Physical Science 100

Introduction and how to get in touch of me

- Office: N263 ESC
- Office hours: by appointment
- Email: ware@byu.edu
- Office phone: 422-2186

- One Class Rule: Show respect for others in the class.

Should you be here?

- Engineering Majors
- Science Majors (physics, chemistry, geology, biology)
- Premed, Pre-dental, etc.

Ways to satisfy the G.E. requirement

- Take Physical Science 100
- Test out of Physical Science
- Take two science classes (one course from two of the three groups):
  - Group 1: CHEM 101, 105, 111/H, 152
  - Group 2: PHSCS 101, 105, 121, 123, 127/H, 137, 167, 220
  - Group 3: GEOL 101/H, 103, 111, 330

The Syllabus

- Available through learning suite, or directly at ps100.byu.edu .
- Read it carefully, and refer to it when you have questions about dates and policies!
- When in doubt read the syllabus!

Grading

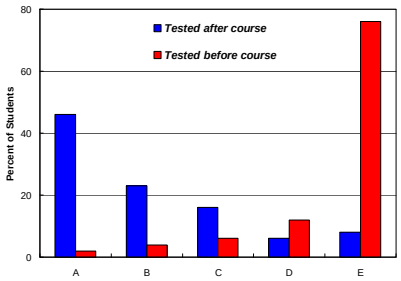
- In Class Quizzes (60 pts, 14% of grade)
  - Please go to ps100.byu.edu and register your clicker!
- Homework due weekly, mostly on Friday (100 pts, 24%)
  - Written answers to questions, often involving short experiments (see syllabus for details).
  - Done in recitation section, and you can hand it directly to your TA
  - Put your section number on everything you turn in
  - Late work is not accepted

- Midterms exams (160 pts, 38% of grade)
  - In the testing center
- Final Exam (100 pts, 24%)
  - You cannot take the final exam before the testing week begins. This is BYU policy.

Grades

- There are two ways to calculate your grade. You'll receive the higher one.
  - Midterm exams + homework + Quizzes + final exam.
  - Final exam only (or pretest only)

So I can just blow off the course and take the final? Correct, but not recommended.



Grading Example

Midterms	Final	Course Grade
A A A A	D-	B
D+ E D- E	A	A

- Moral: Do well on the final.
- The most common grade we give, by far, is "A". The second most common grade is "E". The most significant trait of those that fail is that they don't come to lectures or do their homework.

Past complaint

- This material is stuff I learned in high school (another course, etc.). Why do I have to sit through it again in college?
- Response: You don't! Demonstrate that you know the material (via the challenge exam) and move on.

You can test out

Exemption Exam

- In the testing center
- Available until the drop deadline
- 100 multiple choice questions
- It cannot hurt your grade
- Similar to the final

See http://ps100.byu.edu for more details

I am only here because of the GE requirement. Otherwise I'd never take this class.

A. Totally agree
B. Somewhat agree
C. Neutral
D. Somewhat disagree
E. Totally disagree

Brigham Young's thoughts on science

I want to have schools to entertain the minds of the people and draw them out to learn the arts and sciences. … there is nothing I would like better than to learn chemistry, botany, geology and mineralogy

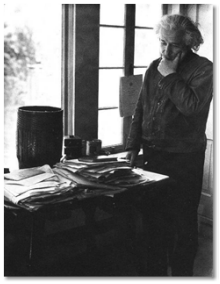
Brigham Young's thoughts on science

If we will not lay to heart the rules of education which our Teacher gives us to study and continue to advance from one branch of learning to another, we never can be scholars of the first class and become endowed with the science, power, excellency, brightness and glory of the heavenly host; and unless we are educated as they are we cannot associate with them

Halftime entertainment

How do we really know anything?

1. Authority
2. Intuition
3. Reason
4. Sensory Data



Authority

- Strength: Draws upon historical experience and expert wisdom.
- Weakness: How do others know? What do you do when authorities disagree?

Examples:

- Voice activated windows
- Newton's corpuscular theory of light
- Galileo and the solar system

Intuition

- Strength: Not filtered through our senses. Can be from the ultimate authority.
- Weakness:
  - Personal. Can't be inspected by others.
  - Not available on demand.
  - Sometimes challenging to verify source.

Reason

- Strength: Based upon non-contradiction. Available for public review. Internally consistent.
- Weakness: Only as good as the assumptions. Should one assumption be proven false, the reasoning must be rebuilt.

Sensory Data

- Strength: The ultimate proof of a scientific idea is in whether or not nature actually behaves as predicted. Reproducibility leads to the laws of nature.
- Weakness: Limited in scope. Subject to unknown biases.

What Planet is this?

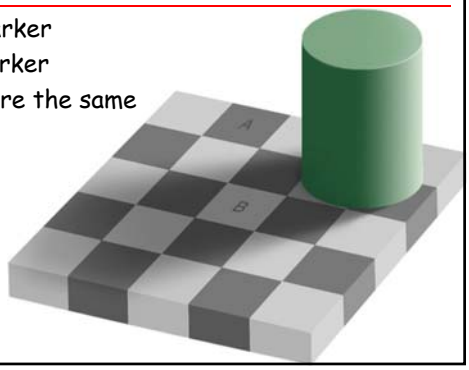
a) Jupiter
b) Earth
c) Mars
d) Saturn
e) Pluto

How do you know this planet is called Saturn

a) Authority
b) Intuition
c) Reason
d) Sensory Data

Which square is a darker shade of gray?

A. A is darker
B. B is darker
C. They are the same



Which square is a darker shade of gray?

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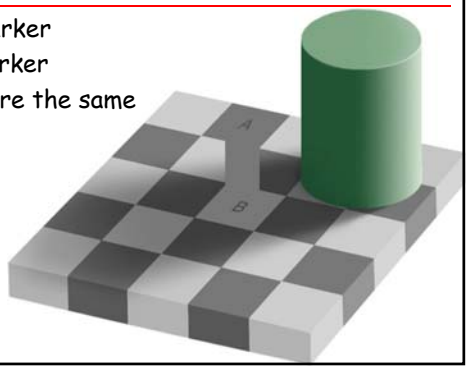


6 Basic Assumptions of Science

- Existence
- Causality
- Position Symmetry
- Time Symmetry
- Noncontradiction
- Occam's razor

Existence

- We all interact with the exact same world, which exists independent from us.
- Our senses are to be trusted.
- Philosophers really get into this assumption ("I think therefore I am…"), but scientists tend to just accept it. (We can't do science without it.)

Renee DesCartes

Causality

- Every effect has a cause that precedes it in time.
- This rules out time travel to the past.

Position Symmetry

- The ***laws*** of nature are the same everywhere in the universe.

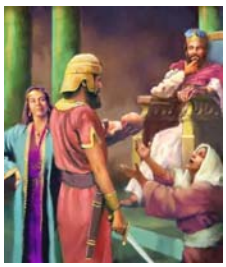
The far side of the galaxy is 100,000 light years away. We can never visit there and do experiments. So we must ***assume*** the laws of Newton, gravity, etc are obeyed at all distant points.

Time Symmetry

- The ***laws*** of nature do not change with time. Experiments done by Galileo should give the same results if done today.

Noncontradiction

- When two ideas contradict each other, at least one of them must be wrong. Otherwise *reason* would not work.



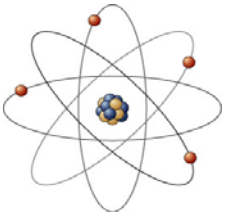
Occam's Razor

- When two ideas explain the same result and do not contradict, we favor the *simpler* one. i.e. Occam's razor "slices away" the extraneous aspects leaving only the simple core.

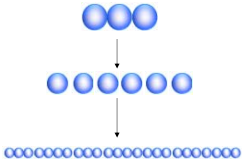
William of Ockham 1288-1348

The Scientific Method

- Models are used to represent reality. Science leads us to truth by building models and refining them through theory and data into general laws.



The grand scheme of science



Goal: Understanding (to be able to predict the future)

An example

- Newton used 4 simple ideas to explain all motion in earth and heaven
  - Three laws of motion and one law of gravity
  - These are the assumptions that the description of motion rests upon.
- This is where our study of physical science begins.

Isaac Newton age 83

Where are we going?
The Grand Outline of PS 100

1. Why does stuff move the way it does?
2. What is stuff made out of?
3. How does the earth work?
4. How do the heavens work?