Introduction

Objective:

Relate and link the knowledge gained from the course to your everyday life experiences

- You will be learning some basic laws of Physics and few simple topics in Chemistry
- Very little mathematics will be used
- Conceptual understanding will be emphasized.

Text: Concepts of Physics and Concepts of Chemistry

by Bobby Bailey and Openstax College

Science had its origins in thinking about nature: "Natural Philosophy"

580 BCE – Pythagoras (founded a school of philosophy)

350 BCE – Aristotle (first attempt at physics)

250 BCE – Archimedes (engineering)

150 BCE – Ptolemy (astronomy)

Science in Renaissance

1543 – **Copernicus** publishes "de Revolutionibus orbium coelestium"
This book was revolutionary", replacing the ideas of Ptolemy.

Around 1589 – **Galileo** creates the idea of modern experimental science.
Galileo's reliance on experiment led to Newton's theories that replaced those of Aristotle.

1687 – **Newton** publishes "Principia Mathematica Naturalis Philosophiae"

We start with Newton's mathematical ideas on Physics and Gravity.

1865 – **Maxwell** gives Electromagnetism and a molecular model for gases

Making tele-communication and cell phones possible!

*Don't forget to put your phone in "**Airplane Mode**" during class!*

1905 – **Einstein** proposes the idea of Relativity and the Photon

We start with the era of "Modern physics".

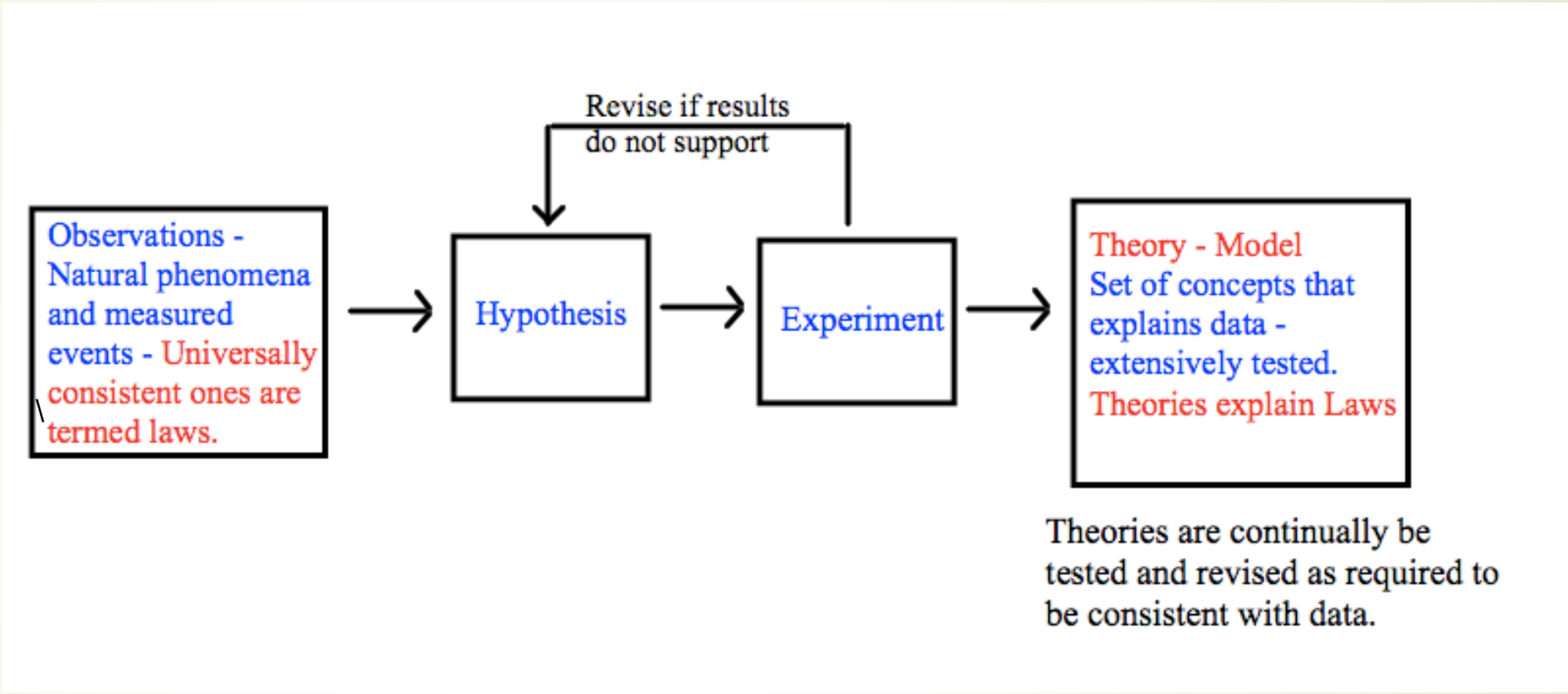
1913 – **Niels Bohr** presents Rutherford-Bohr model

We start with the rise of "Atomic physics".

The Scientific Method (*Formal method of doing science*)

- Recognize a question or problem
- Make an ***hypothesis*** which is an educated guess to solve the problem that has not been thoroughly tested.
- Predict consequences that can be observed and do experiments to see if predicted consequences are present.
- Formulate the simplest general rule that organizes hypothesis, predicted effects and experimental findings.
- A ***theory*** is a synthesis of many well-tested hypotheses that provide reliable predictions of what will happen in an experiment. Theories are not fixed, but evolve with time as new found knowledge refines theories.
- A **law** is a statement of universally consistent natural phenomena and measured events. Things that we observe and agree to be true!

Hypothesis, Law and Theory



Both theories and laws have extensive experimental evidence to support them.

A theory is not a wild guess!

Which is a theory and which is a law?

I. GASES

___ As temperature rises, the pressure in a gas in a closed container increases.

___ The motion of molecules, which is the average kinetic energy of molecules, is related to temperature. Molecules move faster at higher temperature and thus collide with more force so that a higher pressure is generated.

II. GRAVITY

____ According to Einstein, gravity is due to the warping of the structure of space by the presence of mass. The larger the mass, which is a form of energy, the greater the warping of space around it and the greater the force of gravity.

____ As mass of object increases or mass of planet increases, so does the strength of gravitational attraction between the two. The strength is inversely proportional to square of the distance.

The Physical Sciences – Physics, Chemistry, Geology, Astronomy

Physics – study of basic concepts e.g. Motion, force, energy, matter etc.

Chemistry – builds on physics; how matter is put together to make molecules and material

Geology – Apply physics and chemistry to earth science (learn about earth and its processes)

Astronomy – Apply physics, chemistry and geology to other planets and stars

Basic Measurements

- Length, Mass, Time

CGS – Centimeter-Gram-Second
MKS – Meter- Kilogram – Second → (SI units widely used in physics and other sciences)

Metric Prefixes

Symbol	Name	Power of 10	Decimal value	Memory trick
T	Tera	10^{12}		**T**rillion
G	Giga	10^{9}		**G**igantic
M	Mega	10^{6}	1000000	**M**illion
k	kilo	10^{3}	1000	
		10^{0}	1	nothing there = 0
m	milli	10^{-3}	0.001	1 **mil** = 1/1000 inch
μ	micro	10^{-6}	0.0000001	**micro**scopic
n	nano	10^{-9}		**n**ine
p	pico	10^{-12}		**p**ica = 12 point type
f	femto	10^{-15}		**f**ifteen

micro (μ) - one millionth $1\ \mu s = 1 \times 10^{-6}$ s
milli (m) - one thousandth $1\ mm = 1 \times 10^{-3}$ m
centi (c) - one hundredth $1\ cm = 1 \times 10^{-2}$ m
kilo (k) - one thousand $1\ kg = 1000\ g$
mega (M) - one million $1\ MHz = 1 \times 10^{6}$ Hz

Unit Conversions (changing a value expressed in one type of unit to another type of unit)

Example: Suppose that you drive the 10.0 km from your university to home in 20.0 min. Calculate your average speed (a) in kilometers per hour (km/h) and (b) in meters per second (m/s). (Note: Average speed is distance traveled divided by time of travel.)

Solution:

a) Average speed $= \frac{10.0\ \text{km}}{20.0\ \text{min}} = 0.500\ \frac{\text{km}}{\text{min}}$

Now, convert $\frac{\text{km}}{\text{min}}$ to $\frac{\text{km}}{\text{hr}}$: multiply by the conversion factor that will cancel minutes and leave hours. That conversion factor is $60\ \frac{\text{min}}{\text{hr}}$.

Average speed $= 0.500\ \frac{\text{km}}{\text{min}} \times \frac{60\ \text{min}}{1\ \text{hr}} = 30.0\ \frac{\text{km}}{\text{hr}}$

b) Average speed $= 30.0\ \frac{\text{km}}{\text{hr}} \times \frac{1\ \text{hr}}{3600\ \text{s}} \times \frac{1000\ \text{m}}{1\text{km}} = 8.33\ \frac{\text{m}}{\text{s}}$