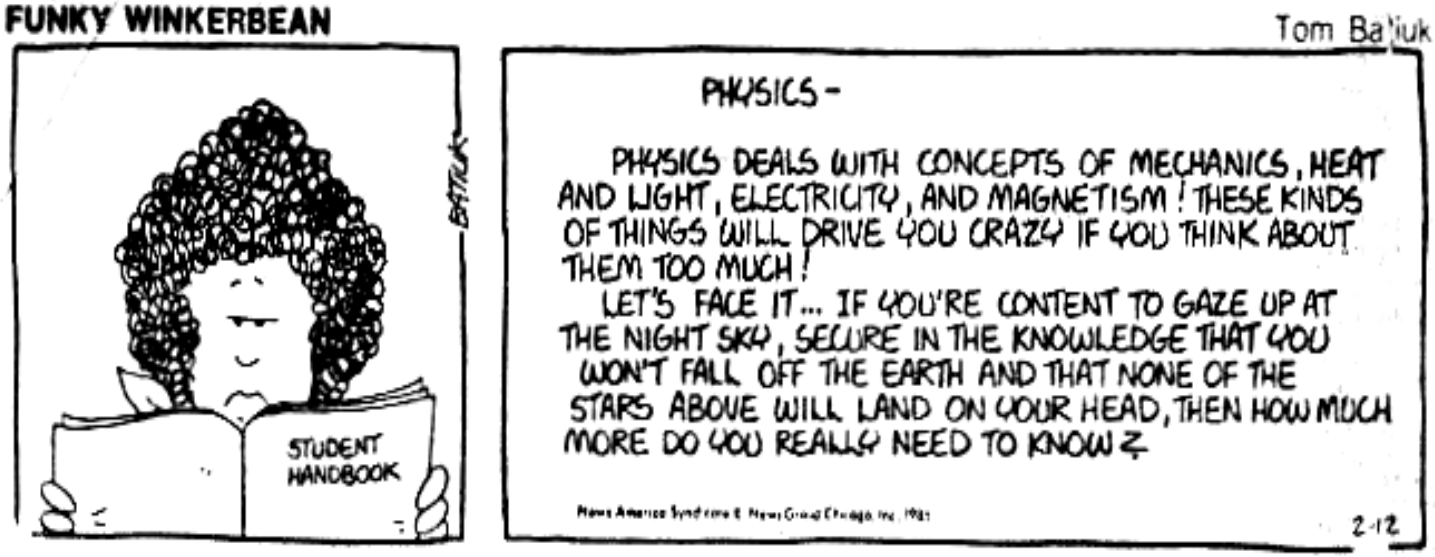
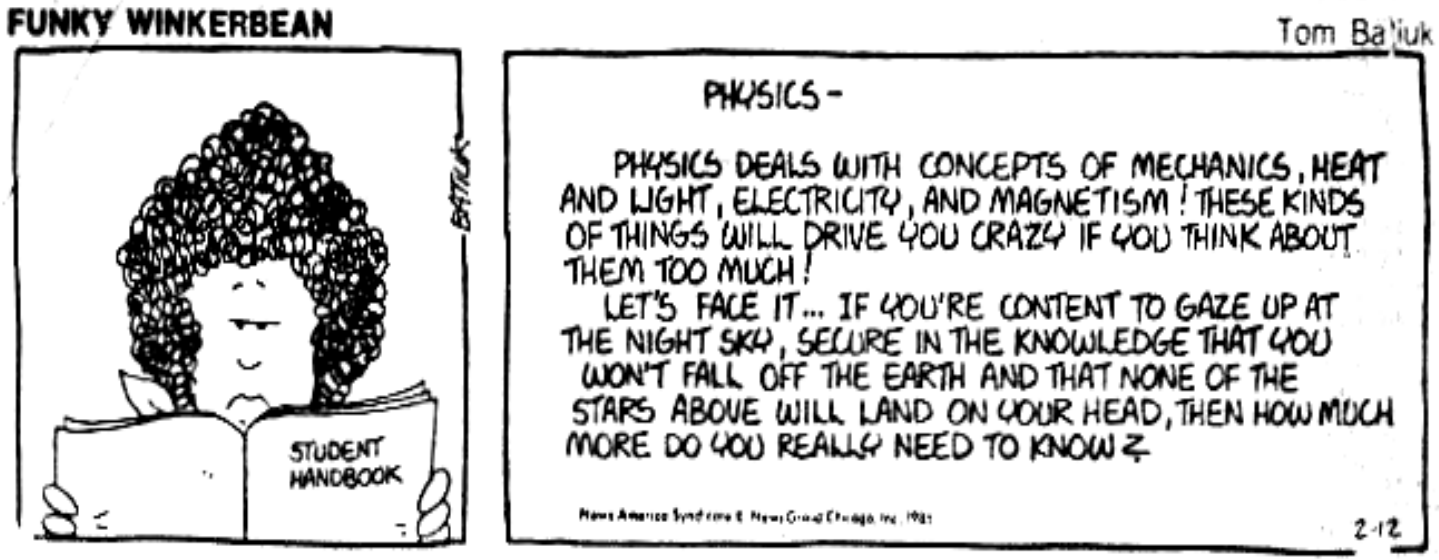
# PHYS 121 – SPRING 2015




## Lecture 0: Introduction

## *SERMON from the STAGE*

*version 01/12/2015, ~ 24 slides*




**On the other hand,**

**if you want to <u>understand</u> how things work**

***<u>or graduate with a science or engineering degree,</u>***

**you need to study physics.**

# THE PHYS 121 TEAM

*led by G. Chottiner*

http://heroized.com/wp-content/uploads/2013/02/tig-team.jpg

- First, a word from our Lab Director, Dr. Driscoll.
- Next, a word from our SI's http://students.case.edu/education/resources/instruction/
  - Stephanie Hougen
  - Ian Ferre
- Dr. Cory Christenson, co-instructor

# ANNOUNCEMENTS

- Get your clickers/smartphone apps ready!
- Exam Dates – *do your research*
  - Exam #1 – Wednesday, February 11
  - Exam #2 – Wednesday, March 18 or 25 (or Friday?)
  - Exam #3 – Wednesday, April 15 or 22 (or Friday?)
    - ENGR 131 EXAMS on February 5, March 17 & April 16
    - ENGR 145 EXAMS on Thursdays, February 5, March 5, April 2 & April 23.
    - MATH 122 EXAMS on Tuesdays, February 3, March 3, April 14.
- Last year's final exam is posted on Blackboard.

# CLASSICAL MECHANICS

***MECHANICS*** ≡ the ***motion*** of objects & how that motion depends on ***forces*** acting on those objects.

***CLASSICAL*** ⇒ only applies to objects much bigger than atoms moving slowly compared to the speed of light.

***MODERN PHYSICS*** (*PHYS 221*) includes:

- quantum mechanics (*very small objects ~ atoms*)
- special relativity (*objects moving fast ~ speed of light*)
- general relativity (*very massive objects ~ earth*)

None of these factors applies to systems we study in PHYS 121.

**2 options for each question: 1 = YES & 2 = NO**

# WHY ARE YOU IN PHYS 121?

How many of you are in PHYS 121 for each of the following reasons?

(*You can answer yes to more than one choice.*)

A. I might decide to major in physics.

B. Because of my deep interest in physics.

C. I have nothing better to do MWF from 11:30 AM – 12:20 PM plus a three hour lab period every second week.

D. Because I failed PHYS 121 the last time I took it.

E. Because the physics department makes me take it.

F. The university (*my advisor*) made me take it because a major that I intend to pursue requires that I take physics.

# The correct answer for almost all of you is F.

*PHYS 121 is a requirement for many technical majors.*

**It's not the physics department**

**that requires you to take PHYS 121!**

- It's the Case School of Engineering

  or the School of Medicine

  or a science and math department in the College of Arts & Sciences.

**2 options for each question**

# SO, WHY ARE YOU IN PHYS 121?

Why do these departments require that their majors take physics?

*You can respond yes or no for each of the following options.*

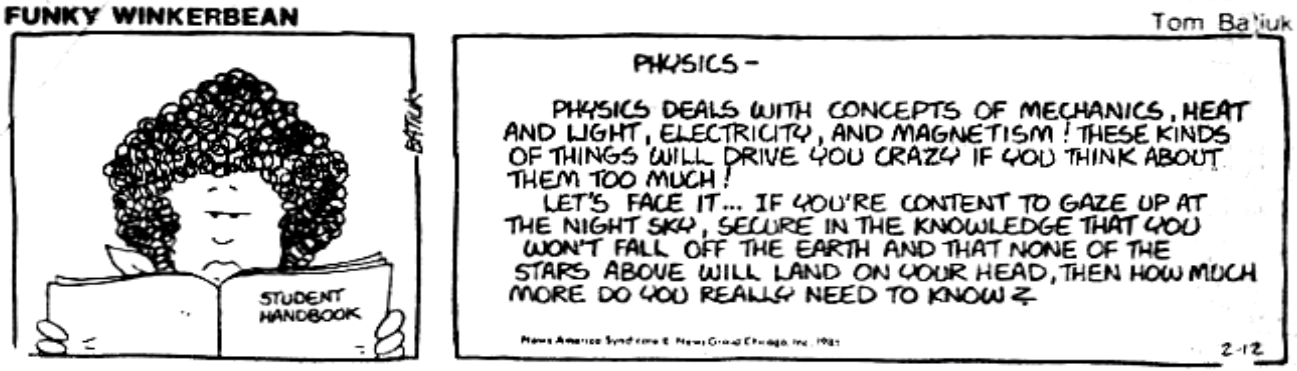
1. To *weed out* students who don't have what it takes to be an engineer or a scientist or a doctor or whatever.
2. Because the faculty in those departments had to take physics when they were students and they think *you should suffer* with a hard, boring class just like they did.
3. Because *understanding physics is the gateway* to understanding just about everything in the universe.

# So, WHY ARE YOU IN PHYS 121?

There used to be some truth to #1 (*to weed out students*) but it's never been the primary reason for requiring physics

– and it could be better stated as

*"If you can't understand first year physics, then you shouldn't be building bridges or airplanes or operating on patients since those are MUCH harder tasks than understanding a simple equation like* ***F = ma****."*




**#3 is the correct answer.**

Physics is critical to an education in any science or engineering field.

**Physics is critical to an education, period, even for liberal art majors**

*who, along with everyone else in the world,*

*should have to take at least 4 semesters of college-level physics, IMHO*!

- Physics is about reality, understanding how things work.
- Physics also helps you use physical phenomena to improve lives

**and make money and/or a living doing it**

*which is where engineers usually come in.*

2 options

# PHYSICS IS HARD!

## *YES* or *NO*? (*1* or *2*, *A* or *B*)

**NO!**

**Engineering & chemistry & biology are hard!**

**Physicists try to find the simplest possible explanation of complex phenomena.**

**Physicists will simplify a problem as much as necessary to understand its essence.**

**Engineers *et al* have to deal with all the complexities inherent in the real world.**

# PHYSICS IS NOT HARD!

## You'll get better with practice, experience & time.

# FAMOUS EINSTEIN QUOTE #1

http://en.wikipedia.org/wiki/File:Einstein_tongue.jpg
http://rescomp.stanford.edu/~cheshire/EinsteinQuotes.html

"Everything should be made as simple as possible, but not simpler."

*The goal of physics is to describe the physical world as simply as possible, while still providing quantitatively useful explanations.*

# MORE EINSTEIN QUOTES

"Common sense is the collection of prejudices acquired by age 18."

*One of the hardest things to do in physics is to recognize incorrect prejudices you have about the behavior of physical objects*

such as lighter objects ‘fall’ more slowly

& you get pushed to the outside of a car when rounding a curve

and replace them with facts.

# MORE EINSTEIN (*MATH*) QUOTES

"God does not care about our mathematical difficulties."

"Do not worry about your difficulties in mathematics.

I can assure you mine are still greater."

"As far as the laws of mathematics refer to reality, they are not certain, as far as they are certain, they do not refer to reality."

- Mathematics is the *language* of physics, but it is not physics, any more than the alphabet or a dictionary is *War and Peace* or the *Lord of the Rings*.
- You absolutely need to be comfortable with math (*algebra*, *trig*, *geometry*, *calculus*) to succeed in PHYS 121
- but learning physics should help you improve your skills in mathematics.
- **If you've never taken calculus, drop this course now!**

*You can talk to me first, if you like, but we'll be relying on calculus almost from the start. It's okay to be in MATH 121 now but only if you had calculus in high school and can handle basic derivatives and integrals.*

# SIMPLIFY, SIMPLIFY

Henry D. Thoreau, *Walden; or, Life in the Woods*, http://www.walden.org/Library/Quotations/Simplicity

- Physicists approach a problem by simplifying it as much as possible, adding in details only as necessary to describe how things work in practice.
- THE SPHERICAL COW: *start by assuming everything is a point in a vacuum.*

http://en.wikipedia.org/wiki/Spherical_cow and

https://www.google.com/search?q=physics+speherical+cow&sourceid=ie7&rls=...&oe=#hl=en&rls=com.microsoft:en-us:IE-Address&sa=X&ei=oLJcUIaIFvO60QH8-YDQBQ&ved=0CB0QvwUoA...2,or.r_gc.r_pw.r_qf.&fp=cbcfeea1c11a0b35&biw=1316&bih=928


http://www.redbubble.com/people/ajwelsh/works/7005746-spherical-cow?p=sticker

# SIMPLIFY, SIMPLIFY

- A critical goal for you in PHYS 121 this semester is to learn ***how*** to simplify a problem – and being able to solve a simple problem.
- The good news is that there's really only one thing to learn in PHYS 121 $\vec{F} = m\vec{a}$
- The bad news is that you could spend the rest of your life trying to appreciate all the nuances of this equation and still come up short.

# PHYSICS BACKGROUND

**4 options**

How much physics have you studied formally before this semester?

A. 0, none, *nada*, aucun, ninguno, keiner, 没有, никто, , لا شيء, אף אחד

B. ~ 1 year (*most likely in high school*)

C. > 1 year

D. < 0 (*my high school physics course was counter-productive.*)

All 4 answers are fine.

There is no requirement in PHYS 121 for you to have had a previous physics course

*although there is a requirement that you know geometry, trignometry, algebra, & some calculus.*

# ARE YOU GOOD at FOLLOWING INSTRUCTIONS

(*when absolutely necessary*)**?**

Have you read the syllabus, as I instructed you to do *via* email before today's class?

A. YES

B. NO

The correct answer is A. YES

- You are expected to review the syllabus & understand class policies explained there.
- I won't repeat these policies in lecture today.
- If you later ask questions that are addressed in the syllabus, my reply might be "*Read the syllabus*."

# 2 options for each question

- How many of you think you **CAN** earn an A in this course?

  A = YES  while  B = NO

- How many of you think you **WILL** earn an A in this course?

  A = YES  while  B = NO

- How many of you are more worried about **FAILING** PHYS 121?

  A = YES  while  B = NO

# GOOD NEWS / BAD NEWS

**You all start the course with an A.**

- If you end up with a lesser grade, you worked your way down.
- The grade distribution for PHYS 121 in spring 2014 was:

| | |
|---|---|
| **A** | *81* |
| **B** | *82* |
| **C** | *37* |
| **D** | *11* |
| **F** | *7* |

- The F's were almost all due to students who quit working in the course but did not withdraw.
- BUT, about 15 students dropped the course in the first two weeks or withdrew before the final exam.

# CHOICES

You will be required to make many ‘choices’ this semester, such as:

- concepts & equations that apply to the problem at hand
- variables that you use
- the axes of your coordinate systems & plots you construct
- whether to trust someone collaborating with you on your homework.

It will often be critical that you choose **wisely**.

Wisdom generally comes with experience.

What will happen if you choose **poorly**?

- See https://www.youtube.com/watch?v=WtcZv89Hspk or https://www.youtube.com/watch?v=Y0Fvsew7K8w

**Keep this in mind the next time you have a choice to make in PHYS 121.**

# END OF SERMON #1