Chapter 32

1. Maxwell's equations - not on test

2. EM waves

2.a) The concepts of energy density, momentum density and their corresponding currents. Be clear on definitions like power, intensity, momentum density, force, pressure.
2.b) Distinction between the force exerted on surfaces with different reflectivities.

Chapters 33-34: not on test by itself. Be prepared to answer questions about the limits of image forming lens systems due to diffraction.

Chapter 35

1. Young's slits: Understand thoroughly this most basic example of interference. Recall that interference results when waves from a single source reach a region of space by following more than one path. Young's slits is the simplest case where there are just two such paths. Young's slits is also a good way to illustrate the wave nature of matter that is postulated in quantum mechanics.

2. Phasor formalism: the phasor approach is usually the most reliable and quickest way to answer questions about interference and diffraction. Be familiar with this approach, especially what is meant by the amplitude and phase of the phasor.

3. Understand the distinction between the electric field and the intensity as detected on a distant screen. Also be clear on the distinction between instantaneous and time averaged intensity.

4. Thin films and Newton's rings are not on the test.

5. Understand simple version of Michelson interferometer as presented in Giancoli, don't worry about the ring formation as discussed in lecture.

Chapter 36

1. Understand the extensions of single slit diffraction to situations where there are more than two beam paths to the detector. The main extensions are:

1.a) The diffraction grating, where we have N slits
1.b) The aperture, where we take into account the fact that the slit has a nonzero size.
1.c) The double aperture, where two slits of nonzero size lead to an interference pattern.

2. Limits on the resolution of image forming optical instruments due to diffraction.

3. Limits on optical spectrometers due to diffraction.

4. Understand the transmission of light through stacks of polarizers

Chapter 37:

1. Lorentz transformation: simultaneity, length contraction.

2. Addition of velocities

3. Redefining momentum and the energy-mass equivalence.

4. Doppler shift: understand how the Doppler shift is related to the relativity of time intervals. Be familiar with the idea of galactic red shift.

Chapter 38

1. Failures of classical physics.
1.a) The shape of the blackbody spectrum
1.b) Photoelectric effect: dependence of the photocurrent on light intensity and wavelength.
1.c) Compton effect

2. The Bohr model
2.a) Assumptions that lead Bohr to his model
2.b) How does the binding energy depend on electron charge, mass, and dielectric function of the medium (recall impurities in semiconductors).
2.c) Understand the Bohr predictions for spectral lines.

Chapter 39

1. The postulates of quantum mechanics
1.a) Meaning of the wave function
1.b) Each observable has a corresponding operator. In the version of

quantum mechanics that we are using, the position observable is unique in that it is its own operator.

1.c) Obtaining expectation values of energy, momentum, position operators from the wavefunction.

1.d) The time-dependent Schroedinger equation tells how the wavefunction evolves with time.

2. Derivation of the time-independent Schroedinger equation.

2.a) Definition of stationary states (known as energy eigenstates).

2.b) Properties of stationary states: energy is definite, other observables have time-independent expectation values.

3. Free particles: plane waves are states of definite energy and momentum, the particle is equally likely to be found anywhere. Wave packets are states in which the momentum is uncertain but the particle is localized in space. The product of the momentum and position uncertainty must be larger than $h/2$.

4. Stationary states of the one-dimensional infinite square well.

5. Qualitative aspects of tunneling: no formulas.

Chapter 40

1. Stationary state solutions of the H atom. Understand that the states are labeled by three quantum numbers (leaving out the intrinsic electron spin for the moment). Know how to go from the quantum numbers to energy, total angular momentum, and z-component of angular momentum.

2. The basic differences in wave functions for s, p, and d-states.

3. Electron spin, Pauli exclusion principle, and the periodic table.

4. Understand that an orbiting electron has an associated magnetic moment. The magnetic moment is proportional to the angular momentum.

5. Stern-Gerlach as a method of measuring the magnetic moment of an atom. This experiment is one of the clearest demonstrations of the quantum physics of angular momentum. Understand the outcome of this experiment for atoms in different quantum states (simple examples only, such as H atoms).

Chapter 41

1. Understand the two lowest molecular orbitals of the H molecule.

The H molecule has two electrons when neutral. What is the occupation of orbitals in the molecule's ground state? First excited state?

2. Rotational and vibrational levels of a simple diatomic molecule.

3. The properties of the ‘electron gas' according to quantum physics. The density of states and the Fermi-Dirac distribution. Understanding the specific heat and why it goes to zero as a linear function of the temperature.

4. Semiconductor physics

4.a) Origin of bands
4.b) Explanation of the origin of metallic vs. insulating behavior in terms of the band theory
4.c) Definitions of valence and conduction band and energy gap
4.d) Why are semiconductors transparent?
4.e) The importance of impurities. The difference between n and p type semiconductors.
4.f) Understand diodes and LEDS

Chapter 42

1. Binding energy, mass spectroscopy

2. The curve of binding energy

3. Radioactivity, °°°°°°°°decays.

4. Radioactive decay and half life.