ASTRONOMY 101, SECTION 004
Spring, 2018
Second Hour Examination

Print Your Name: _____ SID _____

Please legibly write your name and student ID on this answer sheet and print your name on your test.

Now you are ready to begin the test. For each question, select the one ***best*** answer and write it on your answer sheet. Ensure that the number of your answer corresponds to the number of the question.

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Feel free to mark your test, including eliminating answers, doing calculations or estimates, and especially making drawings. You must hand in your test and answer sheet before leaving the test site.

There 80 are multiple choice questions. Mark the best answer A - D. One questions requires a written response, please use the back of your answer sheet.

A proctor will be available to answer questions. You are on your honor as a lady or gentleman not to cheat on this test.

1. The major constituents of the Earth's atmosphere are
    A) methane, ammonia, water vapor, and carbon dioxide in about equal amounts.
    B) 77% nitrogen, 21% oxygen.
    C) 77% oxygen, 42% nitrogen.
    D) 95% carbon dioxide and some water vapor.

2. The presence of oxygen in Earth's atmosphere is thought to result directly from what type of process?
    A) volcanic eruptions
    B) condensation of interplanetary gas clouds
    C) outgassing of the oceans
    D) biological activity of plants and animals

3. The atmospheric gases primarily responsible for the greenhouse effect are
    A) carbon monoxide and argon.
    B) hydrogen and helium.
    C) oxygen and carbon monoxide.
    D) water vapor and carbon dioxide.

4. What protects us from the damaging radiation effects of the high-speed solar wind of **charged** particles, principally electrons and protons, that flows through interplanetary space?
    A) the Earth's magnetic field
    B) the Moon, whose gravitational field shields us from the solar wind
    C) Earth's atmosphere
    D) the rapid rotation of the Earth, which deflects most of the solar wind

5. Which major constituent of the atmosphere of Earth is not present in Venus and Mar's atmosphere?
   A) carbon dioxide, CO_2
   B) oxygen, O_2
   C) methane, CH_4
   D) nitrogen, N_2

6. One distinct difference between Earth and its neighboring planets, Venus and Mars, is the presence of
   A) volcanic activity both earlier in its history and at present times.
   B) liquid water on its surface and water molecules chemically locked into rocks.
   C) a gaseous atmosphere.
   D) desert regions.

7. Which of the following roles played by the massive rain forests of Earth is the most important in the maintenance of the entire world's living environment?
   A) absorption of H_2O as rain and the production of vital timber for fuel and other uses
   B) absorption by plants and trees of CO_2 and production of O_2, renewing our atmosphere and reducing the greenhouse effect
   C) support of a vast variety of wildlife, which is essential for the maintenance of an adequate gene pool for mammals and insects on Earth
   D) absorption of sunlight and the prevention of its reflection back into space, preventing massive worldwide cooling

8. Which of the following areas of human endeavor and development is having an impact on Earth at the present time?
   A) rapid increase in human population
   B) use of carbon dioxide emitting fossil energy sources like coal and natural gas
   C) destruction of Earth's massive rain forests
   D) all of the above

9. We need the ozone layer because it
   A) protects us, using its magnetic field, from the electrons and protons of the solar wind.
   B) shields us from harmful cancer causing solar ultraviolet radiation.
   C) provides a convenient dumping site for chlorofluorocarbon chemicals that are harmful to life.
   D) allows long-distance radio communication by reflecting radio waves back to Earth's surface.

10. Although the greenhouse effect can lead to unlivable hot environments like the surface of Venus, Earth's greenhouse effect currently traps enough heat to allow for
   A) an abundance of oxygen needed for life.
   B) liquid water.
   C) plate tectonics and volcanic activity.
   D) the formation of complex molecules needed for the formation of life.

11. If no greenhouse effect occurred on Earth, what would Earth look like today?
   A) hot and arid
   B) A nitrogen based life form would of taken over replacing carbon based life.
   C) too cold for liquid water to exist
   D) Plate tectonics would of never started, thus Earth would be very flat like the Great Plains.

12.Earth's magnetic field originates in

A) a solid, permanently magnetized core in the interior of Earth.
B) intense electric currents flowing in the Van Allen belts within the magnetosphere of Earth.
C) the tidal ebb and flow of electrically conducting seawater in Earth's oceans.
D) slowly moving currents of molten iron which produce electric currents in the deep interior of Earth.

13.On Earth, the majority of earthquakes occur

A) along the zone of maximum tidal stress around the equator.
B) in the Arctic and Antarctic regions.
C) in the centers of tectonic plates (e.g., North American continent).
D) along the boundaries of major tectonic plates.

14. The tides of Earth's oceans are caused by

A) tidal forces from the massive Jovian planets.
B) tidal forces from the local terrestrial planets
C) tidal forces from the Moon and the Sun.
D) Earth's rapid rotation.

15. Extremely high and low tides occur when

A) the moon is between the sun and the earth (new moon).
B) the moon and the sun are out of line by 90^{o}.
C) the moon and the sun are out of line by 45^{o}
D) the moon and the sun are out of line by 30^{o}

16. Tidal forces occur when

A) gravity's pull is stronger on one side of an object and weaker on the other side.
B) gravity is pulling on a gaseous object like Saturn or Jupiter.
C) a gaseous object is rotating really fast.
D) many objects are in orbit around a much more massive object.

17. If astronauts set up a permanent settlement at Tranquility Base on the Moon (the site of the first lunar landing), how many times each year would Earth rise and set as seen by a resident of this base?

A) 13 times each year
B) once each year
C) never, Earth would remain motionless in the sky
D) 24 times each year

18. People on Earth see

A) only the sunlit side of the Moon.
B) the same side of the Moon at all times.
C) the entire Moon once each month as it rotates.
D) the entire surface of the Moon once per year as the Earth revolves around the Sun.

19. Which of these theories seems to *best* explain the Moon's origin?
    A) Impact Theory- Mars-sized object hit the forming Earth, ejecting material from the upper mantle which went into orbit around the Earth and coalesced to form the Moon.
    B) Capture Theory - The Moon was a stray body captured into orbit around Earth.
    C) Co-formation Theory- The Moon and the Earth formed out of the same material at the beginning of the Solar System.
    D) Fission Theory - The material that would be the Moon was thrown off the Earth and coalesced into a singled body.

20. What is the origin of the majority of lunar craters?
    A) impacts by space probes
    B) surface collapse after loss of groundwater by evaporation
    C) volcanic explosions
    D) impacts by meteoric material

21. About 3.9 billion years ago the heavy meteoritic bombardment ended in our solar system. The moon has smooth, dark regions called maria that do not show evidence of this heavy bombardment. Why is this?
    A) The maria regions are located on the dark side of the moon and thus were shielded from heavy cratering.
    B) Volcanic activity that created the maria smoothed over the heavy cratering.
    C) The moon has not yet completely formed and the cratering was lost when the moon coalesced.
    D) Pure luck allowed this part of the moon to avoid the biggest of the impacts.

22.The impact craters on Earth are younger than a few million years old, whereas ages of lunar craters extend back billions of years. Why is this?
    A) Earth escaped the heavy bombardment that pelted the Moon early in its history.
    B) Planet life has removed most signs of cratering.
    C) Human impact has removed most signs of cratering.
    D) Volcanic activity from plate tectonics has erased older craters on Earth, whereas this process never occurred on the Moon.

23. The surface gravity of the moon is 1/6 that of Earth. If Matt weights 120 lbs on Earth, how much does he weigh standing on the moon?
    A) 60 lbs (a half)
    B) 30 lbs (a third)
    C) 20 lbs (a sixth)
    D) 10 lbs (a twelfth)

24. Which of the following statements is true with regards to the accretion disk that was formed during our early solar system.
    A) As the disk condensed due to gravity, the gas heated up.
    B) As the disk condensed due to gravity, the disk rotated faster due to conservation of angular momentum.
    C) As the disk condensed due to gravity, dust grains within the nebulas gas were much more likely to clump up and thus form proto-planets.
    D) All of the above

25. Why are objects, like planets and asteroids, that are close to the sun deficient in water ice and ammonia ice while mostly being made of heavier materials like metals and silicates?
    A) Heavy materials like metals and silicates 'bullied' out the lighter ices
    B) It was too hot close to the sun for ices to exist
    C) Complex chemical reactions broke down most ices close to the sun.
    D) Metals and silicates weigh more and thus are more likely to form proto-planets due to a strong gravitational force.

26. The Kuiper Belt is found where in the solar system?
    A) beyond the orbit of Neptune
    B) among the orbits of the terrestrial planets
    C) between the orbits of Mars and Jupiter
    D) between the orbits of Jupiter and Uranus

27. The reason why Jovian planets are in general much larger than terrestrial planets is because:
    A) They were able to form much quicker because of the cooler temperature, thus gathered more of our solar system's accretion disk.
    B) There was more material to form planets farther from the Sun.
    C) They are much large in volume but actually have similar masses when compared to the terrestrial planets
    D) They are rotating much faster, thus were able to gather more material.

28. Why don't terrestrial planets have huge hydrogen and helium atmosphere like the jovian planets do?
    A) Those elements are not abundant where the terrestrial planets formed.
    B) They did at earlier times, but have since evaporated into space. **(seems correct but it is not)**
    C) They formed too slowly and were not able to capture much gas before it was blown away by strong solar winds.
    D) The hydrogen and helium were fused into the heavier element that are found in the crust.

29.Terrestrial planets are thought to have dense iron cores because
    A) the accumulation of material into planets in the original solar system nebula would have begun with the heavier elements, to be followed later by lighter materials.
    B) magnetism in iron would be sufficiently powerful to pull more iron into the center of the forming planet.
    C) thermonuclear processes produced iron in the earlier phases of planetary formation.
    D) in earlier molten states the heavy elements sank and lighter materials floated to the surface by chemical differentiation.

30. The definition of a planet set by the International Astronomical Union (IAU) does **not** include which of the following
    A) object orbits a Star
    B) has "cleared the neighborhood" around its orbit.
    C) must be equal to or more massive than Mercury
    D) has sufficient mass to assume hydrostatic equilibrium

31. Pluto, one of the largest Kuiper belt objects, is not considered a planet because
    A) it does not orbit a Star
    B) it has not "cleared the neighborhood" around its orbit.
    C) must be equal to or more massive than Mercury
    D) it does not have sufficient mass to assume hydrostatic equilibrium

32. The Oort cloud is
    A) a band of dust in the plane of the ecliptic, extending from the orbit of Mars to beyond the orbit of Pluto.
    B) an approximate spherical distribution of comets centered on the Sun, extending out to about 50,000 AU, or almost to the closest star.
    C) another name for the early solar nebula.
    D) a relatively flat distribution of comets in the plane of the ecliptic, extending from around the orbit of Pluto out to about 500 AU from the Sun.

33. The asteroid belt is most likely composed of
    A) icy fragments similar to the nuclei of comets.
    B) genuine leather.
    C) rocky debris left over from the formation of the solar system.
    D) the remnants of a gaseous planet disrupted by an impact.

34. Which of the following have an icy composition?
    A) most asteroids
    B) meteoroids
    C) comets
    D) the surface of Mars

35. Terrestrial planets formed to close to the Sun for liquids to survive, yet almost all terrestrial planets have water in one form or another. Where did they get this water?
    A) comet impacts.
    B) chemical synthesis.
    C) it was trapped underground since there formation.
    D) volcanic activity.

36. Which of the following is not a reasonable definition of the edge of our solar system?
    A) the edge of the heliosphere.
    B) the end of the Orrt cloud.
    C) the end of the Kuiper belt
    D) where the Sun's gravity stops.

37. In one orbit around the Sun, Mercury rotates around its axis (3:2 resonance)
    A) twice.
    B) 3 times.
    C) 1½ times.
    D) once, in a synchronous orbit.

38. The large number of impact craters on the surface of Mercury indicates that
    A) it has an internal magnetic field.
    B) the planet has been geologically dead for a long time.
    C) the Sun has been slowly chipping away at the surface.
    D) Mercury use to have several moons.

39. Mercury's average density is similar to that of Earth, even though its mass is 18 times less than Earth's mass. What conclusion can be drawn?
    A) Mercury must contain a greater proportion of heavier elements, particularly iron, in its interior.
    B) Mercury's rocks must have been compressed into a smaller volume by a massive impact with another object sometime in its history to form the higher density.
    C) A gravitational anomaly such as a black hole exists inside Mercury, similar to those detected among stars or at the centers of galaxies.
    D) Mercury must have a larger molten core than does Earth because liquid rocks are denser than solids at the pressures found inside planets.

40. Half way through the test! You can do it! If you were scared half to death twice you would…
    A) die!
    B) Nothing would happen, the two events would cancel out returning you to good health.
    C) be a quarter alive (½ * ½ = ¼)
    D) Gosh this is a hard freebee question, I'm going with answer (E)
    E) See answer (D)

41. There are very few impact craters on the surface of Venus compared to the surfaces of Mercury and Mars because
    A) ancient oceans washed away all the craters formed during the early bombardment phase.
    B) immense lava flows have obliterated all but the younger craters.
    C) plate tectonic motions have recycled the surface several times since the early bombardment period.
    D) wind erosion from its dense atmosphere and chemical action from its corrosive clouds have destroyed most craters.

42. Venus has the hottest surface temperature of any planet because of
    A) its high atmospheric oxygen content.
    B) its retrograde rotation.
    C) a runaway greenhouse effect.
    D) all of the above

43. The gas that is the major constituent of the atmospheres of Venus and Mars and a minor constituent of Earth's atmosphere is
    A) H_2O.
    B) N_2.
    C) CO_2.
    D) O_2.

44. Why did the Russian *Venera* series of spacecraft survive for only a few minutes on Venus's surface?
    A) They landed very fast because there was insufficient atmosphere to slow down their descent.
    B) Conditions of extreme pressure, corrosive atmosphere, and high temperatures caused severe damage.
    C) They were attacked and destroyed by native inhabitants, but the space agency is not telling the world of this.
    D) They landed in very rugged terrain and were not able to land upright; they became damaged when they toppled over.

45.Which of the following properties of Venus are very similar to those of Earth?

A) mass and radius, hence average density and surface gravity
B) temperatures of surface and atmosphere
C) length of solar day and angle of axial tilt
D) magnetic field and magnetosphere

46. Earth and Mars are very similar planets. Which of the following pairs of physical characteristics are most alike for these planets?

A) mass and radius, hence average density and surface gravity
B) temperatures of surface and atmosphere
C) length of solar day and angle of axial tilt
D) magnetic field and magnetosphere

47. Which of the two terrestrial planets have a magnetosphere?

A) Earth and Mercury
B) Mars and Venus
C) Venus and Mars
D) all terrestrial planets have a magnetosphere

48. Mars is the most explored planet other than Earth because of the

A) length of solar day and angle of axial tilt
B) proximity to Earth
C) evidence of liquid water in its past
D) all of the above

49. What evidence of liquid water on Mars has been found?

A) The creation of the massive Mariner Valley was due to flowing water.
B) The discovery of microbes that could of only survived in liquid water.
C) Erosion, like runoff channels and outflow channels, that could of been created by liquids.
D) The giant liquid oceans.

50. Where is the majority of water that once flowed on the surface of Mars?

A) In the atmosphere
B) It chemically evolved into heavier elements.
C) In a layer of permafrost below the surface **and** in the polar caps
D) Escaped the planets gravity

51. Mar's massive volcano, Olympus Mons, has very few impact craters. This suggests that

A) the volcano has been active in the recent past.
B) the volcano was formed well before heavy cratering occurred.
C) the volcano is made of the hardest material know to humanity.
D) Mars, in general, was able to avoid much of the heavy cratering that occurred elsewhere in the Solar System

52. Mars goes through season alike to Earth because of a similar solar day (24.65 hours) and a similar axial tilt (25^{o}). Because of this, Mar's polar caps grow and recess with the change of seasons. What is actually melting and freezing?

A) Water
B) Carbon dioxide
C) Liquid hydrogen
D) Methane

53. In terms of composition
    A) all planets are condensed from the same nebula and have similar compositions.
    B) the Jovian planets are more like the Sun than are the terrestrials.
    C) the terrestrials are more like the Sun, since they formed close to it.
    D) the Sun is unique, made of nothing but hydrogen and helium.

54. The two most common elements found in all jovian planets are
    A) Methane and Ethane
    B) Hydrogen and Helium
    C) Metals and Silicates
    D) Ices like H_2O and methane

55. Which of the following bulk characteristics do **not** describe the jovian planets when compared to the terrestrial planets
    A) strong magnetic field
    B) much more massive
    C) much more dense
    D) much colder surface temperatures

56. The rotation periods for the jovian planets—Jupiter, Saturn, Uranus, and Neptune—are
    A) incredibly short—between 1 and 2 minutes.
    B) very long—on the order of years because of the sizes.
    C) very short—about 10 to 20 hours.
    D) reasonably long—on the order of many Earth days.

57. Rings of dust and icy particles are found around which planets?
    A) all planets that have moons associated with them
    B) all four of the Jovian planets
    C) all four of the terrestrial planets
    D) only Saturn

58. Several of the jovian planets appear to be emitting more energy than they absorb from solar radiation. What is the reason for this?
    A) Rapid rotation is generating excess energy by friction between the planetary atmospheres and the interplanetary medium.
    B) Excess energy comes from impact energy of meteoroids hitting the planetary atmospheres.
    C) The solar wind deposits energy into the planetary atmospheres, and this energy is reradiated.
    D) They are still cooling and contracting from their original formation.

59.Which planet has wide, bright rings that are easily visible from Earth using a small telescope?
    A) Venus B) Jupiter C) Neptune D) Saturn

60. For someone standing on the visible surface of Jupiter, tomorrow's weather forecast is
    A) sunny, possible thin, high cloud.
    B) sunny and clear, because Jupiter has no atmosphere in which clouds can form.
    C) overcast, possible rain with snow at higher elevations.
    D) The question is meaningless, because there is no solid surface on which to stand.

61. Because of the fast rotation periods and gaseous interiors of Jupiter, Saturn, Uranus, and Neptune, they all experience differential rotation. Differential rotation means
    A) parts of the planet rotates in the opposite directions
    B) the equator of the planet does not rotate
    C) the planet rotates at different speed at different times of the year
    D) the equator of the planet rotates faster than the poles

62. Jupiter and the other jovian planets are noticeably oblate (flattened) because
    A) they all have strong magnetic fields that deform their shape.
    B) their powerful gravity acts stronger on the closer poles than the distant equator.
    C) they are fluid bodies that are spinning rapidly.
    D) they are tidally distorted by the pulls for their satellite systems.

63. The series of dark belts and light zones parallel to the equator seen on Jupiter are due to
    A) rapid rotation smearing out the cloud cover.
    B) strong convective currents generated from Jupiter's hot interior.
    C) complex chemical reaction that are temperature and pressure sensitive.
    D) all of the above

64. The Great Red Spot is
    A) a large, long-lived, high-pressure storm in Jupiter's atmosphere.
    B) the colored polar cap of Jupiter.
    C) clouds of dust-laden gas upwelling above the top of a massive mountain or a volcano on the planet's surface.
    D) a type of storm in Jupiter's atmosphere that can last for a few months at a time before disappearing.

65. Saturn and Jupiter's strong magnetic field are of thought to be generated by a
    A) liquid "metal" interior and relatively rapid rotation.
    B) solid iron core forming a permanent magnet.
    C) liquid "metal" core and a slowly rotating interior.
    D) solid interior throughout the planet and slow rotation.

66. Uranus is unique amongst the four Jovian planets because
    A) it was almost named George, after King George of England.
    B) it has no internal heat source.
    C) its spin axis is tilted on its side at 98 degrees relative to the ecliptic.
    D) all of the above

67. What give Uranus and Neptune their blue color?
    A) Both planets are very far from the Sun and are thus blue shifted.
    B) Both planets have a large liquid ocean.
    C) It is due to their high concentration of methane which absorbs long red wavelengths
    D) All of the above.

68.What are the most abundant gases in the atmosphere of Uranus?
    A) hydrogen and helium
    B) carbon dioxide and nitrogen
    C) nitrogen and ammonia
    D) methane and water

69. Neptune and Uranus do not have a high enough internal temperature/pressure to generate magnetic field like Saturn and Jupiter do, yet they still have strong magnetospheres. What is generating these magnetic fields?
    A) A conductive ammonia water slushy
    B) A solid rocky core similar to Earth.
    C) These fields are induced magnetic fields generated from the strong magnetic fields of Jupiter and Saturn.
    D) The highly charged solar wind that concentrates in the outer solar system.

70. 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 solar wind
    C) a major collision with another planet-like body
    D) tidal distortion and deflection caused by neighboring planets

71. Which of the following would explain how we know that all jovians have a solid core?
    A) Earthquakes measured on the surface indicate a solid interior.
    B) Radar cannot penetrate the interior, thus something solid much be at the center.
    C) The oblateness would be much more pronounced if a solid core was not there.
    D) Strong magnetics fields indicate a liquid iron core.

72. What does it mean that the first three Galilean moons, Io, Europa, and Ganymede, in increasing distance from Jupiter, are in a 4:2:1 resonance?
    A) Ganymede orbits twice as fast as Europa and four times as fast as Io.
    B) Io orbits twice as fast as Europa and four times as fast as Ganymede.
    C) Europa orbits twice as fast as Io and four times as fast as Ganymede.
    D) Io orbits twice as fast as Europa and twice as fast as Ganymede.

73. If you were on rotationally tidally locked Io, how often would Jupiter pass by overhead?
    A) Io's orbital period is 1.76 days, so once every 1.76 days.
    B) Because of orbital resonances, it would be 2*1.76 = 3.55 days
    C) Because of orbital resonances, it would be ½ *1.76 = 0.88 days
    D) It would never pass overhead. Jupiter would remain in one spot in the sky.

74. Orbital resonances often perturb tidal locking which can lead to tidal heating. Tidal heating occurs when
    A) the tidal bulge moves back and forth across the surface because the moon's orbital speed is not constant. This movement causes friction in the crust and thus heats the moon.
    B) the exterior of the moon becomes hotter than the interior.
    C) orbital resonances continuously accelerate orbital motion.
    D) tidal locking becomes so tight that not even atmosphere can escape the moon.

75. What is thought to be the cause of Io's volcanoes?
    A) Jupiter's magnetosphere and its trapped charged particles
    B) energy, in the form of heat, emitted by Jupiter
    C) gravitational tidal heating from both Jupiter and Europa
    D) solar radiation focused by Jupiter's gravity

76. The surface of Europa is most like the Earth's
A) tundra.
B) deserts.
C) Arctic Ocean.
D) Himalayan peaks.

77. The weak induced magnetic fields around Europa and Ganymede are evidence of
A) a small liquid iron core.
B) how massively strong the magnetic field of the Sun is.
C) salty liquid water under the icy surface.
D) an unknown scientific phenomenon.

78. Saturn's largest moon, Titan, has a geological young surface because
A) it was recently formed.
B) of severe impacts.
C) of weather like rain and wind.
D) intense volcanic activity.

79. On Titan, the lakes are made mostly of liquid
A) water.
B) argon.
C) methane.
D) metallic hydrogen.

80. The main element in the atmosphere of Titan, which is the same as Earth, is
A) oxygen.
B) argon.
C) hydrogen.
D) nitrogen.

81. In complete English sentences, explain what planet or moon in our Solar System, other than the Earth, would be best suited for humans to settle. Give at least four reasons, based on scientific evidence, why this planet or moon allows for human life. Feel free to be creative, but **please** be factual. Use the back of your answer sheet to finish this question. (4 points)