

Exam 02: Chapter 04–08

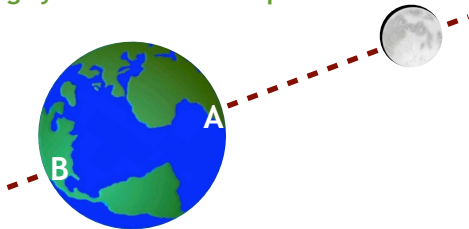
For questions 1–10, use the following multiple choices:

- A) This is a typical characteristic of the terrestrial planets.
 B) This is a typical characteristic of the jovian planets.
 C) This is a typical characteristic of a comet.
 D) This is a typical characteristic shared by both terrestrial and jovian planets.
 E) This is *not* a typical property of planets or comets found in the solar system!
- Heavy iron-nickel core.
 - Small mass but high density.
 - Rocky (low metal) core.
 - Large mass but low density.
 - Highly eccentric orbit.
 - Composition mainly water ice.
 - Differentiated internal structure.
 - Low eccentricity orbit.
 - Prograde rotation and revolution.
 - Highly developed intelligent lifeforms.
11. The density of water is 1 g/cm^3 (1000 kg/m^3). If someone told you that a planet had a density of 5.5 g/cm^3 , or 5500 kg/m^3 , you would guess that the planet was located
- in the Oort cloud.
 - in orbit around Jupiter.
 - in the asteroid belt.
 - in the outer solar system with the jovian planets.
 - in the inner solar system with the terrestrial planets.
12. The density of water is 1 g/cm^3 (1000 kg/m^3). If someone told you that a planet had a density of 1.6 g/cm^3 , or 1600 kg/m^3 , you would guess that the planet was located
- in orbit around the Earth.
 - in the asteroid belt.
 - in the inner solar system with the terrestrial planets.
 - in the outer solar system with the jovian planets.
 - anywhere at all; there is no correlation between an object's density and its location.
13. True or **false**: If you gathered up all the asteroids in the asteroid belt and stuck them together, you would have a planet about as big (massive) as the Earth.
14. Asteroid composition is predominantly
- rocky, with occasional traces of ice.
 - gaseous, resembling Jupiter on a smaller scale.
 - metallic. They are generally solid iron, with maybe traces of ice on the surface.
 - liquid water. We know this because when an asteroid hit the earth 65 million years ago, the water it brought created Earth's oceans.
 - potatoes. A few asteroids are more turnip-like, but they are all starchy tubers.
15. Meteor showers are
- caused by the earth passing near the orbit of an old short-period comet.
 - caused by the earth passing near the orbit of an earth-grazing asteroid.
 - usually annual events, as the orbits again intersect.
 - Both A and B are correct.
 - Both A and C are correct.
16. Why do all of the planets orbit the sun in the same direction?
- They don't. Venus and Uranus orbit the sun in a retrograde direction.
 - This is an illusion created by the motion of the Earth. The planets simply *appear* to move around the sun, but they do not *actually* move around the sun.
 - Coincidence. They all travel the same direction around the sun, but not for any specific physical reason.
 - It's the law: Conservation of Angular Momentum.
17. Most of the extrasolar planets found so far were detected by
- starlight reflected by their surfaces.
 - eclipses when the planets block the light of their parent stars.
 - the planets' changing phases as they orbit their stars.
 - detecting the oxygen in their atmospheres spectroscopically.
 - the "wobble" of their parent stars using spectroscopy.
18. Which of the following statements about the extrasolar planets found to date is **not true**?
- More than 850 exoplanets are known to exist.
 - In 2009 alone, the discovery of more than 70 new exoplanets has been announced.
 - Few exoplanets can be found by direct imaging, since they are so small and so faint.
 - Some are so close to their stars that their periods are just a few days.
 - All known exoplanets are terrestrial, comparable in size and composition to Earth.

For questions 19–27, use the following multiple choices:

- A) This is characteristic of the Earth only.
- B) This is characteristic of the Moon only.
- C) This is a common characteristic shared by both the Earth and its Moon.
- D) This is not typically characteristic of either the Earth or its Moon.

- 19. Young, geologically active surface.
- 20. Magnetic field.
- 21. Presence of liquid water on the surface.
- 22. Presence of water in the form of ice.
- 23. Experiences tidal forces.
- 24. Lack of magnetic field.
- 25. Ancient cratered surface.
- 26. Thick CO₂ atmosphere.
- 27. Ring system and storm spots.



28. True or **false**: On the figure of the Earth to the **left**, the gravitational force on Person A due to the moon is the same as the gravitational force on Person B due to the moon.
29. When would you expect to see a spring tide, or highest high tide?
- A) **When the moon is new or full.**
 - B) When the moon is new or full, but only during the spring months.
 - C) When the moon is new or full, but only at sunrise or sunset.
 - D) When the moon is in its 1st or 3rd quarter.
 - E) Never; a “neap tide” is an old sailor’s term for low tide that leaves a ship grounded.
30. When would you expect to see a neap tide, or lowest high tide?
- A) When the moon is new or full.
 - B) When the moon is new or full, but only during the winter months.
 - C) When the moon is new or full, but only at sunrise or sunset.
 - D) **When the moon is in its 1st or 3rd quarter.**
 - E) Never; a “neap tide” is an old sailor’s term for low tide that leaves a ship grounded.
31. Because the Earth rotates faster than the moon moves along its orbit,
- A) **the moon tugs “backwards” on the earth’s tidal bulge, slowing the earth’s rotation slightly.**
 - B) the moon pushes “forward” on the earth’s tidal bulge, speeding up the Earth’s rotation slightly.
 - C) the Earth experiences exceptionally high ocean tides every day at noon.
 - D) the Earth experiences no ocean tides when the moon is new or full.
 - E) the sun does not pull on the Earth as hard as it pulls on the Moon. This will result in the Moon slowly getting closer and closer to the sun while the Earth moves farther and farther away from the sun.
32. It takes 27.3 days for the moon to complete one orbit with respect to the Earth. How long does it take for the moon to complete one rotation on its axis?
- A) 24 hours
 - B) 24 days
 - C) **27.3 days**
 - D) 365 days
33. Compare the near side and far side of the moon.
- A) Both sides are just a cratered mess. There is no way to make sense or pattern out of the random cratering that covers the moon.
 - B) Both sides are cratered, but the far side of the moon is a much younger surface. You can tell because the craters on that side have less erosion.
 - C) **The near side has smooth, dark maria that are lacking on the far side. The cratered far side has much more rugged terrain.**
 - D) Both sides show a fairly even distribution of craters and maria. If you weren’t told which side was which, you could not really tell them apart in photographs.
34. The lunar maria
- A) are more cratered, and therefore older, than the lunar highlands.
 - B) **have less cratering, and are a younger surface than the highlands.**
 - C) are no different from the the highlands. The dark color is a different type of rock, but the terrain is the same age as the highlands.
 - D) are clear evidence for a watery past. Long ago, the moon had large lakes and seas of liquid water. The maria are the dry seabeds.

35. The best explanation for the formation of the moon is the **Giant Impact Hypothesis**. Which of the following statements does *not* support this idea?
- A) The Moon is very large in size and mass, compared to the Earth.
 - B) The density of the Moon is slightly lower than the density of the Earth.
 - C) The Moon has a smaller proportionally smaller core than the Earth.
 - D) Computer models illustrate the plausibility of a collision resulting in moon formation.
 - E) **Every planet in the solar system has some kind of system of moons, so moons just naturally form around planets all the time.**


Use the following multiple choices to answer questions 36–40:

- A) **This describes the planet Mercury.**
 - B) **This describes the planet Venus.**
 - C) **This describes the planet Mars.**
 - D) **This is true for all terrestrial planets.**
36. **Currently active volcanoes are very likely.**
37. **Home to the largest volcano in the solar system, but it is not currently active.**
38. **Metallic core containing iron and nickel.**
39. **Crushing atmospheric pressure, ninety times as great as Earth.**
40. **One solar rotation takes 176 days, or two full revolutions.**
41. The terrain on Mercury most closely resembles
- A) the Earth.
 - B) **the Earth's Moon.**
 - C) Jupiter's moon Io.
 - D) Saturn's moon Titan.
 - E) Neptune's moon Triton.
42. The rotation of the planet Venus
- A) is synchronous. It takes Venus the same amount of time to spin once on its axis as it takes to complete one orbit.
 - B) is very similar to the Earth. One day on Venus is 24.7 hours, just a little longer than an Earth day.
 - C) is extremely fast. Venus rotates on its axis once every 10 hours.
 - D) **is extremely slow. One rotation of Venus takes 243 days, and Venus spins in a retrograde direction.**
 - E) cannot be measured. The cloud layer is far too thick, and nothing is known about the surface of the planet.

43. The Valles Marineris on Mars
- A) is about the same size the Grand Canyon.
 - B) is a river canyon resulting from millennia of water erosion.
 - C) is a flat basalt plain covering Mars' northern hemisphere, much like the lunar maria.
 - D) is a group of large, active volcanoes near the martian equator.
 - E) **is an enormous crack in the Martian crust, dwarfing the Grand Canyon. Some features appear water-related, but the formation was not due to erosion.**
44. Which of the following is *not* evidence that there has been, and still is, water (liquid and ice) on Mars?
- A) Spectroscopic analysis shows polar caps contain water ice.
 - B) Geologic surface features on Mars look very much like surface features on Earth that are known to have been created by flowing water.
 - C) Hematite, an iron oxide that forms only in the presence of liquid water, has been detected on the Martian surface.
 - D) **Spectroscopic analysis of the atmosphere reveals that it is 95% water vapor.**
 - E) The Phoenix lander literally dug below the Martian surface and struck ice.

Answer questions 45–52 using the following multiple choices:

- A) **This describes Jupiter or Saturn.**
 - B) **This describes Uranus or Neptune.**
 - C) **This is typical of all of the jovian planets.**
 - D) **This is not a property of jovian planets.**
45. **An extensive ring system easily visible using ground-based telescopes (under good conditions, visible using simply binoculars!).**
46. **Sulfur compounds make the cloudy surface appear yellow/gold/orange in color.**
47. **Color chemistry (visual appearance) dominated by the presence of methane.**
48. **Extreme axial tilt results in retrograde rotation.**
49. **Low density indicates a composition of predominantly hydrogen.**
50. **Large storm spots and differential rotation.**
51. **No moons orbiting the planet.**
52. **Retrograde orbit around the sun.**
53. How long has Jupiter's Great Red Spot been there?
- A) For about 30 years. It was first "spotted" by Voyager 1 in 1979.
 - B) Forever. Astronomers have proven that the spot has existed since the planet formed.
 - C) **Unknown. Galileo first observed the spot, but no one has any way to know how long it was there before he saw it!**

54. What causes the pattern of belts and zones visible on both Jupiter and Saturn?
- It's a fashion statement. Belts are very popular this year.
 - The pattern is very random. It just happens to look like dark and light bands to us right now, but that could change at any time into something totally random.
 - These are tidal in nature. They result when the large moons pull on the area of the planet near its equator, creating a light-colored tidal bulge.
 - The warmer zones rise, the cooler belts sink. This is convection in the atmosphere.**
55. What was significant about the discovery of the planet Uranus?
- This existence of the planet was predicted, and its location was accurately calculated, before it was located telescopically.
 - It was the first planet discovered by direct observation using a telescope.**
 - Nothing. Neptune is visible to the naked eye, and the fact of its existence has been known since prehistoric times.
 - It was purely accidental. An astronomer studying photographic plates just happened to see it when he compared two exposures and saw an object appear to move.
56. What was significant about the discovery of the planet Neptune?
- This existence of the planet was predicted, and its location was accurately calculated, before it was located telescopically.**
 - It was the first planet discovered by direct observation using a telescope.
 - Nothing. Neptune is visible to the naked eye, and the fact of its existence has been known since prehistoric times.
 - It was purely accidental. An astronomer studying photographic plates just happened to see it when he compared two exposures and saw an object appear to move.
57. The cores of the jovian planets are most likely
- hydrogen, since the planets are almost entirely hydrogen to begin with.
 - a mix of rocky and icy material. These planets are just a little too dense to have hydrogen at their cores.**
 - iron and nickel, like the terrestrial planets. Planets always accrete around a core of metallic elements.
 - smaller jovian planets. Like those Russian matryoshka dolls: inside the doll, there's another one, just smaller. Inside that one, there's another even smaller one, and so on. That's just how it is with the gas giant: planets inside of planets.
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58. For the jovian planets, the Roche Limit is about 2.5x the planet's radius. What happens to an object that strays inside this limit?
- Tidal forces on the object due to the planet's gravity will literally tear it apart.**
 - Radiation from the planet will scour the object's surface, making it incapable of supporting life.
 - It will be accelerated rapidly, and the gravitational "slingshot" will shoot the object out of the solar system.
 - It will be decelerated until its period of rotation matches its orbital period. Everything within the Roche Limit must be in a synchronous orbit.
59. Saturn's F-ring is very narrow. The rings of both Uranus and Neptune are also narrow.
- This is because the particles are small. A broad or diffuse ring would be made of bigger pieces.
 - This is because the particles are more rocky than icy. Rings that are mostly ice tend to be very broad.
 - This is because the planets are small (compared to Jupiter). Bigger planets have broader rings.
 - This is because the rings have shepherd moons. Small moons on either side of the ring will keep the particles in a narrow region.**
60. **True** or false: All of the gas giant planets have ring systems.
61. **True** or false: Jupiter's moon Io has active volcanoes.
62. **True** or false: Jupiter's moon Europa has liquid water beneath its solid icy surface.
63. True or **false**: Saturn's moon Titan has lakes of liquid water on its surface.

64. Why is Pluto no longer classified as a major planet?
- Because the other planets are just *mean*.
 - Because its moon, Charon, is too large. None of the major planets have large moons.
 - Because it has no rings. A major planet must have a ring system.
 - Because it has an unknown composition. Until we can tell if its rocky or icy, we cannot classify it.
 - Because it shares more properties with Kuiper Belt Objects located in the outer solar system.**
65. How was Pluto discovered?
- It wasn't exactly "discovered." It is easily visible to the naked eye, and has been known since ancient times.
 - Percival Lowell predicted its existence, and Clyde Tombaugh located it on photographic plates in 1930.**
 - Amateur astronomers Eugene Shoemaker and David Levy were observing Jupiter in the early 1990s, and Pluto just happened to also be in their field of view.
 - In the 1840s, Englishman John Adams and Frenchman Urbain LeVerrier had a contest going: whoever did not discover a new planet had to buy the beer. Ok, the beer part is not true, but the contest part is.
 - Pluto is so small and so dim that it took a major search using both the Hubble and Spitzer Space Telescopes to locate it.
66. It's been an exciting semester for astronomy. Which of the following has *not* happened since the beginning of the semester?
- NASA crashed a pair of probes into the moon. On purpose.
 - The Russians announced plans to return to the planet Venus. Again.
 - The European Southern Observatory announced the discovery of 32 new extrasolar planets.
 - Astronomers at JPL using the HST and SST discovered water, methane, and carbon dioxide in the atmosphere of an exoplanet.
 - Comet Elenin disintegrated, and was no longer visible as it made its closest approach to Earth on October 16.
 - NASA launched GRAIL, a pair of probes to orbit the moon and map its gravitational field.
 - A type Ia supernova exploded in the Pinwheel Galaxy, 21 million light years from the Earth. At its peak brightness in September, it was visible using binoculars.
 - The Nobel Prize in Physics 2011 was awarded to Saul Perlmutter, Brian Schmidt, and Adam Riess for the discovery of the accelerating expansion of the universe through observations of distant supernovae.
 - An enormous new ring was discovered around the planet Saturn.
 - An Earth-sized planet was discovered orbiting Alpha Centauri B, just over 4 light years from the Earth.
 - Increasing solar activity has resulted in spectacular northern lights, or aurorae, visible as far south as the mid-continental US.
 - The Curiosity rover discovered an ancient stream bed on Mars, evidence for the past existence of flowing water on the surface.
 - A small comet crashed into Jupiter. The impact was initially reported by and confirmed on video taken by amateur astronomers.
 - A mysterious alien black monolith was discovered on the moon, and another one was found orbiting Europa.**