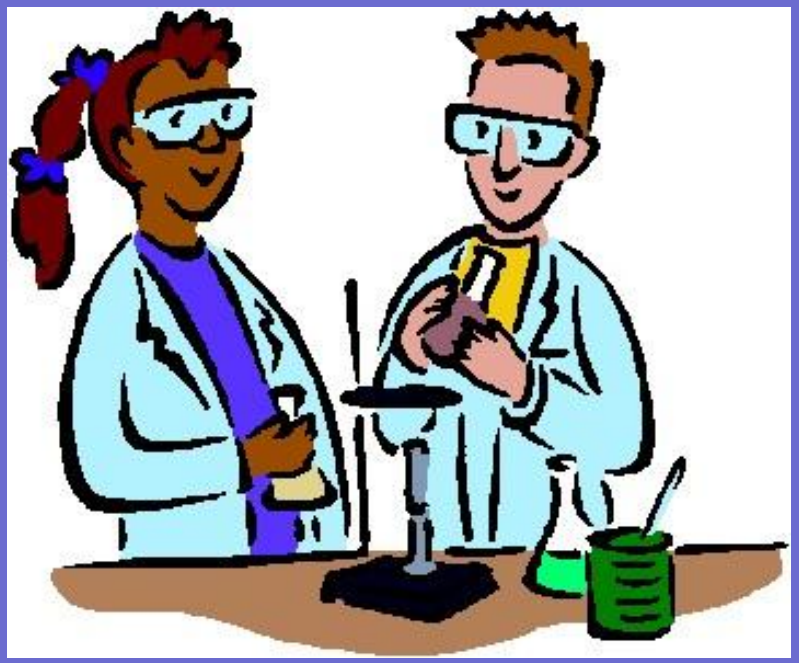
Scientific Method



Step 1: Think Like a Scientist

- Ask Questions
  - Use prior knowledge
  - Make Observations
- Form Hypothesis (answer to own question)

To be a Hypothesis it has to be TESTABLE

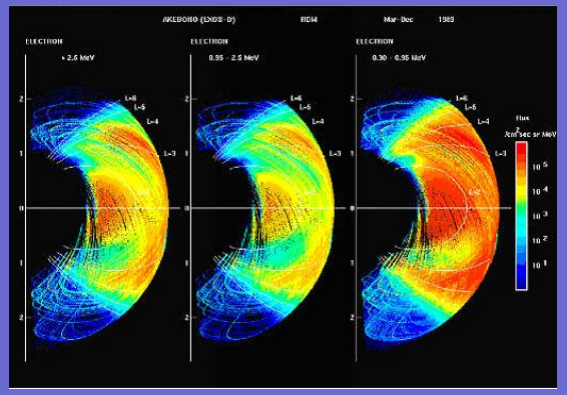
Opinions are not testable

- Favorite flavor of ice cream? NO
- Freezing point of water? YES
- Strength of rope? YES
- Cutest running shoes? NO
- Favorite sports drink? NO
- Life of a light bulb? YES

Step 2: Work like a Scientist

- Use the Scientific Method
  - an orderly way to solve problems
- Design an Experiment
- Collect Data

Step 3:
Write like a Scientist
Data in Science



1. Qualitative
   - uses words or descriptions

2. Quantitative
   - uses numbers

Language of Experiments

- Experiments = designs to test a hypothesis
- Control = condition that does not change
- Variable= condition that changes.
  - Independent Variable
    - Changed by the scientist
    - “What I choose to select to be different”
  - Dependent Variable
    - Changes in reaction to the independent variable, it ***depends*** on it.
    - “What happened because of the choices I made?”

Question	Independent Variable (What I choose)	Dependent Variables (What I observe)	Controlled Variables (What I keep the same)
How much water flows through a faucet at different openings?	Water faucet opening (closed, half open, fully open)	Amount of water flowing measured in liters per minute	•The Faucet •Water pressure, or how much the water is "pushing" "Different water pressure might also cause different amounts of water to flow and different faucets may behave differently, so to insure a fair test I want to keep the water pressure and the faucet the same for each faucet opening that I test."
Does heating a cup of water allow it to dissolve more sugar?	Temperature of the water measured in degrees Centigrade	Amount of sugar that dissolves completely measured in grams	•Stirring •Type of sugar "More stirring might also increase the amount of sugar that dissolves and different sugars might dissolve in different amounts, so to insure a fair test I want to keep these variables the same for each cup of water."

Time is an Example of an *Independent* Variable

In some experiments, time is what causes the dependent variable to change. The scientist simply starts the time then observes and records data.

Question	Independent Variable (What time period I chose)	Dependent Variables (What I observe)	Controlled Variables (What I keep the same)
How fast does a candle burn?	Time measured in minutes	Height of candle measured in centimeters at regular intervals of time (for example, every five minutes)	•Use same type of candle for every test •Wind--make sure there is none

Step 4: Communicate Like a Scientist

- Analyze the results
- Form conclusions from the data
- Compare conclusion to hypothesis
- Share results with other scientists

Theories vs. Laws

- Theory
  - Unifies a broad range of observations and is generally accepted to be true
  - Attempt to explain WHY something happens
  - One scientist cannot form a theory, just a hypothesis
  - more complex
  - Example: atomic theory

- Law
  - Explains a single phenomena
  - Explains WHAT happens
  - Simple and universal, pertains to a single action
  - Can sometimes be explained with a math equation
  - Example: law of gravity

- Both a scientific theory and a scientific law are accepted to be true by the *scientific community* as a whole.

- Both are used to make predictions of events.

- Both are used to advance technology.

If a law is a slingshot, then a theory is an automobile.

THE END