Statics - TAM 210 & TAM 211

Spring 2018

Course distribution

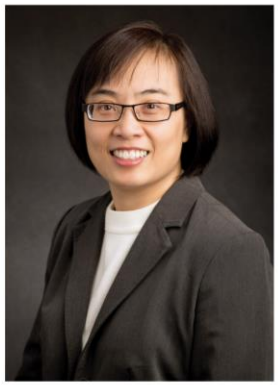
Required	TAM 210	TAM 211
Aerospace Engineering	31	1
Agricultural & Biological	12	3
Bioengineering	2	6
Civil Engineering		41
Engineering Mechanics	1	12
General Engineering		1
Industrial Engineering		9
Mechanical Engineering	67	2
Nuclear, Plasma, Radiololgical	9	1
Systems Engineering and Design	1	15

Other	TAM 210	TAM 211
Biochemistry		1
Chemistry		1
Computer Engineering		2
Computer Science		1
Electrical Engineering		3
Engineering Physics	3	1
Engineering Undeclared	4	2
Geology	1	
Materials Science & Engr	1	1
Math & Computer Science	1	
Mathematics		1
Natural Resrcs & Environ	1	1
Pre-Engineering	2	5
Statistics & Computer Sci		1
Technical Systems Managem	1	
Undeclared	2	23
Urban Studies & Planning		1

If you registered for TAM 210 and are in any major with a blue box, you may want to reconsider your decision and register for TAM 211

TAM 210/211 Team

Professor



Elizabeth Hsiao-Wecksler
Professor

Teaching Assistants

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Siyuan Chen

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Course Assistants

Ahad Rahim

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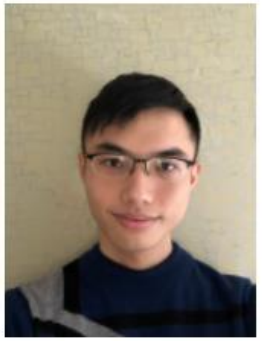

Linfeng Chen

Sean McShane

Shiyao Sun

Timothy Sam

Vincent Hoff

Ziran Zhou

Course website

MAIN PAGE - https://courses.engr.illinois.edu/tam210/

TAM 210/11: Statics

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Welcome to the official course website for TAM 210/11 at UIUC this Spring 2018.

The faculty, graduate teaching assistants (TAs), and undergraduate course assistants (CAs) involved in all of the TAM 2xx courses (TAM 210/211, 212, 251) continue to work to improve the student experience in these very large introductory courses. TAM 210/211 in particular has always been a very difficult transition course for students in their early semesters of college. This course is challenging because students are exposed to multiple online teaching platforms (Prairie Learn, Mastering Engineering, Piazza, CBTF), multiple requirements in terms of frequent tutorials, homework assignments, written assignments, quizzes, structured worksheets in Discussion sections that require working with a team of people, and the need for good personal time management skills. It is one of the first of many rigorous courses that undergraduate engineering students will experience in their time at Illinois. Our goal as educators is to help our undergraduate students to achieve academic success and graduate as engineers. We train our undergraduate students to learn broad fundamental engineering knowledge that will allow them to have enough background to directly address, or know where to look for answers to address, the technological challenges of today and the future. Engineering is not about memorization; it is about being a problem solver, using one's general knowledge, and applying it to new areas.

The key to succeeding in TAM 210/211, or any class, is to practice the material **before** the time for assessment (quiz or exam). This course has many opportunities to practice; use them to your advanatge. Ask for help from the instructional staff, the CARE center in Grainger Library, or your friends (but do not just copy your friends answers - that is not practicing the material).

NOTE: This website is always under construction!! Feel free to peruse, wander, and learn a bit about what's coming up this Spring, but dates/times/assignments etc. are subject to change. If you have any questions, feel free to drop us a line at the discussion forum on Piazza (see link below).

As well as the pages on this website, this course uses:

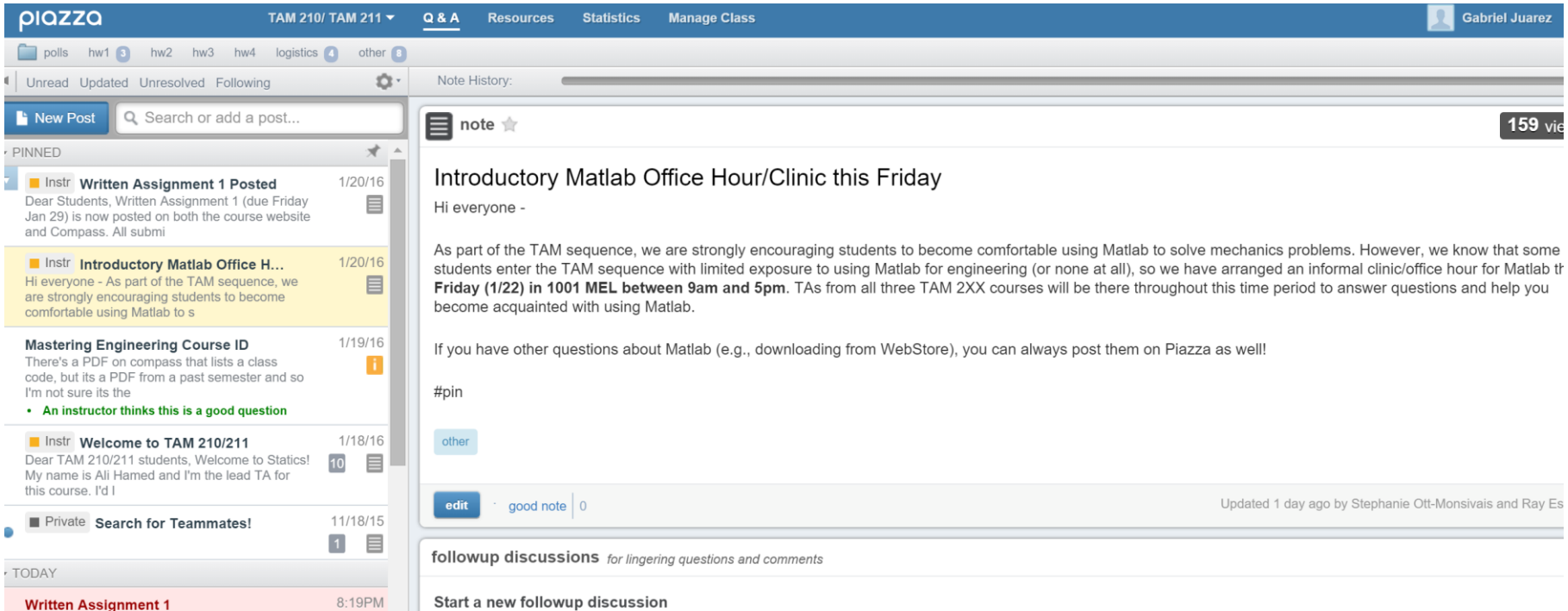
- Online homework via Mastering Engineering
- Online homework via PrairieLearn
- Discussion forum on Piazza
- Gradebook on Compass
- Computerized Testing Facility exam reservation
- Computerized Testing Facility instructions

Course communication

Piazza: https://piazza.com/class/j62o5jknmj61p8

ALL communication in the course will be via Piazza

- Open discussion of questions from class: if there's something you don't understand, chances are other people don't, and someone else may have the answer.
- Regularly checked by TAs, CAs and Profs.



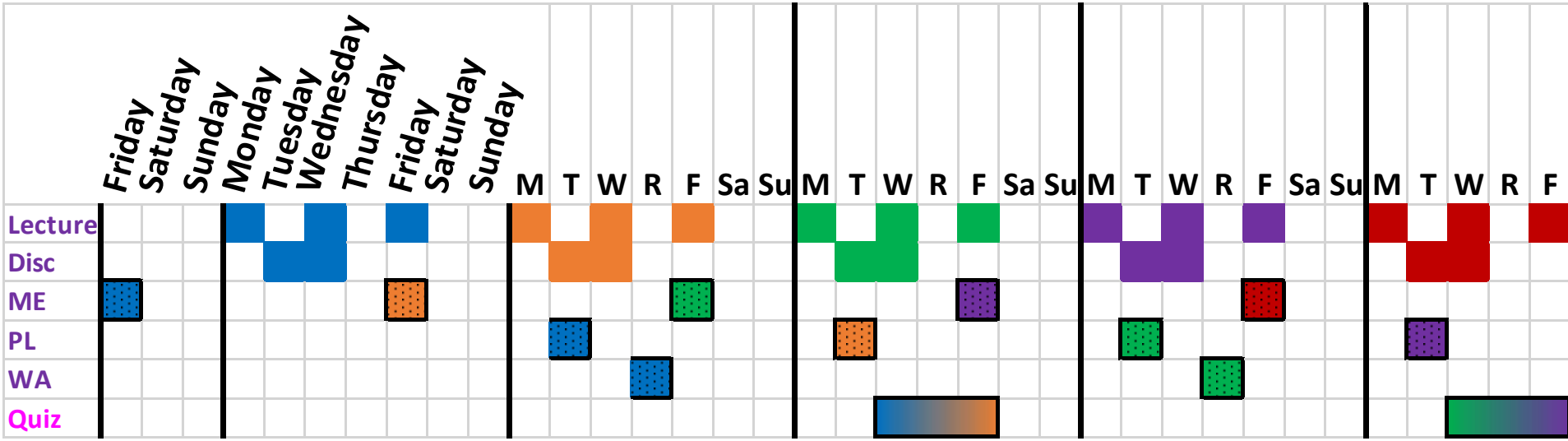
Course format

Learning & Practice

- Preview Hibbeler Chapter & Mastering Engineering Online Tutorial: Complete by Friday **before**
- Lectures and Discussion sections
- PraireLearn Online Homework: Complete by Tuesday **after**
- Written Assignment: Complete by Thursday after **1st week**

Assessment

- CBTF Quiz: Take Wed-Friday after **2nd week**



Grade distribution for TAM 210 & 211

In class i-Clickers: 3%

Discussion group activity: 8%

Online Tutorial (Mastering Engrg): 6%

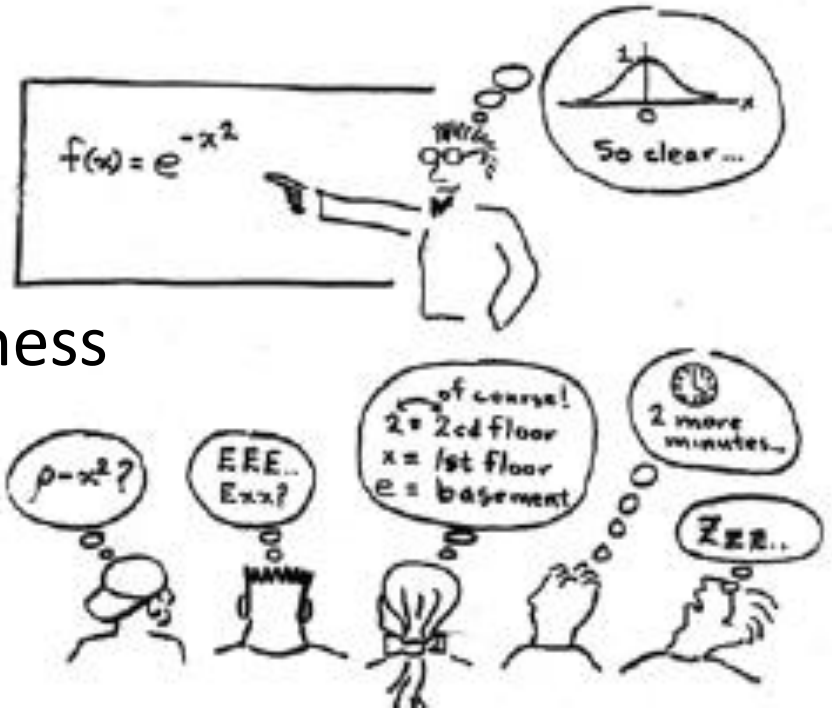
Online Homework (PrairieLearn): 10%

Written Assignments: 8%

Quizzes (@ CBTF): 40%

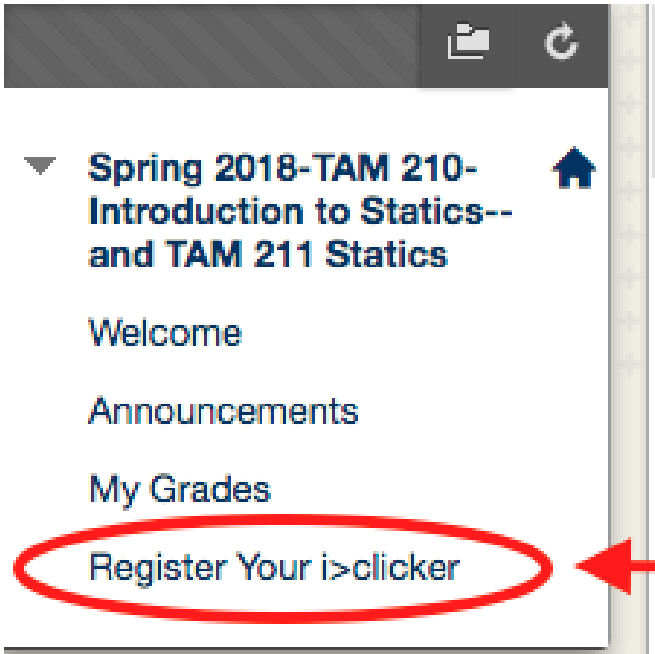
Exam (April 5, 7-9pm): 25%

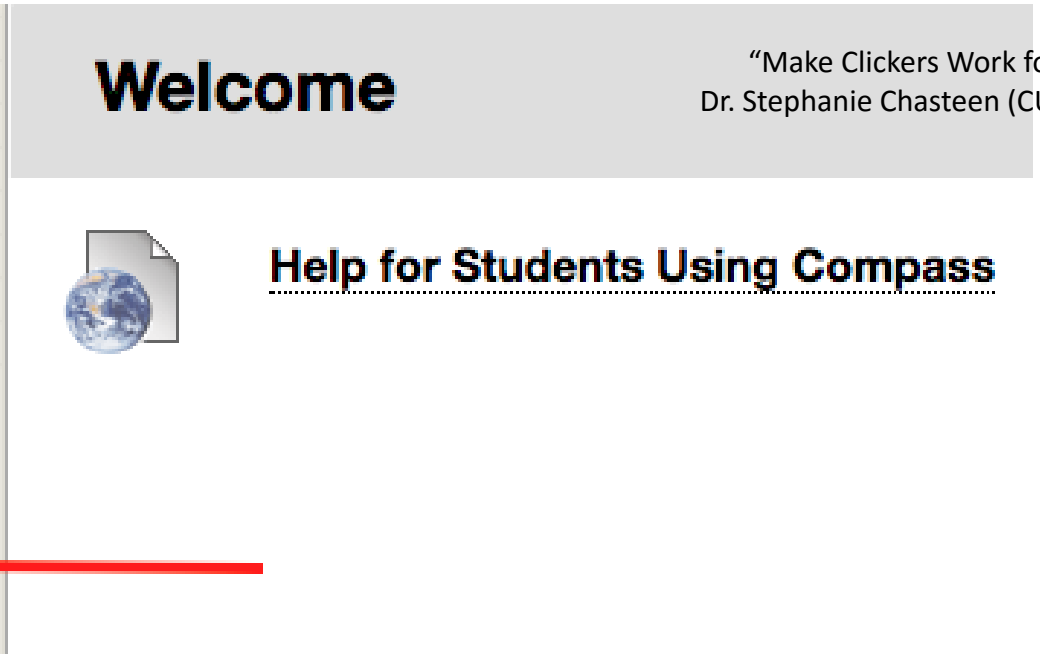
i-Clickers



- Used for in-class assessment
- 50% participation, 50% correctness

- Register your i>clicker on **Compass2g**





Links for Mastering Engineering & PrairieLearn

http://www.pearsoncustom.com/il/ui_eng_mech_statics

https://prairielearn.engr.illinois.edu/

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Online homework via Mastering Engineering

Online homework via PrairieLearn (PL)

Week	Day	Date	Class	Reference Material	Computer Quiz	Disc Se
1	M	Jan 15	M.L.King Day (No lecture)		Quiz 0 (practice) in PrairieLearn	Disc Intro
	W	Jan 17	Lecture 1 Introduction and general principles	Chapter 1		
			Lecture 2	Chapter 2		

Online Homework in PrairieLearn

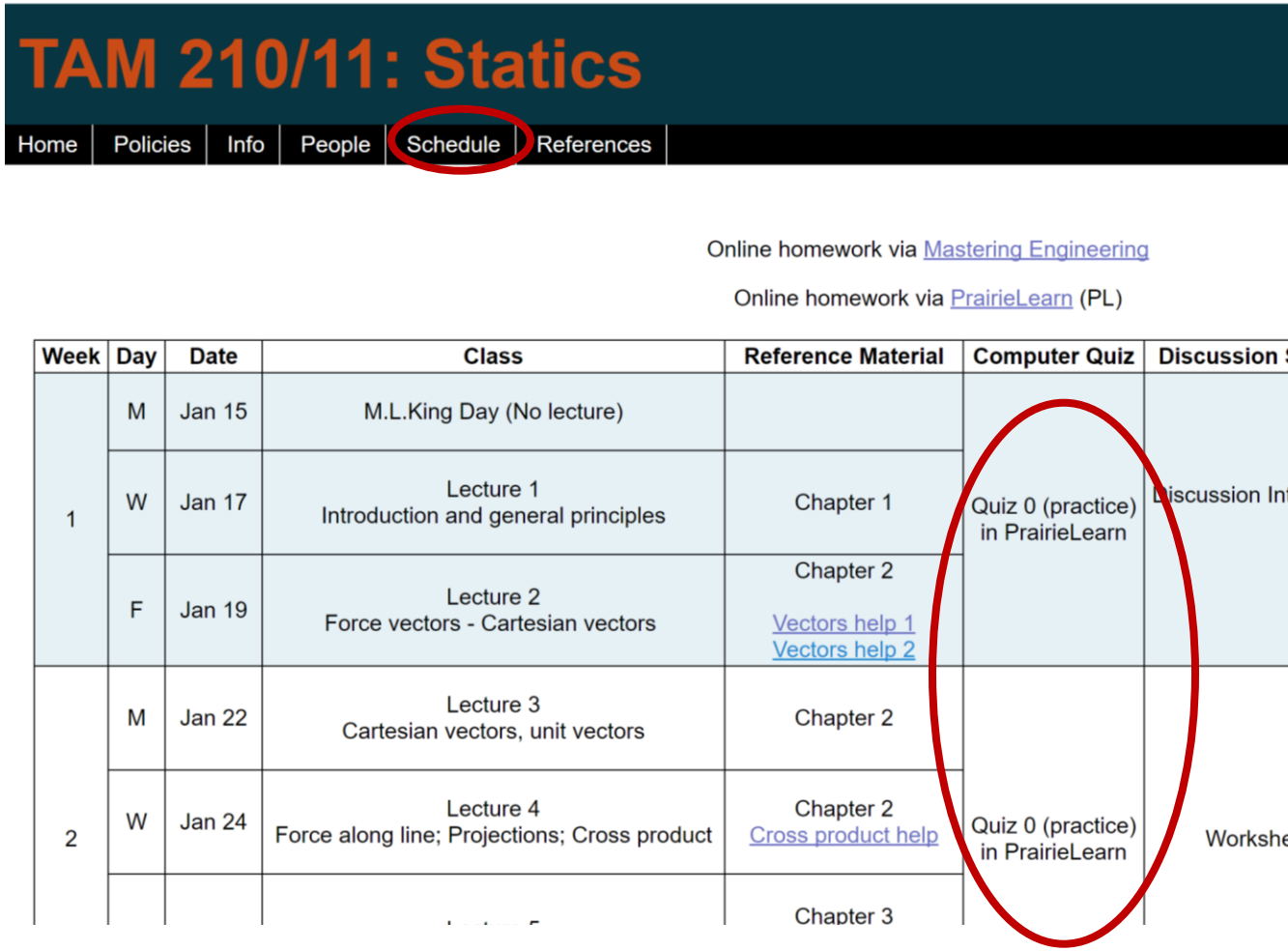
https://prairielearn.engr.illinois.edu/

- Provides instant feedback
- Infinite number of attempts to help with learning
- Complete by 11:59 pm of due date (generally Tuesday)
- **Completion of 1st tutorial is due this Sunday January 21**

- Not trying to solve problems on your own and copying others answers will make taking quizzes ∞ more difficult!

Quiz 0 (Practicing sample format)

- Familiarize students with CBTF quiz format
  - Max points per question decreases with increasing attempts
  - Finding attached help documents
- Complete in PrairieLearn



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	W	Jan 17	Lecture 1 Introduction and general principles	Chapter 1		Discussion In
	F	Jan 19	Lecture 2 Force vectors - Cartesian vectors	Chapter 2 Vectors help 1 Vectors help 2		
2	M	Jan 22	Lecture 3 Cartesian vectors, unit vectors	Chapter 2		
	W	Jan 24	Lecture 4 Force along line; Projections; Cross product	Chapter 2 Cross product help	Quiz 0 (practice) in PrairieLearn	Workshe
				Chapter 3		

Online computational software

- No personal calculators allowed in CBTF
- Need to be able to do calculations during quizzes
- Available options in CBTF: MATLAB, Mathematica, and *online simple calculator (not recommended)*

- While solving PL HW, practice using one of these online options so you can become efficient.

- Most UIUC COE students know (or will learn) MATLAB
- Course website has MATLAB help documents (References)
- TAs will offer MATLAB training/refresher sessions
  - Next week in evenings, 1 hour each
  - EWS Location/Day/Time: TBA

Grade distribution

Final grades: The total score *s* corresponds to final grades as follows.

97% $s < 100\%$ A+	92% $s < 97\%$ A	89% $s < 92\%$ A-
86% $s < 89\%$ B+	82% $s < 86\%$ B	79% $s < 82\%$ B-
76% $s < 79\%$ C+	72% $s < 76\%$ C	69% $s < 72\%$ C-
66% $s < 69\%$ D+	59% $s < 66\%$ D	55% $s < 59\%$ D-
$s < 55\%$ F		

Grades: on Compass2g

- Any errors in grade reporting on Compass must be reported within 2 weeks of the due date or by the last day of class, whichever is earlier.
- Missing grade for discussion section or a written report, contact appropriate TA (personally or via Piazza).
- Missing grade from online tutorial or homework, exam, or i>clicker, contact the instructor (via Piazza).

Support for students:

- Piazza posts (everyday, reasonable working hours)

- CARE Center in Grainger Library

- Prof. Hsiao-Wecksler's Office Hours:
  - MWF 9:30-10:30 am in 154 MEB, or by appointment

- TA Office hours (429 Grainger) – starting Friday Jan 19
  - See course website (Info webpage)
  - Monday, Tuesday, Friday 4-9 pm

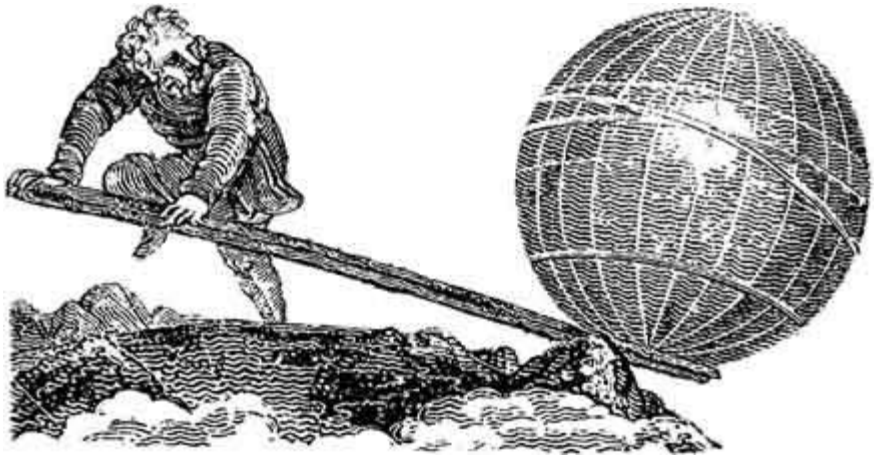
How to make the most from lecture…

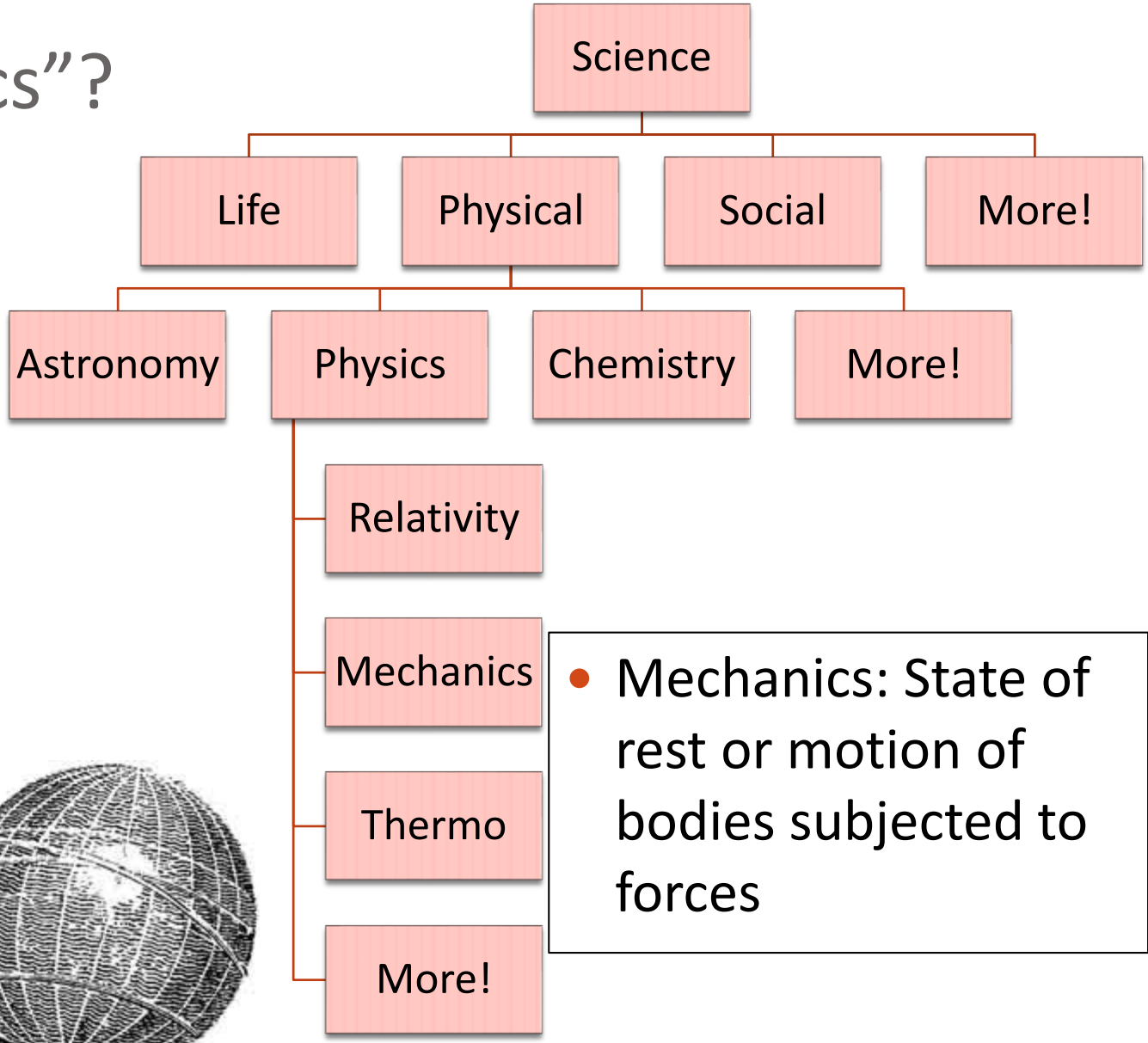
- Attend!
- Use technology - bring your tablets, laptops, etc.
- Traditional technology - Bring paper and pencil/pen
- Participate
  - Ask questions
  - Be prepared to answer questions
  - I don’t know is ok too!
- Develop good time management skills

- Any questions?

Chapter 1: General Principles

What is “statics”?



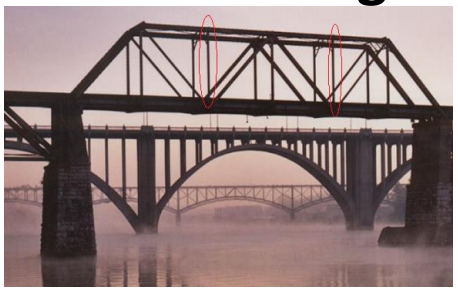


- Mechanics: State of rest or motion of bodies subjected to forces

Mechanics

Mechanics is a branch of the physical sciences that is concerned with the **state of rest or motion of bodies that are subjected to the action of forces**

Rigid Bodies



Statics

Dynamics

Deformable Bodies

Solid Mechanics

Fluid

Compressible and incompressible

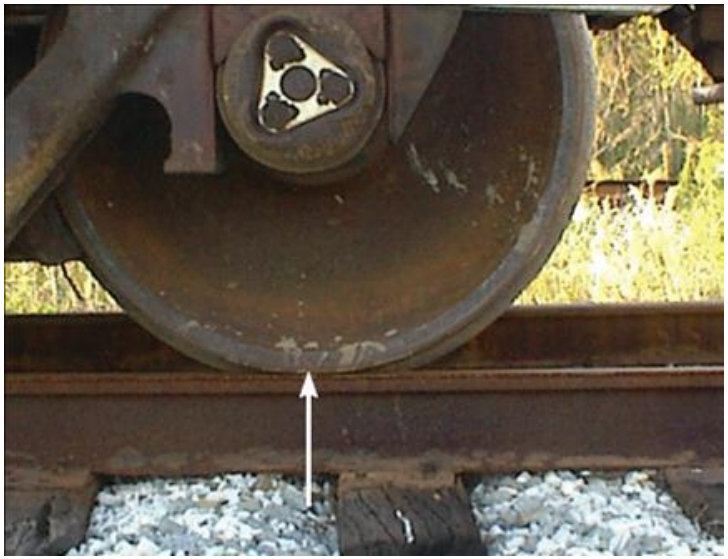
victorstuff.com

Which forces?

www.ashvegas.com

- Mechanics: State of rest or motion of bodies subjected **to forces**

Fundamental concepts



Basic quantities:

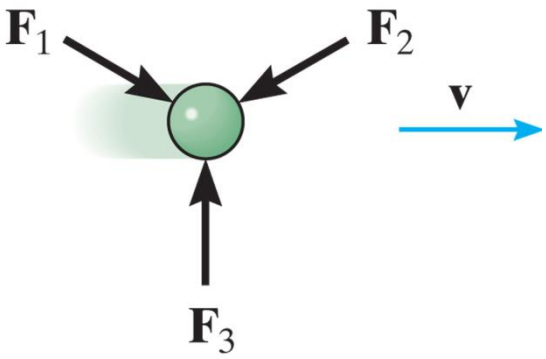
Idealizations:

- Particle:
- Rigid Body:
- Concentrated Force:

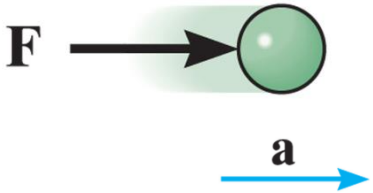
Understanding and applying these things allows for amazing achievements in engineering!

Newton's laws of motion

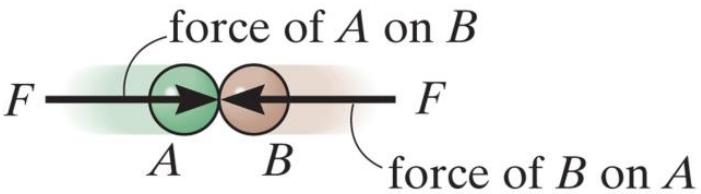
First law:



Second law: a particle acted upon by an unbalanced force ***F*** experiences an acceleration ***a*** that is proportional to the particle mass *m*:



Third law: the mutual forces of action and reaction between two particles are _____, _____ and _____.



Newton's law of gravitational attraction

The mutual **force F of gravitation** between two particles of mass m_1 and m_2 is given by:

G is the universal constant of gravitation (small number)
r is the distance between the two particles

Weight is the force exerted by the earth on a particle at the earth's surface:

Figure: 01_PH003
The astronaut's weight is diminished, since she is far removed from the gravitational field of the earth.

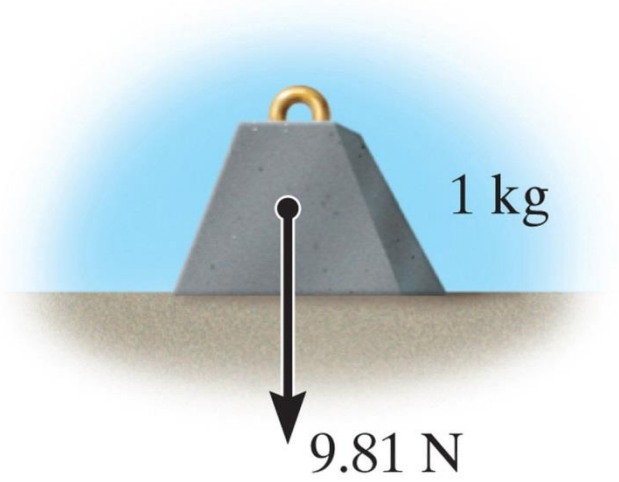
M_e is the mass of the earth
r_e is the distance between the earth's center and the particle near the surface
g is the acceleration due to the gravity

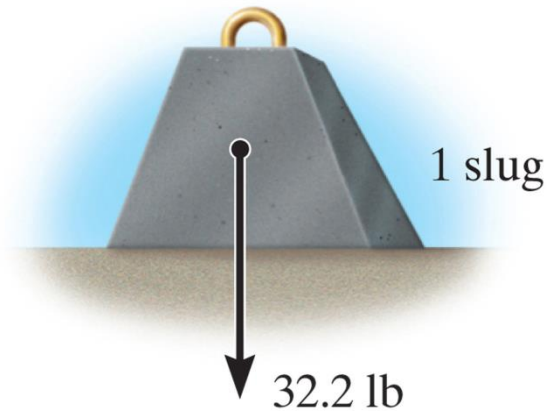
Units

TABLE 1–1 Systems of Units

Name	Length	Time	Mass	Force
International System of Units SI	meter m	second s	kilogram kg	newton* $\left(\frac{\text{kg}\cdot\text{m}}{\text{s}^2}\right)$ N
U.S. Customary FPS	foot ft	second s	slug* $\left(\frac{\text{lb}\cdot\text{s}^2}{\text{ft}}\right)$	pound lb

*Derived unit.





$$G = 66.73 \times 10^{-12} \frac{m^3}{kg \cdot s^2}$$

$$g = 9.81 \frac{m}{s^2}$$

$$g = 32.2 \frac{ft}{s^2}$$

Numerical Calculations

Dimensional Homogeneity

Equations ***must*** be dimensionally homogeneous, i.e., each term must be expressed in the same units.

Work problems in the units given unless otherwise instructed!

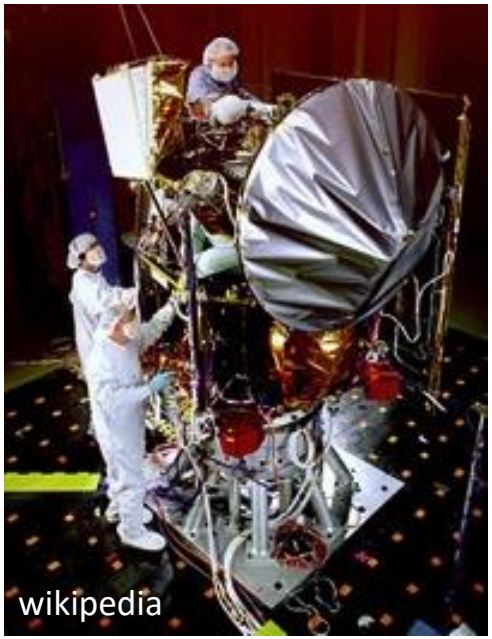
Numerical Calculations

Significant figures

Number of significant figures contained in any number determines accuracy of the number. Use ≥ 3 significant figures for final answers. For intermediate steps, use symbolic notation, store numbers in calculators or use more significant figures, to maintain precision.

Why so picky? Units matter…

- A national power company mixed up prices quoted in kilo-Watt-hour (kWh) and therms.
  - Actual price = $50,000
  - Paid while trading on the market: $800,000
- In Canada, plane ran out of fuel because pilot mistook liters for gallons!



Mars climate orbiter – $327.6 million

General procedure for analysis

1. Read the problem carefully; write it down carefully.
2. MODEL THE PROBLEM: Draw given diagrams neatly and construct additional figures as necessary.
3. Apply principles needed.
4. Solve problem symbolically. Make sure equations are dimensionally homogeneous
5. Substitute numbers. Provide proper units *throughout*. Check significant figures. Box the final answer(s).
6. See if answer is reasonable.

Most effective way to learn engineering mechanics is to ***solve problems!***