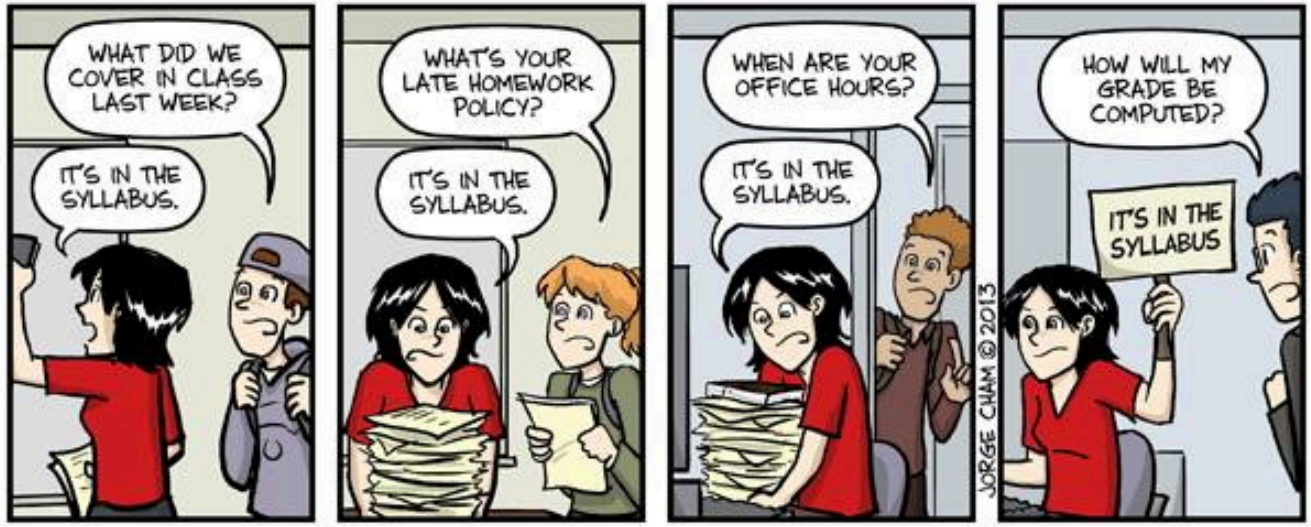
■ **Theme Music: Norah Jones**

Here we go again

with Willy Nelson and Wynton Marsalis

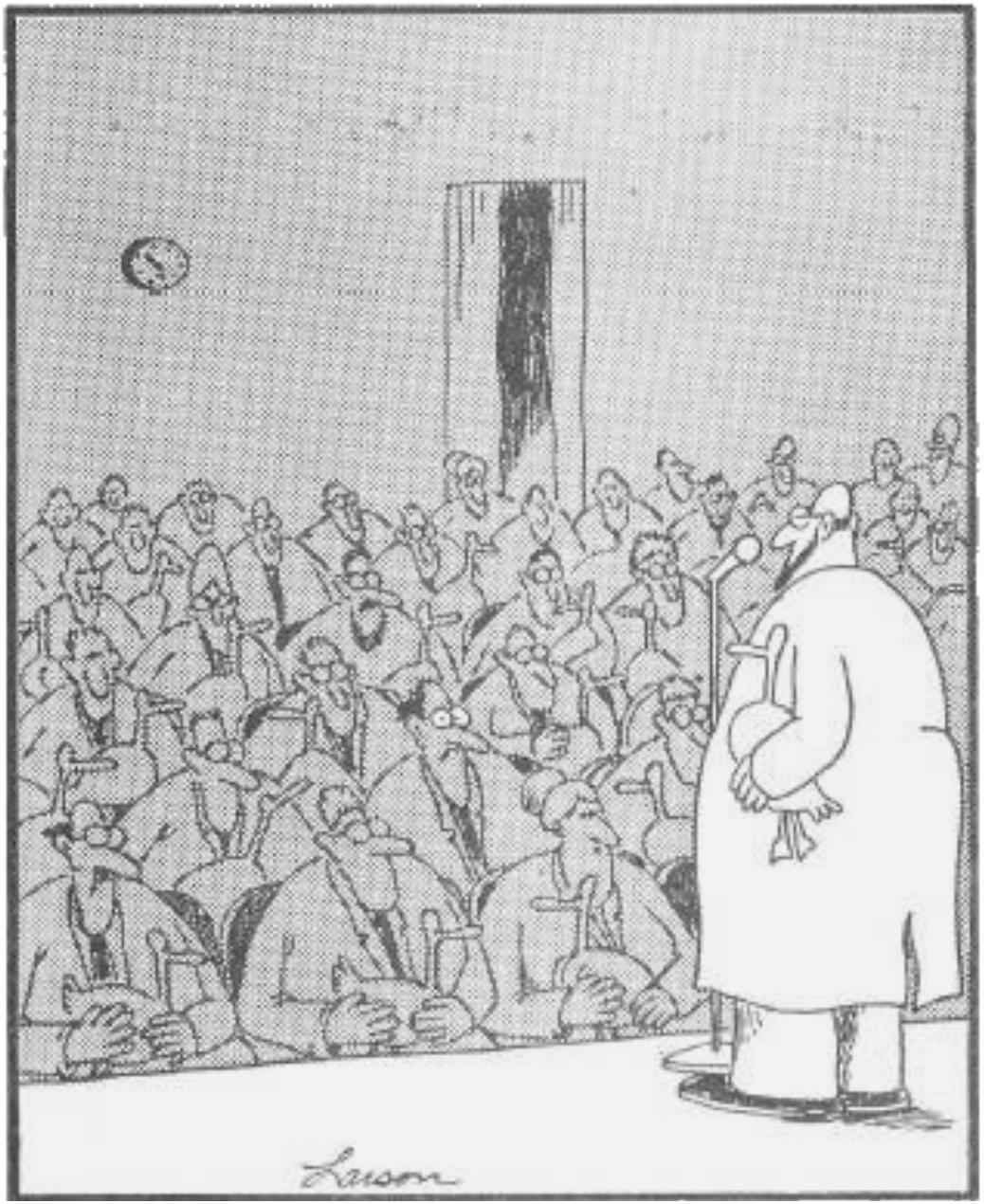
■ **Cartoon: Randall Munroe**

PhD Comics



Did you bring your clicker today?

1. Yes
2. No



Suddenly, Professor Liebowitz realizes he has come to the seminar without his duck.

Outline

- Structure of the class
- Last term's results
- Foothold ideas
  of the Newtonian Framework
- Foothold ideas for Random Motion

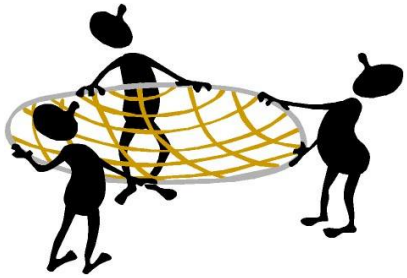
How we do things (Pedagogy)

- Read first (on web)
- Ask a good question (in WebAssign)
- In class
  - I'll give a brief summary and answer one or two of the best questions.
  - We'll do clicker questions and group problem solving. (Recitation, too)
- Out of class
  - Homework is critical!

Weekly Homework

- WA HW
  - 3-5 problems: as many tries as you want, but you won't see the answer until after the deadline.
  - Highly recommended! Do it offline first and paste your results in! WA sometimes drops your work.
  - Be sure to save AND SUBMIT by the deadline. Save ≠ submit. Not saved, can't get late credit.
- Paper HW
  - 1-2 problems: write up as a report with equations, figures, tables, etc.
  - Do it NEATLY: Name, date, and assignment # on each page. NO STAPLES OR CLIPPING TOGETHER. If torn out of a NB tear off perforations.

Science as a way of knowing/ Building a consistent web

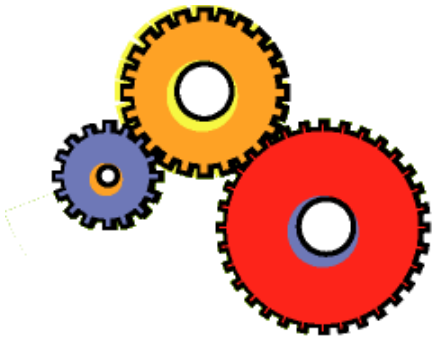


- How do we build a reliable web of knowledge (safety net)?
  - Stakes in the ground!
    Things we can count on in a wide variety of circumstances (but we need to know the limitations of those circumstances)
    I call these *foothold ideas*.

  - Finding different ways to look at the same thing to check for consistency.

How do we know? (Epistemology)

- Giving a reason:
  Distinguishing claims from evidence
  - Claim
  - Data (evidence for the claim)
  - Warrant (reason that the evidence supports the claim)
- Understanding what a particular result, observation, or assumption tells you – and what it does not tell you!
- Playing the implications game – "suspension of disbelief".



Science as conversation

- Science is much more than just a collection of facts and procedures. **Science is a way of holding a conversation to decide to agree that we know something.**
- The best (and most professional) way to learn science is to discuss it with someone who knows about as much as you do – but not exactly the same things.
- In solving hard problems in science, most students run into trouble not because they don't know what they need to know, but because they don't know how to ask the questions that will help them find that knowledge – either in their own heads or from elsewhere.

So -- Work Together

- Work together on problems!
  (But don't write up together.)
  - Course center to get together and get guidance.
    (Mostly to work together)
- The point of this is NOT for the stronger students to help the weaker. Even strong students don't get everything. Trying to explain it to someone is one of the best ways to learn something.
  - If you're struggling in a group, work on how to ask a good question that helps you understand and moves the discussion forward.

Electronic info

- Our home page is where you can get all of the information about the class.

  http://www.physics.umd.edu/courses/Phys132/

- Non-public info (such as HW solutions) appear on our Canvas site. ***http://elms.umd.edu***

- WebAssign – Sign up for our online HW environment.

  Institution code: ***umd***

  Class key: ***9585 4117***

Grading

Hour exams (2 @ 100 pts)	200
Quizzes (~10 @ 10 pts)	100
Final exam (200 pts)	200
Homework (scaled to)	300
Lab	165
Readings & pre-lab	75
Participation (about)	160
Total	**~1200**

In my 131 last term: A>82%, B>73%, C~62%, D~50%

Exams

- Two midsemester exams and one final.
- Midsemester exams
  - Given on Friday
  - Returned on Wednesday and gone over in class
- Written regrade requests encouraged
- Makeup exams the following Thursday (out of class) for anyone who wants, but…
- You will be expected to think (not just recall) on exams!

Hint: Many homework problems are based on exam problems from previous years!

Story

On exams: A ≥ 75%, B ≥ 60%, C ≥ 45%, D ≥ 30%
Class average ~ 60-70%. NOT CURVED.

Three mantras to keep in mind

- Beware one-step reasoning (direct recall)! Look for coherence with what else you know.
- Build your understanding on a sense of the physical and integrate it with your equations!
- ***The physics we are learning in this class is simple – but seeing that it is simple is very difficult!***

What do I expect you to be able to do in this class?

- Reason from principles (not just recall an answer)
- Use equations in symbol form, not just to calculate with, but to think with – to see relationships and functional dependences and manipulate to get an answer.
  - To be able to identify and use dimensions to analyze, create, and check equations.
- To be able to estimate the approximate size of something using personal experience and other things you know well.
- To be able to "tell the story" of what is happening in a problem – or equation.

What principles?

Physics 131 — **Basic Principles of Motion** — Prof. Redish

Description of motion

$$\langle \vec{v} \rangle = \frac{\Delta \vec{r}}{\Delta t} = \frac{\text{vector displacement}}{\text{time it took to do it}}$$

$$\langle \vec{a} \rangle = \frac{\Delta \vec{v}}{\Delta t} = \frac{\text{change in velocity}}{\text{time it took to do it}}$$

Laws that control motion

Newton 0:
An object responds to the forces it feels when it feels them.

Newton 1:
An object that feels a net force of 0 keeps moving with the same velocity (which may = 0).

Newton 2:
An object that is acted upon by other objects changes its velocity according to the rule

$$\vec{a}_A = \vec{F}_A^{\,net} \Big/ m_A$$

Newton 3:
When two objects interact the forces they exert on each other are equal and opposite.

$$\vec{F}^{type}_{A\to B} = -\vec{F}^{type}_{B\to A}$$

Forces

Forces: how objects interact with each other to try to change each other's velocity.

Notation convention.

$$\vec{F}^{\text{ type of force}}_{\text{(object causing force)}\to\text{(object feeling force)}}$$

Types of forces

Spring, Normal, Tension Force N, T

$$T = k\Delta L$$

Friction Force f

$$f \le \mu N$$

Weight Force W

$$\vec{W} = m\vec{g}$$

Electric Force

$$F^E_{q\to Q} = \frac{k_C qQ}{r^2_{qQ}}$$

Using them in problems

1. What objects are you interested in looking at the motion (or lack of motion) of?

2. What other objects interact with those objects?
(A System Schema might help)

3. For each object, isolate the object and see what forces act on it.
(A Free Body Diagram might help)

4. Write a Newton's second law equation for each of the objects you are considering.

5. Put in what you know about each of the forces.

Your resulting equations tell you about relations among the various variables of interest in the problem.

6. Decide what you know and what you want to find out.

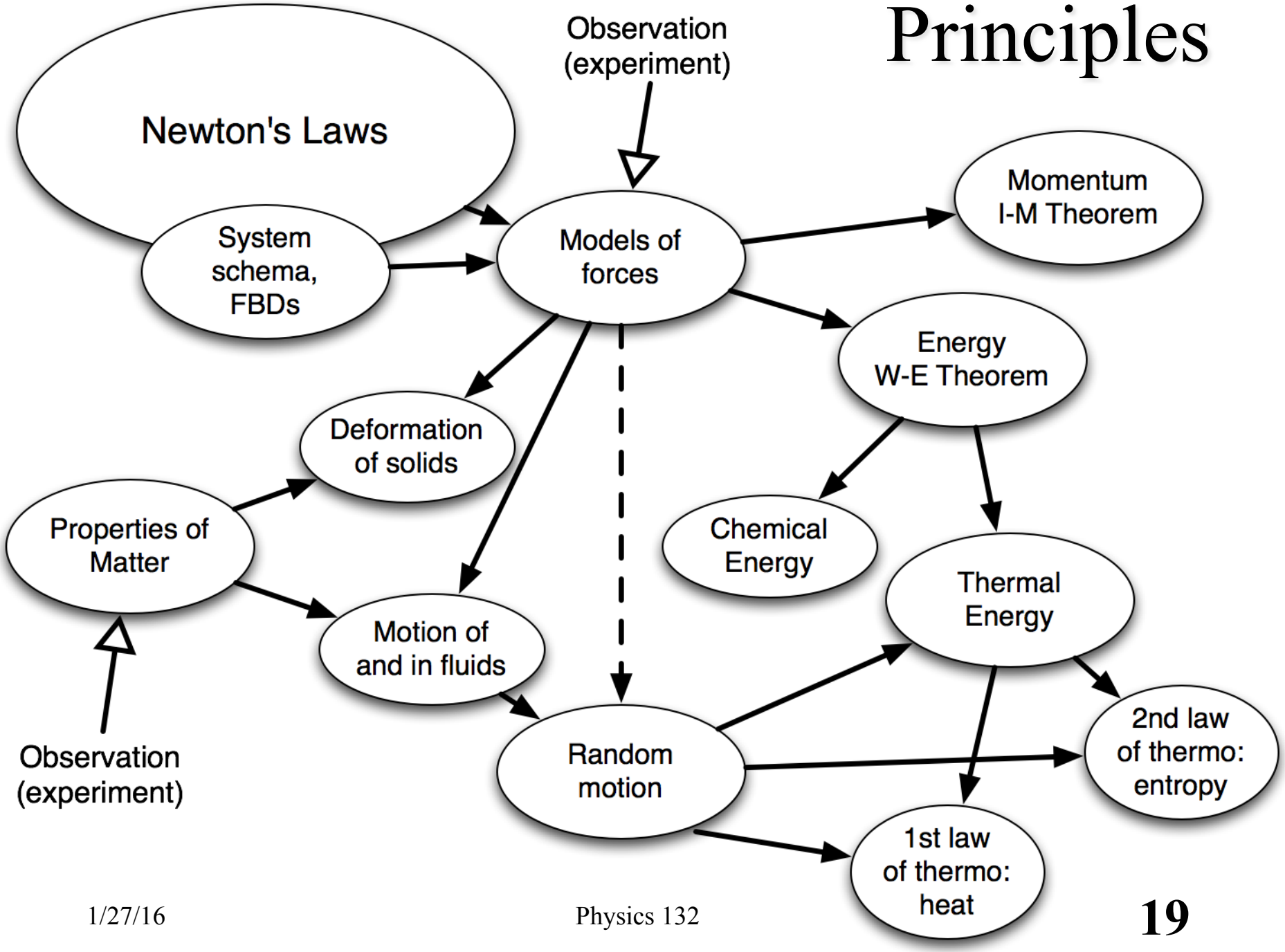
7. See if your equations will let you determine the answers.

Fall 2015

"The chart"

Why is there a gorilla on the chart?

Principles


Observation
(experiment)
Newton's Laws
System
schema,
FBDs
Models of
forces
Momentum
I-M Theorem
Energy
W-E Theorem
Deformation
of solids
Properties of
Matter
Chemical
Energy
Thermal
Energy
Motion of
and in fluids
Observation
(experiment)
Random
motion
2nd law
of thermo:
entropy
1st law
of thermo:
heat

Foothold principles: Newton's Laws

- Newton 0:
  - An object responds **only** to the forces it feels and only at th instant it feels them.
- Newton 1:
  - An object that feels a net force of 0 keeps moving with the same velocity (which may = 0).
- Newton 2:
  - An object that is acted upon by other objects changes its velocity according to the rule

$$\vec{a}_A = \vec{F}_A^{net} \Big/ m_A$$

- Newton 3:
  - When two objects interact the forces they exert on each other are equal and opposite.

$$\vec{F}_{A\to B}^{type} = -\vec{F}_{B\to A}^{type}$$

Kinds of Forces

- Types of forces
  - Spring, Normal, Tension Force N, T $\quad T = k\Delta L$
  - Friction Force f $\quad f \le \mu N$
  - Weight Force W $\quad \vec{W} = m\vec{g}$
  - Electric Force F^E $\quad F^E = \dfrac{k_C q_1 q_2}{r_{12}^2}$

- Notation convention.

$\vec{F}$ type of force
(object causing force)→(object feeling force)

This week

- Go to recitation and lab
  - An on-paper diagnostic survey to see if you get the key concepts from last term. (5 pts)
  - An on-line survey (5 pts)
  - An introduction to some new features of the lab: peer grading.
  - New pix for new students, Dreyfus students (and anyone with a new haircut)
- Make sure you are correctly signed up
  - For clickers – points start next Monday.
  - For a lab group (and every first week of a new lab)
- Readings, but no problem solving HW.

The Diagnostic survey tests some basic concepts

- Relation of force and motion
- Reading multiple graphs
- Keeping the signs straight
- Newton's laws
- Energy

You get a score for each of 7 categories.

I will post these for you to see on Canvas.
(These scores will NOT count for your grade and will be removed after two weeks.)