Term Information

Effective Term	Spring 2025

General Information

Course Bulletin Listing/Subject Area	Physics
Fiscal Unit/Academic Org	Physics - D0684
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	1249
Course Title	Rotational Dynamics, Thermal Physics, and Vibrational Motion
Transcript Abbreviation	Thermal Phys Waves
Course Description	PHYSICS 1249 is the second course in a two-course series for students in physical sciences, mathematics, and engineering. The course covers rotational dynamics, fluids, thermal dynamics, and vibrational motion. The topics are covered in the same depth and rigor as PHYSICS 1250, but this course proceeds at a slower pace, so that the course covers roughly the second half of the PHYSICS 1250 content.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Laboratory, Lecture
Grade Roster Component	Laboratory
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq: Physics 1248 Prereq: Math 1140; Prereq or concur: Math 1140, 1141
Exclusions	Not open to students with credit for 1250.
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0801
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will be able to use their conceptual understanding of Newton's Laws of motion along with models of motion for extended rigid bodies to solve practical problems involving a variety of contexts including matter and its interactions.
- Students will be able to apply their conceptual understanding of fluids and the Ideal Gas Law to solve problems connected to static fluids and fluids in motion. They will also use this knowledge to interpret and evaluate thermodynamic processes.
- Students will use their understanding of thermodynamic processes and the 1st and 2nd laws of thermodynamics to solve practical problems and evaluate heat engines and heat pumps.

Content Topic List

- Rotational Dynamics, Thermal Physics, and Vibrational Motion

Sought Concurrence

No

Attachments

- GE Foundations 1249.pdf: GE Statement

  (GEC Model Curriculum Compliance Stmt. Owner: Gramila,Thomas J)
- Course_Request_Letter_PHYSICS_1248_9.pdf: Course motivation

  (Cover Letter. Owner: Gramila,Thomas J)
- 1249 Syllabus_rev.pdf: Syllabus

  (Syllabus. Owner: Gramila,Thomas J)

Comments

- Natural Sciences GE removed.

  Pre-req corrected

  Updated syllabus reflecting the above uploaded *(by Gramila,Thomas J on 01/24/2024 12:37 PM)*
- In the new GE, courses for the Natural Sciences need to be 4 or 5 credits. This course is only 3 credits. *(by Vankeerbergen,Bernadette Chantal on 12/22/2023 11:50 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Gramila,Thomas J	12/09/2023 08:08 PM	Submitted for Approval
Approved	Humanic,Thomas John	12/10/2023 08:17 AM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	12/22/2023 11:50 AM	College Approval
Submitted	Gramila,Thomas J	01/24/2024 12:37 PM	Submitted for Approval
Approved	Humanic,Thomas John	01/24/2024 03:08 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/24/2024 03:48 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	01/24/2024 03:48 PM	ASCCAO Approval

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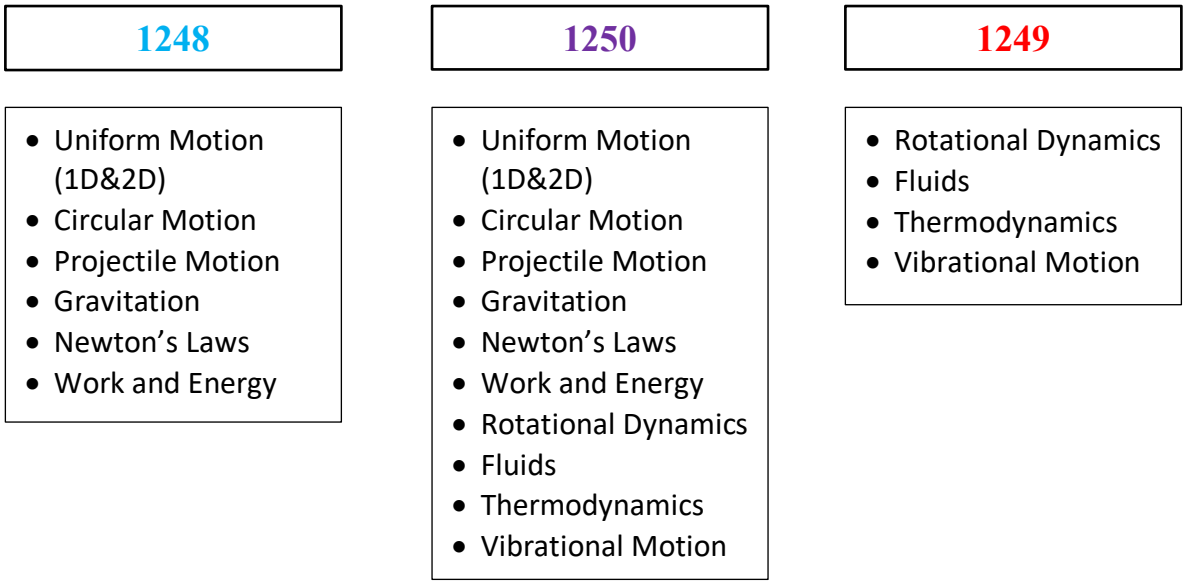
November 14, 2023

Dear Arts & Sciences Curriculum Committees,

I propose two new introductory physics courses, PHYSICS 1248 (Mechanics, Work, and Energy) and PHYSICS 1249 (Rotational Dynamics, Thermal Physics, and Vibrational Motion), as a new pathway for students who cannot immediately enroll into PHYSICS 1250 (Mechanics, Work and Energy, Thermal Physics) due to math placement and would potentially benefit from a reduced pace. The 1248 and 1249 courses combined would be equivalent in content to PHYSICS 1250 but would not require mastery or readiness for calculus. Students successful in this two-semester sequence (and 1251 math prerequisites) would subsequently be ready to take PHYSICS 1251 (E&M, Waves, Optics, Modern Physics). **Figure 1** lists the topics of the existing PHYSICS 1250 course and the proposed PHYSICS 1248 and 1249 courses.



The model for this course is based on a successful model (two-semester mechanics course) at Rutgers University (Extended Analytical Physics 1a and 1b, EAP). This course was transformed and taught by Suzanne White Brahmia who found it to be successful in supporting women and Black and Latinx students (referred to as Underrepresented Minorities) in terms of course completion and persistence. **Table 1** below (from White Brahmia, 2008) shows the passing rate for first-year physics students before and after the implementation of the EAP sequence.

Table 1. Passing rate of first-year physics, API and EAP I combined.

	All	Women	Underrepresented Minorities
Before ('85 & '85)	$64\% \pm 1\%$	$55\% \pm 2\%$	$28\% \pm 1\%$
After ('92 & '93)	$76\% \pm 2\%$	$76\% \pm 3\%$	$59\% \pm 1\%$
Current ('07 & '08)	$73\% \pm 1\%$	$71\% \pm 1\%$	$64\% \pm 1\%$

Table 2 (from White Brahmia, 2008) shows the completion of STEM degrees at Rutgers University within six years. Note the change in the percentage of students from minoritized ethnic/racial groups who completed their STEM degrees within six years after the implementation of this course.

Table 2. Completion of STEM degree at Rutgers University within six years.

	All	Women	Underrepresented Minorities
Before ('85 & '85)	$45\% \pm 3\%$	$32\% \pm 4\%$	$8\% \pm 4\%$
After ('92 & '93)	$57\% \pm 3\%$	$59\% \pm 4\%$	$53\% \pm 4\%$
Current ('07 & '08)	$68\% \pm 2\%$	$70\% \pm 3\%$	$58\% \pm 3\%$

I taught this two-semester sequence at Rutgers University Fall 2017 - Spring 2023. **Table 3** below provides the performance for students in Analytical Physics 2a (Electricity and Magnetism) who took EAP with me and students who took AP (the traditional calculus-based sequence) in 2017 and 2018.

Table 3. Performance in Physics 2a	**EAP students' grades of C or better**	**EAP students' grades of D, F, or Withdrew**	**AP students' grades of C or better**	**AP student grades of D, F, or Withdrew**
Fall 2017	79% $(n = 27)$	21% $(n = 7)$	89% $(n = 505)$	11% $(n = 64)$
Fall 2018	85% $(n = 40)$	15% $(n = 7)$	94% $(n = 580)$	6% $(n = 35)$

Despite taking the EAP course prior to taking or passing calculus, students in EAP performed on par with students who took calculus with the majority of these students passing Physics 2a. While I did not publish findings on the effectiveness of this course, a t-test revealed that one cohort of students who took the extended two-semester sequence with me performed no differently in the Electricity and Magnetism course than their calculus-ready peers who took the traditional sequence.

The purpose of the proposed two-semester course is to provide an alternative pathway to accepted OSU students interested in physics and engineering that allows them to take physics their first year, likely shortening their time to degree.

A similar letter was sent to Dr. David Tomasko, Associate Dean for Undergraduate Education and Students Services in the College of Engineering.

Sincerely and respectfully,

Geraldine L. Cochran, PhD.
Associate Professor

Department of Physics
The Ohio State University
Cochran.604@osu.edu

Course Number: 1249
Course Title: Rotational Dynamics, Thermal Physics, and Vibrational Motion

Instructor: Dr. Geraldine L. Cochran
Office: Physics Research Building Room 1006
Email: cochran.604@osu.edu
Office Hours: TBD

Course Description: PHYSICS 1249 is the second course in a two-course series, for students in physical sciences, mathematics, and engineering. This course covers rotational dynamics, fluids, thermal dynamics, and vibrational motion. The physics content in relation to these topics is covered in the same depth and rigor as in PHYSICS 1250, but is about ½ of the PHYSICS 1250 content.

Note: The first course in this sequence is PHYSICS 1248. The combination of PHYSICS 1248 + PHYSICS 1249 is equivalent to PHYSICS 1250.

Pre-req / Co-req: Math Placement Level M, N or R and PHYSICS 1248.

Course Format (3 credits): This course follows a weekly cycle.

- **Tuesday (Lecture 1, 55 min):** Interactive lectures will introduce course topics and offer an opportunity test your understanding of lecture topics without penalty.
- **Wednesday (Lab, 125 min):** Labs meet in-person. Students work together in the same assigned discussion groups as in recitation.
- **Thursday (Lecture 2, 55 min):** Interactive lecture
- **Friday (Homework 1):** Focuses on conceptual understanding, shorter (~30 minutes)
- **Monday (Homework 2):** Focuses on problem solving, longer (~90 minutes)

Note: Exams are given on Wednesday during lab times. Exam duration is 120 minutes.

Carmen Canvas carmen.osu.edu: Carmen is the Learning Management System (LMS) used at Ohio State. It is the central hub from which your course will be conducted. Course **announcements** will be made on Canvas. Course resources (e.g. practice exams) will be uploaded to Canvas. Please check Canvas **several times a week** to stay up-to-date.

Required Textbook, Homework System, and Lab Manual:

- ✔ *College Physics: Explore and Apply, 2e by Etkina, Planinsic, and Van Heuvelen.* ***You do not need to buy the entire textbook. You should purchase a modified version of the textbook that only covers mechanics. You can purchase the e-text combined with Mastering Physics access*** *from Pearson or the bookstore.* ***Mastering Physics is required for homework.***
- ✔ ***A lab manual is required.*** Please contact the Barnes & Noble bookstore on High Street. ***Students must bring the lab manual to labs that involve experiments.***

To ensure you purchase access to the correct Mastering Physics textbook version and homework system, please, use Carmen Canvas to access Pearson and use the course key: MPCochranXXXXXX.

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Your course grade is determined by the following:

Unit 1 Exam: 20% This is a 120-minute, closed book exam on **February 5**.

Unit 2 Exam: 20% This is a 120-minute, closed book exam on **March 5**.

Unit 3 Exam: 20% This is a 120-minute, closed book exam on **April 10.**

***Makeup exams are offered one week after the regularly scheduled exam. Exams that are not made up within two weeks will receive a grade of 0.**

Recitation Grade (Workshop): 20%. Your recitation grade is determined by activities you complete during the workshops. This may include participation in workshop activities, completion of worksheets, quizzes, and group practice exams.

Online Homework: 20% Online homework is due Fridays and Mondays* by 11:59 pm and through Mastering Physics. LATE HOMEWORK IS PENALIZED AUTOMATICALLY THROUGH MASTERING PHYSICS. You lose 1% for each day it is late. So, you can still submit homework late and earn partial credit. On **Sunday January 19**, homework will be due on Sunday at 11:59 pm. This will be a shorter (~30 minutes) homework assignment.

Labs: 20% Each numbered Experiment has a numbered Prelab. Prelabs are due the Sunday prior to the lab at 11:59pm. Labs should be completed in-person during lab time. Credit will not be given to labs that are not completed in-person.

Course Surveys: 2% Course presurveys are graded based on completion and not accuracy. Course surveys are administered during Lab. Pre-course surveys are held on **January 8.** Post-course surveys are held on **April 16.**

**Lecture Participation – ** Participation in lecture as evidenced by responses to Learning Catalytics questions will be extra credit (up to 3%). The points will be tracked via Mastering Physics and Canvas throughout the semester. However, the extra credit will be finalized and added at the end of the semester. Learning Catalytics points will be administered as 0.7 for participation and 0.3 for the correct answer. So, an incorrect answer is 0.7 point. The correct answer is 1 point.

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Table of Course Weights

Unit 1 Exam	20%
Unit 2 Exam	20%
Unit 3 Exam	20%
Mastering Physics Homework	20%
Labs	20%
Course Surveys	2%
Lecture Participation	3%
Total	**105%**

Course Letter Grade Assignment: Once your overall point total (final score) has been calculated using the weighting scheme shown above, your letter grade will be assigned based on the following scale:

Total Score (%)	Letter Grade
>92	**A**
88 ≤ score <92	**A-**
84 ≤ score <88	**B+**
80 ≤ score <84	**B**
76 ≤ score <80	**B-**
72 ≤ score <76	**C+**
67 ≤ score <72	**C**
62 ≤ score <67	**C-**
56 ≤ score <62	**D+**
50 ≤ score <56	**D**
<50	**E**

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Additional Important Information:

ACADEMIC MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

DISABILITY SERVICES

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

RELIGIOUS ACCOMMODATIONS

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

MENTAL HEALTH

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

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Week	Day (Date)	Activity	Relevant Textbook Sections
1	Sun (1/5)		
	Mon (1/6)		
	Tues (1/7)	**Lecture 1:** Introduction and Review	
	Wed (1/8)	**Lab:** 1250a Review & Pre-surveys	
	Thurs (1/9)	**Lecture 2:** Torque	8.1 - 8.2 Extended Bodies at Rest and Torque
	Fri (1/10)	**Homework 1 Due at 11:59 pm**	8.1 - 8.2 Extended Bodies at Rest and Torque
2	Sun (1/12)		
	Mon (1/13)	**Homework 2a Due at 11:59 pm**	8.1 - 8.2 Extended Bodies at Rest and Torque
	Tues (1/14)	**Lecture 1:** Static Equilibrium & Center of Mass	8.3 - 8.4 Conditions of Equilibrium; Center of Mass
	Wed (1/15)	**Lab:** Calculating Center of Mass and Understanding Static Equilibrium	8.3 - 8.4 Conditions of Equilibrium; Center of Mass
	Thurs (1/16)	**Lecture 2:** Equilibrium continued	8.3 - 8.4 Conditions of Equilibrium; Center of Mass
	Fri (1/17)	**Homework 2b Due at 11:59 pm**	Chapter 8
3	Sun (1/19)	**Homework 3a Due at 11:59 pm**	Chapter 8
	Mon (1/20)	**No Classes**	
	Tues (1/21)	**Lecture 1:** Rotational Kinematics	9.1 Rotational Kinematics
	Wed (1/22)	**Lab:** Rotational Kinematics & Dynamics	9.1 - 9.2 Physical Quantities Affecting Rotational Acceleration
	Thurs (1/23)	**Lecture 2:** Newton's Laws for Rotational Motion	9.3 Newton's Second Law for Rotational Motion
	Fri (1/24)	**Homework 3b Due at 11:59 pm**	9.1 - 9.3

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4	Sun (1/26)	**Prelab Due at 11:59 pm**	9.1 - 9.3
	Mon (1/27)	**Homework 4a Due at 11:59 pm**	9.1 - 9.3
	Tues (1/28)	**Lecture 1:** Rotational Momentum and Energy	9.4 - 9.5 Rotational Momentum and Rotational Kinetic Energy
	Wed (1/29)	**Lab:** Experiment IX - Rotational Dynamics	Chapter 9
	Thurs (1/30)	**Lecture 2:** Unit 1 Exam Review Part A	Chapter 8 & 9
	Fri (1/31)	**Homework 4b Due at 11:59 pm**	Chapter 8 & 9
5	Sun (2/2)		
	Mon (2/3)	**Homework 5a Due at 11:59 pm**	Chapter 8 & 9
	Tues (2/4)	**Lecture 1:** Unit 1 Exam Review Part B	Chapter 8 & 9
	Wed (2/5)	**Lab: Exam 1**	Chapter 8 & 9
	Thurs (2/6)	**Lecture 2:** Gases	12.1 - 12.2 Structure of Matter
	Fri (2/7)	**No Homework Due:**	
6	Sun (2/9)		
	Mon (2/10)	**Homework 6a Due**	12.1 - 12.2 Structure of Matter
	Tues (2/11)	**Lecture 1: Exam 1 Discussion & Gases continued**	12.3 - 12.6 Quantitative Analysis of Ideal Gas
	Wed (2/12)	**Lab:** Experiment XII: A **-** Ideal Gas	Chapter 12
	Thurs (2/13)	**Lecture 2:** Static Fluids	13.1 - 13.2 Density, pressure in fluids
	Fri (2/14)	**Homework 6b Due at 11:59 pm**	
7	Sun (2/16)	**Prelab Due at 11:59 pm**	
	Mon (2/17)	**Homework 7a Due at 11:59 pm**	

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	Tues (2/18)	**Lecture 1:** Static Fluids Continued	13.3 - 13.5 Pressure Variation w Depth, Buoyancy
	Wed (2/19)	**Lab:** Experiment XI - Fluids	Chapter 13
	Thurs (2/20)	**Lecture 2:** Fluids in Motion	14.1 - 14.2 Flow rate and Fluid Speed
	Fri (2/21)	**Homework 7b Due at 11:59 pm**	14.1 - 14.2
8	Sun (2/23)		
	Mon (2/24)	**Homework 8a Due at 11:59 pm**	Chapter 13 & 14.1 - 14.2
	Tues (2/25)	**Lecture 1:** Fluids in Motion Continued	14.4 - 14.5 Bernoulli's Equation
	Wed (2/26)	**Lab:** Fluids in Motion	Chapter 14
	Thurs (2/27)	**Lecture 2: Unit 2 Exam Review Part 1**	Chapters 13 & 14
	Fri (2/28)	**Homework 8b Due at 11:59 pm**	Chapters 13 & 14
9	Sun (3/2)		
	Mon (3/3)	**Homework Due at 11:59 pm**	Chapters 13 & 14
	Tues (3/4)	**Lecture 1: Unit 2 Exam Review Part 2**	Chapters 13 & 14
	Wed (3/5)	**Unit 2 Exam**	Chapters 13 & 14
	Thurs (3/6)	**No Physics Lecture Today**	
	Fri (3/7)	**No Homework Due**	
10	Sun (3/9)	**No Homework Due**	
	Mon (3/10)	**No Classes - Spring Break**	
	Tues (3/11)	**No Classes - Spring Break**	
	Wed (3/12)	**No Classes - Spring Break**	
	Thurs (3/13)	**No Classes - Spring Break**	
	Fri (3/14)	**No Classes - Spring Break**	
11	Sun (3/16)		
	Mon (3/17)	**No Homework Due**	
	Tues (3/18)	**Lecture 1:** Exam 2 Discussion & Thermodynamic Processes	15.1 - 15.2 Internal Energy & Energy Changes
	Wed (3/19)	**Lab:** Thermodynamic Processes	
	Thurs (3/20)	**Lecture 2:** 1st Law of Thermodynamics Part 1	15.3 - 15.4 1st Law of Thermodynamics
	Fri (3/21)	**Homework 11 Due at 11:59 pm**	15.1 - 15.4

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12	Sun (3/23)	**Prelab Due at 11:59 pm**	15.5 Specific Heat
	Mon (3/24)	**Homework 12a Due at 11:59 pm**	15.1 - 15.4
	Tues (3/25)	**Lecture 1:** 1st Law of Thermodynamics Part 2	15.5 - 15.7 Phase Change
	Wed (3/26)	**Lab:** Experiment XII:A - Specific Heat	15.5 Specific Heat
	Thurs (3/27)	**Lecture 2:** 2nd Law of Thermodynamics Part 1	16.1 Irreversible Processes
	Fri (3/28)	**Homework 12b Due at 11:59 pm**	16.1 Irreversible Processes
13	Sun (3/30)		
	Mon (3/31)	**Homework 13a Due**	Chapter 15 and 16.1
	Tues (4/1)	**Lecture 1:** 2nd Law of Thermodynamics Part 2	16.1 - 16.3 Entropy
	Wed (4/2)	**Lab:** Heating and the Microscopic Model	16.1 - 16.3 Entropy
	Thurs (4/3)	**Lecture 2:** Heat Engines and Pumps Part 1	16.4 Engines & Pumps
	Fri (4/4)	**Homework 13b Due at 11:59 pm**	Chapter 16
14	Sun (4/6)	**Prelab Due at 11:59 pm**	16.4 Engines & Pumps
	Mon (4/7)	**Homework 14a Due at 11:59 pm**	Chapter 16
	Tues (4/8)	**Lecture 1:** Heat Engines and Pumps Part 2	16.4 Engines & Pumps
	Wed (4/9)	**Lab:** Experiment XII: C - Heat Engines	16.4 Engines & Pumps
	Thurs (4/10)	**Lecture 2:** Unit 3 Exam Review Part 1	Chapters 15 & 16
	Fri (4/11)	**Homework 14b Due at 11:59 pm**	Chapters 15 & 16
15	Sun (4/13)		
	Mon (4/14)	**Homework 15a Due at 11:59 pm**	Chapters 15 & 16
	Tues (4/15)	**Lecture 1:** Unit 3 Exam Review Part 2	Chapters 15 & 16
	Wed (4/16)	**Lab:** Unit 3 Exam	Chapters 15 & 16
	Thurs (4/17)	**Lecture 2:** Vibrational Motion & Mechanical Waves	Chapter 10
	Fri (4/18)	**Homework 15b Due at 11:59 pm**	Chapter 10
16	Sun (4/20)		
	Mon (4/21)	**(Last Day of Classes)**	
	Tues (4/22)		
	Wed (4/23)	**First Day of Final Exams**	
	Thurs (4/24)		
	Fri (4/25)		

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