Astronomy 1102/1104 17 April, 2009
Our Solar System

Examination 3

Practice version

Name: _____

Signature: _____

Student ID number: _____

Section: _____

Instructions:

On the scannable answer sheet:
- Fill in your name (last name first!) and ID number (in col. A-J).
- Put your section number in columns K-M
- Identify the form in Special Codes column P.
- Answer all 40 questions using a number 2 pencil.

In addition:
- Do not open your exam until instructed to do so.
- Be sure to also answer each question in the blanks provided on this exam sheet.
- The exam ends at 12:00.
- When done, raise your hand and a TA will collect your exam.
- No one may leave between 11:50 and 12:00.

And of course:
- You may not use any notes, texts, calculators or communications devices.
- All work must be your own.

Score: _____ out of 40.

Useful equations:

$p^2 \propto a^3$

$F = ma$

$F = G\, m_1\, m_2 / r^2$

$v = \lambda\upsilon$ (for light, v=c)

$E = h\upsilon$ (h = Planck's constant.)

$\theta_R \sim \lambda/D$ (The constant of proportionality depends on the units of λ and D.)

$\lambda_{mI} = C/T$ (If λ in μm and T in K, then C = 2880 μm K.)

$L = 4\pi r^2\, \sigma T^4$ (σ = the Stefan-Boltzmann constant.)

$\Delta\lambda/\lambda = v/c$

$T = T_{ref} / R^{1/2}$ (If R is in AU, then T_{ref} = 300 K.)

Useful constants:

$c = 2.998 \times 10^8$ m/s = 300,000 km/s

$h = 6.626 \times 10^{-34}$ J s

$\sigma = 6.570 \times 10^{-8}$ W m^{-2} K^{-4}

Pick the best answer to each question.

_____ 1. Which of the following statements is **FALSE**?

a. Asteroids can be carbonaceous or dominated by silicates.
b. Asteroids can be compact or little more than piles of rubble.
c. Some asteroids have orbits which cross the Earth's.
d. Some asteroids have moons.
e. Robotic spacecraft have returned samples from asteroids to the Earth.

_____ 2. The Kirkwood Gaps are gaps in the ...

a. outer moons of Jupiter caused by orbital resonances with the Galilean Satellites.
b. rings of Saturn caused by orbital resonances with the larger moons.
c. Main Asteroid Belt caused by orbital resonances with Jupiter.
d. Kuiper Belt caused by orbital resonances with Neptune.
e. All of the Above.

_____ 3. The largest object in the Main Asteroid Belt is ...

a. Ceres.
b. Jupiter.
c. Ganymede.
d. Pholus.
e. Vesta.

_____ 4. Which the following is **NOT TRUE** about the rings of Saturn and objects in the Main Asteroid Belt?

a. Both show structure from orbital resonances with other objects.
b. Objects in both systems are tightly confined to a single plane.
c. Both contain objects spanning a wide range of sizes.
d. Both contain objects covering a range of compositions.
e. All of the above statements are true for both Saturn's rings and the Main Asteroid Belt.

_____ 5. Ammonia (NH_3), ammonium hydrosulfide (NH_4SH), and water vapor (H_2O) have different condensation temperatures, lowest for ammonia and highest for water vapor. Therefore, in Jupiter's atmosphere, these compounds will condense ...

a. in distinct cloud layers, with ammonia on top and water below.
b. in distinct cloud layers, with water on top and ammonia below.
c. into a thick cloud mixture at a common altitude.
d. into clouds which are completely obscured by a stratospheric haze.
e. at the same altitude, but with different clouds at different latitudes.

_____ 6. The Great Red Spot on Jupiter ...

a. was discovered by Voyager 1 in its fly-by in 1979.
b. is believed to have dissipated entirely and reformed several times in the last four centuries.
c. is the only rotating storm system present in Jupiter's atmosphere.
d. is the longest-lived cyclone (low-pressure system) in the Solar System.
e. None of the above.

_____ 7. Compared to Jupiter, the other Jovian planets display more subdued cloud features and softer color contrasts, because of ...

a. a lack of active weather and appreciable winds on the outer planets.
b. the colder temperatures and consequently thicker stratospheric hazes on the other planets.
c. the significant tilt of Jupiter's rotation axis, which produces strong seasons.
d. the presence of more dust suspended in the atmospheres of the other planets.
e. All of the above.

_____ 8. What is the dominant element in the jovian worlds?

a. Hydrogen.
b. Helium.
c. Carbon.
d. Iron.
e. Nickel.

_____ 9. Uranus and Neptune lack which of the following that Jupiter and Saturn have?

a. Clouds in their atmospheres.
b. Methane.
c. Ammonia.
d. Magnetic fields.
e. Metallic hydrogen.

_____ 10. Jupiter's powerful magnetic field ...

a. is generated by the metallic hydrogen in its interior.
b. protects the Galilean satellites from cometary impacts.
c. oscillates in strength because Io has an elliptical orbit.
d. precesses with a 2.7-hour period.
e. All of the above.

_____ 11. Which of the following statements is **FALSE**? The rings around the four Jovian worlds ...

a. are all remarkably thin.
b. all consist of particles in Keplerian orbits.
c. have nearly identical compositions.
d. are structured by interactions with moons.
e. None of the above.

_____ 12. The Cassini Division in Saturn's rings ...

a. is occupied by Hyperion.
b. is occupied by Iapetus.
c. is maintained by an orbital resonance with Mimas.
d. is maintained by an orbital resonance with Iapetus.
e. has been filled in by fresh ring material and can no longer be seen.

_____ 13. Why do Saturn's rings disappear every 15 years?

a. The eruptions on Enceladus, which feeds the rings, cycle with a 15-year period.
b. Iapetus and Phoebe have a long-term resonance of 15 years.
c. Twice in Saturn's 30 year orbit around the Sun, the Earth passes through its equatorial plane.
d. Fifteen years is the average time for the orbital decay of a ring particle.
e. None of the above.

_____ 14. What is the dominant component of the rings of Saturn?

a. Metal.
b. Rock.
c. Ice.
d. Gas.
e. Plasma.

_____ 15. Rank the Galilean moons of Jupiter from most dense to least dense.

a. Io, Europa, Ganymede, and Callisto.
b. Callisto, Ganymede, Europa, and Io.
c. Ganymede, Callisto, Io, and Europa.
d. Europa, Io, Callisto, and Ganymede.
e. Igor, Capella, Enchilada, and Gallifrey.

_____ 16. On Ganymede, the areas with grooved terrain (sulci) are ...

a. younger than the regia.
b. less cratered than the regia.
c. not as dark as the regia.
d. All of the above.
e. None of the above.

_____ 17. Volcanic activity on Io ...

a. never took place.
b. ended about a billion years ago.
c. ended about 100 million years ago.
d. ended within the last five million years.
e. is still on-going.

_____ 18. Which of the following comparisons of Europa and Callisto is true?

a. Both have differentiated interiors.
b. Europa is more cratered than Callisto.
c. Callisto shows more evidence of faulting and volcanic activity on its surface.
d. Callisto has a thicker ocean beneath its surface.
e. None of the above comparisons are true.

_____ 19. Io's surface is ...

a. greyish brown and covered in craters
b. icy and covered in linea, long faults which cross and overlap each other.
c. yellowish from deposits of sulfur compounds from constant volcanic activity.
d. hidden from view by a thick atmosphere of nitrogen.
e. a combination of heavily cratered ancient terrain and younger grooved terrain.

_____ 20. Which of the following moons looks like the Death Star in Star Wars?

a. Mimas.
b. Hyperion.
c. Iapetus.
d. Titan.
e. Enceladus.

_____ 21. Portions of the surface of which moon of Saturn most closely resemble Europa?

a. Triton.
b. Titan.
c. Iapetus.
d. Miranda.
e. Enceladus.

_____ 22. Which of the following techniques have **NOT** been used to learn what is underneath the clouds of Titan?

a. Imaging at near-infrared wavelengths where Titan's atmosphere is transparent.
b. Radar imaging using a transmitter and receiver on Cassini.
c. Mapping the strength and direction of Titan's magnetic field.
d. Following the motion of Cassini as it passes by to probe the gravitational field.
e. All of the above.

_____ 23. Which of the following moons has geysers ejecting water into space?

a. Hyperion.
b. Mimas.
c. Titan.
d. Iapetus.
e. Enceladus.

_____ 24. Which of the following statements about the atmosphere of Titan is **FALSE**?

a. The upper atmosphere consists of a haze of hydrocarbon aerosols.
b. The dominant constituent is nitrogen.
c. It contains clouds of methane and related hydrocarbons.
d. The atmospheric pressure at the surface is similar to that of Mars.
e. None of the above.

_____ 25. How many spacecraft have gone into orbit around Neptune?

a. None.
b. One.
c. Two.
d. Three.
e. Four.

_____ 26. Which of the following moons is believed to resemble Pluto most closely?

a. Miranda.
b. Enceladus.
c. Iapetus.
d. Triton.
e. Proteus.

_____ 27. How many moons have been detected orbiting Uranus?

a. Nine.
b. Twelve.
c. 27.
d. 61.
e. 146.

_____ 28. Which of the following is believed to be a captured moon?

a. Ariel.
b. Miranda.
c. Triton.
d. Callisto.
e. Ceres.

_____ 29. Which of the following is the weakest argument for Pluto as a member of the Kuiper Belt?

a. Pluto is smaller than Triton, which may have also originated in the Kuiper Belt.
b. Pluto grows a coma and a long tail when it is at the point in its orbit closest to the Sun.
c. Pluto's composition is similar to that of other known Kuiper Belt objects.
d. Pluto is not the largest object orbiting beyond Neptune.
e. Pluto's orbit is similar to the orbits of other known Kuiper Belt objects.

_____ 30. Which of the following statements about Centaurs is **FALSE**?

a. They can be over 200 km across.
b. They are in unstable orbits.
c. They could be described as oversized comets.
d. They orbit the Sun between Jupiter and Neptune.
e. None of the above.

_____ 31. The diameters of Trans-Neptunian Objects measured with the *Spitzer Space Telescope* tend to be larger than estimates at optical wavelengths, because ...

a. the albedos tend to be lower than expected.
b. the objects are hotter than expected.
c. the distances are smaller than expected.
d. of the higher cratering rates beyond Neptune.
e. the surfaces involved have fewer craters.

_____ 32. Why can't Neptune alter Pluto's orbit around the Sun?

a. Pluto is always much further from the Sun than Neptune.
b. Pluto is in an orbital resonance with Neptune that ensures they are never close to each other.
c. Pluto and Neptune orbit in different planes.
d. Pluto's orbit never comes anywhere close to Neptune's orbit.
e. Actually, a collision of the two is inevitable within the next billion years.

_____ 33. What is Pluto's moon Charon thought to have in common with our own Moon?

a. It has the same average density.
b. It has the same basic composition.
c. It has the same approximate mass.
d. It probably formed as a result of a giant impact on the object it now orbits.
e. All of the above.

_____ 34. Which of the following statements about the tails of comets is **FALSE**?

a. They can point in the direction that comets are moving.
b. Comets usually have two tails.
c. They are composed of many small particles and molecules of gas.
d. They usually appear when comets are in the inner Solar System.
e. None of the above.

_____ 35. The nucleus of a comet ...

a. could be described as a dirty snowball.
b. is usually irregularly shaped.
c. typically has a surface with both craters and recent signs of activity.
d. vents gas and dust when it is close to the Sun.
e. All of the above.

_____ 36. The dust tails of comets point away from the Sun because ...

a. comets are always moving toward the Sun.
b. radiation pressure pushes directly away from the Sun.
c. the magnetic fields of comets always point away from the Sun.
d. comets are always moving away from the Sun.
e. the dust always falls behind the comet in its orbit around the Sun.

_____ 37. How does the Nebular Theory for the formation of the Solar System explain the Oort Cloud?

a. Objects in the Oort Cloud would have formed a planet, but were prevented from doing so by Jupiter.
b. The Oort Cloud contains those objects which inherited the orbits of objects formed as they fell to center of the collapsing dust cloud.
c. The Oort Cloud contains the fragments of massive ice giants destroyed in collisions with Jupiter.
d. Objects in the Oort Cloud have been captured by the Sun after it formed.
e. None of the above.

_____ 38. Which of the following objects would have formed in a gravitational instability?

a. Ceres.
b. Saturn.
c. Mercury.
d. Earth.
e. Charon.

_____ 39. How does the Nebular Theory for the formation of the Solar System explain the orbital properties of the major planets?

a. They were ejected by a rapidly spinning Sun as it formed.
b. They formed in a disk which developed around the forming Sun.
c. They were captured by the Sun after it formed.
d. They formed after a near collision with another star which pulled material off of the Sun.
e. None of the above.

_____ 40. What is the major difference between objects in the Kuiper Belt and objects in the Main Asteroid Belt?

a. Objects in the Kuiper Belt are mixtures of ice and rock, while objects in the Asteroid Belt are predominantly rock or rock and metal.
b. Objects in the Kuiper Belt can have orbits which are inclined up to 90° to the plane of the Solar System
c. Objects in the Asteroid Belt frequently have retrograde orbits, but objects in the Kuiper Belt are usually in prograde orbits.
d. Most objects in the Asteroid Belt are between Mars and Jupiter, while most objects in the Kuiper Belt are between Saturn and Uranus.
e. All of the above are true.