

# Physics 120: FOUNDATIONS OF PHYSICS I

Fall, 2009

“It seems to me a superlative thing to know the explanation of everything, why it comes to be, why it perishes, why it is.” — Plato

## Contact Information:

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**Note: Moodle will be used “newton”**

## Meeting Times:

*Lecture* (Youngchild 121): 8:30-9:40 am MWF

*Laboratory* (Youngchild 115): 1:00-4:00 pm M, T  
8:00-11:00 am T

*Office Hours:* 2:30-3:30 pm MW, 2-3 pm Th

*Group Homework Sessions:* Wed. 8:30-10:30 pm,  
YC 115

## Course Outline and Goals:

Physics 120 provides an algebra-based introduction to concepts in classical physics: motion (kinematics) and forces (dynamics); conservation of momentum and energy; fluids; vibrations, waves and sound; and thermodynamics. The goals of this course are:

- To develop an intuitive understanding of fundamental physical concepts.
- To use this conceptual understanding to quantitatively analyze and solve problems.
- To look beyond the textbook exercises and think about how these concepts apply beyond the classroom.

## Required Materials:

D. C. Giancoli, *Physics, Principles with Applications*, 6th Ed., Pearson-Prentice Hall (2005).

Note: All reading and homework will be based on the **6th** edition. Topics, page numbers and homework problems are different in earlier editions.

Laboratory Instructions for Physics 120 and shared Laboratory Notebook. Instructions will be distributed in class; notebooks in the lab section. Your student account will be charged \$14.35 for these after the second week of class.

## Course Philosophy:

The lectures in this course will be devoted to understanding the concepts of classical physics, not repeating the text word-for-word. This requires commitments from you: you must read the assigned reading before coming to class, and you should be ready to participate in class. Be prepared for homework and exam problems based on material covered in the text but not in the lectures. There will be a homework help and review session offered on Wednesday evenings.

## Assignments:

I will collect homework every Friday at the *beginning* of class; late homework will not be accepted since solutions will be immediately posted on Moodle. I expect you to devote considerable effort to the homework; this expectation is reflected in the weighting the homework receives in the grading formula. Homework must be *neatly written or typed*, and include complete explanations of your work. Homework will be returned the following Wednesday in class.

Reading quizzes will be administered via Moodle prior to each class. The quiz will be available starting 24 hours before class, and will close 15 minutes prior to class time. *I rely on your commitment to the Honor Code to take these quizzes independently, and not to share the questions with your classmates.* Reading quizzes are **open book**.

There will be four short quizzes in class with questions that are representative of questions on the exams. These provide timely feedback to both you and me about your understanding of the material, and help prepare you for the exams.

There will be two hour exams and a comprehensive final examination for this course. Expect an approximately equal mix of conceptual and quantitative questions. Exams will be preceded by an optional review session scheduled outside of class.

**Laboratory:**

Laboratory experiments are an integral part of grappling with physical ideas. There will be one three hour lab per week.

**Grading Formula:**

Grades in this course are determined as follows:

|                       |     |
|-----------------------|-----|
| Weekly homework:      | 20% |
| Reading quizzes:      | 5%  |
| In class quizzes (4): | 10% |
| Exams (2):            | 25% |
| Final:                | 20% |
| Laboratory:           | 20% |

With hard work, it is certainly possible for everyone to get an **A** in this course; that is my goal. However, hard work alone is not sufficient for a particular final grade. Grades will be based on your achievement on the assignments described above.

**Honor Code:**

*No Lawrence student will unfairly advance his or her own academic performance or in any way limit or impede the academic pursuits of other students of the Lawrence community.*

Honor the Honor Code. All work on quizzes, exams and the final must be your own. I encourage you to work together on the homework; however, you are responsible for writing your own answers, and for ensuring you can solve the problems independently. All written work must be accompanied by a signed reaffirmation of the Honor Code, "I hereby reaffirm the Lawrence University Honor Code."

**Healthy Balance:**

All members of the Lawrence community – students, staff, and faculty – have the responsibility to promote balance in their lives by making thoughtful choices. Balance results from two skills: avoiding imbalance through careful planning, and managing and containing imbalance when it occurs. This course will be demanding, but should not overwhelm your academic (let alone whole) life. If it threatens to, come talk to me, a tutor, friend, counselor, or adviser.

**Proposed Daily Schedule:**

| <b>Monday</b>   | <b>Lab</b>                 | <b>Wednesday</b>   | <b>Friday</b>  |
|---|----------------------------|--|--|
| Sep 14<br>Introduction: Sect. 1.1-1.8, 2.1  | Intro to computer analysis | Sep 16<br>Kinematics: Sect. 2.2-2.8                                      | Sep 18<br>Vectors: Sect. 3.1-3.4<br>Projectile motion: Sect. 3.5                             |
| Sep 21<br>Projectile Motion: Sect 3.5-3.7, Inertial Frames: Sect. 4.1-4.2<br><b>Quiz 1: Ch. 1-2</b> | Kinematics                 | Sep 23<br>Newton's 2nd law: Sect. 4.3-4.4<br>Applications: Sect. 4.6-4.7 | Sep 25<br>Friction: Sect. 4.8,<br>Newton's 3rd law: Sect. 4.5                                |
| Sep 28<br>Circular Motion and Free Body Diagrams: Sect. 5.1-5.3, 5.5                                | Free fall                  | Sep 30<br>Gravitation: Sect. 5.6-5.7<br><b>Quiz 2: Ch. 3-4</b>           | October 2<br>Weightlessness: Section 5.8; Work: Sect. 6.1-6.2                                |
| Oct 5<br><b>EXAM 1: Ch. 1-5</b>   | Force and acceleration     | Oct 7<br>Energy: Sect. 6.3-6.5   | Oct 9<br>Conservation of Energy: Sect. 6.6-6.8   |
| Oct 12<br>Linear Momentum; Conservation of Momentum: Sect. 7.1-4                                    | Inelastic collisions       | Oct 14<br>Collisions, Center of Mass: Sect. 7.5-7.9                      | Oct 16<br>Rotational Motion: Sect. 8.1-8.4   |
| Oct 19<br>Rotational Dynamics: Sect. 8.5-8.8  | Ballistic pendulum         | Oct 21<br>Fluid Statics: Sect. 10.1-10.6<br><b>Quiz 3: Ch 6-8</b>        | Oct 23<br><b>NO CLASS: Reading period</b>  |
| Oct 26<br>Archimedes; Fluid Flow: Sect. 10.7-10.8   | Hooke's law                | Oct 28<br>Bernoulli, Harmonic Motion 10.9-10.10, 11.1-3                  | Oct 30<br>SHM & Waves: Sect 11.4-11.9  |
| November 2<br><b>EXAM 2: Ch. 6-10</b>   | Driven String              | Nov 4<br>Waves 11.11-13,<br>Sound: Sect. 12.1-12.3                       | Nov 6<br>Sound: Effects and Applications: Sect. 12.4-12.7 (12.8, 9 for cultural information) |
| Nov 9<br>Temperature: Solids and Gasses: Sect. 13.1-13.2, 13.4, 13.6-13.9                           | TBA                        | Nov 11<br>Kinetic Theory and Heat: Sect. 13.10, 14.1-14.4                | Nov 13<br>Heat and Conduction: Sect. 14.5-14.8   |
| Nov 16<br>Open Questions<br><b>Quiz 4: Ch 11-14</b>   | Recapitulation             | Nov 18<br><b>NO CLASS: Reading Day</b>                                   | Nov 20<br><b>FINAL 8:30-11:30 am</b>   |

**Final Exam: Friday, Nov. 20 8:30-11:30 am in YC 121.**

## Physics 120 Grading Guidelines

Solutions are graded on a scale of 0-10 points. For 10 points, the problem must have the following pieces:

- a diagram
- a narrative describing the physical reasoning, including starting assumptions
- a neatly composed answer
- the proper units
- the correct answer

One point will be deducted from the following scale for each piece missing.

- 10 points: Mathematically correct solution with a complete explanation, including everything above.
- 9 points: Solution that is well explained and reasoned but has a minor algebraic error.
- 8 points: Solution starts with the correct equation, and physical reasoning, but mathematical errors make it impossible to complete the solution.
- 7 points: The correct equation appears somewhere near the start of the solution (and random incorrect equations are absent), but you can't follow what goes on from there.
- 6 points: The right idea is mentioned, but misses the first mathematical step (e.g. the first equation is wrong).
- 5 points: An attempt at an assigned problem

**Homework assignments will be posted on Moodle.**