

Welcome to Physics 101!

Lecture 01: Introduction to Forces

<http://courses.physics.illinois.edu/phys101/index.asp>

Physics 101 covers...

- Forces
- Kinematics
- Energy/Momentum
- Rotations
- Fluids
- Waves/Sound
- Thermodynamics

Meet the Lecturer

- Scott Willenbrock
willen@illinois.edu

- Office Hours

Monday 11-12 am or by appointment

437C Loomis

- Research

- » Particle Physics
- » Renewable Energy
and Energy Efficiency



- <http://physics.illinois.edu/outreach/zero-net-energy-house/>

Course Format

(upward) Spiral Learning

● Checkpoints	25
● iClickers	25
● Homework	100
● Lab	150
● Discussion	100
→ 11 quizzes; drop lowest 1	
● Exams (3 x 100)	300
● Final Exam	300
	<hr/>
	1000

Excused (EX) Absences

- Can get excused absences for:
 - ➔ Discussions
 - ➔ Labs
 - ➔ Exams
- ONLY for:
 - ➔ Illness
 - ➔ Emergency
 - ➔ Required attendance at University event
 - ➔ Religious observance or practice
 - ➔ Serving as volunteer emergency worker
- Absence excuses must be submitted within
2 WEEKS of absence!

← Step 1

Absences

Types of Absence

Two types of absence can be recorded in the gradebook:

- [Excused absences](#)--issued a grade of EX
- Unexcused absences--issued a grade of ABS
 - Equates to a grade of zero (0) for the missed course component.

The **only** course components eligible to be issued a grade of EX:

- Discussions
- Labs
- Exams

Rectangular Snip

Regardless of the type of absence, Discussions and Labs **cannot be made up**.

The consequences of absences, excused or otherwise, are discussed in the [Grading Policy](#).

Excused Absences

Excused absences will be granted and documented in accordance with University policy as described in [Article 1, Part 5 Class Attendance, of the Student Code](#).

Excused absences fall into the following categories as defined by the code:

- illness
- emergency beyond the student's control (e.g. an auto accident or death in the family)
- required attendance at a University event (e.g. varsity athletics)
- religious observance or practice
- serving as an volunteer emergency worker

Procedures

The [Excused Absences application](#) will guide students through the procedure for documenting missed classes, including the effects of the absence on students' grades.

Final Exams

Failing to show-up for a final exam will result in an AB grade **resulting in failure (F) for the course**.

In accordance with University policy as described in [Article 3, Part 1 Grades and Grading Systems of the Student Code](#), only an authorized member of the Dean's Office **of the student's college** can change an AB final exam grade to an EX.

University policy will apply for EX grades so granted, as described in [Article 3, Part 2 Examinations of the Student Code](#).

Step 2 →

Grading Scale

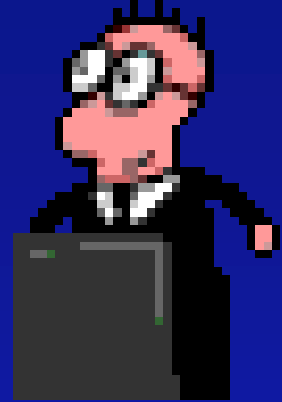
● 950-1000	A+	● 810-834	C+
● 920-949	A	● 780-809	C
● 900-919	A-	● 750-779	C-
● 880-899	B+	● 720-749	D+
● 860-879	B	● 690-719	D
● 835-859	B-	● 610-689	D-
		● <610	F



Reading, Lecture, & Checkpoints

- Need to complete Checkpoints BEFORE Lecture!
- Answer Checkpoints 25/1000 points
 - Due 8 AM day of lecture.
 - 1 point for honest attempt
 - No EX: 28 Checkpoints, can miss three and still get all 25 points.
- Everyone gets 1 point for today!

P101 Lectures



- Participation is key!

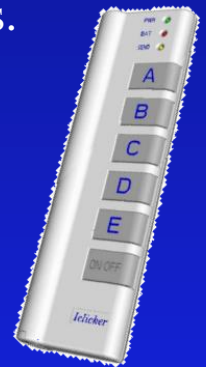
- ➔ Come to lecture prepared!

- ➔ 1 point for each lecture using iclicker

- » No EX, 28 Lectures: can miss three and still get all 25 points.

- » Available at bookstore---*register using link on our web page.*

- » Using multiple clickers is an academic integrity violation.



- Not everything you need for exams!

- ➔ Concepts, Connections, Motivation

Lecture

- ➔ Comprehensive Overview

Text

- ➔ Calculations

Homework, Discussion

- ➔ Hands-On

Lab

- No laptops, phones, etc. in lecture!

- ➔ Lecture notes will be available on webpage.





P101 Homework



- Web based (byteShelf), immediate feedback
- 100% if done before 8 AM deadline
- 80% credit on unfinished parts until following Tuesday
- 0% after that
- Always keep 5 significant figures!
- First one is due Tues Jan. 27 at 8 AM!

Discussion Sections

- Director: Dr. Elaine Schulte

eschulte@illinois.edu

Course Manager and Instructor



- Starts this week!
- Quiz during last 25 minutes of section;
11 quizzes, drop lowest score
- First section: math review, dimensional analysis.



P101 Labs



- Director: **Professor Munir Nayfeh**
m-nayfeh@illinois.edu
research: Atomic and molecular physics



- First Lab is Wed, Jan. 28!
- No “dropped” labs..... Don’t miss one!

Email policy



1. Read the course web site before emailing staff.
2. Please DO NOT email physics or homework questions. Use Office hours!
3. Send questions on Lectures, Checkpoints, and iClickers to Scott Willenbrock.
4. Send questions on Discussion/Quizzes/Exams to Elaine Schulte.
5. Send questions on Labs to Munir Nayfeh.
6. You should use your @illinois.edu email address

Newton's Laws of Motion



1. NEWTON'S FIRST LAW:

If there is zero net force on an object, then its speed and direction will not change.

Inertia

2. NEWTON'S SECOND LAW

If a nonzero net force is applied to an object its motion will change

$$F_{\text{Net}} = ma$$

Acceleration

Net Force

Mass

3. NEWTON'S THIRD LAW

The forces that two interacting objects exert on each other are equal in magnitude and opposite in direction.

Example: Forces in P101

- Non-Contact ---- Gravity $W = G \frac{M_{Earth} m_{object}}{r_{Earth}^2}$
(Weight)
- $G = 6.7 \times 10^{-11} \text{ m}^3 / (\text{kg s}^2)$
 - ➔ Earth: Mass = $6 \times 10^{24} \text{ kg}$, radius = $6.4 \times 10^6 \text{ m}$.
- Contact
 - ➔ Normal: Perpendicular to surface
 - ➔ Friction: Parallel to surface
 - ➔ Anything touching the object
 - » Rope: Tension
 - » Spring $F = -kx$

Example: Weight of Object



- Calculate the gravitational force (i.e. weight) on a 3 kg book held 1 meter above the surface of the earth.

$$W = G M_{\text{Earth}} m / r_{\text{Earth}}^2$$

$$= (6.7 \times 10^{-11} \text{ m}^3 / (\text{kg s}^2)) (6 \times 10^{24} \text{ kg}) (3 \text{ kg}) / (6.4 \times 10^6 + 1)^2 \text{ m}^2$$

$$= 29.4 \text{ kg m/s}^2$$

$$= 29.4 \text{ Newtons (N)}$$

Gravitational ACT



- If the book is raised 10 meters above the surface of the earth, the book's weight will be:
 - A) 100 times stronger
 - B) 10 times stronger
 - C) Nearly the same
 - D) 10 times weaker
 - E) 100 times weaker

$$\begin{aligned} W &= G M_{\text{Earth}} m / r_{\text{Earth}}^2 \\ &= (6.7 \times 10^{-11} \text{ m}^3 / (\text{kg s}^2)) (6 \times 10^{24} \text{ kg}) (3 \text{ kg}) / (6.4 \times 10^6 + 10)^2 \text{ m}^2 \\ &= 29.4 \text{ kg m/s}^2 \end{aligned}$$

Near surface of earth $r = 6.4 \times 10^6 \text{ m}$

$$W = m (G M_{\text{Earth}} / r_{\text{Earth}}^2) = m (9.8 \text{ m/s}^2) = mg$$