Final Exam Prep Sheet

General Guidelines

Your final exam will be held on Tuesday, Dec. 11, 2007 from 1:00pm-3:00pm in Curtis 452 (If you're not sure where that is, be sure to look at a campus map). I will hand out the exam at precisely 1pm, so if you are late, you will have less time to work.

The exam will be closed book. However, you will be given a fresh copy of the accompanying equation sheet.

You are required to bring a calculator.

The exam will be similar in structure to, but slightly longer than the midterm exam. There may be a few short answer problems, and 3-4 longish problems.

The exam will be **comprehensive**. Material on the midterm is still fair play. It will include everything up to and including the material on collisions. General Relativity will **not** be on the exam, but special relativity almost certainly will.

As a reminder, we covered chapters 1-9 in your book (and, for those of you who want to do some extra reading, chapters 2-5, 7, 9-11, 14, 19, 39, 40 in Halliday, Resnick, and Walker).

Note, also, that I spent considerable time on certain topics in class which are glossed over in your textbook. If I talked about it at length and gave you a homework problem or recitation assignment which discusses it, I clearly think it's important and you should know it.

We have discussed the following topics in great depth:

1. Fundamental Composition of Matter – Leptons, Baryons, quarks, mediator particles. Fundamental properties, composition, charge, and scales.
2. The Concept of Conservation Laws, why they're important, and which one's we've seen so far.
3. Newton's Laws of Motion – including the definition of momentum in relativistic form.
4. The 4 Fundamental Forces. Know them in ranked order, and be able to qualitatively describe which particles/scales they act on. You should also know Gravity and E&M in a little more detail.
5. Gravity – Including the superposition principle, gravity near the surface of the earth, and the solution of a body in a circular orbit. You should definitely be able to solve for projectile motion.
6. Net forces – In simple systems, you should be able to vectorially add forces and compute the net forces (and accelerations) of particles.
7. Springs – Conceptually you should understand their relation to molecules and solids, but you should also know Hooke's law, and understand the oscillating properties of springs (and oscillations of pendulums, for that matter). You should also understand the relation between potential and kinetic energy in springs.

8. Young's Modulus & Pressure – You should understand the relation between the spring model of solids and compression in macroscopic solids. You should also understand the concept of pressure and be able to use it to relate force and surface area.

9. Work – What happens when you push a particle over some distance? How much work will you do? What work does the particle do on you? What happens if the force and displacement don't line up with one another?

10. Kinetic, Potential, and Relativistic Energy – Know what forms energy can take. Understand how energy can be converted from one form to another. What is the potential energy of different systems? What are the relativistic limits of a fast moving particle?

11. Relativity – You should know how to transform between the perspectives of different moving observers. You should understand length contraction and time dilation. You should understand relativistic energy and momentum.

12. Thermal Energy – You should be able to compute changes in the thermal energy of materials with different specific heats. You should understand how friction and heat are related. You should understand how to compute friction from a free body diagram.

13. Quantized Energy – Know how to compute the photon energies for particular transitions of a system. Understand the particular case of the Hydrogen atom. Know which wavelengths of light correspond to which parts of the spectrum (optical, UV, etc.).

14. Quantum Mechanics – Know how to compute the wavelength of a particle. Be able to describe the effects of quantum weirdness we discussed in class.

15. Center of Mass – Understand how to compute center of mass, center of mass velocity, total momentum, and be able to distinguish translation from rotational or thermal motion. Be able to compute the moment of inertia of simple systems.

16. Collisions – Know the difference between and elastic and inelastic collision, and be able to compute the outcome from a 1-d elastic collision. Understand the results of Rutherford and Compton scattering.