

**AST 111 Tu-Thu 10:30am - 11:45am**  
**STUDY GUIDE FOR FINAL EXAM ON**  
**Tuesday December 18, 2012 at 9:50am -11:40 am in PSF 166 (our classroom)**  
**Taking this exam is required to pass the course!**

1) THIS STUDY GUIDE CONTAINS ONLY THE MATERIAL THAT IS NEW. YOU MUST USE THE PREVIOUS STUDY GUIDES FOR THE COMPREHENSIVE SECTION OF THE TEST.

If you have lost your copy, they are available on the web- linked from the class syllabus.

2) MAKE SURE THAT YOUR NAME IS ON THE ANSWER SHEET AND YOU HAVE PUT IN YOUR AFFILIATE ID NUMBER LEFT JUSTIFIED. I will subtract points if this is not done.

3) BRING A PICTURE ID. I WILL ASK YOU TO PLACE IT ON THE TABLE IN FRONT OF YOU AND WILL GO AROUND THE CLASS DURING THE EXAM CHECKING EACH ID.

You must not use either your cell phone or your laptop.

You must not share a textbook.

**Chapter 23: Jupiter and Saturn JUPITER**

[Know the Celestial Profile for each planet PAGE 520]

1. Jupiter is the largest planet in the solar system and the second most massive object
2. It can be considered a Failed Star - why? It radiates more heat than it receives from the Sun. What is the heat source?
3. We find Jupiter sized planets around other stars. How do we know this?
4. The Great Red Spot is a very long lived storm. Who first saw it? (Pages 508-509)
5. How does the average density of Jupiter compare to that of the Earth?
6. What is the average composition of Jupiter and Saturn? Of the atmosphere of Jupiter and Saturn? How deep do we see into their atmospheres? (Pages 508-509)
7. Jupiter is not a perfect sphere. It is oblate (flattened) because it is rotating rapidly.
8. What are the rotation periods and how fast do the winds move on Jupiter and Saturn? (Shown in class)
9. We detect radio waves from Jupiter. They are produced by what feature of Jupiter?
10. Do Jupiter and Saturn have Aurorae? (Yes)
11. What is the Io Plasma Torus? What is Io?
12. What are the Belts and Zones of the Jovian atmosphere? What are they telling us about the heat flow from the interior? Which are rising and which are falling? (Pages 508-509)
13. What happened to the Galileo Probe?
14. All the Jovian planets have rings. When were the rings of Jupiter discovered and how? (Page 517)
15. What is the Roche Limit? What does it have to do with Planetary Rings?
16. I spent quite a bit of time on the Shoemaker-Levy 9 impact. Do we have any evidence that such impacts have occurred elsewhere in the Solar system? (Yes! And on Jupiter more recently)
17. What do we know about the Jovian and Saturnian interiors? What happens to hydrogen gas as

the pressure increases?

18. Why do we think that Jupiter and Saturn might have dense cores since we can't see deep into the atmosphere?

19. Why does Saturn radiate more energy than receives from the Sun? (Page 519)

20. I discussed the Galilean Moons of Jupiter in some detail. They are Io, Europa, Ganymede, and Callisto. (Know Table 23-2)

21. You will need to know the distinguishing features of these moons. Why is Io so interesting? Why is Europa so important?

22. Io has a large number of erupting volcanoes. These blast sulfur into space to form the Io torus. What causes the heating that results in volcanoes on Io?

23. Europa probably has a liquid ocean underneath a thick ice layer. Why do we think this?

24. Ganymede has both old and young surface regions. The craters look like they were formed by impacts with shaved ice.

25. Callisto has cratered regions and probably an old surface. It has not suffered as much tidal heating as the other moons.

26. Are the rings of Jupiter old? (No: Page 518)

## **SATURN**

1. Saturn is the second most massive planet and it has a lower density than Jupiter and water.

2. It also rotates rapidly, almost as rapidly as Jupiter, and so it is oblate (flattened).

3. It radiates nearly twice as much heat as it receives from the Sun. What is the source of heat for this planet? (Page 519)

4. Saturn also has a magnetic field. But it is weaker than that of Jupiter.

5. Why are the clouds of Saturn less distinct than those of Jupiter. (Methane crystal haze)

6. What is the name of the spacecraft orbiting Saturn? What was the name of the Titan lander?

7. Read about the discovery that the rings are actually particles and not solid. The pictures from the various spacecraft flybys revolutionized our understanding. For example, the Spokes seen in Voyager images. The breaking up of the rings into many smaller narrower rings. The Shepherd satellites associated with the F ring. (Pages 528-529)

8. Saturn has a lot of moons. Some are more important and interesting than others.

9. Titan is definitely known to have an atmosphere and the existence of this atmosphere has been known for sometime.

10. What are some of the organic compounds detected in the atmosphere of Titan? (Table 23-3)

11. Titan probably has a rocky core but the rest is very icy. It is larger than Mercury. There are lots of unanswered questions.

12. The Huygens lander probed the atmosphere and surface of Titan.

13. Read about the smaller moons.

14. Parts of the surface of Enceladus resemble the surface of Ganymede: cracks and new surface plus regions that are heavily cratered. Plus gas is being ejected right now.

15. How do we determine the relative ages of the moon's surfaces? (Number of craters)

## **Chapter 24: The Outermost Planets: Uranus, Neptune, Pluto**

### **Uranus:**

1. Look at Celestial Profile 9 and 10 (Page 548: Look at the Celestial Profiles for all the planets)

2. When was Uranus discovered and by whom? (Page 536)

3. How is the direction of rotation of Uranus different from that of the Earth? How does that affect the seasons on Uranus? (Discussed in class and Figure 24-3)
4. What is the structure and composition of its atmosphere? I showed recent pictures of the clouds in class.
5. What do we know about the internal structure of Uranus?
6. What is the direction and strengths of the magnetic fields of the outer planets? Why are those of Uranus and Neptune so unusual? (Figure 24-7)
7. How were the rings of Uranus and Neptune discovered? How do they differ from those of Saturn? (See pages 544-545)
8. What do we know about the Shepherd satellites of the Uranus rings?
9. How many moons does Uranus have? How many had we found before the Voyager flights?
10. The largest moon is Titania. How does its size compare to that of our own Moon?
11. Look at the pictures on Pages 543 and 546. What are the various explanations of the surface features of Miranda? (Figure 24-11)
12. Where, in the Solar System, is it thought that Uranus and Neptune originated?

### **Neptune**

1. Be familiar with the data in Celestial Profile 10 (and the other Celestial Profiles).
2. When was Neptune discovered and by whom? ( A triumph of Newton's laws and the Law of Gravity)
3. We know very little about Neptune - even with the Voyager flyby. It shows a lot more atmospheric features than does Uranus.
4. What do we know about the internal structure of Neptune?
5. Do the rings of Neptune also have shepherding satellites?
6. What are some of the unusual features of Triton?
7. How is its orbital plane tilted with respect to the ecliptic? What causes the plumes and geysers?

### **Pluto**

1. How was Pluto discovered? Could there be any more "planets" as large as Pluto in our Solar System but farther away? (Yes, nearly as large and maybe larger)
2. What is the surface of Pluto like?
3. What is Charon.
4. How was Charon discovered?
5. How many moons does Pluto have? (Lots)
6. Is Pluto massive enough to affect the orbit of Neptune? (No) How long have we known this?
7. What was important about the transits of Charon across Pluto?
8. Does Pluto have an atmosphere? What is its surface like?
9. What are the Kuiper Belt Objects?
10. What space craft is on its way to Pluto and when will it arrive? ( Page 554)

## **Chapter 25. Solar System Leftovers: Meteorites, Asteroids, and Comets**

### **Meteorites:**

1. What are meteoroids, meteors, meteorites, meteorwongs? Where do the particles in meteor showers come from? What is a radiant? (Figure 25-5)
2. What is a Fall and what is a Find?

3. Where is the Barringer Meteorite Crater? How old is it?
4. What are the different kinds of meteorites? What is the importance of carbonaceous chondrites?
5. What is meant by pre-solar grains in meteorites?
6. What do the existence of iron, stony-iron, and stony meteorites tell us about the asteroid belt?
7. Do some meteorites come from Asteroids? From the Moon? From Mars? (Yes)
8. When are some of the important meteor showers? (Table 25-2).

### **Asteroids:**

1. Who was the first to discover an asteroid? When was this and which asteroid was it? How many are known now- roughly?
2. Where are most of the asteroids located? What do they look like? What are their sizes? (Page 569-569)
3. What are the Kirkwood gaps? What are the Trojan asteroids? Where are they located? What is the importance of earth crossing asteroids to us?
4. What is the evidence for asteroid collisions?
5. NEAR orbited and took pictures of which asteroid? (Pages 568-569)
6. What is so interesting about Mathilde?
7. What are the major classes of asteroids?
8. What recent spacecraft visited Vesta and took pictures (The Dawn Probe).
9. What is the evidence that some meteorites come from Vesta? (Pages 568-569)

### **Comets:**

1. What are the various parts of a comet? How big are they? What is the composition of the Coma?
2. What is a gas tail? A dust tail? What causes them to face away from the sun? What are the names of some famous comets? (Pages 574-575)
3. What happens to the debris from a comet after a passage near the sun? How is this material related to Meteor Showers?
4. How long does a comet last? How does its appearance change as it orbits the sun?
5. What was Shoemaker-Levy 9? What does its existence and behavior tell us about hits on the earth?
6. What is the Oort cloud? The Kuiper belt?
7. How often do collisions of asteroids and comets with the Earth occur?
8. What is the evidence for these collisions? Is there a nearby crater?
9. What is now thought to have caused the extinction of the dinosaurs? Where is the crater probably located?
10. What was the Tunguska Event? When did it happen? What do people think was the cause?