Things you should be able to answer for Exam I:

From the supplementary notes:

1. Elementary particles are thought to have no internal structure. Which of the following is an example of an elementary particle: an atom, an atomic nucleus, an electron, a proton, a neutron, a quark?
2. In an electrically neutral atom which of the following must be true: e = p, p = n, e = n? (e = # of electrons, p = # of protons, n = # of neutrons) Two electrically neutral atoms are isotopes of the same element; which of the following must be true: $e_1 \neq e_2$, $p_1 \neq p_2$, $n_1 \neq n_2$?
3. If the diameter of a proton is taken to be 1 unit long, about how many units is the diameter of the electron orbit in hydrogen?
4. Be able to estimate the spacing between atoms in a substance given its mass density and its atomic composition. What are typical numerical values for the atomic spacings in a solid, a liquid, and a gas? Why do we say that the atomic spacing in a solid is about the size of the atoms in the solid? Be able to estimate the size of a macromolecule given the number of atoms it contains and something about its conformation (i.e., a linear or globular molecule). Why are large biomolecules usually tightly clumped in a "ball?"
5. Be able to estimate where a system of particles' center-of-mass is using graphical techniques. What is meant by a rigid translation of a system of particles? To describe a rigid translation only a limited amount of information is necessary; why and what is the information? Regardless of how the particles in a system are moving, the motion of the system can always be broken down into two parts; what are they?

From Chapter 1:

6. What is meant by *dimensional analysis*? Be prepared to analyze an equation for dimensional consistency.
7. How is a vector different from a scalar? How do you add two vectors graphically? How do you find the components of a vector? How do you add two vectors using their components? How do you find the magnitude of a vector from its components?

From Chapters 2 and 3 and class:

8. Define position, displacement, average velocity, instantaneous velocity, average acceleration, and instantaneous acceleration. Given a set of measured positions and times, how would you best generate information about the instantaneous velocity and instantaneous acceleration? What is the interpretation of velocity and in terms of a position versus time graph? What is the interpretation of acceleration and in terms of a velocity versus time graph? Be able to sketch velocity and acceleration versus time graphs given a position versus time graph. Be able to sketch velocity and position versus time graphs given an acceleration versus time graph. How many position or velocity or acceleration graphs are necessary to describe motion along a line? In a plane?

From Chapter 4 and class:

9. What, roughly, is meant by the term "macroscopic?" Macroscopic forces can be divided into two types: field and contact. What distinguishes a macroscopic field force from a macroscopic contact force? Give an example of each kind of force.
10. Acceleration is different in one crucial way from position and velocity; what is it? State Newton's Laws of Motion. Be able to explain where acceleration comes from. Be able to apply Newton's Third Law correctly. What is a *free body diagram*? Be able to draw a correct free body diagram and be able to correctly state where the forces come from for a given situation (such as an assigned homework problem).
11. Define "weight." How is weight related to mass? We say that the Earth's gravitational field near the Earth's surface has a magnitude of about 9.8 N/kg. What experiment leads us to that conclusion? What is meant by "free fall?" Does a body in free fall have to be traveling downward? Where (if any place) does a body in free fall have zero acceleration? Why do <u>all</u> freely falling bodies, irrespective of mass, have an acceleration of about 9.8 m/s^2? What is the difference between a free fall trajectory in which velocity is vertical and one in which the velocity has both vertical and horizontal components? What happens to the horizontal component of velocity when a body is in free fall?

From the Labs:

12. Be able to answer all questions. Be able to state what were the main points of the labs. Be able to state how data were actually collected and analyzed. Be able to state how the motion sensor works.