ASTR 138 Fall 2017 Exam 3 – 11/16/2017

Wien's Law: $\lambda_{max} = C / T$, where C = 2,900 in units of (micrometers*Kelvins degrees)
Newton's Universal Law of Gravitation: Force of Gravity = $G M_1 M_2 / R^2$

1) An observer vacations in Calgary, Alberta on the 51˚ north latitude line and goes star gazing. How many degrees above the horizon is the north star?
   a) It is not visible; it is below the horizon
   b) 23.5˚
   c) 69˚
   d) 0˚
   e) 51˚
2) An observer is located in Caracas, Venezuela, at +10.5˚ (north) latitude. Can the observer see the north celestial pole?
   a) Yes
   b) No
   c) Sometimes
3) The same Venezuelan observer plants a vertical pole and watches the shadow cast by the sun over the course of a year. When does the pole cast no shadow at noon?
   a) Never. It always casts a shadow.
   b) Twice yearly, on the equinoxes
   c) Twice yearly, between the equinoxes and the Dec 21 solstice
   d) Twice yearly, between the equinoxes and the June 21 solstice
   e) Once yearly, near December 21
4) Which person sees the most circumpolar stars?
   a) The Venezuelan (10˚ N. latitude)
   b) The Costa Rican (20˚ N. latitude)
   c) The Texan (32˚ N. latitude)
   d) The Alaskan (58˚ N. latitude)
5) Lunar eclipses (moon goes faint and reddish in color) occur during lunar phase
   a) new
   b) first quarter
   c) full
   d) last quarter
6) How much time elapses between a star's rising time and setting time?
   a) Less than 12 hours
   b) 12 hours
   c) More than 12 hours
   d) It depends on the star
7) On the celestial sphere, the zero of the *declination* coordinate is located at
   a) the celestial equator
   b) the vernal equinox
   c) the celestial north pole
   d) the celestial south pole

8) An atom goes from a highly-excited state to a less-excited state.
   a) A photon is absorbed by the atom.
   b) A photon is emitted by the atom.
   c) No photons are involved in this process.
9) On January 1, a careful observer notes the exact compass point on the horizon where the sun rises. A few days later, the sun rises
   a) at an azimuth further north
   b) at the same place
   c) at an azimuth further south
10) On July 17, a careful observer notes the exact point on the horizon where the star Altair rises. On July 24, Altair rises at
   a) an azimuth further north
   b) the same place
   c) an azimuth further south
11) If the earth's orbit were exactly circular instead of elliptical, would the heat and cold of the seasons be different?
   a) the seasons would be more intense (greater hot-to-cold swings)
   b) the seasons would remain about the same as they are now
   c) the seasons would be less intense
12) If the earth's axial tilt was changed from 23.5˚ to 13.5˚,
   a) the seasons would be more intense
   b) the seasons would remain about the same as they are now
   c) the seasons would be less intense
13) An gamma-ray telescope should probably be placed
   a) underground
   b) on the ground
   c) in space
14) What sort of light has the shortest wavelength?
   a) Radio waves
   b) Infrared light
   c) X rays
   d) Visible light
   e) Microwaves
15) Which wavelength regime contains potentially ionizing photons?
   a) Microwave
   b) Infrared
   c) Visible
   d) X-rays
   e) Radio
16) What sort of light travels the fastest?
   a) a laser beam
   b) a radio wave
   c) both travel the same speed.
17) What coordinates are most useful for locating things in the sky in the here-and-now?
   a) right ascension and declination
   b) x and y
   c) longitude and latitude
   d) azimuth and altitude

18) What item in this list is not part of “local” coordinates?
   a) meridian
   b) N, S, E, and W compass points
   c) zenith
   d) vernal equinox
   e) nadir
19) What is the ecliptic?
   a) the plane of the earth and the moon
   b) the plane of the earth and the sun
   c) the plane of the earth's equator
   d) the average plane of the solar system
20) What is the obliquity of the earth, also known less precisely as its “tilt?”
   a) 0˚
   b) 15˚
   c) 23 ½ ˚
   d) 45˚
   e) 66 ½ ˚
21) The obliquity of the earth is the angle between which two planes?
   a) celestial equator, moon's orbit
   b) prime meridian, celestial equator
   c) azimuth, altitude
   d) ecliptic, celestial equator
22) During a crescent moon, what causes the dark portion?
   a) Sunlight does not strike that portion
   b) The earth casts a shadow on the moon
   c) The dark portion does not exist. Only the crescent physically exists.
23) Spring tides occur during lunar phase
   a) first quarter
   b) full
   c) last quarter
24) When is a new moon on the meridian (high in the sky, exactly south)?
   a) noon
   b) 6 pm
   c) midnight
   d) 6 am
25) When is a third quarter moon on the meridian?
   a) noon
   b) 6 pm
   c) midnight
   d) 6 am
26) About how long does it take Uranus to orbit the sun once?
   a) 1 earth day
   b) 1 earth year
   c) 30 earth years
   d) 84 earth years

27) At about what wavelength does the earth, at roughly 290 Kelvin, emit most of its light?
   a) 290 Kelvin
   b) 0.1 micrometer
   c) 1 micrometer
   d) 10 micrometer
   e) 100 micrometer
28) Earth emits most of its thermal radiation in the
   a) Ultraviolet
   b) Visible
   c) Infrared
   d) Radio
29) Molecules of water and carbon dioxide are important for the greenhouse effect on earth. What sort of spectrum do these molecules exhibit?
   a) thermal
   b) blackbody
   c) line
   d) Doppler
30) An atom with all its electrons, but one electron is elevated to a high energy level, is termed
   a) excited
   b) ionized
   c) neutral
   d) auroral
31) An X-ray photon _____ a visible light photon.
   a) is less energetic than
   b) is more energetic than
   c) has the same amount of energy as
32) Chronologically first, this Renaissance thinker published a fairly detailed sun-centered cosmology that was influential for later scientists. He was a Polish cleric. He was
   a) Kepler
   b) Galileo
   c) Tycho
   d) Copernicus
   e) Newton
33) This Danish gentleman was the most able naked-eye observer of his day. His catalog of planet positions was used by another to find the true shape of planetary orbits. He was
   a) Kepler
   b) Galileo
   c) Tycho
   d) Copernicus
   e) Newton
34) This English genius co-invented calculus. He might not have published his law of universal gravitation if it had not been for the encouragement of Sir Edmund Halley. He was
   a) Kepler
   b) Galileo
   c) Tycho
   d) Copernicus
   e) Newton

35) If all the water vapor were somehow removed from the earth's atmosphere (this is a thought experiment), the average earth temperature at ground level would
   a) decrease
   b) stay the same
   c) increase
36) Which gas is the most effective "greenhouse gas" in the earth's atmosphere as it exists now, averaged over time and area?
   a) nitrogen
   b) ozone
   c) carbon dioxide
   d) water vapor
   e) methane
37) Which layer of earth's interior gets the "most liquid" award?
   a) inner core
   b) outer core
   c) mantle
   d) crust
38) Most of Uranus and Neptune (except for the outer bits) is in which phase?
   a) plasma
   b) gas
   c) liquid
   d) solid
39) Most of Jupiter's mass is in
   a) hydrogen
   b) helium
   c) H_2O
   d) rock
40) Saturn's rings are
   a) gas
   b) liquid
   c) many solid, icy chunks
   d) solid
41) Which planet's atmosphere is mainly <u>not</u> CO_2?
   a) Venus
   b) Earth
   c) Mars
42) The heavy bombardment phase of solar system formation appears to have been over by age
   a) 4 billion years ago
   b) 3 billion years ago
   c) 2 billion years ago
   d) 1 billion years ago
43) Heavily cratered terrain generally indicates
   a) a geologically young surface
   b) a geologically ancient surface
   c) many volcanos
44) Neap tides occur at
   a) new moon
   b) full moon
   c) last quarter moon

45) Over the course of one orbit around the earth, the moon spins on its axis
   a) once
   b) twice
   c) the moon does not spin
   d) 29 ½ times
46) The favored theory for the formation of the moon is usually called
   a) the capture hypothesis
   b) the fission hypothesis
   c) the giant collision hypothesis
   d) the co-creation hypothesis
47) Titan is a natural satellite of
   a) Mars
   b) Jupiter
   c) Saturn
   d) Uranus
   e) Neptune
48) The moons of Neptune are named after
   a) minor sea dieties
   b) characters from Shakespeare or Alexander Pope
   c) mythical paramours of Jupiter
   d) French Romantic composers
49) Which moon orbits retrograde?
   a) Callisto
   b) Triton
   c) Oberon
   d) Phobos
   e) Io
50) Which is the outermost planet "known to the ancients?"
   a) Jupiter
   b) Saturn
   c) Uranus
   d) Neptune
51) Which planet was discovered via the math of orbital mechanics?
   a) Jupiter
   b) Saturn
   c) Uranus
   d) Neptune
52) The large Venusian volcano Maxwell Montes dominates the topography on the northern continent of
   a) Ishtar
   b) Aphrodite
   c) Pwill
   d) Ophelia
53) The Martian topographical feature known as Valles Marineris is, geologically,
   a) an impact crater
   b) a shield volcano
   c) a rocky plain with seasonal dust coverage
   d) a rift

54) The Martian topographical feature known as Olympus Mons is, geologically,
   a) an impact crater
   b) a shield volcano
   c) a rocky plain with seasonal dust coverage
   d) a rift
55) The Martian topographical feature known as Hellas is, geologically,
   a) an impact crater
   b) a shield volcano
   c) a rocky plain with seasonal dust coverage
   d) a rift
56) Photodissociation is thought to play a role in the evolution of inner planet atmospheres. Which planet is least affected by photodissociation?
   a) Venus
   b) Earth
   c) Mars
   d) Jupiter
57) The symbol gamma (γ) represents a photon of light energy. The (unbalanced) reaction $H_2O + CO_2 + \gamma \rightarrow C_6H_{12}O_6 + O_2$ describes:
   a) photosynthesis
   b) photodissociation
   c) combustion (burning)
58) The (unbalanced) reaction $CH_4 + O_2 \rightarrow CO_2 + H_2O$ describes:
   a) photosynthesis
   b) photodissociation
   c) combustion (burning)
59) The reaction $H_2O + \gamma \rightarrow H + OH$ describes:
   a) photosynthesis
   b) photodissociation
   c) combustion (burning)
60) Venus and Mars have very different amounts of greenhouse effect. Why?
   a) Their atmospheres are composed of different molecules
   b) Mars has 0.008 of 1 atm, while Venus has 90 atm.
   c) Mars is a lot closer to the sun than Venus
61) On a Mars photograph, you see a crater. The crater floor is flat, and appears to be sediment washed in by water. Which occurred first in time?
   a) the rains
   b) the crater impact
62) Uranium 238 decays to Lead 206. A sample of lunar basalt has a ratio of U238:Pb206 of 1:3. Assuming the initial amount of Pb206 was negligible, how many half-lives have elapsed?
   a) one half life
   b) two half lives
   c) three half lives
   d) four half-lives
63) Which moon is completely tidally locked, in a 1:1 spin-orbit resonance with its planet?
   a) the moon
   b) Europa
   c) Titan
   d) Callisto
   e) all of the above

64) Which planet is missing a strong internal heat source? This calms the weather.
   a) Jupiter
   b) Saturn
   c) Uranus
   d) Neptune
   e) none of the above
65) "Life as we know it" requires liquid water. What moon is disqualified on that account?
   a) Enceladus
   b) Europa
   c) Ganymede
   d) Earth's moon
66) Phobos and Deimos are moons of
   a) Venus
   b) Earth
   c) Mars
   d) Jupiter
   e) Saturn
67) Jupiter's magnetic field is
   a) strong and generated inside a molten metal core
   b) strong and generated inside a metallic hydrogen zone
   c) weak and generated inside a molten metal core
   d) weak and generated inside a metallic hydrogen zone
68) In relation to its spin axis, the magnetic field of this planet is seriously wonky.
   a) Earth
   b) Jupiter
   c) Saturn
   d) Uranus
69) The number of major planets in the solar system is
   a) 6
   b) 7
   c) 8
   d) 9
70) The planet with no ring system is
   a) Jupiter
   b) Saturn
   c) Uranus
   d) Neptune
   e) none of the above