ASTRONOMY 3: INTRODUCTORY ASTRONOMY: THE SOLAR SYSTEM
WINTER 2010
FINAL EXAM *STUDY GUIDE*

The final is nearly all non-mathematical, like the midterm. It is much less mathematical than the homeworks. You won't need a calculator, but you can bring one if you like.

There are 70 multiple choice questions (1 point each) and 10 short answer questions (3 points each) for a total of 100 points. Short answer questions will only require 1-3 sentences. The exam is 35% of your grade.

The exam is weighted about 60% on material since the midterm and 40% material from before the midterm. As before, chapter that we covered in more depth (multiple lectures) are more important in terms of the number of question.

You should know Kepler's laws and especially Kepler's 3rd law (his original version and Newton's version) backwards and forwards. You should know what causes the phases of the moon very well.

1. The scales and the appearance of the sky (chapter 1, 2)
    a. The distance scale
    b. Daily motion of the sky: the celestial sphere
    c. Appearance of the sky: seasons on earth, stars and planets, winter and summer constellations, southern and northern hemispheres
    d. Phases of the moon, eclipse

2. Brief History of Solar System Exploration: (3)
    a. Geocentric versus heliocentric model of the solar system: how did they account for the retrograde motion of the planets?
    b. Kepler's three law of planetary motion

3. Energy and Motion (4)
    a. Newton's three laws of motion and the concept of force
    b. Law of universal gravitation.
    c. Acceleration along a curved orbit and angular momentum

4. Light and telescopes (5,6)
    a. dual nature of light
    b. inverse square law: surface brightness decreases as inverse square of the distance
    c. photons of different wavelength: different type of photons
    d. Windows of Earth atmosphere: ability of different types of photons from outer space in reaching the ground

5. Starlight and Atomic Structure (5)
    a. Temperature and heat

b. intensity and color of black body radiation
c. elements: atoms, protons, neutrons, electrons.
d. absorption and emission lines: atomic transitions
e. Doppler effect

6. Overview of the solar system (7)
   a. two classes of planets
   b. dynamical and chemical properties of planets
   c. minor planets: asteroids, Kuiper Belt objects, and comets.
   d. a brief tour of individual planets and their distinguishing properties

7. Formation of the solar system (8)
   a. The nebula hypothesis
   b. protostellar disks
   c. gross properties of the solar system: terrestrial versus gaseous giant planets, space debris
   d. the age of the solar system: nuclear decay
   e. building of the solid planets: condensation, coagulation, impact, fragmentation
   f. gas accretion onto cores
   g. clearing of debris particles and gas

8. Planetary Geology (9)
   a. Diverse surface of terrestrial planets
   b. Probing planetary interior with seismic (P and S) waves
   c. The core-mantle structure inside the Earth, Venus, Mars, Mercury, and the Moon.
   d. Sources of heat for planetary interiors: accretion, differentiation, radioactive decay.
   e. Heat transfer by convection, conduction, and radiation: cooling and planetary size
   f. shaping the surface by impact craters, volcanism, tectonics, erosion.

9. Planetary Atmospheres (10)
   a. Atmospheric temperature structure of Earth's atmosphere
   b. What is the greenhouse effect and how does it affect various planets
   c. Methods of creating and losing atmospheres
   d. Particular properties of Venus, Earth, and Mars
   e. Atmospheric circulation

10. The Giant Planets (11)
   a. Internal structure and composition of jovian planets
   b. Atmospheric features of jovian planets
   c. Temperature and cloud structure of jovian atmospheres
   d. Similarities/differences between Jupiter/Saturn and Uranus/Neptune
   e. Generic properties of their magnetic fields

11. Satellites of the Giant Planets (11)
   a. Orbital resonances of the Galilean satellites

b. Surface geology and interior structure of the Galilean Satellites
c. Formation of the Galilean satellites
d. Titan: Atmosphere, Interior, Surface properties
e. Triton: Composition and Origin
f. Formation and capture of irregular satellites

12. Asteroids, Comets, Kuiper Belt, and Pluto (12)
a. Pluto's place in the Solar System
b. Basic definitions of comets, asteroids, and meteorites
c. Parts of comets
d. Types of meteorites
e. Differences between comets and asteroids—composition and location
f. Kuiper Belt and Oort Cloud, general properties

13. Extrasolar Planets (13)
a. Methods of detection: primarily radial velocity and transits
b. What can be learned about a planet from radial velocity data?
c. What can be learned about a planet from transit data?
d. General properties of these planets compared to Solar System planets
e. Differences between "hot Jupiters" and our jovian planets

14. The Sun (14)
a. Sun's internal structure
b. Sun's atmosphere structure
c. Sunspots and Solar cycles
d. Regulation of the fusion rate by the solar "thermostat"

15. Life in the Universe (24)
a. Necessary conditions for life, as we know it
b. What the fossil record tells us about life on Earth
c. Drake equation
d. Definition of a habitable zone