AST 111 - Fall 2018
Tue - Thu 10:30 - 11:45
STUDY GUIDE FOR EXAM 1

OPEN NOTES CLOSED BOOK

1. **YOU MUST NOT USE YOUR LAPTOP, TABLET, TEXTBOOK, OR YOUR CELLPHONE**
   a. Bring a calculator –(NOT the one on your cellphone) Do Not cheat off your neighbor!
   b. Bring a Number 2 Pencil and an eraser.
2. **HINTS ON TAKING "OPEN NOTES" TESTS-- WHEN STUDYING:**
   a. Carefully read the Chapter Summary, learn the "New Terms"
   b. Try to do the Review Questions, and the Discussion Questions.
   c. Work as many problems as you can. Feel free to ask me if you are having problems doing them.
3. **TAKING THE TEST**
   a. **Read the test questions carefully!**
   b. Go through the test once and answer all the questions that you can. Then go back and do the other questions.
   c. You may mark on the test booklet: cross off obviously wrong answers, work the problems, and show your work.
   d. Circle the answer on the test booklet - this is the last resort if you have made a mistake on the answer sheet.
   e. Carefully darken in the answer on the answer sheet, do not rip, mutilate, fold, or spindle it.
   f. Check your answer sheet. Make sure you have answered all 50 questions.
   g. MAKE SURE THAT YOUR NAME IS ON THE ANSWER SHEET AND YOU HAVE PUT IN YOUR FULL UNIVERSITY ID NUMBER-LEFT JUSTIFIED. FILL in the BUBBLES! I will subtract points if this is not done.
   h. **BRING A PICTURE ID.**

1. Appendix A: Units and Astronomical Data

a. Look at the Units - remember that I do not use the SI Units - just cgs units
b. Look at the material in Tables A-1 through A-6
c. Review Conversions. Note that if you watch what units you are using then the ones you don't want will cancel out.
d. Review the different types of temperature (A-4) . I will mostly use the Kelvin scale.
e. Review Powers of 10. Addition, subtraction, multiplication and division of exponents.
f. Know the prefixes for the metric system. How big is a nanometer? A Megameter?

2. Chapter 1. The Scale of the Cosmos

a. Review scientific notation. How do we work with things like 3×10^3 times 0.00012 and so on.
b. As you read this chapter, make sure that you know the meanings of all the words that are in **bold-face** type. For example, what is an Astronomical Unit? How big is a light year? What is a light year?
c. Read the Review Questions - try to do the problems on Page 9.
d. Look at the Boxes: The Scientific Method; Scientific Arguments
e. *Know the meaning of all words in italics and in **BOLD** in this chapter and all chapters.*

3. Chapter 2. The Sky

a. What are the constellations? Asterisms? How are stars named in each constellation? What is meant by Alpha Orionis? Beta Orionis? Delta Cephei?
b. Skip the part on Star Brightness: sections 2-1d, 2-1e (we do this in AST 112)
c. Look at the material on pages 18-19. Look at the Figures and read the figure captions. Where is Polaris?
d. What is latitude and longitude? What is the latitude and longitude of Tempe? What is the Celestial Sphere, angular measurement, the horizon? Where are the zenith and nadir?
e. What is a circumpolar star? How does the sky appear to change as we move north and south? What is the North Celestial Pole? South Celestial Pole? Celestial Equator?
f. Know degrees, minutes of arc, and seconds of arc. Know why the angular diameter of an object is different from the linear diameter of that object.
g. What causes Precession. Which star is now the Pole Star? What bright star will be the Pole star in 12,000 years?
h. What is meant by the Ecliptic? Which stars and constellations are overhead at midnight through the year? Why do they change during the year? (Look at Figure 2-9)
i. What is the inclination of the Earth's Poles to the ecliptic? What is meant by the Vernal and Autumnal Equinoxes? The Summer and Winter Solstices?
j. Be familiar with the material on pages 22-23. (The Cycle of the Seasons)
k. What causes the Seasons? How does the rising and setting points of the Sun (with respect to the horizon!) change through the year? Where, approximately, does the Sun rise at the Summer and Winter Solstices? At Spring and Fall Equinoxes.
l. When approximately are the Spring and Fall Equinoxes and the Summer and Winter Solstices.
m. Remember that the planets move along the ecliptic.
n. Read about the Milankovitch hypothesis. It may be correct.

4. Chapter 3. The Cycles of the Moon.

a. Know the phases of the Moon and how they change during the month. Know when the moon, in a particular phase, rises or sets or is on the meridian. (Look at page 34-35)

b. What is the length of a sidereal and synodic day or month? Which is longer and why? What is the rotation period of the Moon? What must it be to always keep the same face toward the Earth?

c. What are the Umbra and Penumbra of the shadow of the Earth or the Moon? What is a lunar eclipse? A Solar Eclipse? An Annular Eclipse? How often do they occur? Why don't eclipses occur at every Full or New Moon? What is the color of the Moon during a Lunar Eclipse and why?

d. What must be true about the angular size of the Sun and the Moon in order for solar eclipses to occur? When will the next solar eclipse occur that is visible from the US? Note that he defines perigee and apogee in this chapter. What are they?

e. What part of the Sun is best seen from the ground during a total Solar Eclipse.?

f. What is an eclipse season? What is the line of nodes of the Moon's orbit around the Earth? Note that the intersection of two planes is a straight line.

g. Skip the Saros Cycle: 3-4c

5. Chapter 4: Origins of Modern Astronomy

a. Where is Stonehenge? What was it used for? Where are some other astronomical alignments located (mentioned in class)? What is archeo-astronomy? What does it tell us about primitive people?

b. Look at the contributions of the Greeks. What was their world picture? What did Aristotle do? What did they believe about the Earth? Who was Aristarchus and what did he propose?

c. What is Parallax? Why did the fact that stars not show any Parallax motion convince the Greeks that the Earth was not moving? Why were they wrong? (Look at pages 60-61)

d. What did Eratosthenes measure?(Figure 4-6) How did he do it? What else did he invent or discover? (Mentioned in Class)

e. What is retrograde motion? What did Ptolemy invent to explain retrograde motion (incorrectly, of course)? How accurate were his predictions? The name of the circles upon circles model is the epicycle model. The circles are epicycles and they revolve around the earth on deferents. (Pages 60-61)

f. Who were Copernicus, Tycho, Kepler, and Galileo and what were their contributions to studies of the motions of the earth and planets? How did Copernicus change the solar system in his attempt to understand retrograde motion? What did Tycho do? Where did he do it? Note that the name of his observatory was Uraniborg. (Figure 4-9)

g. What did Kepler do? Where did he obtain the observations that he analyzed?

h. What did Galileo do? Where did he live? What evidence convinced him that Copernicus and Kepler were right? What did he see through his telescope? What did he invent?

i. Who discovered the Galilean moons and how? Know that Venus goes through phases just like the Moon. What does this tell us -and Galileo - about the structure of the solar system?

j. Read about the trial of Galileo.

k. Know Kepler's 3 Laws of planetary motion. What is an ellipse? The Focus of the Ellipse, The semi-major axis of the ellipse. How do we calculate the semi-major axis? (Table 4-1)

l. Look at Figure 4-17. Try to understand when, in time, the various astronomers contributed to the development of astronomy.

m. What are the various parts of the scientific method?

6. **Chapter 5. Newton, Galileo, and Gravity (SKIP Section 5-3)**

a. When was Newton born?

b. Know about Galileo and the experiments that he performed. He learned that falling bodies are accelerated, that the amount of acceleration does not depend on the mass of the object, and that motion was as natural as standing still.

c. Know Newton's 3 laws of motion. What is momentum? Why is velocity not the same thing as speed? What is acceleration?

d. What does F=ma mean? What happens if we apply the same amount of force to objects with different masses? Be familiar with Table 5-1

e. Know the Law of Gravity. What is an inverse square law? How is skateboarding explained by Newton's third law? What about a rocket launch?

f. Why do we talk about an orbiting space craft as being in Free Fall? (Page 86-87)

g. What is the circular velocity of an object in orbit? Remember that "r" is the distance from the center of the earth, sun, etc to the satellite. (Page 84-85)

h. What is the distance from the center of the Earth to an object in Geosynchronous orbit? Why do we care about Geosynchronous orbits? (Pages 86-87)

i. The different kinds of orbits in an inverse-square-law force are ellipse, circle, parabola, hyperbola, straight line. Some are closed and some are open. (Know what is meant by an open and closed orbit: Page 87)

j. The escape speed is that speed that allows a space craft to just escape from a planet. That does not mean that it has escaped from the gravity of the planet. Just that, if it is traveling at that speed or faster, it will never fall back to the planet.

k. Read how Newton re-discussed Kepler's laws and "explained" them. What does Kepler's Third law look like after Newton

worked on it. How can we use it to determine the mass of the Sun, of Jupiter, the Earth, binary stars (discussed in class)?

l. Read about the tides. Why is there a tide on the opposite side of the Earth from the Moon?

m. What are spring tides and neap tides?

n. SKIP 5-3

o. Try to do problems 1 and 3 on pages 99-100. Review all the problems that I have handed out.

Chapter 6: Light and Telescopes

a. What is meant by electromagnetic radiation? What are some of the properties of light?

b. What is meant by the wavelength and frequency of light? What is their product?

c. What is an Angstrom? I use Angstroms in class not nanometers. What is the velocity of light in cm/sec?

d. What is a photon? What is meant by the wave-particle duality of light?

e. What is the relationship between wavelength, frequency, and energy of light? How does the energy of a photon of light depend on its wavelength? What kind of light is most energetic, least energetic?

f. What are the various parts of the spectrum? Know the different kinds of light (Figure 6-3.) such as: infra-red, ultraviolet, X-ray, Gamma-ray

g. What is meant by atmospheric windows? Where in the spectrum is the atmosphere transparent, opaque (Figure 6-3; page 106)?

h. What are refracting telescopes? Reflecting telescopes? How do they differ? (Figure 6-4)

i. What is meant by the primary lens or mirror of a telescope? Eyepiece?

j. What is the fundamental difficulty with refracting telescopes? (Chromatic Aberration: Figure 6-6)

k. How does a telescope form an image? Note that the image is upside down (Figure 6-5). How is your eye like a lens?

l. What is meant by the focus of a lens or mirror? What is the focal length of a lens or mirror?

m. What is an achromatic lens? Does it really cure chromatic aberration or does it just use it?

n. What is a Newtonian telescope? Cassegrain telescope? Prime Focus? (Look at Pages 112-113)

o. Skip mountings.

p. Where are the Very LargeTelescopes located? Why on a mountain top?

q. What is the light-gathering power of a telescope? On what does it depend? (Page 107)

r. What is the resolving power of a telescope? On what does it depend? Why is it relatively unimportant for ground based telescopes?

s. What atmospheric effect reduces the resolving power of a telescope? (Pages 108-109)

t. What are some of the advantages of a reflector over a refractor for large astronomical telescopes.

u. Active optics means that the shape of the mirror can be changed (slightly) over a few minutes to correct for the atmosphere.

v. What are some of the new large telescopes called and where are they? LBT, VLT, Keck.

w. Why are radio telescopes so big? A radio interferometer makes a lot of separate radio antennas act as a single antenna improving the resolution. (Figure 6-25)

x. One such observatory is the VLA. Where is it located? Did you see it in the movie “Contact”? We do not listen to the signal from a radio telescope with headphones. (Figure 6-25)

y. Where is the Arecibo radio telescope located? (Figure 6-15)

z. We launch satellite observatories to observe in wavelengths blocked by the atmosphere or to observe without worrying about the effects of “seeing.”

zz. Some of the infra-red satellites were or are ISO, IRAS, and Spitzer. In the UV we have or had IUE, EUVE, and HST (Fig 6-17). In the X-ray we have CHANDRA, XMM, and Swift.

zzz. What is a CCD?

zzzz. Why do we need “Laser Guide Stars” ?

zzzzz. Skip Section 6-6