Physics 244
Spring 1993

The text is Modern Physics by Tipler. This was chosen at the suggestion of the students in previous semesters. We will not cover the whole text and we will cover some topics not in the text. Therefore lecture notes will be distributed and the material you are responsible for is that material covered in the lecture notes.

The syllabus gives the approximate content of each of the lectures. The syllabus also gives the related sections in several other texts in case you want to read more or see the material in a somewhat different presentation. You can find these in the library.

Other texts at approximately the same level which you may find useful include:
Modern Physics, Sproull and Phillips (particularly for solids)
Modern Physics, Krane
Modern Physics, Ohanian
Modern Physics, Serway, Moses, Moyer
Introduction to Modern Physics, Anderson
Somewhat more advanced texts include:
Quantum Physics, Eisberg and Resnick
Atomic Spectra and Atomic Structure, Herzberg
Introduction to Solid State Physics, Kittel
Thermodynamics, Sears

Problems will be assigned each Friday and collected the following Friday.

There will be three one-hour exams and a two-hour final. The exams will be at the ordinary scheduled lecture hour. The tentative hour-exam dates are Feb 15, March 22 and April 26 . For grading purposes each hour exam counts 1/5 and the final 2/5. The homework will be used to resolve the grades for those people near the boundaries. Exceptionally good or poor homework can make a change of one-half a letter grade.

There are optional discussion sections where we will answer questions, review, and go over homework problems. Come to as many of these as you wish.

Office hours: M. B. Webb Rm B-317 Sterling Hall, 1:20 PM T and Th . Also your TA will announce office hours.

We will use many results from your elementary physics course, but we will not have time to review them in lectures. Therefore, you will want to review the appropriate parts of your general physics text as we go along. In the first section of the course on kinetic theory, we will use things from classical mechanics such as force, momentum, kinetic energy, pressure, and from thermodynamics such as Avagodro's number, the ideal gas laws, and the equipartition of energy.

Physics 244 Syllabus

Lect. 1 Kinetic theory, pressure of a gas, ideal gas laws, mean free path, collision cross section.Tipler 2.1, 2.2, 2.6; Krane 1.1; Sproull and Phillips 2.2, 2.5; Sears "Thermodynamics" 11.2-11.5

Lect. 2 Transport properties, diffusion, Fick's laws, thermal conductivity, viscosity. Tipler 2.6; Sears Chapt. 13

Lect. 3 and 4 Distribution functions, expectation values, derivation of Boltzmann energy distribution. Tipler 2.4; Krane 12.1; Sproull and Phillips 2.4; Sears Chapt. 14

Lect. 5 Maxwell-Boltzmann distribution of molecular speed, equipartition of energy, applications. Tipler 2.5; Krane 12.3, 12.4; Sproull and Phillips 2.4; Sears Chapts. 12,15

Lect. 6 Electromagnetic waves, classical nature of light, radiation from an accelerated charge, light scattering, Raleigh, Thomson. Your elementary physics text; Krane 3.1;Blanchard et al. Chapter 5; Crawford "Waves" Berekely Physics Course 7.5

Lect. 7 Wave-particle duality, photoelectric effect, Einstein hypothesis, x-rays. Tipler 3.5,3.6; Krane 3.3; Sproull and Phillips 3.3, 3.5

Lect. 8 Compton Scattering, de Broglie hypothesis, electron diffraction. Tipler 3.6, 5.2; Krane 3.4-3.6, 4.1; Sproull and Phillips 3.8-3.10

Lect. 9 de Broglie waves for a free particle, wave packets, group velocity, Born interpretation, Uncertainty principle. Tipler 5.4-5.9; Krane 4.2-4.6; Sproull and Phillips 4.4

Lect. 10 Uncertainty Principle, Bohr Model of the Hydrogen atom. Tipler 4.3, 5.7; Sproull and Phillips 3.4, 4.2

Lect. 11 Schroedinger equation, time dependent, time independent, separation of variables, review of potential energy. Tipler 6.1; Sproull and Phillips 4.4

Lect. 12 Square well, quantization. Tipler 6.2; Krane 5.3, 5.4; Sproull and Phillips 4.3

Lect. 13 Operators, expectation values, transitions between states. Tipler 6.4, 6.5; Sproull and Phillips 4.6,4.7

Lect. 14 Boundary conditions, finite wells and barriers, tunneling. Tipler 6.3, 6.7; Krane 5.7; Sproull and Phillips 4.5

Lect. 15 Simple harmonic oscillator. Tipler 6.6; Krane 5.5; Sproull and Phillips 4.8

Lect. 16 Hydrogen atom, Schroedinger eqn. in polar coordinates, separation of variables, eigenfunctions, quantum numbers. Tipler 7.1-7.3; Krane 6.4, 6.5, 7.1, 7.2, 7.4; Sproull and Phillips 5.2

Lect. 17 Physical interpretation of the quantum numbers, orbital angular momentum and magnetic moment. Tipler 7.1-7.3; Krane 7.2, 7.3, 7.4;Sproull and Phillips 5.2

Lect. 18 Electron spin, exclusion principle, periodic table, electron configurations. Tipler 7.4, 7.6; Krane 7.5, 7.6, 8.1, 8.2; Sproull and Phillips 5.3, 5.4

Lect. 19 Properties of many electron atoms, x-ray spectra. Tipler 7.6, 7.7; Krane 8.4 - 8.6; Sproull and Phillips 5.4

Lect. 20 Molecules, ionic, covalent, vibration and rotation spectra. Tipler 8.1, 8.3; Krane Chapt. 13; Sproull and Phillips Chapter 6

Lect. 21 Black body radiation, Einstein coefficients, lasers. Tipler 3.4, 8.4; Krane 3.2, 8.8; Sproull and Phillips 3.2, 5.7

Lect. 22 Geometry of Crystals. Krane 14.1; Kittel "Intro. to Solid State Physics" Chapt. 1

Lect 23 Classical free electron gas, conductivity, mobility, Hall effect, Einstein relation. Tipler 9.2; Sproull and Phillips 8.6, 10.4

Lect. 24 Quantum free electron gas, k-space, Fermi momentum and energy, density of states. Tipler 9.2, 9.3; Sproull and Phillips 8.4

Lect. 25 Energy bands, nearly free electron approximation, Brillouin zones. Tipler 9.5; Krane 14.4; Sproull and Phillips 7.5

Lect. 26 Motion of electron in a crystal, effective mass, insulators and conductors, "holes". Sproull and Phillips 8.2, 8.6; Wert and Thomson Chapter 9

Lect. 27 Fermi-Dirac distribution function, intrinsic semiconductors. Tipler 10.1; Krane 12.5, 12.7; Sproull and Phillips 8.3, 10.2

Lect. 28 Carrier statistics, donors, acceptors, n- and p-type. Sproull and Phillips 10.3

Lect. 29 Semiconductor junctions, fields in the junction, I-V characteristics. Sproull and Phillips 10.4, 10.6

Lect. 30 Nuclear properties, constituents, empirical mass formula. Tipler 11.1, 11.2; Krane 9.1-9.4; Sproull and Phillips 11.3, 11.6

Lect. 31 Radioactivity, statistics, α-decay, β-decay, neutrino. Tipler 11.3; Krane 9.5-9.9; Sproull and Phillips 11.2, 11.4

Lect. 32 Nuclear reactions, cross section, nomenclature, direct reactions, compound nucleus formation, fission, fusion. Tipler 11.4, 11.5; Krane Chapt. 10; Sproull and Phillips 11.7