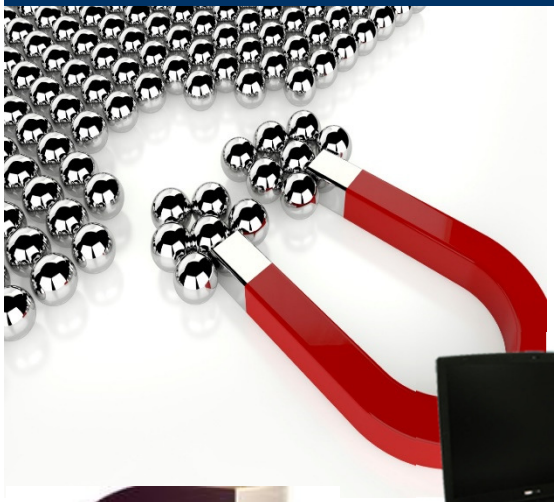
Welcome to Physics 101!

Professor Mikel “Micky” Holcomb

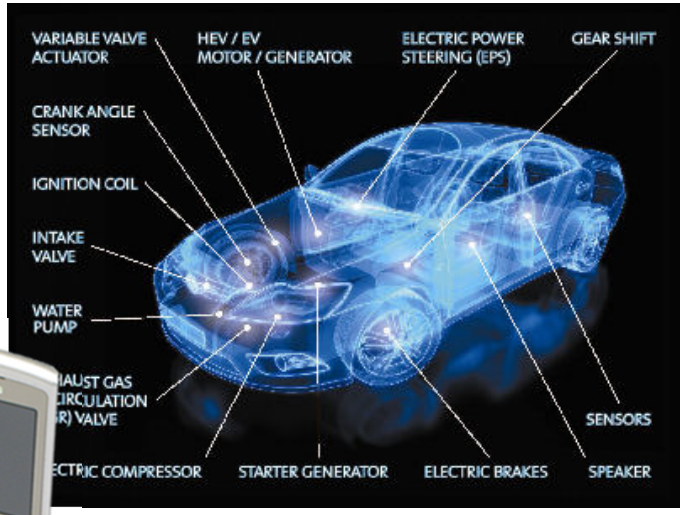
Office: 437 White Hall

Material Physics Experimentalist

Applications of Magnetism



Sound



Various Automotive

Information storage

Reducing Friction

Health

Energy generation

Why we should care about magnetism

How to Learn Physics

What is the best (scientifically proven) thing you can do to learn some physics in this class?

Get Over Your Fear of Being Wrong

and don't assume you are right just because you've been observing physics for ~20 years

It's ok to start out with the wrong answer, as long as you learn the right one (ideally before the test).

When you talk, you learn what you don't know.

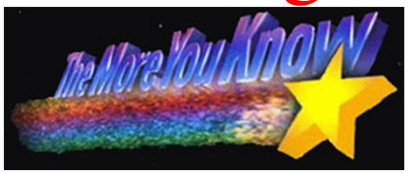
If you had all the right answers you wouldn't need this class.

What are lemmings famous for?

Don’t believe everything you see on the internet!

http://www.snopes.com/disney/films/lemmings.asp

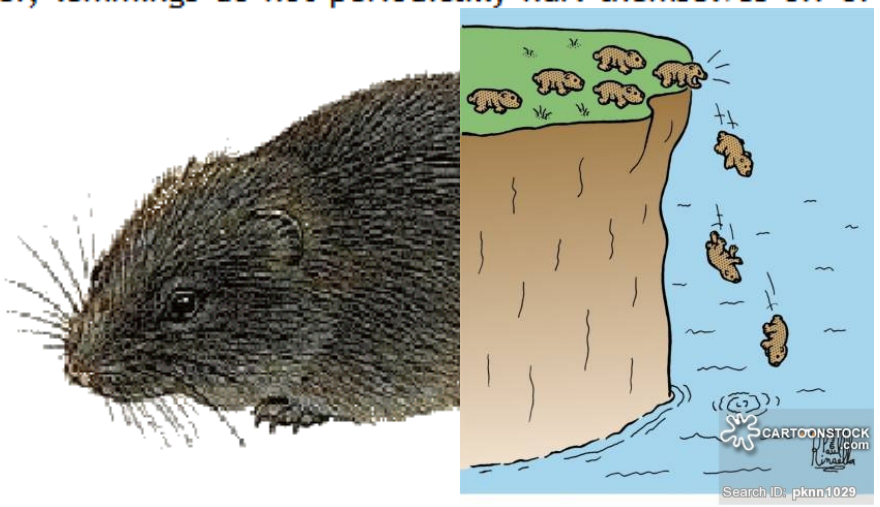
White Wilderness



Claim: During the filming of the 1958 Disney nature documentary *White Wilderness*, the film crew induced lemmings into jumping off a cliff and into the sea in order to document their supposedly suicidal behavior.

Status: *True.*

Origins: Lemming suicide is fiction. Contrary to popular belief, lemmings do not periodically hurl themselves off of cliffs and into the sea. Cyclical explosions in population do occasionally induce lemmings to attempt to migrate to areas of lesser population density. When such a migration occurs, some lemmings die by falling over cliffs or drowning in lakes or rivers. These deaths are not deliberate "suicide" attempts, however, but accidental deaths resulting from the lemmings' venturing into unfamiliar territories and being crowded and pushed over dangerous ledges. In fact, when the competition for food, space, or mates becomes too intense, lemmings are much more likely to kill each other than to kill themselves.

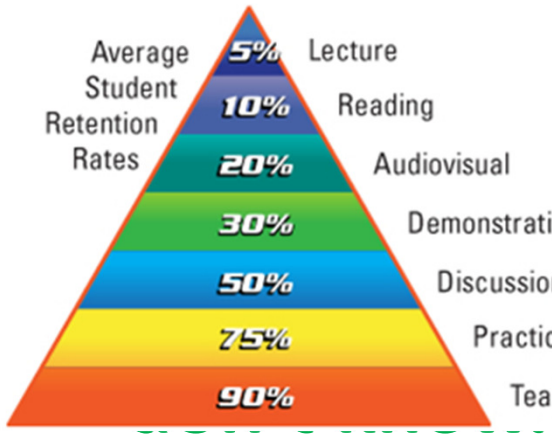


"Come back, you fools! That's just a myth! We lemmings don't really do that!"

Disney's *White Wilderness* was filmed in Alberta, Canada, which is not a native habitat for lemmings and has no outlet to the sea. Lemmings were imported for use in the film, purchased from Inuit children by the filmmakers. The Arctic rodents were placed on a snow-covered turntable and filmed from various angles to produce a "migration" sequence; afterwards, the helpless creatures were transported to a cliff overlooking a river and herded into the water. *White Wilderness* does not depict an actual lemming migration — at no time are more than a few dozen lemmings ever shown

Still, no one wants to raise their hand

Limit: 3 per person



Name: Date:

Void if not turned in the day earned.

Extra Credit point on Final Exam

I get excited when you tell me the wrong answer; then I know what misconceptions to address. No ESP.

Discussing your thoughts helps to make them clearer.

Why take Physics?

Why do you think the university requires you to take physics?

Why Study Physics

Physics is the basis of many other sciences, including chemistry, physiology, neuroscience, oceanography, seismology, and astronomy.

Most important reason

Great topic for practicing

Very Marketable Skills:

Problem Solving, Estimation, and Scientific Communication

Most people are not good at these skills. Competitive advantage

Why Study Physics

Raise your hand if you are pre-med or are interested in a medical related job.

Why should premeds care?

Dr. Mark Paternostro

Professor of Physiology and Pharmacology, West Virginia University School of Medicine

Also on WVU **Medical School Admissions Committee**

"Physics is the basis of understanding many principles of physiology! From muscle function to cardiovascular blood flow to neurobiology, understanding physics is critical to the study of medical physiology and ultimately patient care."

Changes the Way You Think

"Why didn't they teach us this stuff earlier!?! I've been walking around with all of these incorrect ideas about how the world works."
– Previous Student of Mine

"I was unaware of how incorrect my instinctive understanding of physics is because of the movies and cartoons I was exposed to. It's cool how this class changes my understanding of the world." – Another Student

Subdivisions of Physics

(just for your information, definitions not tested)

Mechanics	cause and effect of forces, motion and energy of objects
Thermodynamics	heat a med
Cryogenics	study peratures
Plasma Physics	studie trically charged gases
Solid State Physics	study aterials
Geophysics	physic canoes, oceanography)
Astrophysics	how ir interact
Acoustics	the study of sound and how sound travels
Optics	the study of light and how it travels
Electromagnetism	the interaction between electric, magnetic fields and charges
Fluid Dynamics	observes the behavior of moving liquids and gases
Biophysics	from the molecular scale to whole organisms and ecosystems
Statistical Physics	models the effects of systems of many particles
High Energy Physics	searching for fundamental particles with high energy collisions
Atomic Physics	understanding the structure of the individual atom
Molecular Physics	understanding the structure of molecules
Nuclear Physics	structure of atomic nucleus and nuclear reactions
Quantum Physics	study of extremely small systems and quantization of energy

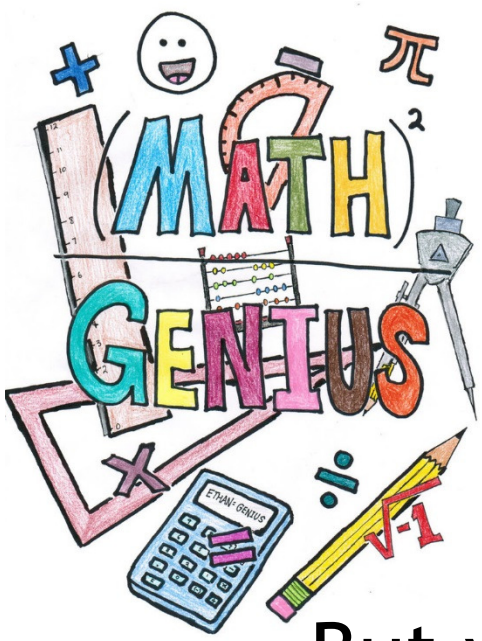
Is Physics Hard?

Raise your hand if your friends think physics is hard.

Is Physics Hard?

Why are Physics courses often considered difficult?

Physics uses math



Myth

You need to be a math genius.

But you should be OK with math.

You must know basic algebra and trigonometry (only right triangles).

You may use a non-graphing calculator.

Can You Solve This?

With a little review, you should easily be able to solve this system of equations (not by trial and error) for X and Y.

$$X + Y = 33$$
$$X - Y = 5$$

Otherwise, you might want to take another math class before 101 or plan to spend a lot of time practicing your math skills.

You have to memorize formulas

Information Sheet for Test #2 (Physics 101)

$v = v_o + at$ $x = x_o + v_o t + \frac{1}{2}at^2$ $v^2 = v_o^2 + 2a(x - x_o)$

$W = mg$ $g = 9.8\ m/s^2$ $f_k = \mu_k N$ $f_s \le \mu_s N$

Newton's 1st Law: Every object continues in its state of rest, or of constant speed in a straight line, until a nonzero net force acts on it.

Newton's 2nd Law: net F = ma

Newton's 3rd Law: When one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object.

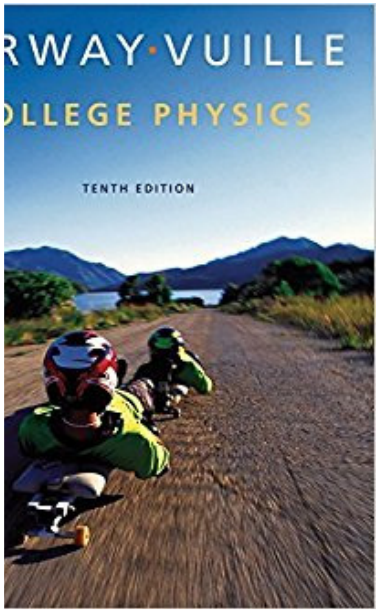
Definition of Work:
work = (component of force in the direction of displacement)(displacement)

Kinetic Energy: $KE = \frac{1}{2}mv^2$

Work-Energy Theorem **($W = \Delta KE$)** Work done by all the forces = change in kinetic energy

Gravitational Potential Energy: $GPE = mgy$ where y is change in vertical height

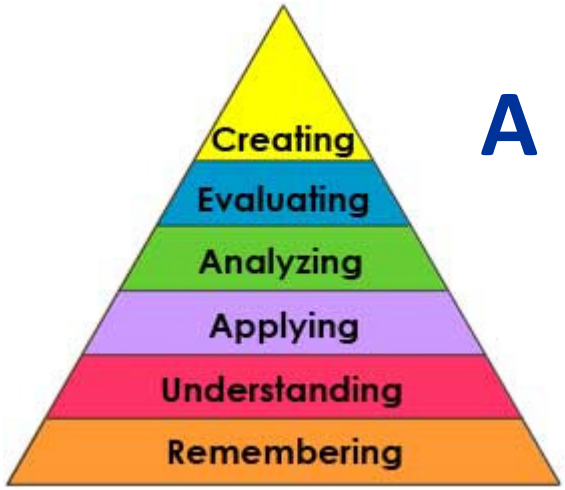
Elastic Potential Energy: $EPE = \frac{1}{2}kx^2$ where x is the amount of compression



"Never memorize what you can look up." - **Einstein**

CANNOT learn physics by watching me solve problems

Bloom's Taxonomy



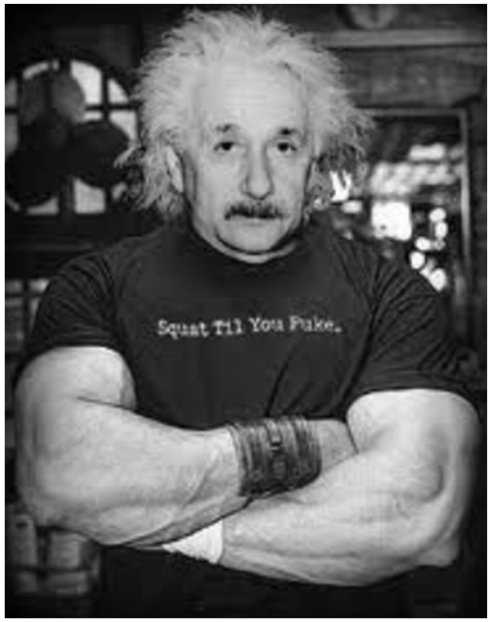
A photographic memory may not get you an A in this course.

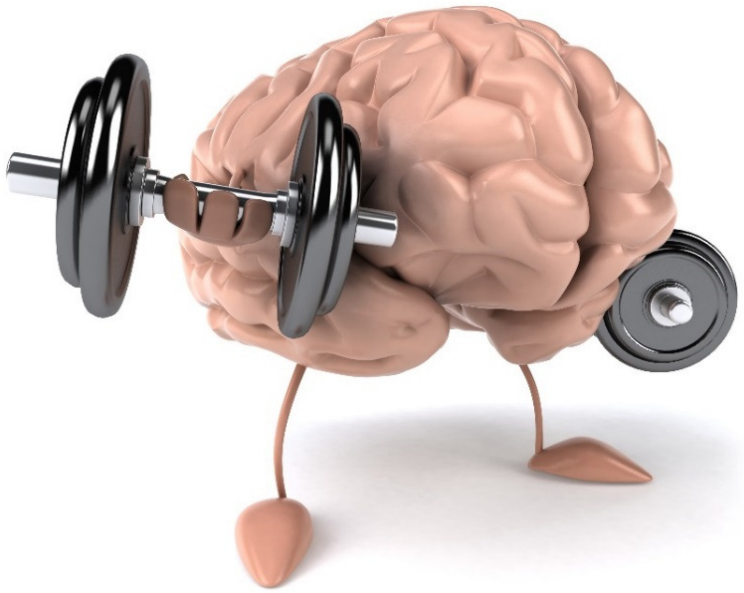
You have to be able to solve problems, which takes LOTS of practice! I provide suggestions.

The important work is up to you!

http://www.linkedin.com/news?actionBar=&articleID=1019800993&ids=cjgRd3cSej4MciMPejAMc3wVcj0Nb3AMdjcOe3oNc34IczwPe3ARdj4MciMPcPsMe3sMcz0N&aag=true&freq=weekly&trk=eml-tod2-b-ttl-3&ut=01V92dTupYal41

Physics (and math) is like a muscle





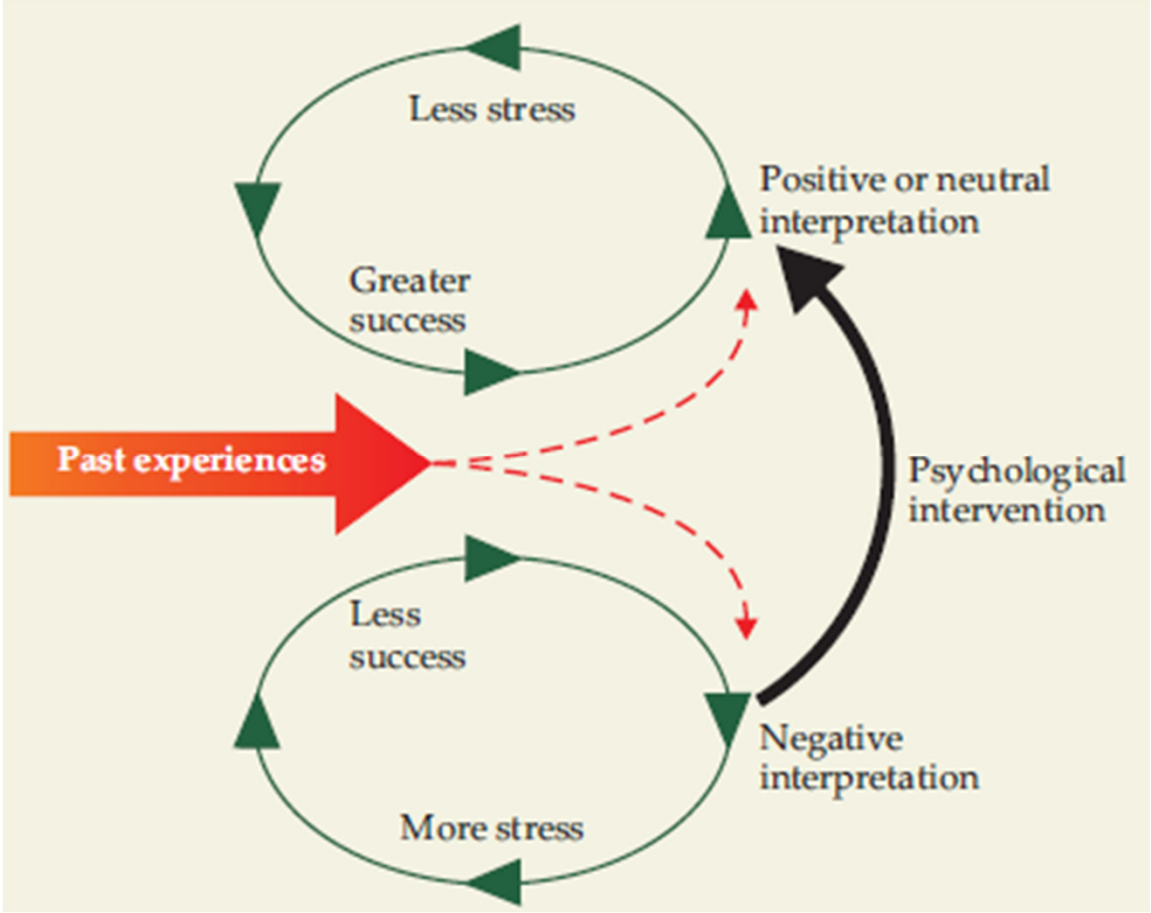
not a talent or innate ability!

You have to train to get better at problem solving.

What do you do when you start lifting weights?

You have to increase the difficulty of the problems you try in order to get better. If you focus on only easy problems, you'll only be able to solve easy problems.

How You Learn Depends on How You Think About Learning

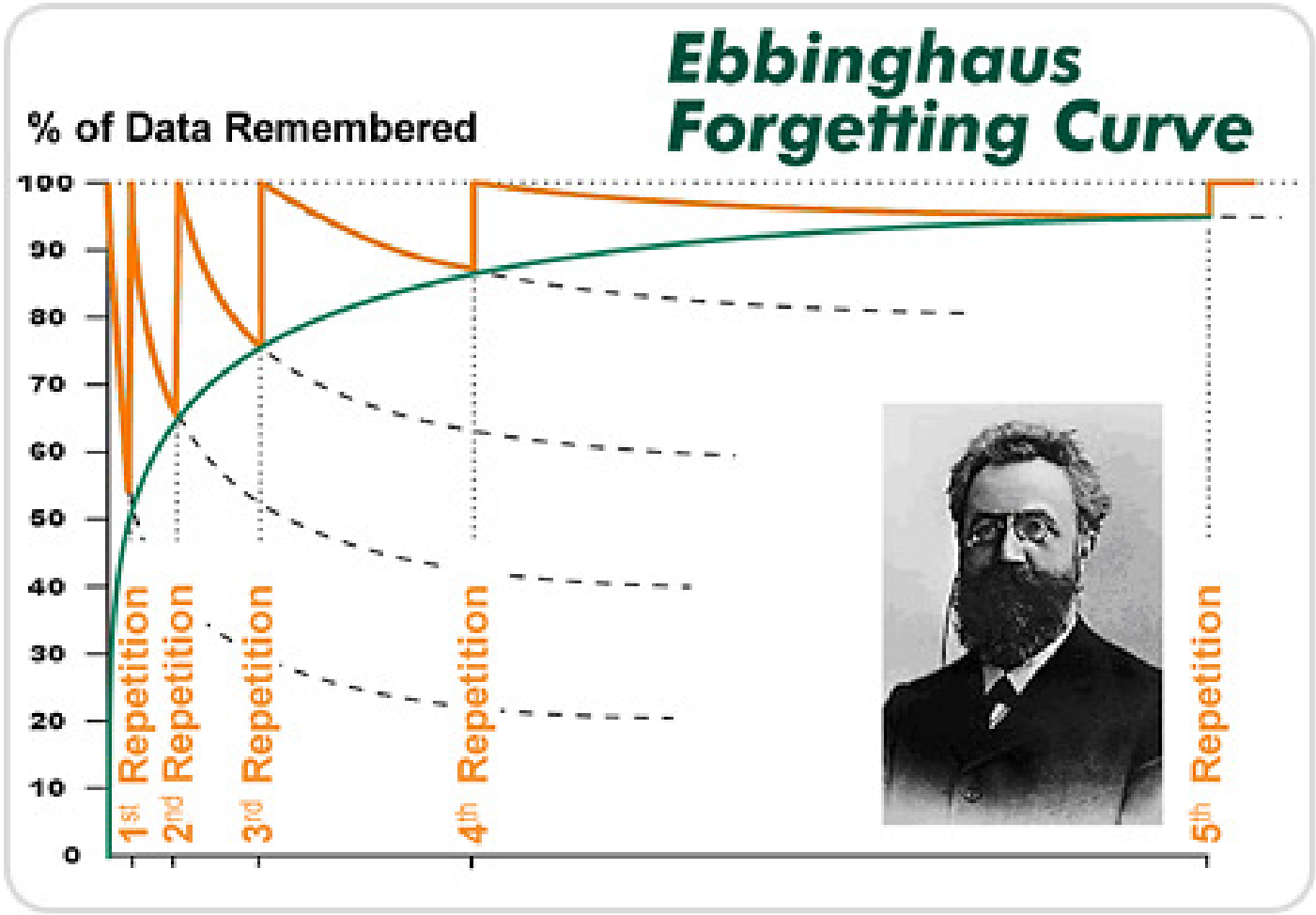


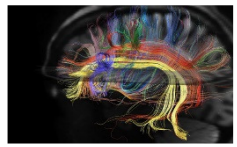
If you view hard problems or a non-ideal test score as opportunities to learn, then your much more likely to take the right steps to improve your performance for future tests.

Click here for link to supporting scientific literature

On the other hand, if you have a negative interpretation (the professor is dumb, assigns hard problems or I'm just not good at this), then you are setting yourself up for future failure. EVEN *IF* it's true, you aren't thinking about the steps to improve!

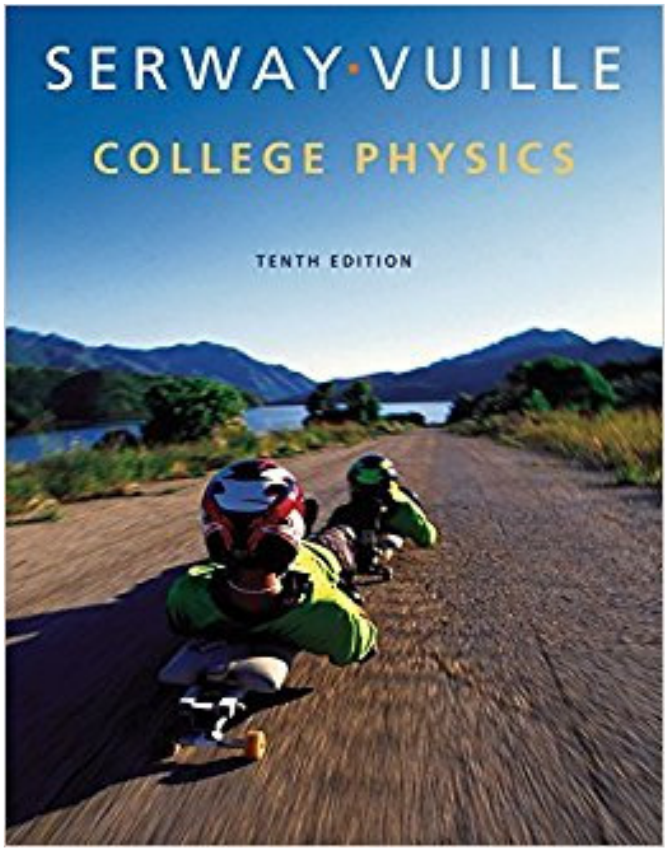
What are Some Learning Steps?





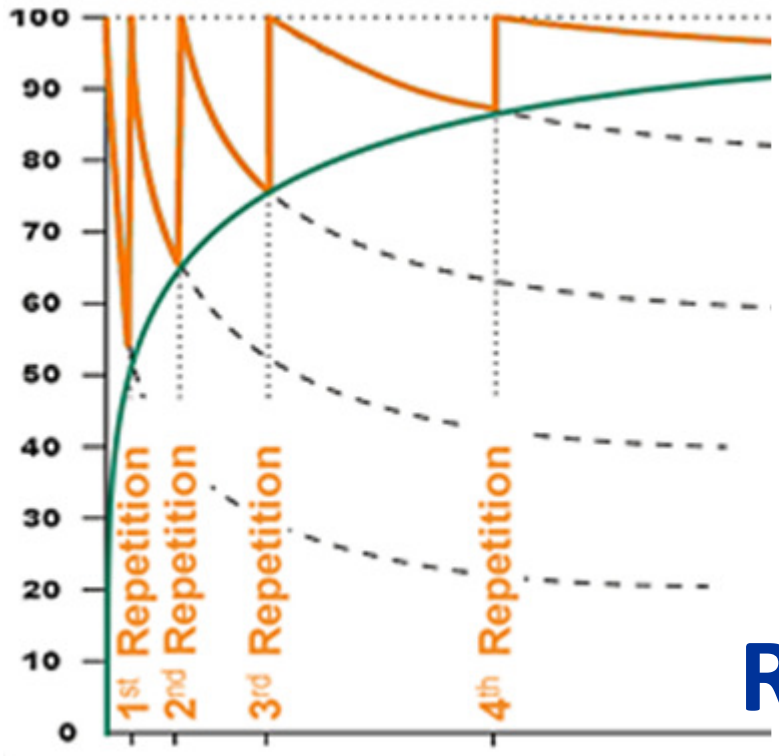
We Learn Through Repetition: the more times (and more ways) we repeat something, the more important our brains think it is, and the more likely we are to remember it

The Challenging Part



I'm required to cover 13 chapters in 15 weeks! Not much time for repetition!

Learning Improves With Repetition



Final Exam

Weekly Quizzes

Lab

Finish off Homework?

Lecture

Try it (HW, 10% Bonus)

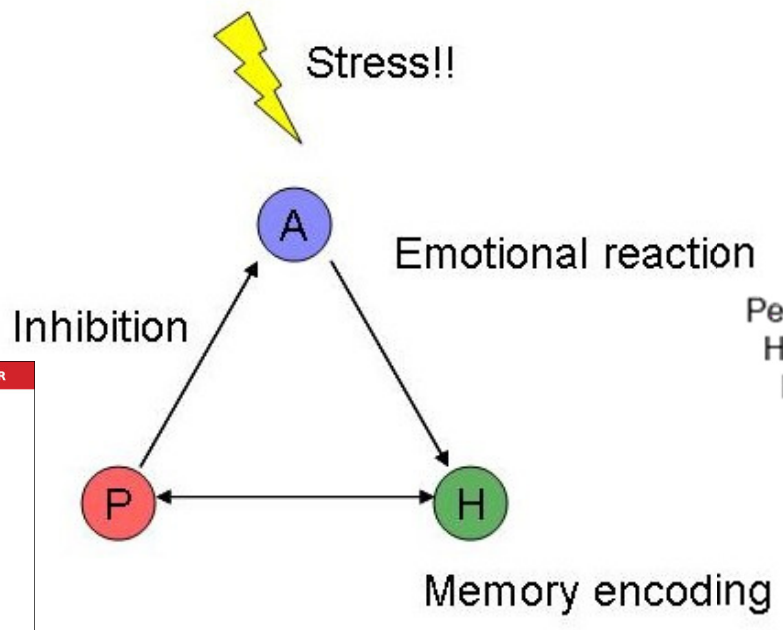
Read sections before class

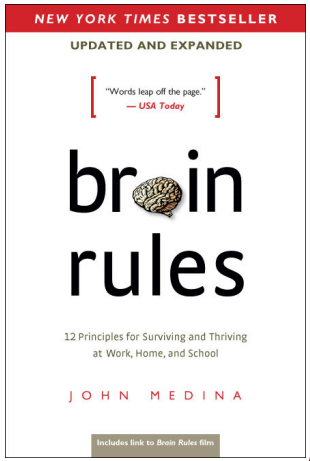
Other Ways to Boost Learning

Amygdala (A): Fight or Flight

Hippocampus (H): Memory

Prefrontal Cortex (P): Executive Function





Why Cramming Doesn't Work

(We will have online quizzes every Wed night to break this down. Was popular last year.)

The Lab for This Course

Labs start next week! Don't need to by anything for the lab. Your TA will provide the materials. (supposed to be provide via ecampus, maybe email)

I have no control over the lab and do not know who your TA is. Please contact your TA for lab questions. If needed, go to 111 White Hall to learn who is TA.

Since everyone has lab on a different day of the week, lab topics may appear slightly before or after their discussion in lecture. Typically after.

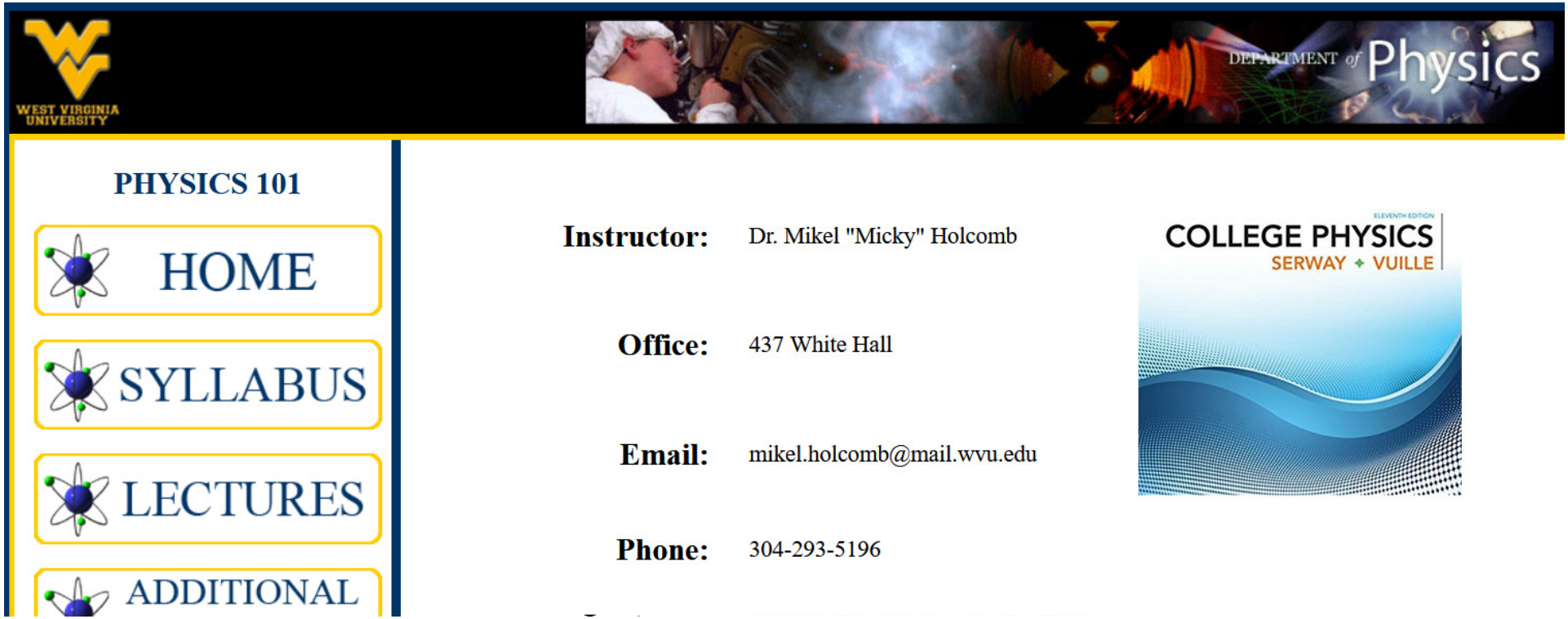
Main Points on the Syllabus

Office Hour: Wed 12:30-1:30 PM in office, Tues 1:30-2:30 (online)

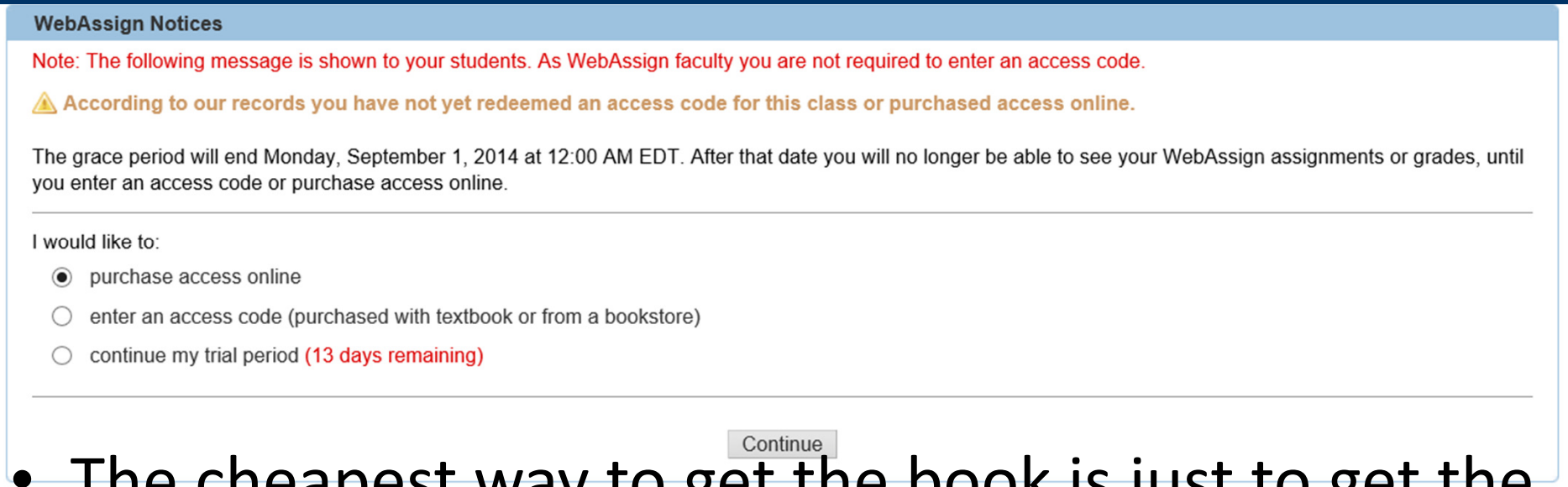
mikel.holcomb@mail.wvu.edu

Course Website: community.wvu.edu/~miholcomb

Previous lectures online, update periodically



Cheapest Book Options



- The cheapest way to get the book is just to get the ebook straight through WebAssign. If you don't buy the book/webassign package, you will be forced to buy the ebook anyway.
- WebAssign is free for 10 days from class start.
- As long as you are ok with reading the ebook, there is no requirement to have the physical book.

Cengage/WebAssign Issues?

Fall 2021 Cengage Virtual Office Hours for Students

August 17 - September 30

(every) Tuesday | Wednesday | Thursday

2-4pm

Zoom:

https://cengage.zoom.us/j/97652162052

If urgent and not during these hours:

joshua.swinehart@cengage.com

Let's Try to Set Up the Homework

This is my first time directly linking Webassign/Cengage through ecampus.

Should we see what it looks like together, because I have no idea?

If so, I'll need a volunteer to log into their ecampus, so we see how it looks.

GroupMe for Discussion

In the past I used Facebook for class discussion, but lately people have wanted other options.

GroupMe is an app that is supposed to be good for group discussion (which is vital for student learning). Used last year.

Ask questions, set up study groups

Other Useful Stuff in the Syllabus

Final Grade Point Scheme

Teaching Schedule (HW due every night except tonight and quiz dates)

Honor Code

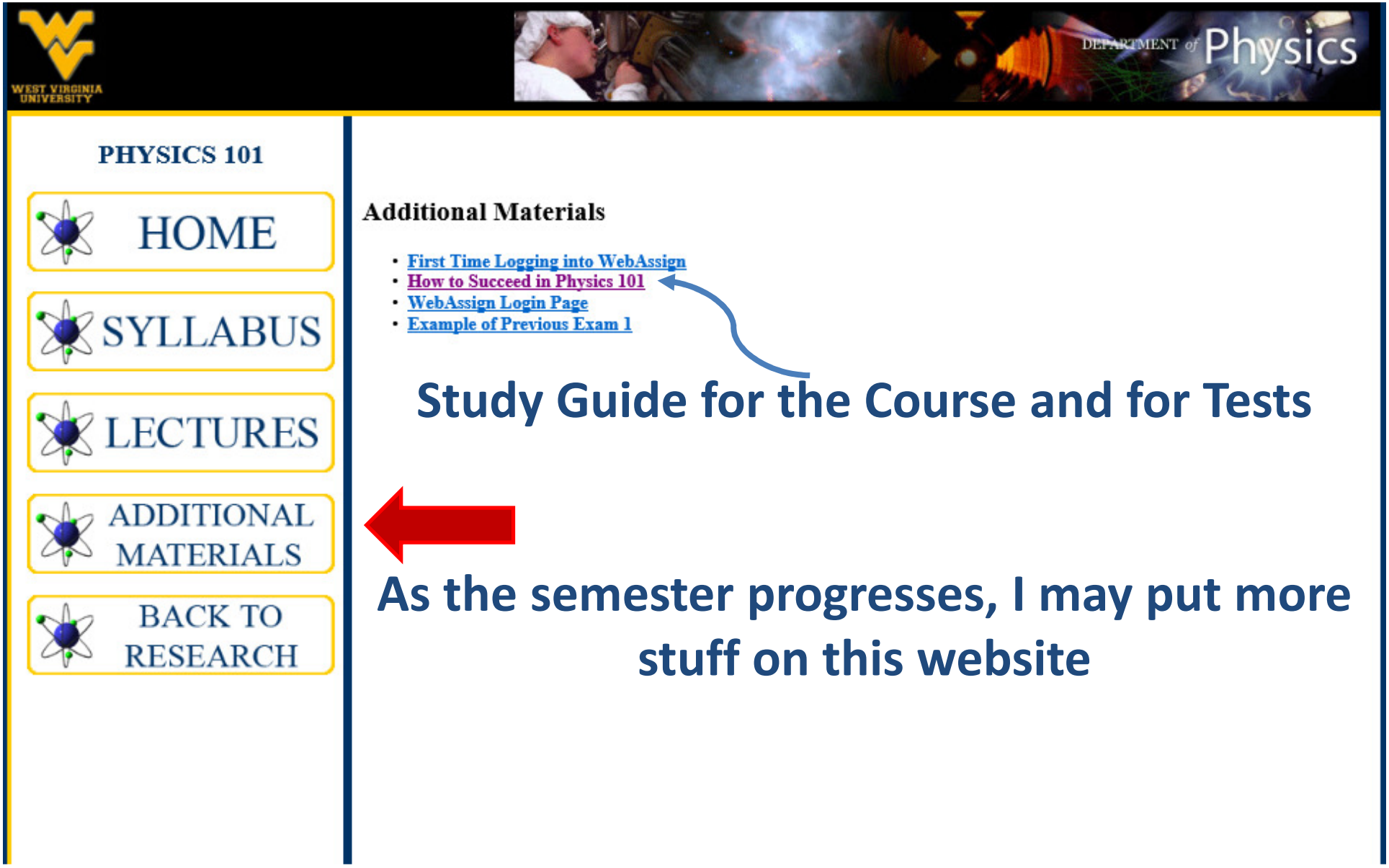
Late Policy

I generally have extra slides that we didn't have time for in class or past versions of class material, that you might still find helpful.

I will often put extra clicker questions up.

The final slide will be where you can find the answers to clicker problems, once we get to them.

Additional Materials



Study Guide for the Course and for Tests

As the semester progresses, I may put more stuff on this website

Two Main Kinds of Professors

Teaching professors	Research professors
Rare at prestigious universities like WVU, but more commonly found in intro classes	Most of the professors at WVU
Teach several courses per semester	Teach less
	They do research, write papers, present their work, etc.

What does a professor do?

Job Responsibilities of a Research Professor (Most WVU Professors)

Teach one or two classes per semester

Plan cutting edge research and manage the students that do it

Write papers in scientific journals

Find funding for your research

Present your research a lot

Department Service (meetings, qualifiers, committees)

Career development and reference letters

Science Outreach

Please keep in mind when emailing me.
I check my email after lunch and 5pm.

My Typical Day (Past Semester)

Most professors at WVU are: 40% Teaching, 40% Research, 20% Service

8-9am	Class Prep
9-10:15	Lecture
10:15-11	Office Hours/Class Prep/Grading
11am-12pm	Group Meeting/Research
12-1pm	Lunch/Respond to Class Emails
1-3pm	Research Writing (Papers/Grants)
3-4pm	Office Hours/Meet with Grad Students
4-5:30pm	Service (Quals, Dept meetings, etc)
5:30pm	Pick up my kids
Evening	Try to look at email if able

The exact timing of everything has a tendency to change wildly. Hard to predict.

If you seriously put your best effort into this class, it is VERY hard to fail it.

That being said, it is not so easy to get an A.

Making it more like the real world

We will start with problems where you only have the information you need.

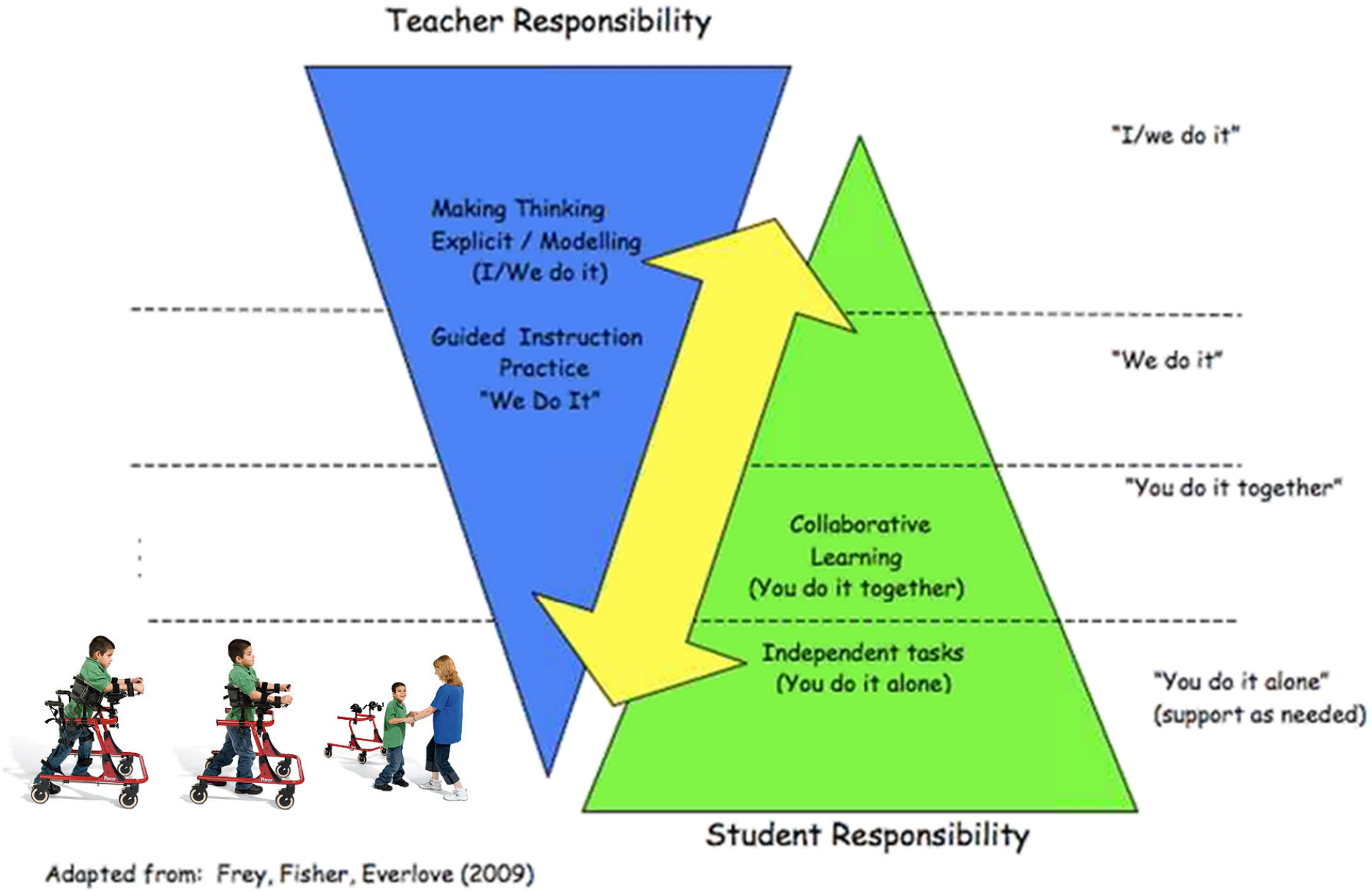


Ways to increase difficulty:

- Give you extra information so you have to figure out what information is important.
- Give you less information, so that you have to look things up, such as the formula for the volume of a sphere or the radius of the Earth

  On a test I would give you all needed info, but not necessarily on homework. Look in the book!
- Multi-step problems improve problem solving skills

Increasing Your Learning

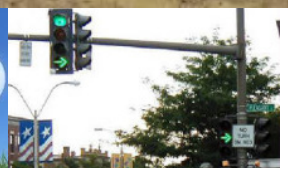


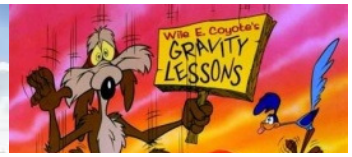
Adapted from: Frey, Fisher, Everlove (2009)

Why Study Physics

Physics is **crucial to understanding the world around us**, the world inside us (biology) and the world beyond us (universe).

Just a Few Examples: Why does the Earth keep turning? Why don't we feel it turn? Why do bones break? How do selt belts make us safer? Why does an aneurism burst? What are the consequences of texting and driving? What is the fastest I should go around a curve on an icy day?





Physics is everywhere regardless of whether you understand it. But if you do, you can make your life easier and safer, and probably earn more money!

Professors have lives too

Besides being a mom and a professor, I also play guitar and sing. When I lived in Nashville, I recorded 3 CDs.

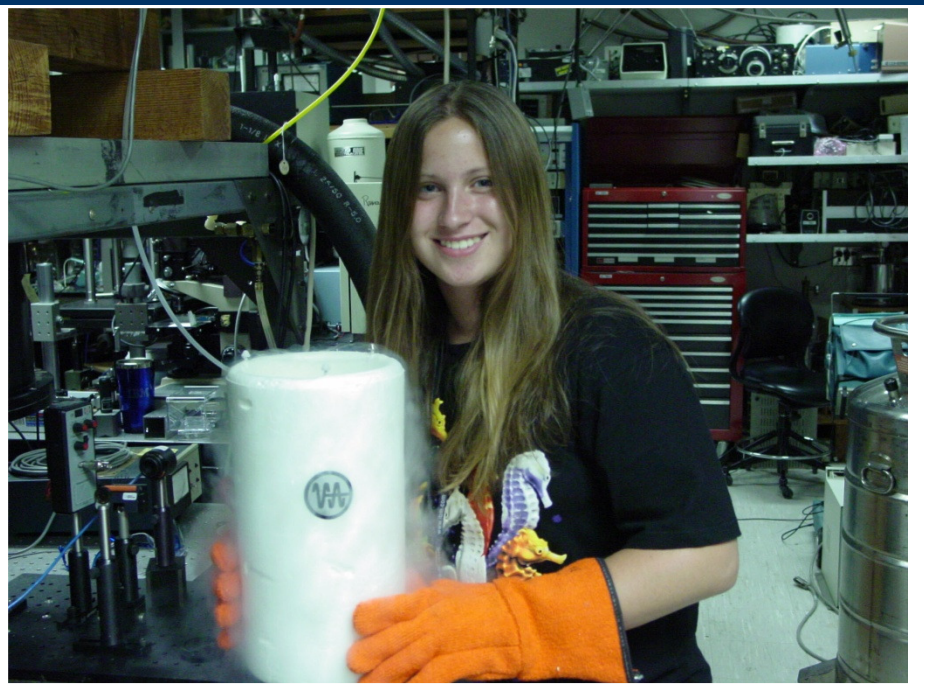
WEBillion$

In the Business of Developing Dreams • Est. 2007, Berkeley, CA

Careers for Scientists

Traditional

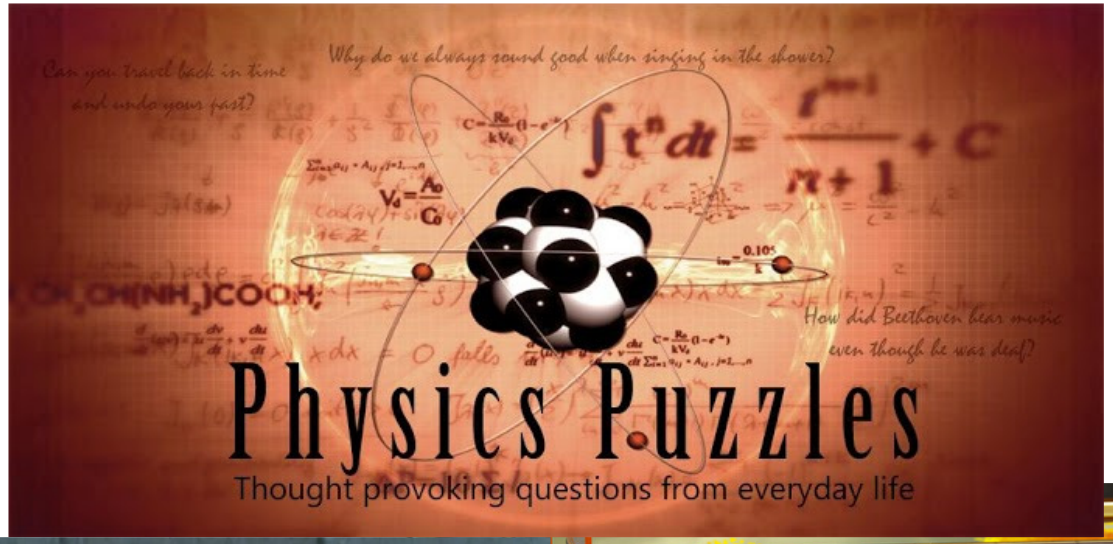
- Academia (Professor)
- Industry (IBM Research)
- National Lab (Berkeley Labs)



Non-traditional

- Medical equipment inventor
- Financial Advisor
- Policy
- Science funding
- Science journalists/editor

If you like solving puzzles, you'll like physics.



How Do We Learn?

Continuously:

The brain learns whether we want it to or not.

Unfortunately, our brains don't know what is or isn't "correct" information.

Why discussion is critical; how else do you discover the your misconceptions?

The Real World

In the "real world," when might physics be used?

Some Topics from Past Classes

Rollercoasters Basketball

Seat Belts Figure Skating

Space Fast Computing

Breaking Bones Construction

Flight Blood Pressure

Bungee Jumping Football