Wayne State University – Physics for the Life Sciences I – PHY 2130

Winter 2018 – January 8 to May 1

Instructor

Name	Dr. Matthew Gonderinger
E-mail	fg8281@wayne.edu Please include "PHY 2130" in the subject line of any e-mails you send me. I will usually respond to e-mails within two business days; if you still have not received a response after this time, please e-mail me again and see me in person before or after class. Looking for answers to frequently asked questions in the syllabus or other course materials posted on Blackboard is often faster than waiting for me to answer your question by e-mail, so please rely on these other sources of information.
Phone	(402) 807-3795
Office	Physics (666 W Hancock) 218
Office hours	Wednesdays 12:00 pm – 2:00 pm (in the STEM Commons) Thursdays 11:00 am – 1:00 pm (in the STEM Commons) Additional office hours are available by appointment.

Course information

Lectures	Mondays and Wednesdays, 8:30 am – 9:45 am in Science Hall 1117
Discussion sections	Mondays 10:30 am – 12:20 pm in Manoogian 0064 (section 003) Tuesdays 9:30 am – 11:20 am in Old Main 1115 (section 001) Wednesdays 10:30 am – 12:20 pm in Manoogian 0024 (section 002) Thursdays 9:30 am – 11:20 am in Manoogian 0068 (section 010)
Textbook	This course does not require a traditional textbook. Instead, we will use an online wiki developed and used at the University of Maryland. The online wiki can be found at https://goo.gl/kK9jJ1. For your convenience, the pages of this wiki have been compiled into a single document available on Blackboard. A printed version of this document is available for purchase in the bookstore (NEXUS Physics 2130 Coursepack). Please note that the online version at the link above contains all the most recent changes to the content. There are two textbooks that may serve as useful supplements to the online wiki. The first is the OpenStax College Physics textbook which is available online for free at https://openstax.org/details/books/college-physics. The second is College Physics: A Strategic Approach (3rd edition) by Knight, Jones, and Field. These books are similar to most traditional physics textbooks. They include many topics that we will not be studying in this course, and they omit certain topics that we will be studying in this course. For many topics, however, these textbooks are good resources for further reading and practice problems.
Clickers	All students will need an i>clicker 2 ("clicker"). These are the same clickers used in some other courses at Wayne State. Clickers can be purchased from the campus bookstore and must be registered via the course Blackboard website. i>clicker 2 [ISBN: 9781429280471]
WebAssign	All students will need a WebAssign access code which can be purchased directly from the Webassign website (www.webassign.net). The class key for this course is wayne 4826 5663.

Course description	Introduction to physics for students in the life sciences, preparing for medicine, dentistry, pharmacy and health sciences and for general Liberal Arts and Sciences students. Covers motion, forces, energy, diffusion, fluids, thermal physics with many biological examples.
Corequisite	PHY 2131
Credit hours	4.0

Learning outcomes

When confronted with problems involving motion, forces, models of matter, and energy, students will be able to:

- Recognize which physical phenomena or principles are relevant for the problem;
- Think critically and use appropriate concepts to qualitatively analyze the problem; and
- Use appropriate mathematical techniques and concepts to obtain quantitative solutions to the problem.

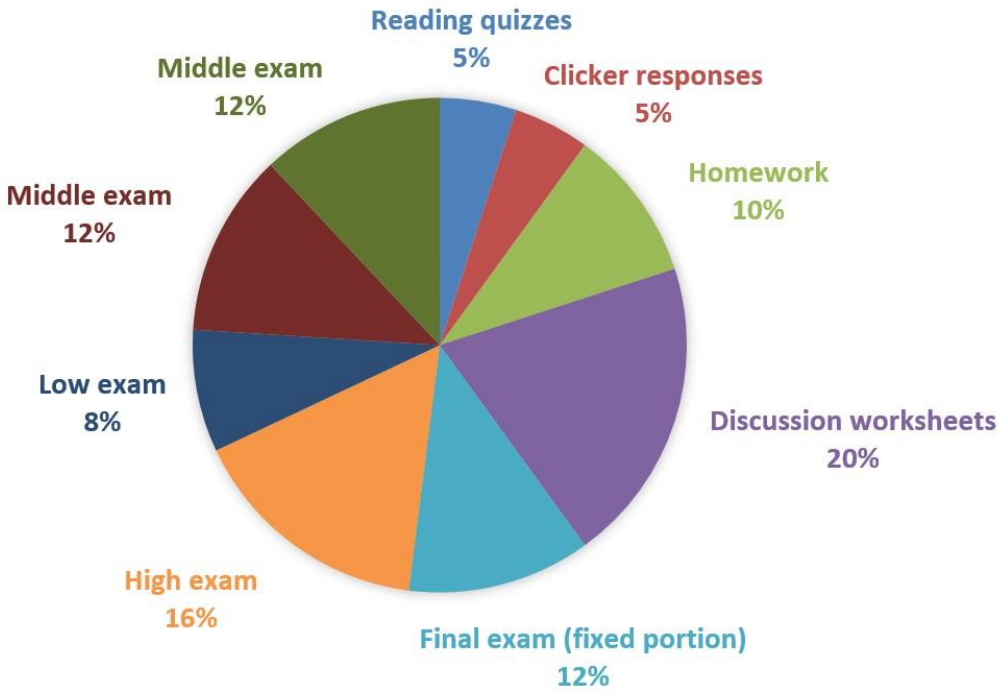
More broadly, students will be able to:

- Describe, explain, and discuss basic physical principles, theories, laws, and their interconnections, as well as recognize the changing nature of science;
- Explain and discuss the role of physical principles in the life sciences;
- Communicate scientific problems, concepts, data, applications, and solutions orally and in written form;
- Make connections between physical concepts and how they connect to other sciences;
- Apply appropriate concepts to analyze and model problems and situations by invoking fundamental principles of physics;
- Compose graphical representations of physical situations and problems;
- Formulate and use appropriate concepts, connections, and mathematical/computational techniques to derive symbolic or quantitative solutions to problems in physics; and
- Based on sound scientific reasoning, argue and defend conclusions.

Grading

The grading scale used for final grades and the breakdown of the final course grade are shown here.

Percent	Letter grade
90-100	A
85-89	A-
80-84	B+
75-79	B
70-74	B-
65-69	C+
60-64	C
55-59	C-
50-54	D+
45-49	D
40-44	D-
0-39	F



Grade adjustments Exam scores and final grades will not be curved. The grading scale above should not be used to determine a letter grade on an individual exam or quiz; it is used for midterm and final grades only.

Extra credit All extra credit and other bonus point opportunities are at the discretion of the instructor.

Exams

Exam information There will be three in-class exams on the following days:

Wednesday, February 7
Wednesday, March 7
Wednesday, April 11

There will be a final exam on Friday, April 27 from 2:45 pm to 4:45 pm. The in-class exams will be held in the same room as the lectures. The final exam will be the same for all sections of PHY 2130 and all sections will take the exam at the same time.

Exam grades Of the four exams (three in-class exams and the final exam), your highest exam score will count as 16% of your course grade; your lowest exam score will count as 8% of your course grade; and the other two exams scores will each count as 12% of your course grade. Your score on the final exam will be counted twice, once as either 8%, 12%, or 16% of your course grade (depending on your other exam scores) and a second time as a fixed 12% of your course grade.

Make-up exams Students who miss an exam for any reason (planned or unplanned) should notify the instructor immediately, preferably in advance. In-class exams cannot be rescheduled; the final exam may be rescheduled only in situations described in the final exam information sheet found at https://reg.wayne.edu/finals/final_exam_schedule_winter_2018_092017_v_2.pdf.

	No make-up exams will be given, and a missed exam will count as a 0. Any student who misses two or more exams will automatically receive a final grade of F.
Exam rules	You must bring your Wayne State ID to the exam and present it to the exam proctor if asked. Graphing and scientific calculators are allowed during the exam. No other electronic devices (including calculators on smartphones) are allowed during the exam. An equation sheet will be provided on the exams. Students are not allowed to bring any notes or other materials into the exam.

Homework

WebAssign	The homework will be online through WebAssign, www.webassign.net. For more information about Webassign, please see the Course information page on Blackboard.
Due dates and extensions	Homework assignments will be due on Fridays at 11:59 pm unless otherwise noted. No extensions on homework assignments will be granted. Your lowest assignment grade will be dropped at the end of the semester.
Submissions	You can submit answers to a WebAssign question a maximum of ten times. You will receive full credit if you get the correct answer on one of your first three submissions. You will be penalized 5% of the points for each submission after the third. If you do not have the correct answer after your tenth and final submission, you will get zero points for the problem.
Rounding	WebAssign has a default tolerance of $\pm 2\%$ for most submitted numerical answers. Exceptions are problems which explicitly ask about significant figures and problems requiring an integer answer.
Homework questions	If you have a question about a homework problem, please ask me in person or e-mail me directly. Do not send messages through WebAssign – I do not frequently check WebAssign and am unlikely to see your message.

Clicker responses and reading quizzes

Clickers information	All students will need to bring their own clicker to every lecture. Clickers will be used to answer questions during lecture, and student responses will be recorded. Using another student's clicker, or letting another student use your clicker, is not allowed and is considered cheating. The minimum penalty for clicker misuse is zero credit for clicker responses for the entire semester.
Grading clicker responses	The clicker questions will be worth 5% of the total course grade. There are no make-up opportunities or second chances for missed clicker responses for any reason (absence from class or otherwise). However, only 75% of the total number of clicker questions in all the lectures combined will be counted toward your grade. You do not need to have the correct response to receive credit. Your clicker must be registered via Blackboard to receive credit for your responses.
Reading quizzes	Reading assignments are listed in the schedule at the end of the syllabus. Students should read the assigned sections before each class. Short quizzes to accompany the reading assignment will be posted on Blackboard. These will consist of three multiple choice questions and one short answer question. You will have approximately 24 hours to take the quizzes but they must be completed by 12 pm noon on the day before class.

Grading reading quizzes	For each quiz, you will earn 70% of the points for completing and submitting the quiz. For each multiple choice question that you answer correctly, you will earn an additional 10% of the points for that quiz. The reading quizzes will be worth 5% of the total grade for the course. The three lowest reading quiz grades will be dropped at the end of the semester.

Discussion sections

Introduction	The discussion sections give you the opportunity to practice applying concepts to computational problem solving and work on homework problems. You will work together in groups (guided by teaching assistants) on worksheets and have an opportunity to get help on homework questions from each other and the teaching assistants.
Graded worksheets	Attendance and participation in the discussion sections is required and will be recorded. Each student must turn in their own worksheet at the end of each week's discussion section for grading. The discussion section worksheets will be worth a total of 20% of your final grade. The lowest worksheet grade will be dropped.
Materials	Students should bring their textbook (printed or electronic), calculator, laptop (if you have one), and pencil and paper every week.
Preparation	The schedule of discussion worksheets at the end of the syllabus lists the lectures covering the relevant topics for each discussion worksheet. The discussion worksheets will be most effective for your learning if you review the topics in these lectures before going to discussion.

Notes

Course drops and withdrawals	In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Academica. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: http://reg.wayne.edu/pdf-policies/students.pdf.
Last day to drop with tuition cancellation	January 22
Last day to withdraw	March 25
Religious holidays	Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

Studying resources

The Physics Resource Center is in Physics 172 and provides drop-in office hours with graduate teaching assistants. Supplemental Instruction and various workshops are available through the Academic Success Center (www.success.wayne.edu).

Student disabilities

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located in the Adamany Undergraduate Library. The SDS telephone number is 313-577-1851 or 313-202-4216 (Videophone use only). Once your accommodation is in place, someone can meet with you privately to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Students who are registered with Student Disability Services and who are eligible for alternate testing accommodations such as extended test time and/or a distraction-reduced environment should present the required test permit to the professor at least one week in advance of the exam. Federal law requires that a student registered with SDS is entitled to the reasonable accommodations specified in the student's accommodation letter, which might include allowing the student to take the final exam on a day different than the rest of the class.

Academic dishonesty – cheating and plagiarism

Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (http://www.doso.wayne.edu/student-conduct-services.html). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student's test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.

Fabrication: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

Plagiarism: To take and use another's words or ideas as one's own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student's access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or

stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

In this course, the minimum penalty for the first instance of cheating by a student is a grade of 0 for the work in question (homework assignment, quiz, exam, etc.). This 0 grade may not be dropped or replaced. Repeated instances of cheating will result in a failing grade for the course. For all instances of cheating, the Department of Physics and Astronomy will be notified to ensure that the procedures described in the Student Code of Conduct are followed.

Reading assignments schedule

MONDAY	WEDNESDAY
January 8 **Lecture 1** *1. Introduction to Class* *1.1 The disciplines: Physics, Biology, Chemistry, and Math* *1.1.1 Science as Making Models* *1.1.4 What Physics can do for Biologists* *1.2 Thinking about thinking and knowing* *1.2.1 The nature of scientific knowledge* *1.2.3 Knowing-how-we-know Icons*	January 10 **Lecture 2** *2. Modeling with Mathematics* *2.1 Using math in science* *2.1.1 How math in science is different from math in math* *2.1.2 Measurement* *2.1.3 Dimensions and units* *2.1.3.1 Complex dimensions and dimensional analysis* *2.1.3.2 Changing units* *2.1.3.3 Natural scales* *2.1.4 Estimation* *2.1.4.1 Useful Numbers* *2.2.2 Scientific Notation* *2.2.3 The idea of algebra: unknowns and relationships* *2.2.3.1 Symbols in science*
January 15 **NO CLASS**	January 17 **Lecture 3** *Interlude 1: The Main Question – Motion* *3. Kinematics: Where and When?* *3.1.1 Coordinates* *3.1.2 Vectors* *3.1.3 Time* *3.1.4 Kinematics Graphs*
January 22 **Lecture 4** *2.2.5 Values, change, and rates of change* *2.2.5.1 Derivatives* *2.2.5.1.1 What is a derivative?* *3.2 Kinematic Variables* *3.2.1 Velocity* *3.2.1.1 Average Velocity* *3.2.1.2 Instantaneous velocity* *3.2.1.3 Calculating with average velocity*	January 24 **Lecture 5** *3.2.2 Acceleration* *3.2.2.1 Average acceleration* *3.2.2.2 Instantaneous acceleration* *3.2.2.3 Calculating with constant acceleration* *3.2.3 Kinematics graphs and consistency* *3.2.3.1 Reading the content in the kinematic equations*
January 29 **Lecture 6** *4.1 Newton's Laws* *4.1.1 Physical content of Newton's Laws* *4.1.1.1 Object egotism* *4.1.1.2 Inertia* *4.1.1.3 Interactions* *4.1.1.4 Superposition* *4.1.1.5 Mass* *4.1.1.6 Reciprocity* *4.1.2 Formulation of Newton's Laws as foothold principles* *4.1.2.1 Quantifying impulse and force* *4.1.2.2 Newton 0* *4.1.2.2.1 Free-body diagrams* *4.1.2.2.2 System Schema Introduction*	January 31 **Lecture 7** *3.1.2.1 Adding Vectors* *4.1.2.1.2 Adding forces* *4.1.2.3 Newton's 1st law* *4.1.2.4 Newton's 2nd law* *4.1.2.4.1 Reading the content in Newton's 2nd law*

MONDAY	WEDNESDAY
February 5 **Lecture 8** *4.1.2.5 Newton's 3rd law* *4.1.2.5.1 Using System Schemas for Newton's 3rd Law* *4.1.2.6 Center of mass*	February 7 **EXAM 1**
February 12 **Lecture 9** *4.2 Kinds of Forces* *4.2.3 Gravity* *4.2.3.1 Flat-earth gravity* *4.2.3.1.1 Free-fall in flat-earth gravity* *4.2.3.3 The gravitational field*	February 14 **Lecture 10** *4.2.1 Springs* *4.2.1.1 Realistic springs* *4.2.1.2 Normal forces* *4.2.1.2.1 A simple model of solid matter* *4.2.1.3 Tension forces*
February 19 **Lecture 11** *4.2.2 Resistive forces* *4.2.2.1 Friction* *4.2.2.2 Viscosity* *4.2.2.3 Drag*	February 21 **Lecture 12** *4.2.4 Electric Forces* *4.2.4.1 Charge and the Structure of Matter* *4.2.4.2 Polarization* *4.2.4.3 Coulomb's Law* *4.2.4.3.1 Coulomb's Law – Vector Character* *4.2.4.3.2 Reading the Content in Coulomb's Law*
February 26 **Lecture 13** *4.3 Coherent vs. random motion* *4.3.1 Linear momentum* *4.3.1.1 Restating Newton's 2nd law: Momentum* *4.3.1.2 Momentum conservation*	February 28 **Lecture 14** *4.3.2 The role of randomness: Biological implications* *4.3.3 Diffusion and random walks* *4.3.3.1 Fick's Law* *4.3.3.1.1 Reading the content in Fick's law*
March 5 **Lecture 15** *5. Models of matter* *5.1.1 Density (Solids)* *5.1.2 Young's Modulus* *5.1.6 Soft matter* *5.1.6.1 Mechanical Properties of Cells*	March 7 **EXAM 2**
March 12 **NO CLASS**	March 14 **NO CLASS**
March 19 **Lecture 16** *5.2 Fluids* *5.2.1 Pressure* *5.2.2 Archimedes' Principle* *5.2.3 Buoyancy* *5.2.5.2 Internal Cohesion* *5.2.5.2.1 Surface Tension*	March 21 **Lecture 17** *5.2.6 Fluid Flow* *5.2.6.1 Quantifying Fluid Flow* *5.2.6.2 The Continuity Equation* *5.2.6.3 Internal Flow – The HP Equation*

MONDAY	WEDNESDAY
March 26 **Lecture 18** *6. Energy* *6.1 Kinetic energy and the work-energy theorem* *6.1.1 Reading the content in the Work-Energy theorem*	March 28 **Lecture 19** *6.2 Energy of place -- potential energy* *6.2.1 Gravitational potential energy* *6.2.2 Spring potential energy* *6.2.3 Electric potential energy*
April 2 **Lecture 20** *6.3 The conservation of mechanical energy* *6.3.1 Interpreting mechanical energy graphs* *6.3.2 Mechanical energy loss -- thermal energy* *6.3.3 Forces from potential energy*	April 4 **Lecture 21** *6.4.1 Energy at the sub-molecular level* *6.4.2 Atomic and molecular forces* *6.4.2.1 Interatomic forces* *6.4.2.1.1 The Lennard-Jones Potential* *6.4.2.2 Chemical bonding*
April 9 **Lecture 22** *6.5 Energy in fluid flow* *6.5.1 The work-energy theorem in fluids* *6.5.2 Bernoulli's principle* *6.5.2.1 Reading the content in Bernoulli's principle* *5.3 Heat and Temperature* *5.3.1 Measuring Temperature*	April 11 **EXAM 3**
April 16 **Lecture 23** *5.3.2 Thermal Properties of Matter* *5.3.2.1 Thermal energy and specific heat* *5.3.2.2 Heat Capacity* *5.3.2.3 Heat Transfer*	April 18 **Lecture 24** *Interlude 2: The Micro to Macro Connection* *7. Thermodynamics* *7.1 Kinetic theory: the ideal gas law* *7.2 The 1st law of thermodynamics*
April 23 **Lecture 25** *To be determined*	

Discussion worksheets schedule

WORKSHEET	LECTURE TOPICS	DATES
Worksheet 1	Lectures 1 & 2	Tuesday, January 16 – Monday, January 22
Worksheet 2	Lectures 3 & 4	Tuesday, January 23 – Monday, January 29
Worksheet 3	Lecture 5	Tuesday, January 30 – Monday, February 5
Worksheet 4	Lectures 6 & 7	Tuesday, February 6 – Monday, February 12
Worksheet 5	Lectures 7, 8, & 9	Tuesday, February 13 – Monday, February 19
Worksheet 6	Lecture 10	Tuesday, February 20 – Monday, February 26
Worksheet 7	Lectures 11 & 12	Tuesday, February 27 – Monday, March 5
Worksheet 8	Lectures 12, 13, & 14	Tuesday, March 6 – Friday, March 9 & Monday, March 19
Worksheet 9	Lectures 15 & 16	Tuesday, March 20 – Monday, March 26
Worksheet 10	Lecture 17	Tuesday, March 27 – Monday, April 2
Worksheet 11	Lectures 18 & 19	Tuesday, April 3 – Monday, April 9
Worksheet 12	Lecture 20	Tuesday, April 10 – Monday, April 16
Worksheet 13	Lecture 21	Tuesday, April 17 – Monday, April 23