

# Study Guide for Exam 1

Astronomy 105G: The Planets  
Spring 2009

**Exam date: Thursday, February 26**

The material for the exam covers roughly the first 4 chapters and about half of chapter 5 of your textbook (up until energy levels of atoms). So basically all the lectures through February 19, or lectures 1-11 (you do not have to study chapter S1 starting on page 90). Also included may be questions regarding the topics that you discussed in lab (the first 5 labs). Topics that may have been skipped over or gone over quickly from those chapters could be on the exam. Since you were required to read the entire chapters and encouraged to ask questions about any difficulties you encountered, all topics are fair game. But you can be sure that *if some broad topic is not listed here on this study guide, it probably will not show up in the exam.*

The format of the exam will be some combination of multiple choice, true false, short answers, labeling figures, and short quantitative problems. Bring a calculator, if you don't have one don't worry. Most or all of the problems you can do without one.

Below is a list with some explanation of the things you should be familiar with, as well as some hints. You will **not** have to memorize and complicated equations or constants. These will be provided if necessary. You will have to know what they mean and how they can be used to solve problems. The numbers and headings below do not necessarily correspond to the numbering or labeling scheme used in your textbook.

## I Large Numbers and Scales in the Universe

1. How distances are measured in astronomy and the scales involved. Is a light year a measure of time? What do we mean by an astronomical unit?
2. Powers of 10 and scientific notation. Be comfortable using this. Also make sure you know how to convert from one set of units to another.
3. The relative sizes of various objects in the universe like the Moon, Sun, solar system, galaxy, etc. In what order are the planets?
4. The relative scale of time in the history of the universe. What fraction has human history been important?

## II What Do We See When We Look Up in the Sky?

1. Be able to describe, in your own words, a constellation, asterism, celestial sphere, ecliptic, north (south) celestial pole, circumpolar stars, the zodiac, zenith, latitude and longitude, horizon.

2. Why do objects travel across the sky in the direction that they do? Is the concept of the celestial sphere helpful to you to imaging the location and orbiting direction of objects?
3. Angular size and how it relates to the real size of an object and how far away it is. Know how to compute this quantity.

### III Basics of the Earth – Sun – Moon System

1. The reasons for seasons on Earth and how they change over the course of a year.
2. The significance of solstices and equinoxes. What happens on these days?
3. How the Earth orbits the Sun. Is it circular? What is the orbital plane like?
4. Phases of the Moon (are you tired of that yet?) and its orbital and rotational properties.
5. Solar and lunar eclipses, why and why not they occur.

### IV The History of Astronomy and Kepler's Laws of Planetary Motion

1. What were the beliefs of the early Greek astronomers about the universe? Why did they think this? Was it unreasonable, based on the observations they made?
2. The main players in all of this (Ptolemy, Copernicus, etc.)
3. Understand some of the reasons why the Ptolemaic model held for so long. In other words, make sure you understand retrograde motion and stellar parallax.
4. Make sure that Kepler's three laws make sense to you and try to grasp the importance that they hold for astronomy even today. The third law is very important for solving problems.
5. You may be asked to use Kepler's laws to describe orbits of fictitious objects. What information do these laws give that were not available before?
6. Understand what an ellipse is and how it pertains to Kepler's Laws.

### V Physical Concepts Useful for Astronomy and Newton's Laws

1. Motion: speed, velocity, linear momentum, acceleration, angular momentum. Does a force **always change** the acceleration? What are scalars and what are vectors?
2. Not motion: mass, density, force, weight. Difference between mass and weight.
3. How the above concepts are used in Newton's 3 laws of motion.
4. Understand Newton's laws of motion and how to apply them to generic or hypothetical cases, like in Quiz 2.
5. Conservation of angular momentum and energy. This is why planets stay in orbit. Also, energy converted between potential and kinetic. How do these conservation laws explain Earth's orbit about the Sun (like at aphelion and perihelion).

6. Gravitation and the quantities involved that cause a force of gravity. How does distance come into play? Again, don't remember the value of  $G$ , it will be given if needed.
7. Is gravity a relatively strong force?
8. Newton's generalization of Kepler's 3rd law. Why is this important?

## VI Radiation and Matter

1. Understand the basic idea of the electromagnetic spectrum, that it shows a range in frequency and wavelength, where visible light fits in. What are some high frequency types of radiation? Low frequency? How is energy related to frequency. How are wavelength and frequency related? At what speed does radiation travel?
2. The composition of matter - atoms, molecules, protons, electrons, neutrons. What charges do these things have?
3. Even though we haven't yet gone into details about light, why are we studying it in an astronomy class?

## VII Example Problems

Here are some example problems, some from your homework, that represent the types of **quantitative computations** I expect you will be able to perform on the exam. Any equations will be provided. Check the solutions of the homework problems online to see worked out examples of some of these. Or, bring your questions to the review session.

**Chapter 1:** 41, 42,

**Chapter 2:** 52

**Chapter 3:** 53

**Chapter 4:** 41, 43, 44, 53, 54, 55, 56, 58, 60

**Chapter 5:** 49, 50, 51