

Welcome to PHY101: How the “World” Works I



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What is science?

• Science is the body of knowledge that describes the order within nature and the causes of that order

• Science is an activity dedicated to gathering of knowledge about the world and organizing and condensing it into testable laws and theories using the *Scientific Method*

The Scientific Method

- 1) Observe the world around you
- 2) Frame a question and formulate a hypothesis
- 3) Make a prediction based on the your hypothesis
- 4) Test your prediction with an experiment
- 5) If prediction is *falsified*, formulate another hypothesis; if prediction is validated, make more predictions

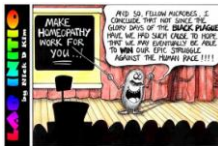
Pioneer of the Scientific Method: Ibn al-Haytham (Alhazen, 965-1039)

Science versus Pseudoscience

A hypothesis is scientific only if it is *falsifiable*!

“No number of experiments can prove me right; a single experiment can prove me wrong.” –Albert Einstein

Pseudoscience lacks evidence and posits hypotheses that are not falsifiable.



Question

Which of the following is *not* a scientific hypothesis?

- A. Electrons carry electric charge.
- B. Electrons are one of nature’s secrets.
- C. Magnetic fields bend electron trajectories.
- D. Electrons interact with neutrons.

In science

Experimental evidence must be reproducible, otherwise it is not valid.

Anyone would commits fraud is cut-off from the scientific community. There are no second chances.

A theory is a synthesis of a large body of information that encompasses well-tested and supported hypotheses.

Theories as well as facts can change.

What is physics?

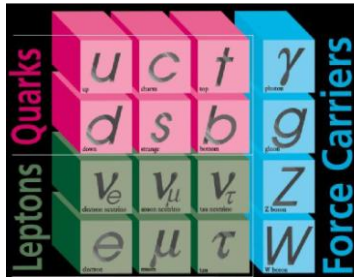
It’s knowledge of nature.

What is nature? It’s matter and it’s energy. They are indeed related.

How does one “piece” of matter interact with another “piece” of matter in terms of a few fundamental laws?



Matter: The Standard Model



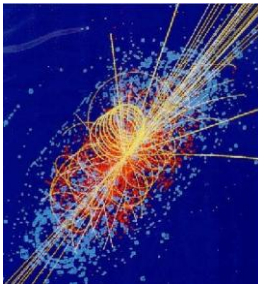
<http://www.d0.fnal.gov/Run2Physics/WWW/results/fnal/NP/N04C>

The matter in our universe



<http://home.slac.stanford.edu/pressreleases/images/darkmatter2.jpg>

When matter interacts I



<http://www.particle.kth.se/fmi/kurs/PhysicsSimulation/Images/6b/fysikb1.jpg>

When matter interacts II



<http://www.ics.uci.edu/eppstein/pix/natx/cubs/>

What does it take to learn physics?

*Since math is a concise way of stating scientific ideas, it will be useful to know a little math

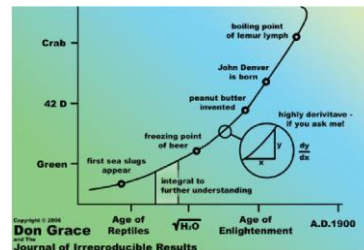
•Algebra: What is the volume of a sphere with

radius 1 cm?
Use: $V = \frac{4}{3}\pi r^3$

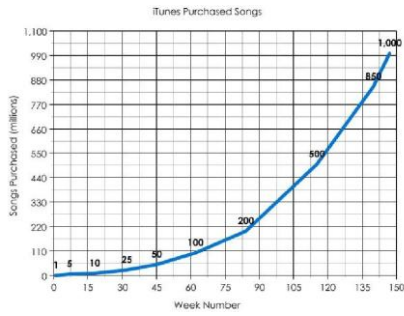
•Vectors: Addition and subtraction

•Interpreting graphs

Graphs



Graphs



In this course you will

Learn critical thinking skills



<http://www.markstivers.com/cartoons/>

Solve problems...creatively



Our first problem



How many MandMs are there in this glass sphere?