Study Guide for Physics 1180 Exam #2

Note: The exam will consist of both multiple-choice questions (about 35) and short problem solving questions (about 6). There is EXTRA CREDIT embedded within the exam.

Measurement

Be able to keep track of units and be able to use conversions. For example: Given: Speed = 60 mile per hour, what is this speed in meters per second? (You would be given that 1.6 km = 1 mile, and 1000 m = 1 km).

Special Relativity

Know the terminology: Speed parameter & Lorentz factor.
Time Dilation & Length Contraction; Know how motion affect clocks and meter sticks. Be able to calculate time in length in one frame compared to those in another frame.

Know some of the implications of Einstein's postulates of special relativity. Describe the twin paradox. Why do both observers agree that the travelling twin ages less than the stay-at-home twin? Describe the pole-in-the-barn paradox.

Be able to calculate relativistic momentum, rest energy, relativistic kinetic energy, and total relativistic energy. Know the relationships among these quantities.

Do photons have mass? Do photons have momentum?

Be able to interpret the behavior of worldlines on a spacetime diagram. (Remember that on a spacetime diagram, time is on the vertical axis and position is on the horizontal axis.)

Quantum Mechanics

What is a "photon"? Be able to calculate the energy of a photon using Planck's formula given the frequency or wavelength of the photon (and vice versa).

What is the photoelectric effect. Be able to determine whether light will be able to eject electrons from a metal given certain parameters of the light and the metal. What is the "work function" of a metal?

What is the Compton effect? You do NOT need to know trigonometry. If given the value of the cosine function for a particular angle, you should be able to calculate the wavelength shift of the scattered photon.

Be able to describe the Bohr model of the hydrogen atom. You do NOT have to derive any of the formulas. Just be able to use the formulas to calculate the orbital radius of an electron energy and energy of an electron in a particular state of the hydrogen atom.

Be able to calculate the energy of a photon involved in the transition when an electron jumps from initial state to a final state. Know the terminology: terms include "ground state" and "excited state."

Given a "wave function," be able to determine the "probability density" of the particle in a region of space. Be able to use the probability density to calculate the probability of finding the particle in a given region of space.

What is the "Heisenberg uncertainty principle"? Be able to use this principle to calculate the spread in position and/or momentum of a particle if given a set of parameters.

What is "quantum tunneling?" Be able to describe what factors will make it easier/harder for a particle to penetrate an energy barrier.