

ASTRONOMY 111 Session 003
Date: November 26, 2007
Instructor: Dr. Jie Zhang

Fall 2007

In-class Exam #3

I understand that this examination lasts from **7:20 PM to 8:20 PM**. I have not received, nor given any aid, nor assistance, nor answers, nor questions to anyone else during this examination period. I understand that any violation of the GMU honor code will result in my being reported directly to the honor committee, **without warning**. I understand that any honor code violation can cause me to fail the course, be suspended, and/or be expelled from the university; and, it will automatically be entered into my official records.

Test Form: **X**
Name (Print): _____
Signature: _____
Student ID: _____

In your **scantron**, please record the **ID number** (from far-left to right, the 8-digit G number without letter G), **name, subject and date**.

The class will resume at 8:30 PM. Please come back at this time.

Chap. 0: 1
Chap. 10: 5
Chap. 11: 9
Chap. 12: 9
Chap. 13: 8
Chap. 14: 8
Survey : 10

Note: Answer Keys --- asterisk symbol indicate the correct answers.

(Chap. 0)

1. Your answer to question 1 must be "A"

(Chap. 10)

2. The Moon has
 - A an atmosphere of CO₂, but no evidence of water.
 - B a lot of evidence for an atmosphere and the presence of liquid water.
 - C *no measurable atmosphere or liquid water.
 - D no measurable atmosphere, but plenty of groundwater.
3. What is the current state of plate tectonics on the Moon?
 - A just in the process of beginning.
 - B very active, causing mountain uplift around the edges of several lunar maria
 - C dying out; only the lunar maria show signs of lava flow today.
 - D *absent; the Moon is a geologically dead world
4. What is the most likely cause of the smooth and relatively crater-free surfaces of lunar maria?
 - A volcanic ash that rained on the surfaces of the basins in recent geological times
 - B dust storms that eroded and smoothed the surface
 - C sediments left behind after water flowed into the basins and evaporated
 - D *lava flows relatively late in the geological history of the Moon
5. The best explanation for the creation of the Moon is
 - A *it formed when a large proto-planet collided with the proto-earth.
 - B it formed near the Earth and was captured.
 - C it formed simultaneously with the Earth, in orbit around it, out of the solar nebula.
 - D it spun off of the Earth because of rapid rotation.
6. One effect of the ocean water's tidal drag on Earth is to
 - A tilt its spin axis farther and farther away from the perpendicular to the ecliptic.
 - B speed up its rate of spin, thereby gaining energy from the Moon's orbital motion.
 - C *slow down Earth's spin rate.
 - D speed up Earth in its orbital motion around the Sun.

(chap. 11)

7. A friend claims they saw Venus rising in the east as the brightest object in the sky just as the Sun set. They are wrong because
- A most other planets would normally be seen as brighter.
 - B in that position Venus would not reflect much light.
 - C Venus has a retrograde orbit and rises in the west, not the east.
 - D *Venus never rises at sunset, because it is always close to the Sun in the sky.
8. There is no evidence of plate tectonics (continental drift) on Mercury. The most likely explanation is that
- A the planet cooled too slowly and the mantle remained too soft.
 - B *the planet cooled too rapidly and the mantle became too rigid.
 - C Mercury has no iron core like Earth.
 - D Plate tectonics can only occur on a body with continents separated by oceans.
9. The “retrograde rotation” of Venus refers to
- A *Venus rotates in the opposite direction of its orbit motion around the Sun
 - B Venus rotates in the same direction of its orbit motion around the Sun.
 - C Venus rotates at the same rate of its orbital motion around the Sun
 - D Venus occasionally moves from west to east against the background sky
10. The near-surface atmospheric conditions on Venus, compared with other terrestrial planets, are
- A no atmosphere, very variable temperature.
 - B dense methane, ammonia, and H₂O atmosphere, low temperature.
 - C CO₂ atmosphere, low pressure, and low temperature.
 - D *CO₂ atmosphere, high pressure, and high temperature
11. How did the terrestrial planets, Venus, Earth and Mars, acquire their original atmospheres?
- A capture of solar wind gases from the Sun as they stream past the planets
 - B the impact and melting of icy comets from the planetary system and perhaps beyond
 - C gravitational capture of material from the original solar nebula by the planets
 - D *outgassing of the planets through volcanoes.
12. The greenhouse effect is far less effective on Mars than on Earth. Why is this?
- A The Martian surface temperature is very low, and this reduces the effectiveness of the greenhouse effect.

- B There is less energy being conducted upward from the Martian interior to the surface of Mars because of the thickness of its crust compared to that of Earth.
- C The Mars contains no atmosphere.
- D *The Martian atmosphere is very thin and traps less infrared radiation from the surface.

13. Water on Mars today is principally found

- A in the atmosphere as vapor.
- B *in the polar ice caps and in permafrost in low latitudes.
- C in lakes and streams.
- D not in any place on Mars

14. The carbon dioxide atmosphere of Mars was much denser in Mars's early history than it is now. What process is now believed to have begun this atmospheric thinning?

- A The solar wind stripped the outer atmosphere from the planet.
- B The light CO_2 molecules escaped directly into space because of the weak gravity of Mars.
- C The CO_2 molecules were broken down by solar UV photons, creating the lighter molecules, CO and O_2 , which then escaped into space.
- D *The CO_2 was washed out of the atmosphere by water rain, and was locked in the crust.

15. On Mars, which of the following features have NOT been seen or detected?

- A dust storms and dust devils
- B advancing and receding polar icecaps
- C thin, wispy clouds
- D *active volcanoes

(Chap. 12)

16. The best time to observe Jupiter from Earth is when it is
- A at conjunction—when it appears closest to the Sun.
 - B at maximum eastern or western elongation and is farthest away from the Sun in our sky at sunrise or sunset.
 - C high above our southern horizon at sunrise or sunset.
 - D *at opposition—hence closest to Earth.
17. The zones and belts of Jupiter
- A *are cloud bands pulled into stripes by differential rotation.
 - B are hurricanes created by a combination of heating and convection.
 - C are rings of numerous small particles at different speed
 - D are created by differential heating from metallic hydrogen.
18. The Great Red Spot on Jupiter is
- A the shadow of a satellite on the cloud top of the atmosphere.
 - B a hot volcanic spot on the surface
 - C *a large, stable, circulating storm system in the atmosphere.
 - D a large red crater on the surface.
19. Jupiter gives out more energy than it receives from the Sun. What is the cause of this?
- A the greenhouse effect in Jupiter's atmosphere
 - B nuclear reactions in Jupiter's interior
 - C gravitational tidal force exerted on Jupiter from the Sun
 - D *remnant heat from the original formation of the planet.
20. A layer of _____ inside Jupiter is responsible for its strong magnetic field.
- A *liquid metallic hydrogen
 - B liquid hydrogen
 - C liquid metallic helium
 - D liquid helium
21. The reason for the slightly flattened or oblate shape of Jupiter and Saturn is
- A *it is spinning rapidly, and is composed mostly of fluid and gaseous matter.
 - B it was formed in this way at the time of planetary formation, and has solidified to this shape.
 - C tidal distortion from its moons and from the Sun have distorted its shape.
 - D it is moving rapidly around its orbit, flattening its shape.
22. Saturn's rings are
- A solid disk, much like a thin wheel.
 - B *made of numerous small pieces of ice and rock
 - C sparse collections of mountain-sized boulders.

D several satellites which are moving so fast that they are flattened to have the ring shape

23. The particles in Saturn's rings

- A move in circular orbits, with the outer particles moving fastest
- B all move at the same rate as if they are one solid disk.
- C revolve in different directions depending on the distance from the planet.
- D *move in circular orbits, the inner particles moving faster in agreement with Kepler's third law.

24. The Roche limit around a planet is defined as

- A the distance beyond which the orbital velocity of a body is greater than the escape velocity and matter is no longer captured by the planet.
- B the distance inside which all objects have synchronous rotation.
- C the outer extent of the magnetic field of the planet.
- D *the distance inside which disruptive tidal forces will overcome the mutual gravitational forces between particles, preventing particles to accrete to form a large body.

(Chap. 13)

25. Which of the following motions is seen to be characteristic of the four Galilean moons of Jupiter?
- A They orbit the planet in a planar orbit carrying them over both the north and south poles of Jupiter.
 - B They orbit the planet in the opposite direction to the planet's rotation.
 - C They each keep the same face toward the Sun at all times.
 - D *They each keep the same face toward Jupiter at all times.
26. In what important way does the Jupiter-moon system resemble a miniature Solar System, perhaps providing a hint to the initial formation of both systems?
- A The reflectivity of their surfaces decreases, the farther away they are from the central object, because the nearer objects have thicker clouds around them.
 - B *Average density of objects decreases as distance increases from the central object, because the heat from the central object would have melted and evaporated the volatile low-density ices from the closer objects.
 - C Average density of objects increases the farther away they are from the central object, because this central object can attract high-density material over a greater range of distances than for low-density material.
 - D There is no particular order of density of the objects with distance.
27. The outer three Galilean moons of Jupiter differ from Io, the innermost such moon, by having surfaces of
- A *water ice.
 - B smoothly polished rock.
 - C carbon dioxide.
 - D sulfur.
28. The internal temperature of Io is high because of
- A electric currents flowing through its interior.
 - B *tidal heating from Jupiter's gravity.
 - C magnetic interaction between Io's and Jupiter's magnetic fields.
 - D Volcanic flows depositing enormous amounts of heat with each eruption.
29. The ice rafts on Europa
- A *float on a subsurface of liquid water or soft ice.
 - B are pulled around the surface by tidal forces from Jupiter.
 - C are anchored to rocky material under the surface.
 - D are actually "dry ice," which is frozen carbon dioxide.
30. How are the relative ages of the different types of terrain on Ganymede estimated?
- A The lighter the coloration, the older the terrain.

- B The colder the surface, the older the terrain.
- C *The denser the cratering, the older the terrain.
- D The smoother the surface, the older the terrain

31. Saturn's moon Titan is different from all other moons of planets because

- A lakes of water with floating icebergs are seen upon its surface.
- B *it possesses a thick atmosphere.
- C its orbit carries it directly over both poles of the planet.
- D continuously erupting volcanoes are observed upon it.

32. What observational facts lead to the conclusion that the small outer moons of Jupiter were captured by its gravitational field rather than being formed at the same time as the planet?

- A They move in circular orbits in the planet's equatorial plane in the same direction as Jupiter's rotation.
- B They move within the dust ring around Jupiter, above the planet's equator.
- C They move in circular orbits above the planet's equator in a retrograde direction, opposite to that of Jupiter's rotation.
- D *They move in orbits that are steeply inclined to Jupiter's equator, many of them in a retrograde direction, opposite to Jupiter's rotation.

(Chap. 14)

33. Which object was discovered as a result of the detailed prediction of its position using Newton's gravitational theory to explain deviations in the motions of known planets?
- A Jupiter
 - B *Neptune
 - C Mercury
 - D Saturn
34. What are the most abundant gases in the atmosphere of Uranus?
- A *hydrogen and helium
 - B nitrogen and ammonia
 - C carbon dioxide and nitrogen
 - D methane and water
35. Which of the following effects is now thought to be the most likely cause for the inclinations of the spin axes of several of the planets, such as Uranus (and even Earth), to the perpendicular of their orbital planes?
- A an out-of-balance force on the irregular mass distributions of planets from their moons, some of which have significant masses
 - B a small but steady force on one hemisphere of the planet from the highly directional solar wind
 - C *a major collision with another planet-like body
 - D tidal distortion and deflection caused by neighboring planets
36. Seasons on Uranus are
- A *very extreme because of the great tilt of its axis
 - B mild, giving it a surface that is always featureless
 - C similar to those on Earth or Mars
 - D nonexistent because of its distance from the Sun.
37. What is believed to be the basic structure of the interior of Uranus and Neptune?
- A *rocky core, mantle of liquid water and hydrogen, gaseous atmosphere
 - B iron core, rocky mantle, gaseous atmosphere
 - C rocky core, mantle of liquid water, icy crust
 - D iron core, mantle of liquid water and hydrogen, gaseous atmosphere
38. Which scientific method was used to make the initial discovery of the thin and dark rings around Uranus?
- A spacecraft exploration of the planet
 - B direct photography from Earth
 - C X-ray photography from space
 - D *occultation of a star as the planet and rings moved in front of it
39. The Pluto-Charon system moves in which way in its mutual motion?

- A *Charon orbits Pluto with exactly Pluto's rotation period.
- B Charon orbits Pluto twice, while Pluto rotates once.
- C There is no relationship between rotation period of Pluto and orbital period of Charon.
- D Charon orbits Pluto once, while Pluto rotates twice.

40. Pluto was disqualified as a normal planet in 2006 because of the following arguments except

- A Pluto's orbit is steeply inclined to the plane of the ecliptic.
- B *Pluto has only one satellite.
- C Pluto's orbit is highly eccentric.
- D Pluto is too small in size, compared with those giant planets in the outer solar system.

Optional Survey Questions.

The following 10 questions, from 41 to 50, are voluntary questions that are intended to improve the teaching and learning of this course in the future. I appreciate your cooperation. Your answer to these 10 questions (or the lack of answers) will not affect your grade in this exam, since your grade is solely based on questions 1 to 40.

41. Your overall interest in astronomy, regardless how this class is set up, is
- A extremely high
 - B high
 - C intermediate
 - D low
42. Your rating of the text book, in the way how the book organizes observational facts and presents physical laws, is
- A excellent
 - B very good
 - C good
 - D poor
43. Your rating of the teaching, in the way how instructor puts together the presentation notes, explain the observations and discuss the physical principles, is
- A excellent
 - B very good
 - C good
 - D poor
44. Since the instructor is a non-native English speaker, to what extent do you think that the instructor's English (e.g., accent) adversely affects your learning in this class
- A severely affects my learning (I can not tolerate it)
 - B affects my learning to a modest extent (yes, it is a problem for me)
 - C slightly affects my learning (I am okay with it)
 - D It does not affect my learning at all (not a problem for me)
45. How often do you preview the textbook before classes?
- A Always
 - B often
 - C Occasionally
 - D Never
46. How often do you review the lecture notes and the textbook after classes?
- A Always
 - B often

- C Occasionally
- D Never

47. How many hours, in average, do you do the study to prepare for the exam just before each of the past three in-class exams?

- A More than 15 hours
- B 10 to 15 hours
- C 5 to 10 hours
- D Less than 5 hours

48. How often do you attend the lectures?

- A Always (> 90%)
- B More than half (>50%)
- C Less than half (<50%)
- D Seldom (< 20%)

49. Judged by your commitment to this class (the time you spend on the lectures, the book and the exams), what final grade do you expect to get from this class?

- A A
- B B
- C C
- D D

50. Please write here any comments and suggestions. Especially, what can be done to best motivate you to study for this class? Do you like the idea to have homework for this class? What is the most important thing you have learned from this class? Thank you.