

# LB 273, Fall 2012: Physics of the Life Sciences, I

## Course Syllabus

### Course Description

LB 273 is the first semester of the Lyman Briggs College calculus-based introductory physics sequence, and will be taught by Brian O'Shea, Gerd Kortemeyer, and James (J.T.) Lavery. This course will start by focusing on Newton's classical mechanics, will move on to thermodynamics and statistical mechanics, and will finish with an exploration of fluid dynamics. All of these topics will be made relevant by using examples that show how the form and behavior of biological systems are constrained by the laws of physics.

The primary goals of this course are:

1. To provide you with an overarching conceptual understanding of physics and the interconnectedness of physical phenomena, and how the laws of physics affect living organisms. For example, we will explain to you why Godzilla simply could not exist, and why bugs don't need lungs, but humans do.
2. To provide a mathematical toolkit for expressing and manipulating the laws of physics, which will help you to make quantitative predictions about the motion of falling objects, the behavior of cells, and the flow of blood through your arteries.
3. To increase your problem-solving skills and provide you with problem-solving strategies that are broadly useful. Specifically, we will increase your ability to identify the important elements of a problem (in a physics context or otherwise), to break it down into its component pieces, to solve each piece individually, and to put this back together into a complete solution. A few years after this course is over, it is likely that you will have forgotten the formula for the kinetic energy of an object that rolls without slipping - but you hopefully will have retained these problem-solving strategies.

We will work toward the goals expressed above throughout the course, using research-tested active learning techniques such as think-pair-share and small-group problem solving. In lecture, we will use these methods, have discussions, and use physics demonstrations – very little time will be used for lecturing!

## Readings and required course materials

Course reading materials are available in the required course pack, and are an essential part of learning the material covered in this course. A paper version of the course pack is available **ONLY** at the MSU bookstore, though we will also have PDF versions available online at <http://msu.lon-capa.org> if you don't want to purchase a paper copy. The material is organized by topics over the course of the semester. For each topic, there are three stages:

- 1) Read the material before the first day that it will be discussed in class and respond to a few short questions online prior to the first lecture where it will be discussed.
- 2) Material will be worked on in lectures and hands-on sessions
- 3) LON-CAPA homework is due after the material has been discussed in class

The written course material establishes the expected learning outcomes for this course, and students are expected to read ALL of the material on a given subject before coming to class.

In addition to the course pack, you are required to purchase an iClicker and a copy of the Washington Group's Tutorials in Introductory Physics (including homework book) by McDermott et al. The course pack can only be found at the MSU bookstore at the International Center. The iClickers are available at the campus bookstore, among other places, and you can purchase either the original iClicker or the iClicker 2. The Washington tutorials can be purchased at any bookstore or on Amazon – just make sure to buy the package that contains both the in-class materials and the homework book!

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## Course activities

**In-lecture activities:** The lecture component of this course will be used to clarify and elaborate upon the reading materials, rather than comprehensively cover all of the subjects discussed in the reading. To this end, we will engage in a range of activities, including think-pair-share (also known as “clicker questions”), lecture demonstrations, small group and individual problem solving, and conceptual tutorials.

**Hands-on learning sessions:** The hands-on component of this course will be used to enhance your conceptual understanding of the material and your problem-solving skills. To further these goals, you will participate in a variety of activities: physics tutorials, in-class guided problem solving, laboratory exercises, and occasionally some other activity that has intellectual utility for the course. These assignments will generally be worked on in groups of 2-4, depending on the project.

**LON-CAPA Homework:** One of the most important things that you can do to master physics is *to do physics problems*. We will assign homework using the course's LON-CAPA website (at <http://msu.lon-capa.org>), which will generally focus on one or two specific topics. The homework questions will consist of multiple-choice, numerical response, and graph-oriented questions. LON-CAPA will also be used for the pre-class reading questions, which will be assigned separately.

**Exams:** One of the ways that we assess your learning will be by three midterm exams and a cumulative final examination. These will be composed primarily of free response questions. Exam questions will be taken from the reading materials, topics discussed during the lectures, the LON-CAPA homework, and from the work that you do during your hands-on sessions.

## Grading Information

The course grade is determined by contributions from several sources: LON-CAPA reading questions and homework, assignments in the hands-on sessions, in-lecture “clicker questions,” and exams. Each of these contributes to the final grade in the following percentages:

45%	Midterm exams (3 exams, 15% each)
15%	Final exam
5%	Clicker questions
10%	LON-CAPA homework
5%	LON-CAPA reading questions
20%	Hands-on learning sessions

The course grading scale is as follows:

4.0	≥ 92%
3.5	≥ 84%
3.0	≥ 76%
2.5	≥ 68%
2.0	≥ 60%
1.5	≥ 52%
1.0	≥ 44%
0.0	< 44%

Please consult the LB 273 Grading Policies document (available on the course LON-CAPA page, at <http://msu.lon-capa.org>) for more detailed information about grading.

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## Other important information

**Class Hours:** The classroom component of this course meets three times a week, on Monday, Wednesday, and Friday in C-106 Holmes Hall. There is one lecture section, which is from 11:30 a.m. to 12:20 p.m. Please bring paper, pencil, a calculator, and your iClicker to class every day.

The hands-on sessions meet Monday through Thursday in the Lyman Briggs Physics Lab, which is E-26 Holmes Hall (in the basement of the East wing). You are expected to attend the section that you are enrolled in. If you need to change sections for a week you must contact Dr. Kortemeyer in advance, and he will work with you to find a hands-on session that fits into your schedule. Please make sure to let the LA running the session know that you are there temporarily!

**Office hours:** Professor O'Shea's office hours for Fall 2012 will be Fridays from 1:00-3:00 p.m. in his Holmes Hall office (193-A East Holmes), and by appointment. You are also welcome to stop by his Holmes Hall office whenever the door is open. Professor Kortemeyer's office hours are on Fridays from 9:30-11:00 a.m. in the physics lab, as well as by appointment, and J.T. will have his office hours from 3-5 p.m. on Fridays in the help room, with schedule to be determined. Note that there will be no office hours or help room hours during the first partial week of class or the weeks of Thanksgiving and of final exams.

**Help room:** The help room is a place to get assistance with homework problems and exam preparation. It is located on the 5<sup>th</sup> floor of East Holmes Hall and is staffed by the course's undergraduate learning assistants. Help room hours will be announced during the first week of class in lecture and via email. **Help room hours start the week of September 3rd.** The help room hours may change, depending on attendance patterns and TA/LA availability. These changes will be announced in lecture and via email.

**LON-CAPA discussion boards:** Each homework problem in LON-CAPA provides an attached discussion board. We encourage you to make extensive use of this resource. We request, however, that students do not simply post the answers to specific homework questions – while it is helpful in the short term, it is detrimental to overall learning.

**What to do if you are having difficulty in this class:** Physics can be a challenging subject to learn, and the methods used to study for physics are closer to those for mathematics than for other sciences. The primary reason for this is that, in physics, we take a small number of concepts and learn to apply them in a variety of ways - so, instead of having a great deal of information to retain, you must instead deeply understand a small amount of information. If you are having difficulties in this class, we have several suggestions:

- Consult the “How to study physics” links located in the Supplementary Materials folder on our LON-CAPA page. There are lots of useful ideas in there.
- Purchase a copy of Schaum's 3000 Solved Problems in Physics, and judiciously choose practice problems from within this book. It's often very useful to look at a problem, attempt to solve it, and then look at the provided solution afterward - solving many problems helps you to see common methods of solution, and to solidify concepts!
- Consider using an alternate resource to the LB 273 textbook, such as the Khan Academy lectures on physics (<http://www.khanacademy.org/>), the Light and Matter textbook (<http://www.lightandmatter.com/lm/>), or one of the standard calculus-based physics texts. Many older editions of the latter are available used on Amazon.com for around \$10!
- Work in a group with at least one other person, and make sure to explain the solutions to problems to each other - explaining the material helps to solidify it in your mind!
- Hire a tutor. Many physics graduate students are interested in tutoring, and are willing to work either on a regular basis (e.g., weekly) or for an hour or two right before exams. (Professor O'Shea has a list of physics and astrophysics graduate students who are interested in being tutors.) Tutors typically cost around \$15/hour for one person, with possible discounts for more than one person. It's particularly effective to email your tutor ahead of time with specific questions, etc. so they can be prepared.

- **Above all, if you feel like you're falling behind, please talk to Professor O'Shea, Professor Kortemeyer, or J.T. immediately!** He will be able to help you find resources, talk about your study habits, and generally offer moral support.

**Honors Project Information:** If you are interested in doing an Honors project, please contact Professor O'Shea some time within the first two weeks of class. We have a wide range of equipment available for an honors project, including normal and high-speed video cameras, an infrared camera, and various Pasco sensors that are identical to the ones used in lab, but which plug into iPads and portable PASCO sensor platforms. We encourage people to do interesting projects, particularly in groups, and in collaboration with the graduate teaching assistant – see [http://www.pa.msu.edu/~osheabr/honors\\_options.html](http://www.pa.msu.edu/~osheabr/honors_options.html) for some ideas, and for a list of honors options done in previous semesters. Please email us if you have any questions!

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## Instructor Information

Professor O'Shea is in charge of all aspects of the lecture component of the course, including exams and the LON-CAPA site (at <http://msu.lon-capa.org>). Professor Kortemeyer is responsible for hands-on sessions and the help room. Mr. Lavery is responsible for many of the logistical aspects of the course, including the grading of hands-on session material and exams. Our contact information is:

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**Contacting course staff:** All course staff can be reached at the e-mail addresses found above. Please be sure to put "LB 273" and the nature of your query in the subject heading of the email (for example: "LB 273: missed exam due to illness, need to schedule retake"). We will respond within 48 hours. **The course staff does not check their LON-CAPA email on a regular basis.**