

**PH 351-4B Modern Physics I, PH 351L-G7 Lab**Text: Modern Physics for Scientists and Engineers, Thornton & Rex, 2nd Ed., 2000

Prerequisite: PH 222

Professor: Tom Nordlund Office: CH 345 Tel: 934-0340

Time: 4B (5:30-6:45 PM), Tues/Thurs Classroom: CH 396

Lab\*: Mon., 5:30 – 8:30 PM, CH 460

Office Hours: Mon 3:15-4:45 PM Thurs 11:00 AM-1 PM Other: by appt.

Tentative schedule<sup>†</sup>

	Date	Material <sup>‡</sup>	Topics	Notes
1	Aug. 19	GRE material. Ch 1	GRE Exam. Historical setting,	
2	Aug 24,26	Ch 3.1-3.6	Exper. basis of QM	1 <sup>st</sup> lab Aug. 30*
3	Aug 31, Sept. 2	Ch 3.7-3.9; 4.1-4.2	Structure of atom	
4	Sept. 7,9	Ch 4.3-4.7	<i>cont'd</i> ;	Labor Day Sept. 6(no lab)
5	Sept. 14,16	Ch 5.1-5.4	Matter waves	
6	Sept. 21,23	Ch 5.5-5.7; Ch 6.1	Uncertainty, Schröd Eq	
7	Sept. 28,30	Ch 6.2-6.5	Quantum theory	Sept 30: Exam 1: Ch 1,3-5
8	Oct. 5,7	Ch 6.6-6.7	Harm osc, barriers	
9	Oct. 12,14	Handouts	QM in nanotech. H atom	
10	Oct. 19,21	Ch 7.2-7.4	H atom	
11	Oct. 26,28	Ch 7.5-7.6, 8.1	Spin, Zeeman effect	
12	Nov. 2,4	Ch 8.2	Many-e atoms	Nov 4: Exam 2 Ch 6-8.1
13	Nov. 9,11	Ch 8.3, 10.1	Ang. momentum	
14	Nov. 16,18	Ch.10.1-10.3	Molecules, lasers	
15	Nov. 23	Ch 10.3	Solids	Thanksgiving Nov26-30
16	Nov 30, Dec 2	Review, Ch 3-8,10 Dec. 4 Exam		Dec. 2: In-class Final Exam
	Dec 7	Ch 3-8,10		Take-home Final due

**Grading:** Lab 15%; Homework 25%; Exams 1 & 2, 30%; Final Exam 30%. The exams will be graded A-, C+, etc.

**Homework:** Weekly, due Tuesdays in class.<sup>§</sup> Write Problem set number at top of first page. For each problem/question, indicate both chapter and problem/question number. For example, question 3 in chapter 7 should be listed as “Q7.3”, problem 3 in chapter 7 “7.3”. (Q indicates question). Please invest in a stapler and use it.

Selected solutions will be made available in Campbell Hall as announced in class. *Do not be misled by thinking you understand the solution when you see it!* If you could not do the problem without seeing the solution, know that you will have difficulty on exams.

\* Lab schedule to be discussed first day of lecture.

† The lecture material schedule may change slightly throughout the term. The exam dates are firm, unless changes are announced by Sept. 16.

‡ The schedule will likely shift.

§ Late homework: 20% off per day late.

**Lab:** Procedures, policies and scores will be determined by the lab instructor, in consultation with the course professor. There will not be a lab every week. The lab TA will hold a 1-hr. problem session on special lab days.

**Text reading assignments.** Material should be read before class. The syllabus will guide your reading, but keep track of whether the class is proceeding ahead or behind schedule. Some lecture material not in text will be made available as printed or emailed notes.

**Exams 1 & 2.**\*\* Approx. 75 min. in duration. *Problems* will mirror homework problems and class examples; *conceptual questions* will assess qualitative understanding of lecture and assigned reading. One 3x5 note card may be used. Make-ups allowed, at instructor's discretion, only under extraordinary circumstances and must be justified in writing, with supporting documents.

**Final Exam.**\*\* The final is comprehensive; 60% in-class, 40% take-home. Problem types as in midterm. One 8.5 x 11 in. note sheet may be used on the in-class part.

Set	Initial Homework Sets	Notes <sup>†</sup>
1	Ch 3: Questions 3,5,7; Problems 2, 5, 7, 11, 12, 13, 16, 18, 29, 30, 32 (Problem 12: see table 14.5, p. 490.)	Due Aug. 31
2	Ch 3: 37, 38, 39, 47, 51 Ch 4: Questions 1, 12; problems 1, 3, 5, 11	Sept. 7
3	Ch 4: problems 16, 22, 33, 35, 37, 38, 41, 42. Hints follow. 4.16 Eq 4.19, $r$ = Bohr radius; $a$ = centripetal acceleration. For $\text{Li}^{++}$ , the radius and the velocity expressions are different because of the higher nuclear charge. You should think about this, but a rule of thumb is that when you see an " $e^2$ " (charge of electron squared) in an expression involving an electron around an atom, you should replace that " $e^2$ " with " $Ze^2$ ". 4.22 Use eq. 4.31. 4.33 Use eq 4.38 and get the expressions for H and He to look similar by moving the $Z^2$ term into the parentheses. Also, consider the fact that the Rydberg constant for He is not identical to that of H. 4.35 Follow derivation of Rydberg eq in text. As in problem 33, $R$ will be that for $\text{He}^+$ . 4.37 Calculate the wavelengths of the $K_\alpha$ lines. If they are closer than the resolution of the spectrograph, then... 4.38 The correct equation comes from 4.41, which is based on the Bohr theory, not on Moseley's (eq. 4.40). 4.41 Can you do this non-relativistically? Use 1 <sup>st</sup> -year physics text results for elastic collision. 4.42 If the small potential difference were not there, what would happen to electrons with ~no kinetic energy? How would the observed current vs. voltage then change? Read page 148 carefully.	Sept. 14

\*\* Tables of integrals and math data are allowed on exams, unless explicitly restricted before the exam.