



Welcome to Physics 101!



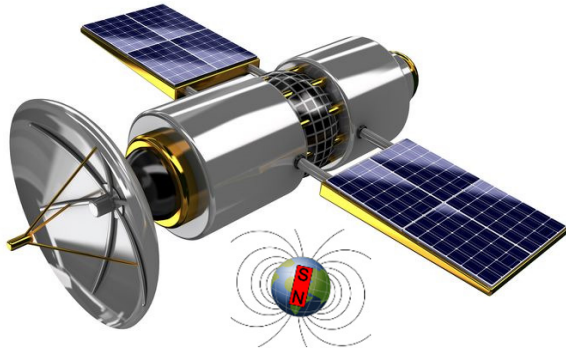
**Please choose the seat you plan to sit in all semester.
A seating chart will be passed around. You may not
change your seat unless you get prior approval!**

Professor Mikel “Micky” Holcomb

Office: 437 White Hall

Material Physics Experimentalist

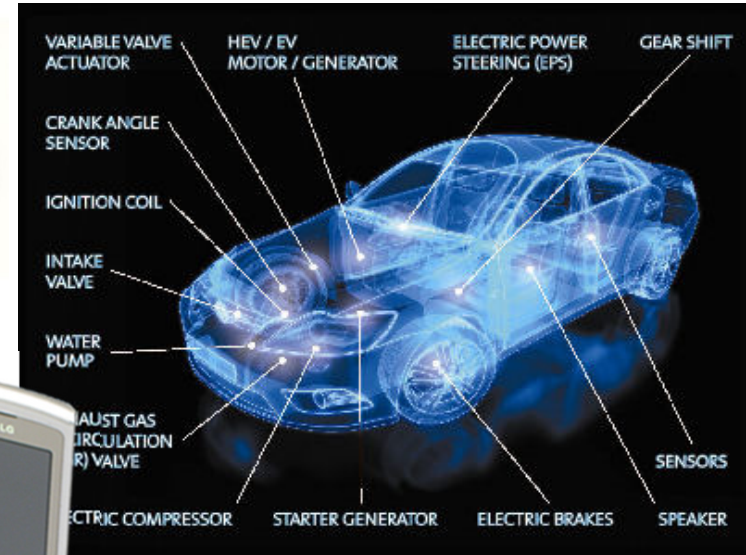
Applications of Magnetism



Satellite Orientation



Sound



Various Automotive



Reducing Friction



Information storage



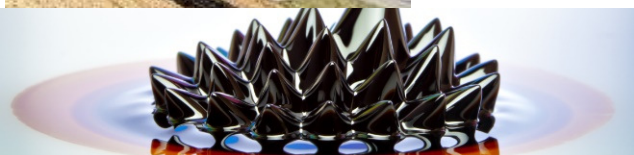
Health



Energy generation



Why we should care about magnetism





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

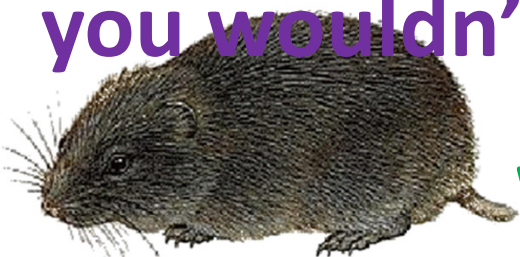
Get Over Your Fear of Being Wrong

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.



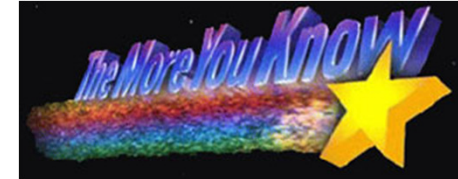
What are lemmings famous for?



Don't believe everything you see on the internet!

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

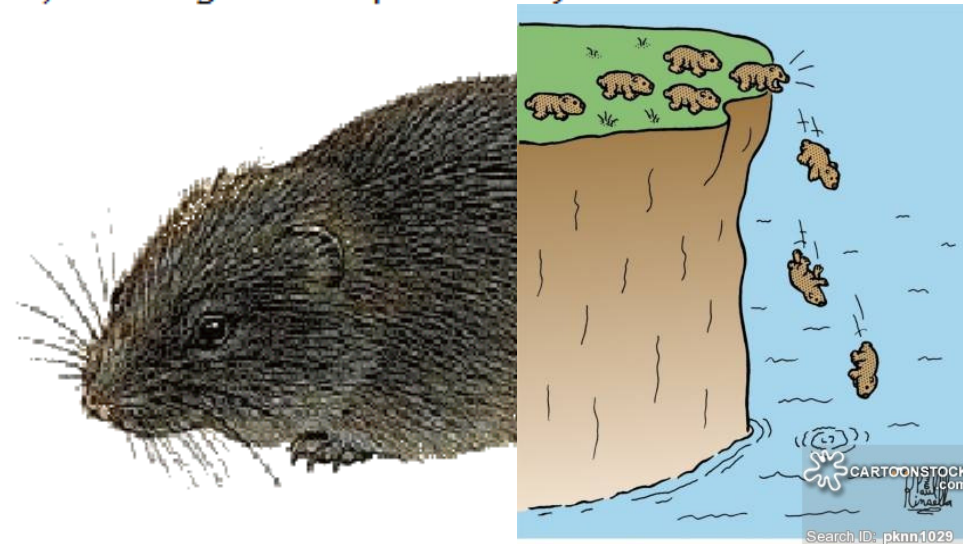
White Wilderness



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.*

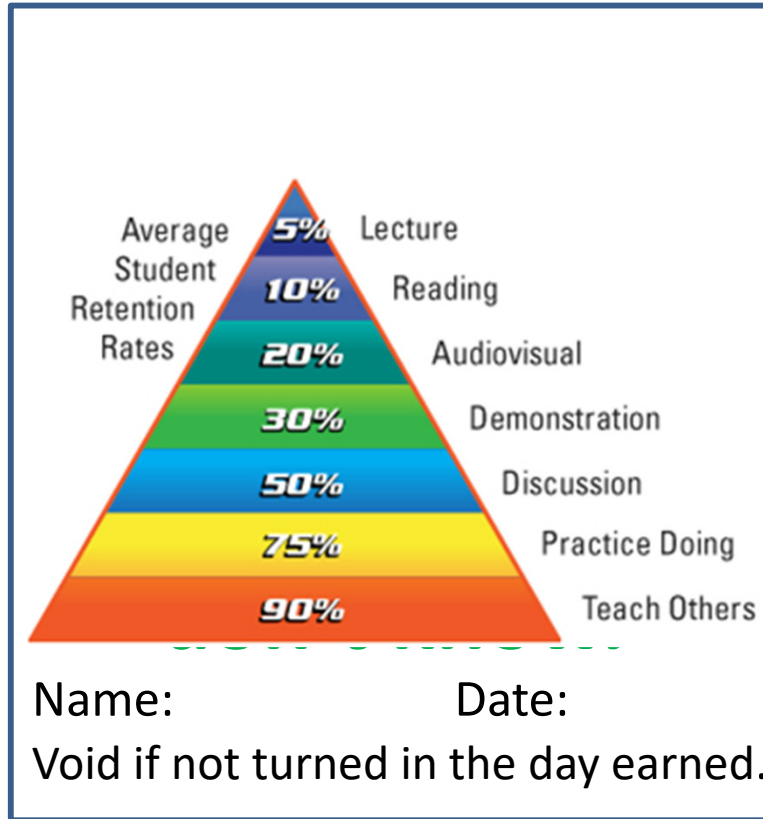
Origins: Lemming suicide is fiction. Contrary to popular belief, lemmings do not periodically hurl themselves off of cliffs and into the sea. Cyclical explosions in population do occasionally induce lemmings to attempt to migrate to areas of lesser population density. When such a migration occurs, some 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.



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

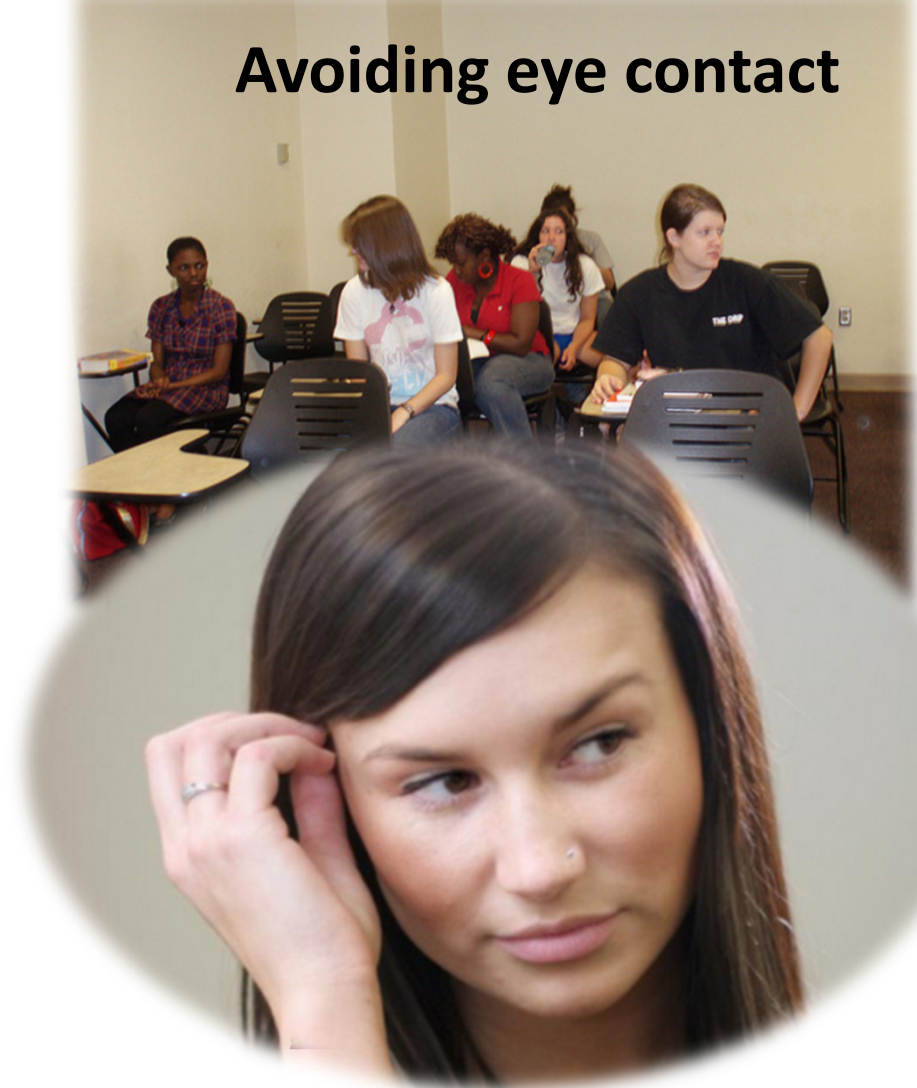
Still, no one wants to raise their hand

Limit: 3 per person



Extra Credit point on a Quiz

Avoiding eye contact



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

Thermodynamics

Cryogenics

Plasma Physics

Solid State Physics

Geophysics

Astrophysics

Acoustics

Optics

Electromagnetism

Fluid Dynamics

Biophysics

Statistical Physics

High Energy Physics

Atomic Physics

Molecular Physics

Nuclear Physics

Quantum Physics

cause and effect of forces, motion and energy of objects

heat a

study

studie

study

physic

how in



med

operatures

trically charged gases

materials

canoes, oceanography)

) interact



the study of sound and how sound travels

the study of light and how it travels

the interaction between electric, magnetic fields and charges

observes the behavior of moving liquids and gases

from the molecular scale to whole organisms and ecosystems

models the effects of systems of many particles

searching for fundamental particles with high energy collisions

understanding the structure of the individual atom

understanding the structure of molecules

structure of atomic nucleus and nuclear reactions

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?**



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)

$$v = v_0 + at$$

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$W = mg$$

$$g = 9.8 \text{ m/s}^2$$

$$f_k = \mu_k N$$

$$f_s \leq \mu_s N$$

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: $\text{net } F = ma$

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:

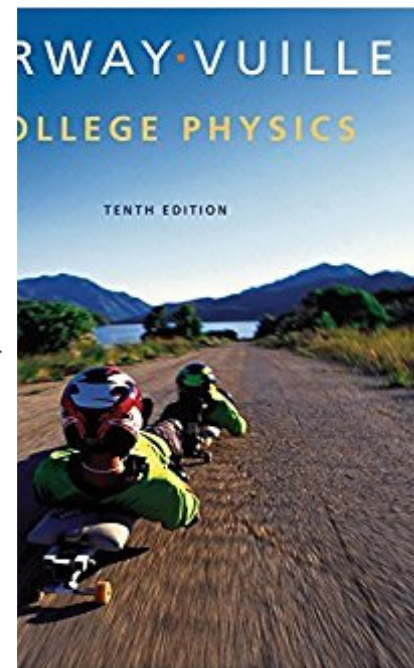
$$\text{work} = (\text{component of force in the direction of displacement})(\text{displacement})$$

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



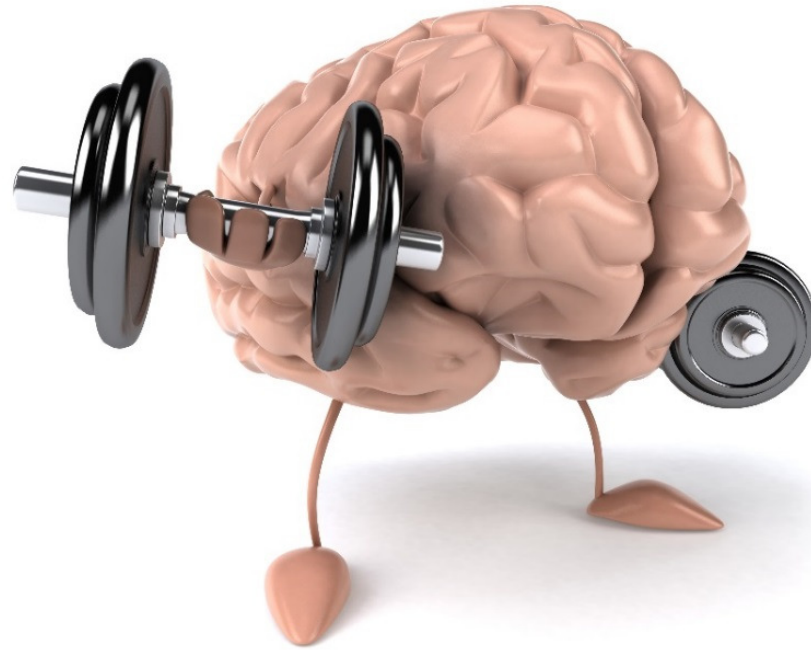
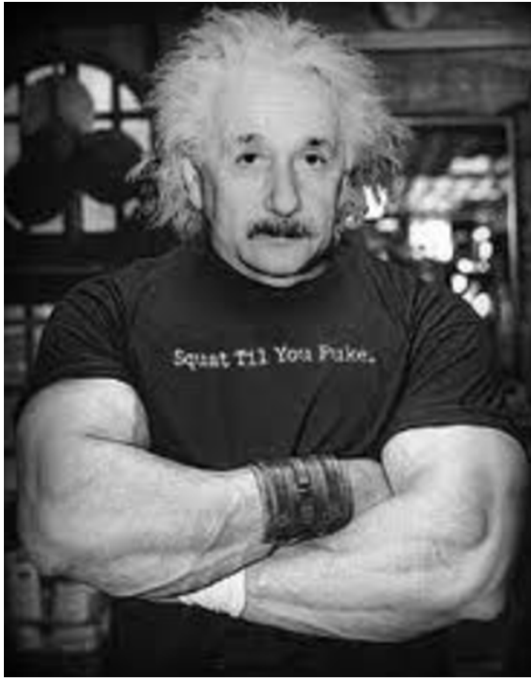
A photographic memory may not get you an A in this course.



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

The important work is up to you!

Physics (and math) is like a muscle



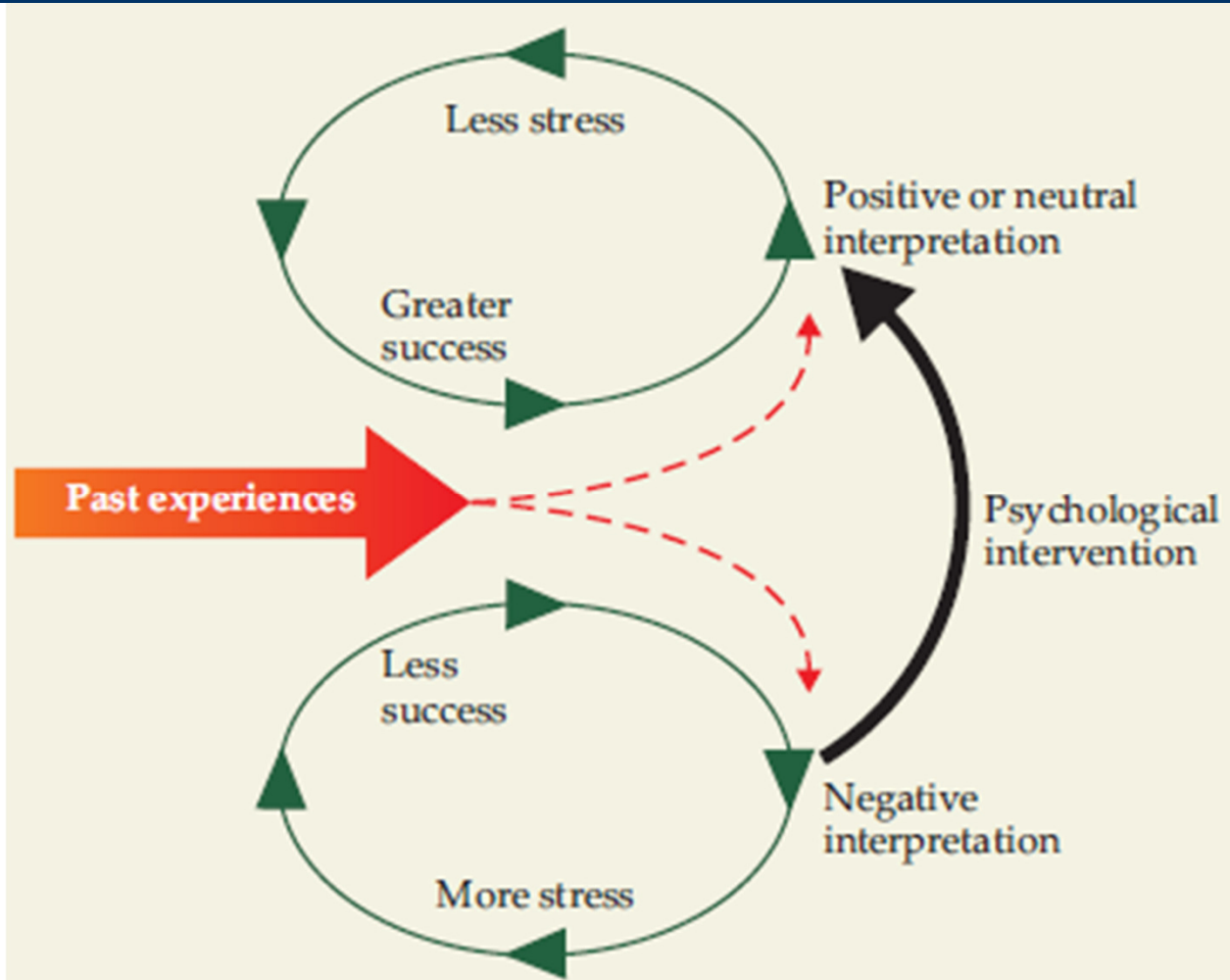
not a talent or
innate ability!

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

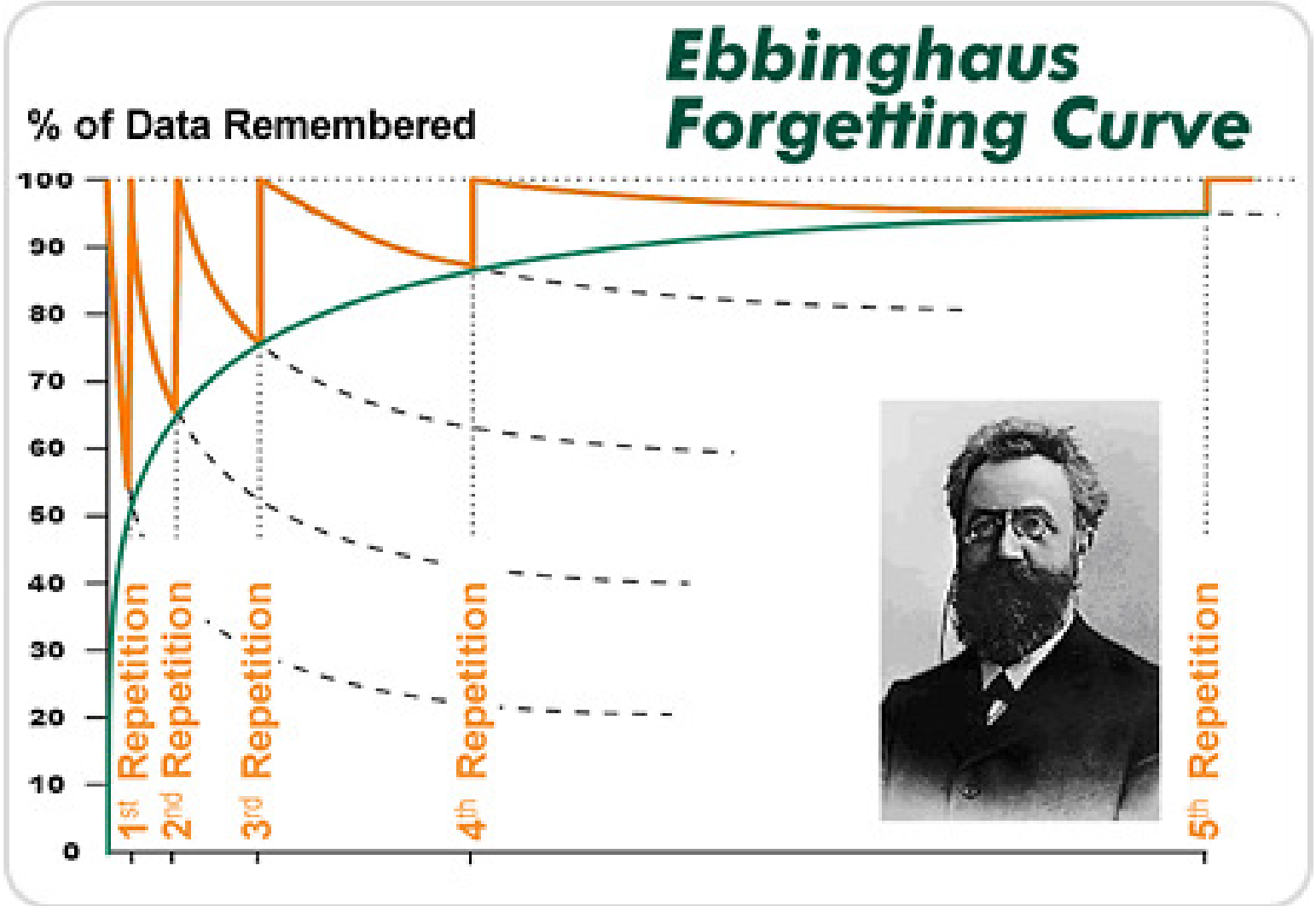


If you view hard problems or a non-ideal test score as **opportunities to learn**, then you are much more likely to take the right steps to improve your performance for future tests.

[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!**

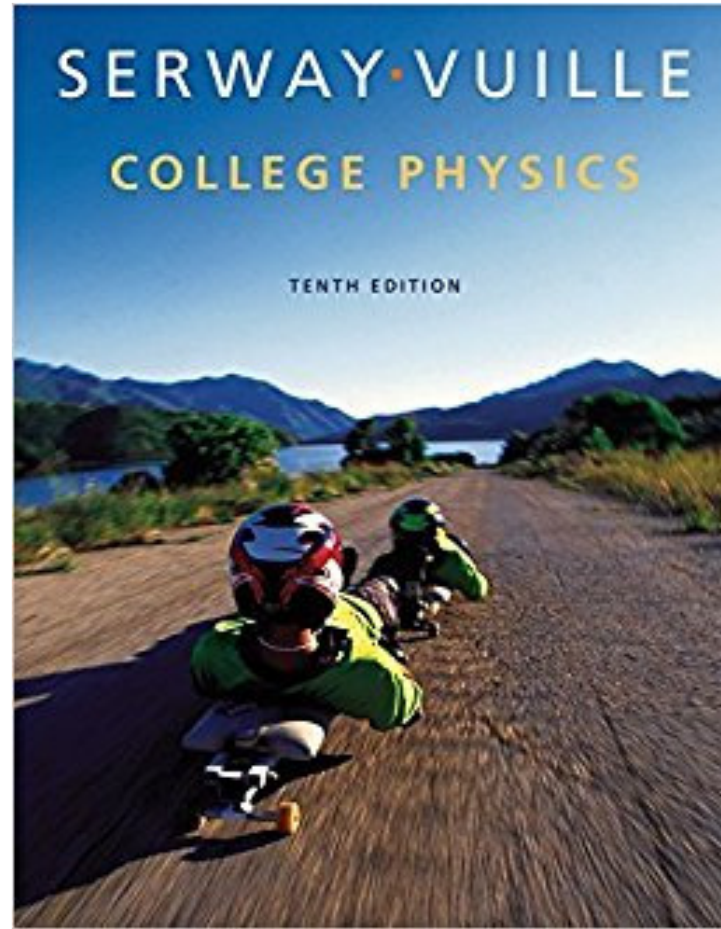
What are Some Learning Steps?



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 12 chapters in 15 weeks! Not much time for repetition!



Learning Improves With Repetition



Final Exam

Weekly Quizzes

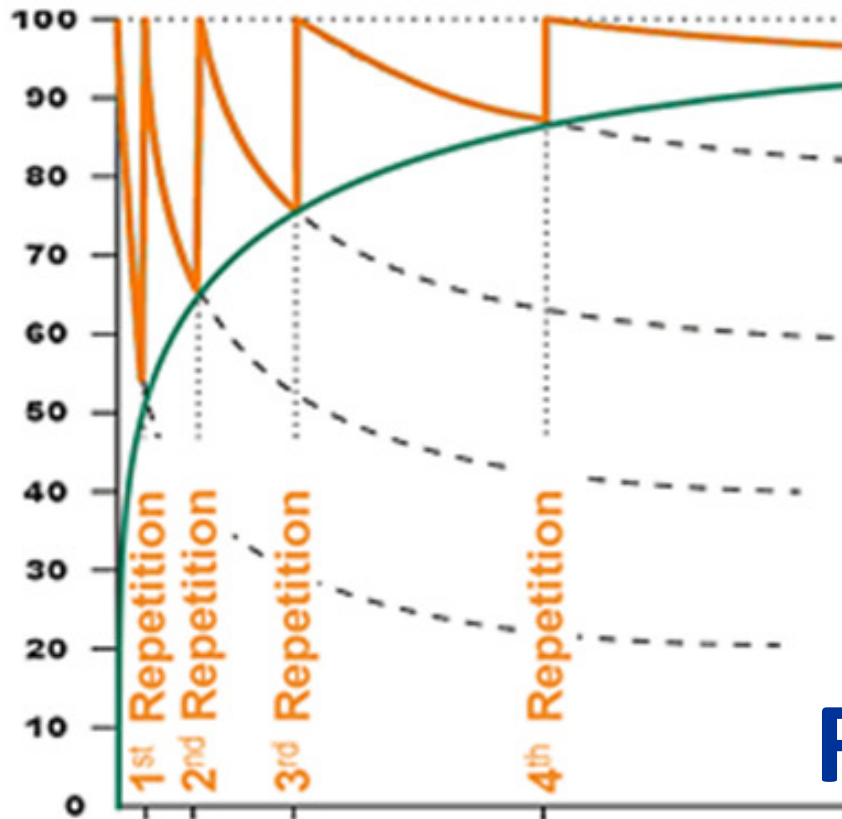
Lab

Finish off Homework?

Lecture

Try it (HW, 10% Bonus)

Read sections before class





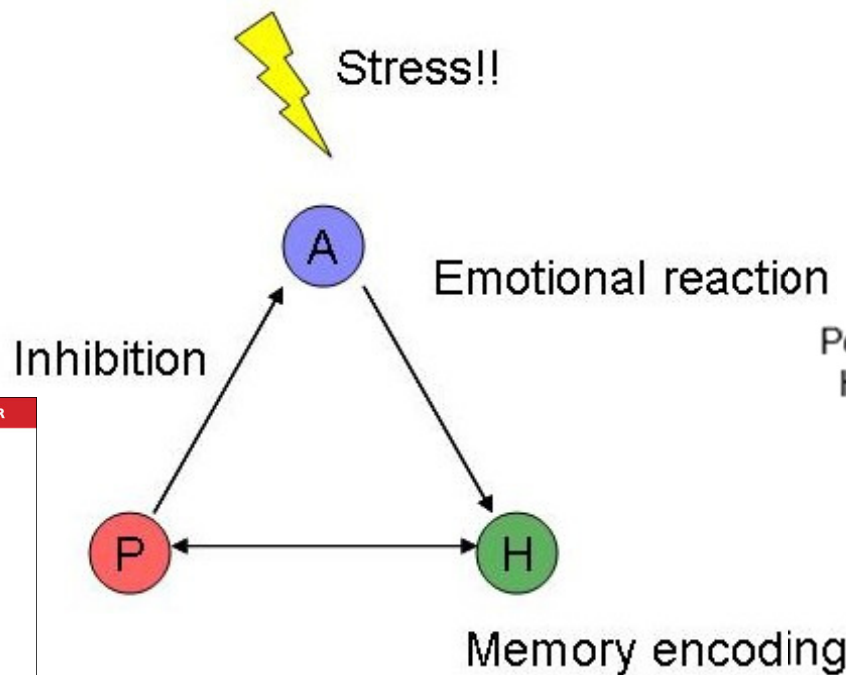
Other Ways to Boost Learning



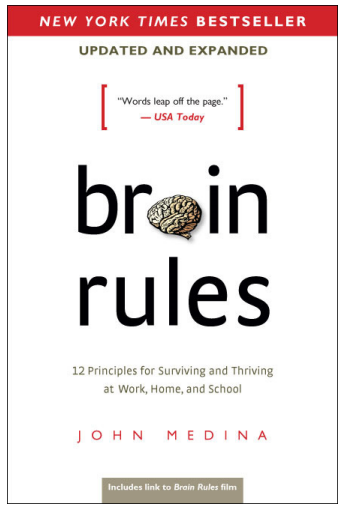
Amygdala (A):
Fight or Flight

Hippocampus (H):
Memory

Prefrontal Cortex (P):
Executive Function



Performance,
Happiness,
Health



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 **now**! Don't need to buy 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.



Main Points on the Syllabus



Office Hour: Wed 12:30-1:30 PM in office AND online
mikel.holcomb@mail.wvu.edu

Course Website: community.wvu.edu/~miholcomb
Previous lectures online, update periodically



WEST VIRGINIA
UNIVERSITY



DEPARTMENT of Physics

PHYSICS 101



HOME



SYLLABUS



LECTURES



ADDITIONAL

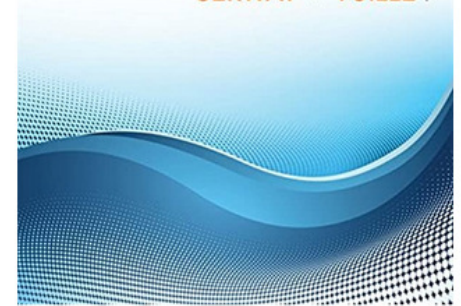
Instructor: Dr. Mikel "Micky" Holcomb

Office: 437 White Hall

Email: mikel.holcomb@mail.wvu.edu

Phone: 304-293-5196

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COLLEGE PHYSICS
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Cheapest Book Options



WebAssign Notices

Note: The following message is shown to your students. As WebAssign faculty you are not required to enter an access code.

⚠ According to our records you have not yet redeemed an access code for this class or purchased access online.

The grace period will end Monday, September 1, 2014 at 12:00 AM EDT. After that date you will no longer be able to see your WebAssign assignments or grades, until you enter an access code or purchase access online.

I would like to:

- purchase access online
- enter an access code (purchased with textbook or from a bookstore)
- continue my trial period (13 days remaining)

Continue

- 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?



Spring 2022 Cengage Virtual Office Hours for Students

January 11- February 17

(every) Tuesday | Wednesday | Thursday
10 am – 12 pm

Zoom: <https://cengage.zoom.us/j/97652162052>

If urgent and not during these hours:

joshua.swinehart@cengage.com and/or

general Cengage customer support



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



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



DEPARTMENT of Physics

PHYSICS 101



HOME



SYLLABUS



LECTURES



ADDITIONAL MATERIALS



BACK TO RESEARCH

Additional Materials

- [First Time Logging into WebAssign](#)
- [How to Succeed in Physics 101](#)
- [WebAssign Login Page](#)
- [Example of Previous Exam 1](#)

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

Rare at prestigious universities like WVU, but more commonly found in intro classes

Teach several courses per semester

Research professors

Most of the professors at WVU

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.



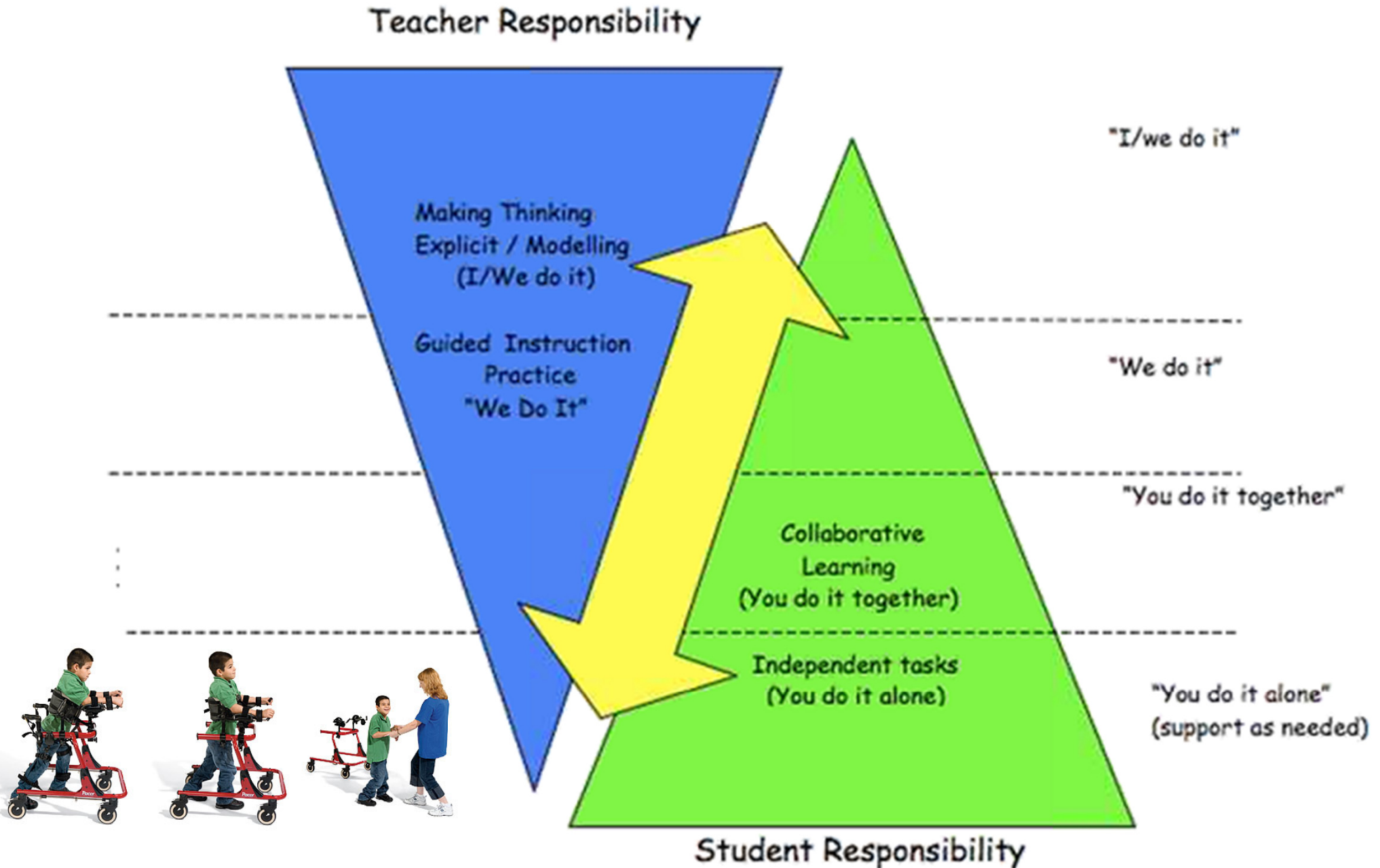
Ways to increase difficulty:

- 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)



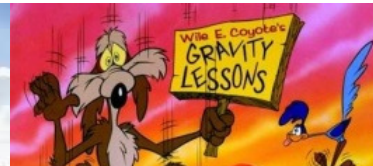
Why Study Physics



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 seat 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.



WEBillions\$

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.

Can you travel back in time and undo your past?

Why do we always sound good when singing in the shower?

$\int x^n dx = \frac{x^{n+1}}{n+1} + C$

$C = \frac{R_0}{kV_0} (1 - e^{-\lambda})$

$V_d = \frac{A_0}{G}$

$\sum_{j=1}^n A_j x^{j-1} = 0$

$\frac{d}{dx} (x^2) = 2x$

$\frac{d}{dt} (v) = a$

$\frac{d}{dt} (x) = v$

$\frac{d}{dt} (t) = 1$

$\frac{d}{dt} (t^2) = 2t$

$\frac{d}{dt} (t^3) = 3t^2$

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Physics Puzzles

Thought provoking questions from everyday life

How did Beethoven hear music even though he was deaf?





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?



**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