Chapter 1

Section 1: The Nature of Science

- What do scientists do?
  - They investigate, plan experiments, observe, and test results

- Science has many branches
  - **Science** is observing, studying, and experimenting to find the nature of things

- Science is divided into two main branches
  - **Social Science** which deals with human behavior
  - **Natural Science** tries to understand how nature works

- Three main branches of natural science
  - Life Science, Earth Science, and Physical Science

- Physical Science has two main branches
  - Chemistry and Physics

- **Chemistry** is the science of matter and its changes

- **Physics** is the science of forces and energy

Both depend greatly on mathematics

- **Pure Science** is when scientists do experiments to learn more about the world

- **Applied Science** is when people (usually engineers) use pure science to build practical machines

- **Technology** is the application of science

- A **scientific law** is a *summary* of many experimental results and observations – it tells how things work
  - Law of Gravity

- A **scientific theory** is an *explanation* for some phenomenon that is based on observation, experimentation, and reasoning
  - A theory is **not** a guess
  - Kinetic Theory

- Math helps us describe physical events
  - A = L * W
  - F = M * A

- Scientists also use models to study things
  - Computer modeling
  - Physical Models

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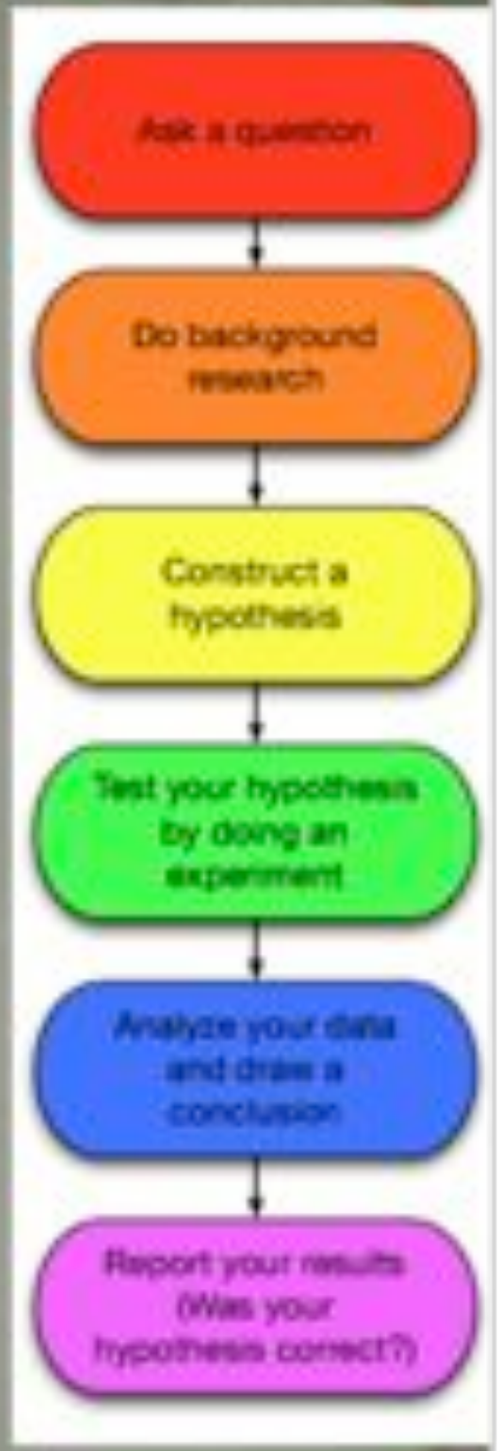
Section 2: The Way Science Works

- The most important skill in science is critical thinking
  - **Critical Thinking** is the ability to assess claims critically and to make judgments based on reason
  - Don't believe something just because you are told... check it out for yourself

- Scientists ask questions about the world we live in
- There is a basic procedure that scientists follow to solve problems

- **Scientific Method** – A series of steps used to solve a problem scientifically

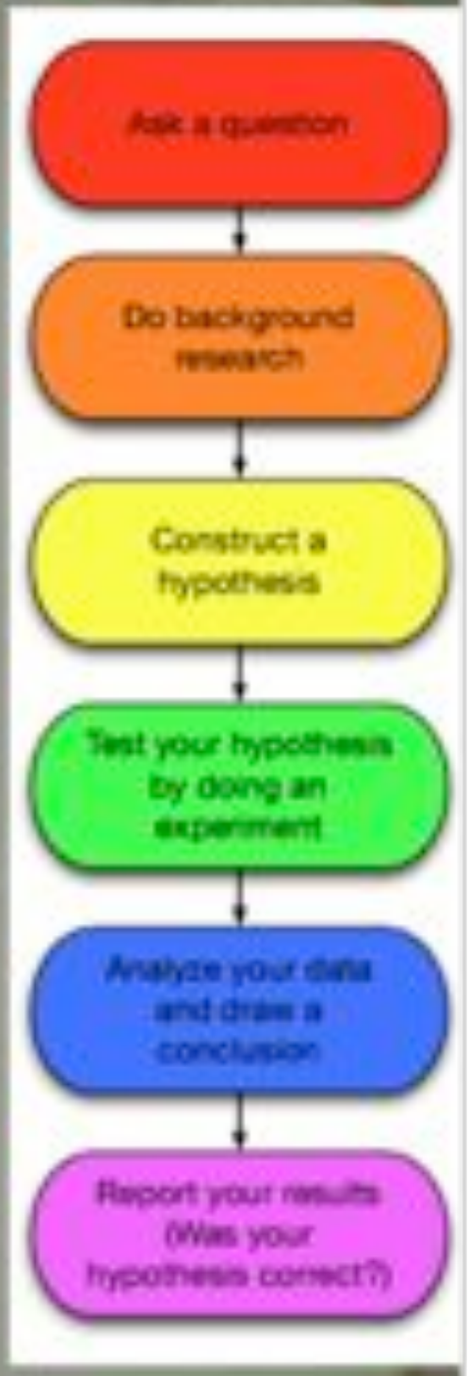
- 1.) Ask a question
  - What are you trying to solve?
- 2.) Do background research
  - Maybe someone else already has an answer
- 3.) Construct a hypothesis
  - This is a educated guess, or a possible answer to the question



- 4.) Test hypothesis by performing an experiment
  - This is how scientists collect data
  - Probably the most important step

- 5.) Analyze your data, draw a conclusion
  - Using the experiment data, you decide what your answer is to your question

- 6.) Report your results
  - Scientific journals, peer review



Setting up an Experiment

- Experiments need to be conducted correctly so that the data obtained can be trusted
- A good experiment uses at least two study groups
- The two groups are exactly alike except for one difference, or **variable** (factor that can be changed)
- The **control group** is what gives your something to compare too

Which laundry detergent works best?




Control Group	Experimental Group(s)

What else should we be sure to keep the same?

Which liquid allows plants to grow the fastest?

Control Group	Experimental Group(s)

What else should we be sure to keep the same?

- Scientists always use the international System of Units (SI), or the Metric System

- Sharing data between scientists is much easier when everyone uses the same units

- **Base Units**: (7 base units total)

Quantity	Unit	Abbreviation
Length	Meter	M
Mass	Kilogram	Kg
Time	Second	S
Temperature	Kelvin	K

- To change the size of the unit of measurement we use different prefixes
  - As opposed to using completely different units (inches, feet, yard, mile)

Prefix	Symbol	Meaning	Multiple
Giga	G	Billion	1,000,000,000
Mega	M	Million	1,000,000
Kilo	k	Thousand	1,000
------	------	------	------
Deci	d	Tenth	0.1
Centi	c	Hundreth	0.01
Milli	m	Thousandth	0.001
Micro	μ	Millionth	0.000001
Nano	n	Billionth	0.000000001

- **Derived Units**
  - Area – A = l x w
  - Volume
  - Pressure
  - Weight
  - Force
  - Speed

- These units are **combinations** of base units

- Practice converting!!! Page 17 #1-8

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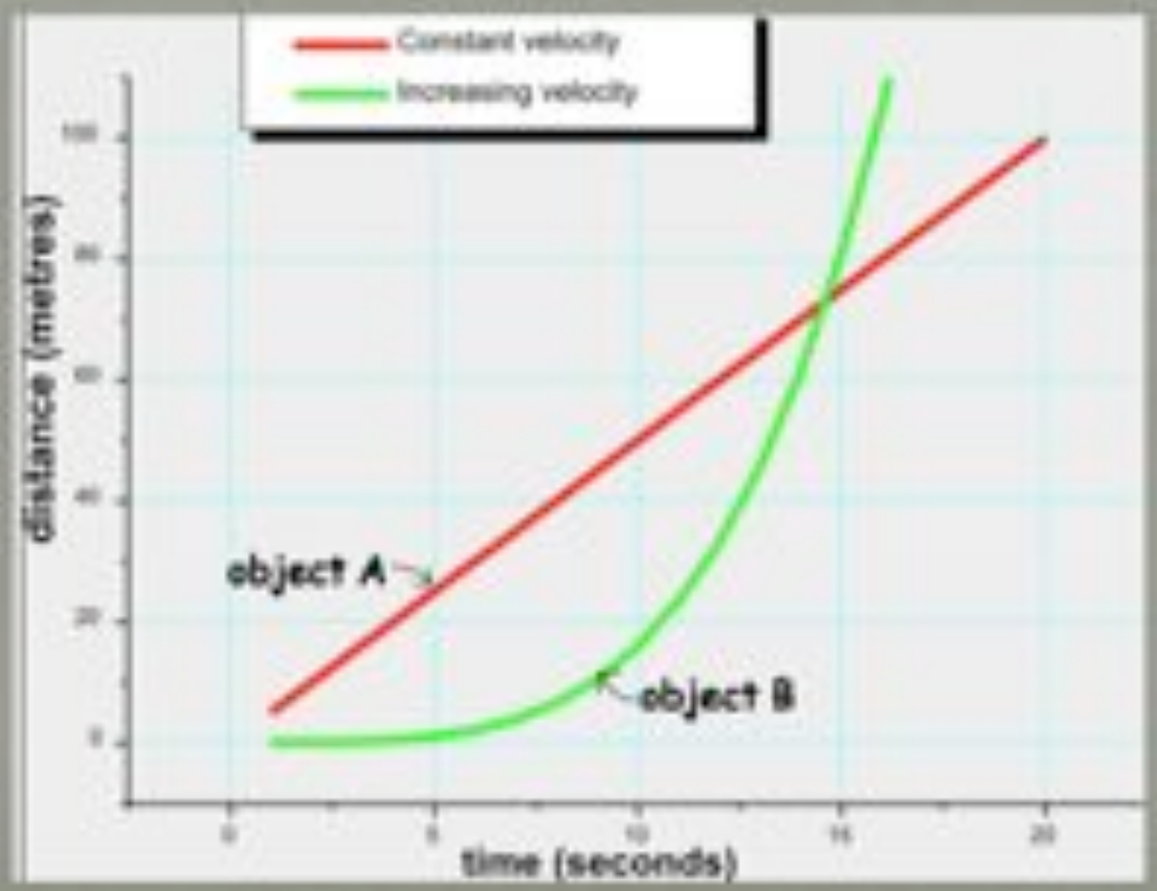
Section 3: Organizing Data

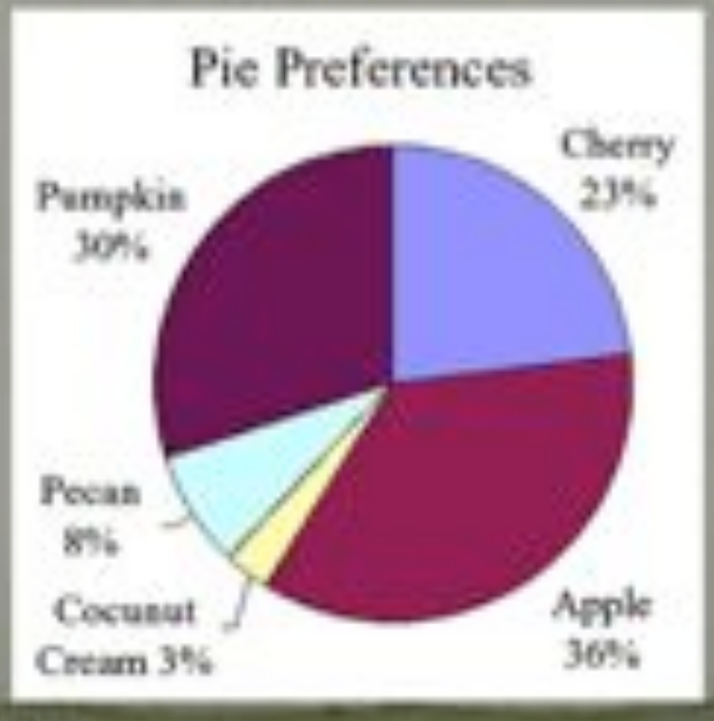
- After completing an experiment, we have to be able to show the results
  - Often times it helps to make a chart of some sort

- **Line Graphs** are best for continuous changes



- **Bar Graphs** compare items

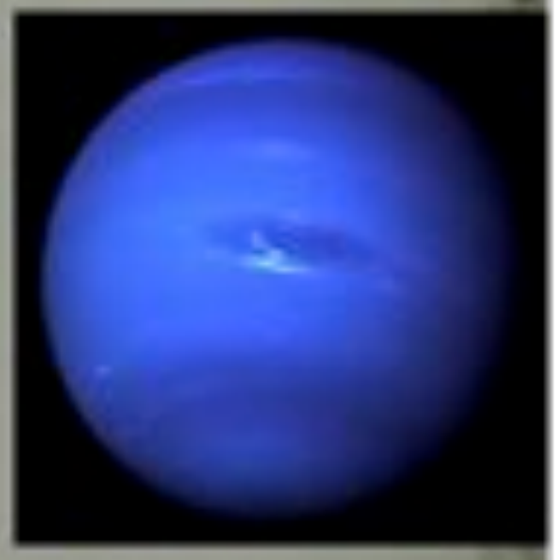
- **Pie Charts** show the parts of a whole



- In science we often need to express very large or very small measurements
  - For example, the speed of light is 300,000,000 m/s

- What if we wanted to calculate the time light would take to travel from Neptune to Earth
  - 4,500,000,000,000 meters apart

- $t = \frac{\text{distance from Earth to Neptune (m)}}{\text{distance light travels in 1 s (m/s)}}$



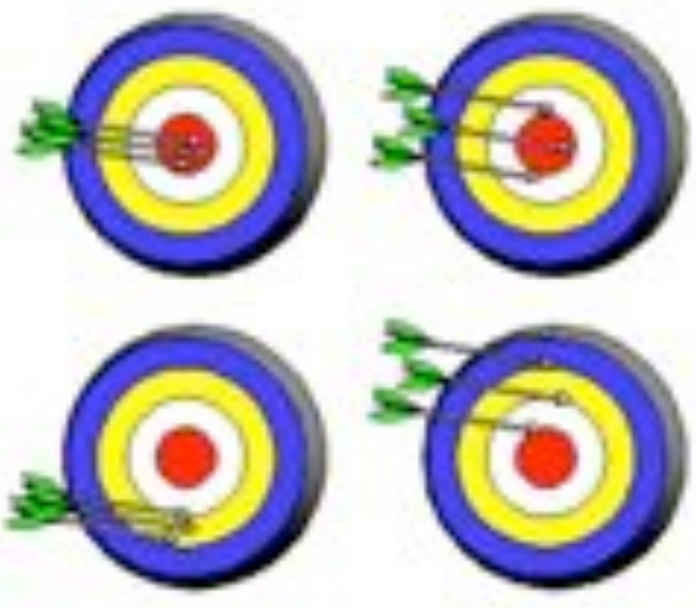
- Lots of zeros!!!
  - **Scientific Notation** is a method of expressing a quantity as a number multiplied by 10 to the appropriate power
  - 4,500,000,000,000 m = 4.5×10^{12} m
  - 300,000,000 m/s = 3.0×10^{8}

- Practice Questions!!!

- **Precision** – the exactness of a measurement
  - A ruler is more precise than a meterstick
  - A caliper is more precise than a ruler

- **Accuracy** – a description of how close a measurement is to the true value

Precision vs. Accuracy



- To show the precision of a measured quantity we use significant figures

- **Significant Figures** are basically the number of units after the decimal point to show the precision of a measurement

- In calculations, the answer is only as precise as the least precise measurement used in the calculation