

## PHYS 309 -- Introduction to Modern Physics -- Spring 2007

Location: MP-312 Time: Mon, Wed 3:40pm - 4:55pm

Prerequisites: PHYS 212 -- Elec., Magnet., Optics MATH 275 - Multivar. Vector Calc.

Corequisites: PHYS 310 -- Introductory Modern Physics Lab

Text: "Modern Physics" by Kenneth Krane, 2nd edition

Lecture materials/homework solutions: <http://newton.boisestate.edu/ap/>

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Graduate teaching assistant: Aaron Thurber, [AaronThurber@boisestate.edu](mailto:AaronThurber@boisestate.edu);

Homework help sessions: Mon, 4:55pm - 5:40pm; Office Hours: Mon, Wed 5:00pm - 6:30pm or by appointment

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<u>Week</u>	<u>Mon date</u>	<u>Topics</u>
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		<b>Part I: Photons and Matter Waves</b>
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| 1. | 1/15 | (Holiday); Particle-like Properties of Electromagnetic Radiation; Photons; Photon Processes; reading: 3.1,3.2, 3.3, 3.6 |
| 2. | 1/22 | Matter Waves; Wave-particle Duality and Uncertainty Relationships; reading: 4.1-4.3, 4.5, 4.6                           |
| 3. | 1/29 | 1-D Schrodinger Equation.; Applications; Particle in a Box; reading: 5.1-5.3, 5.4, 5.6                                  |
| 4. | 2/5  | Simple Harmonic Oscillator; Steps and Barriers; Tunneling; reading: 5.5, 5.7  |

		<b>Part 2: Atoms and Molecules</b>
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| 5.  | 2/12 | Bohr Model of the Atom; Hydrogen Atom in Wave mechanics reading: 6.1, 6.4, 6.5, 6.7, 6.8, 7.1-7.3 |
| 6.  | 2/19 | (Holiday); <b><u>Exam 1 on February 21</u></b> (Based on Part I)                                  |
| 7.  | 2/26 | Angular Momentum; Spin; Energy levels; reading: 7.4-7.8;  |
| 8.  | 3/5  | Pauli Principle; Many-Electron Atoms; reading: 8.1-8.4  |
| 9.  | 3/12 | X-ray and Optical spectra reading: 8.5, 8.6   |
| 10. | 3/19 | Molecular Bonding; reading: 9.1-9.2 ;   |

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**SPRING BREAK 3/26 - 3/30**

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| 11. | 4/2 | Ionic and Covalent bonding; reading: 9.3-9.5 |
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		<b>Part 3: Statistical Physics</b>
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| 12. | 4/9  | Statistical Physics, Maxwell-Boltzmann distribution reading: 10.1-10.5 <b><u>Exam 2: April 11</u></b> (Based on Part II) |
| 13. | 4/16 | Quantum Statistics: Bosons, Fermions; Applications; reading: 10.6; 10.7  |

#### **Part 4: Solid-State Physics**

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| 14. | 4/23 | Crystalline Solids; Band Theory; Conductors and Insulators<br>reading: 11.1-11.6 |
| 15. | 4/30 | Semiconductors; Superconductivity; Optional Review;<br>reading: 11.7-11.9        |
| 16  | 5/7  | <u><a href="#">Final Exam (May 9; 3.30 - 5.30pm)</a></u>                         |

**GOALS:** To obtain a basic understanding of the key concepts of modern physics, especially quantum physics, and to apply these concepts to describe the elementary behavior of electrons, atoms, molecules, and condensed matter. Examples will be drawn from many fields, including physics, chemistry, materials science, and microelectronics. The course objectives will be accomplished through lecture and discussion of selected topics in class, through group exercises, and by students working through the assigned parts of text, including all assigned homework problems. Assessment will come from the tests (which will be based on the assigned parts of the text, the assigned homework problems, and the lectures) and the assigned homework.

**EXAMS:** 75% of your grade is based on the exams. ALL EXAMS WILL BE COUNTED, AND NO MAKE-UP EXAMS WILL BE GIVEN. There will be two in-class exams, each worth 25% and a final exam, worth 25%. You may bring one 8.5" by 11" sheet of formulas for each one-hour exam, along with your formula sheets from your previous PHYS 309 exams. All formula sheets must be labeled at the top by exam number, be signed and handwritten by you, and be turned in with your exam. Your formula sheet should contain only numbered formulas from those sections of the chapters that are covered on the exam, and you must write the textbook equation number next to each formula. No other comments, drawing, or other information are allowed on the formula sheet. It is your responsibility to know the meaning of every symbol on your formula sheet, and to understand the meaning, applicability, and use of every equation you include on your formula sheet.

**HOMEWORK:** 25% of your grade is based on the homework. List of homework problems and their due dates will be given in the lecture notes. Hand in what you have on the due date, at the beginning of class. NO LATE HOMEWORK ACCEPTED. Homework problems will form the basis for many of the exam problems. Look over your graded homeworks and the complete solutions posted on the course website carefully and make sure you can work and understand every assigned homework problem. You are strongly encouraged to talk to the teaching assistant/instructor about homework problems that you do not understand.

- Homework should be clearly written and easy to follow. It should be clear that the student understands the solution for full credit. Homework that is not legible will not be graded (i.e. too much crossing out, erasing, solution doesn't follow in a linear fashion, or written on paper with dark lines/grids). Homework written on both sides of papers is acceptable as long as the writing from one side is not visible on the opposite side, otherwise the work is not visible. Show all of your work for the solution.
- Physical quantities have units. Solutions should include unit notation throughout for all physical quantities used. This makes the homework more readable and is more beneficial to the student.
- Results should be clearly marked.
- Diagrams and drawings must have labels. Plot axes should contain labels and units, as well as the plot having a meaningful title. "y" vs "x" is not a meaningful title.

- Rows and columns in tables need labels and units.
- Incorrect solutions that have the correct result at the end will receive zero points. Incorrect or partially correct solutions that have the result that can be found with the solution given will receive partial credit.
- All of the homework in this class can be done by hand with the aid of basic scientific calculator functions. Use computers and advanced calculators to check solutions, but show the calculation (calculus based problems might be easy to use a computer to solve, but this does not demonstrate understanding by the student). “Magic answers” that show no work, or were only solved by a computer or advanced calculator will receive no credit.

**READING:** Consult the syllabus and read the assigned sections before the material is covered in class. As you read, write down any questions you have and bring them to class. Ask questions in class.

**ACADEMIC HONESTY:** Although you are encouraged to discuss the class lectures, readings, and homework assignments with your classmates, all the work that you turn in must be your own. **NO CHEATING OR PLAGIARISM (PRESENTING OTHER PEOPLE'S WORK AS IF IT WERE YOUR OWN) WILL BE TOLERATED, INCLUDING ANY USE OF HOMEWORK SOLUTIONS FOUND ON THE WEB OR ELSEWHERE.** If you make use of sources besides the class lectures or textbooks, you must provide explicit written references to the sources you used. Failure to follow this rule or any others listed in the Academic Handbook could have drastic consequences, including (but not limited to) ejection from the course with a failing grade.

**GRADING:** A = 90 - 100, B = 75 - 90, C = 60 - 75, D = 45 - 60