

Your name (print) _____

AST 1002 Section 1 – Dobrosavljevic Planets, Stars, Galaxies Mid-Term 2 – Fall 2019

Instructions:

1. Use a number 2 pencil for marking the machine scoring sheet.
2. Enter and encode your name in the identification location on the machine scoring sheet.
3. Write your name on the top of this page.
4. Each question has one answer. Circle the correct answer and mark the same answer on the machine scoring sheet. You may use these exam sheets as scratch paper.
5. When you complete the exam, hand your exam sheets, and machine scoring sheet, to a proctor.

*NOTE: Anyone discovered in any way to have **cheated** on this exam will **fail** the course.*

*Please read the problems **CAREFULLY**.*

Choose the **closest** answer.

Potentially useful information:

Speed of light (c) = 3×10^5 km/sec;	“nano-”(n) = 10^{-9}	<u>Circles:</u> area = πr^2 ,
Mass of Earth (M_{\oplus}) = 6×10^{24} kg;	“micro-”(μ) = 10^{-6}	perimeter = $2\pi r$;
Mass of sun (M_{\odot}) = 2×10^{30} kg;	“milli-”(m) = 10^{-3}	<u>Spheres:</u>
Lifetime of the sun (T_{\odot}) = 10^{10} yrs;	“kilo-”(k) = 10^3	volume = $\frac{4}{3} \pi r^3$
Planck's constant (h) = 6.6×10^{-34} J·sec;	“mega-”(M) = 10^6	surface area = $4\pi r^2$
Stefan-Boltzmann constant (σ) = 5.67×10^{-8} W/m ² ·K ⁴	1 AU = 1.5×10^8 km;	
Gravitational constant (G) = 6.67×10^{-11} m ³ /kg·sec ²	1 l.y. = 10^{13} km;	
Speed = distance/time or distance = rate x time	1 pc = 3.26 LY = 206265 AU;	
density = mass/volume	1 year = 3.16×10^7 sec;	
F = ma		

$$P^2(\text{yr}) = a^3(\text{AU}) \quad 1^\circ = 3600 \text{ arc sec}; \quad \lambda_{\text{max}}(\text{meter}) = \frac{2.9 \times 10^{-3}}{T(\text{K})} \quad g = \frac{GM}{R^2}$$
$$T(\text{K}) = \frac{2.9 \times 10^{-3}}{\lambda_{\text{max}}(\text{meter})} \quad \frac{(M_1 + M_2)}{[in \text{ solar masses}]} = \frac{a(\text{AU})^3}{p(\text{yr})^2} \quad F = \frac{GMm}{r^2}$$

$$B = \frac{L}{4\pi d^2} \quad M = \frac{f_O}{f_E} \quad \frac{B_{\text{far}}}{B_{\text{near}}} = \frac{d_{\text{far}}^2}{d_{\text{near}}^2} \quad \frac{LGP_A}{LGP_B} = \frac{D_A^2}{D_B^2} \quad E = mc^2$$

$$L = 4\pi R^2 \sigma T^4 \quad d(\text{parsec}) = 1/p(\text{arcsec})$$

1. The mass of the electron, 0.000,000,000,091 kg, can be written in shorthand notation as

- a. 0.91×10^{-11} kg.
 - b. 9.1×10^{-10} kg.
 - c. 9.1×10^{-12} kg.
 - d. 9.1×10^{-11} kg.
-

2. The number of arc seconds in 1° is

- a. 2.06×10^5 .
 - b. 360.
 - c. 3600.
 - d. 60.
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3. From Earth's North Pole,

- a. only stars that are 23.5° above the celestial equator can be seen.
 - b. the whole of the celestial sphere is visible at some time during the year.
 - c. only stars that are within 66.5° of the north celestial pole can be seen.
 - d. only half the celestial sphere can be seen on any clear night.
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4. The plane of the ecliptic intersects the celestial equator

- a. everywhere because these are two different names for the same plane.
 - b. at two points, the summer and winter solstices.
 - c. along the prime meridian.
 - d. at two points, the vernal and autumnal equinoxes.
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5. Earth would *not* have seasons if

- a. its axis of rotation were perpendicular to its equatorial plane.
 - b. its equatorial plane were perpendicular to its orbital plane.
 - c. the observer's vertical axis (zenith) were perpendicular to Earth's orbital plane.
 - d. its axis of rotation were perpendicular to its orbital plane.
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6. Precession is the

- a. motion of Earth along its orbital path during a year.
 - b. slow coning motion of the spin axis of Earth, similar to that of a spinning top.
 - c. daily spinning motion of Earth, producing the apparent motion of the Sun and the stars.
 - d. gradual reversal of Earth's magnetic field.
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7. If the Moon is between the Sun and Earth and almost in line with the Sun, we call its phase

- a. gibbous.
 - b. full Moon.
 - c. The Moon never goes between the Sun and Earth.
 - d. new Moon.
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8. Approximately when does a full Moon rise?

- a. sunrise
 - b. noon
 - c. sunset
 - d. midnight
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9. In Ptolemy's geocentric theory of the solar system, what name is given to the small circle around which the planet moves while the center of this circle orbits Earth?

- a. celestial equator
 - b. ecliptic
 - c. deferent
 - d. epicycle
-

10. The phenomenon of parallax is the

- a. change in apparent position of a nearby object compared to background objects as a result of the motion of the observer.
 - b. apparent change in angular size of an object as it moves toward or away from an observer.
 - c. change in direction of motion of a planet from retrograde to direct motion.
 - d. change in the apparent position of a nearby object compared to background objects as a result of the motion of the object.
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11. The model of the solar system that Johannes Kepler proposed was

- a. Sun-centered, with elliptical planetary orbits.
 - b. Sun-centered, with planets moving in circles around it.
 - c. Earth-centered, with the Sun, the Moon, and the planets moving in ellipses.
 - d. Earth-centered, with planets moving in epicycles.
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12. A distant asteroid is discovered that takes 50 years to orbit the Sun once. According to Kepler's third law, what is the average distance of this asteroid from the Sun?

- a. 13.6 AU (cube root of 2500)
 - b. 50 AU
 - c. 2500 AU
 - d. 353 AU (square root of 125,000)
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13. What did Galileo see when he observed Venus through his telescope?

- a. Venus has phases like the Moon, and its largest angular diameter is at crescent phase.
 - b. Venus has phases like the Moon, and its largest angular diameter is at gibbous phase.
 - c. Venus has phases like the Moon and, also like the Moon, is almost constant in angular size.
 - d. Venus has an angular size, which increases and decreases markedly but does not show phases (e.g., crescent).
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14. What is the one fundamental difference between X rays and radio waves?

- a. The wavelengths of X rays and radio waves are very different.
 - b. The speeds of X rays and radio waves in outer space are different.
 - c. Radio waves are always wavelike, whereas X rays always behave like particles.
 - d. X rays and radio waves always come from different sources.
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15. Which of the following types of electromagnetic radiation has the longest wavelength?

- a. microwaves
 - b. radio waves
 - c. infrared radiation
 - d. ultraviolet light
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16. Many amateur astronomers have telescopes with mirrors 20 cm ($1/5$ m) in diameter. In comparison, one of the largest astronomical telescopes in the world is the Keck telescope, with a diameter of 10 m. How much greater is the light-gathering power of the Keck telescope than the power of a 20-cm telescope?
- a. 50 times greater
 - b. 2500 times greater
 - c. 125,000 times greater
 - d. 7 times greater
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17. A particular reflecting telescope has an objective mirror with a focal length of 1.2 m and an eyepiece lens of focal length 6 mm. What is the magnifying power of this telescope?
- a. 2000
 - b. 200
 - c. 5
 - d. 20
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18. Stars A and B have the same radius, but the spectrum of star A peaks at a wavelength of 500 nm, whereas star B's spectrum peaks at 1000 nm. What is the ratio of the Kelvin temperature of the surface of star A to the Kelvin temperature of the surface of star B?
- a. 4
 - b. $1/2$
 - c. 2
 - d. $1/4$
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19. Where are the asteroids located?
- a. All asteroids have orbits between the orbits of Mars and Jupiter.
 - b. Their orbits are distributed more or less uniformly throughout the Solar System.
 - c. Most asteroids have orbits between the orbits of Mars and Jupiter, but there are gaps caused by resonances with Jupiter.
 - d. Most asteroids have orbits between the orbits of Mars and Jupiter, but there are gaps caused by the motions of the largest asteroids moving through the asteroid belt and sweeping out regions much like the shepherd satellites in the rings of Saturn.
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20. Comets are typically
- a. slushy mixtures of liquid and ice.
 - b. chunks of ice that begin to vaporize if they pass close to the Sun.
 - c. gaseous bodies from which some of the gas is pushed out by the Sun to form a long tail.
 - d. chunks of rock that are generally a few tens of kilometers in diameter.
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21. Which is the most abundant gas in Earth's atmosphere?

- a. oxygen
 - b. hydrogen
 - c. carbon dioxide
 - d. nitrogen
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22. Which major constituent of the atmospheres of Venus and Mars is present in only very small amounts in Earth's atmosphere?

- a. oxygen, O₂
 - b. carbon dioxide, CO₂
 - c. nitrogen, N₂
 - d. methane, CH₄
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23. The chemical constituent that absorbs UV radiation in the stratosphere of Earth's atmosphere, thereby heating these layers to relatively high temperatures, is

- a. CO₂, carbon dioxide.
 - b. N₂, nitrogen.
 - c. O₃, ozone.
 - d. H₂O, water vapor.
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24. What is a typical speed of drift for a continent sliding over Earth's surface?

- a. a few centimeters per million years
 - b. a few centimeters per year
 - c. a few meters per year
 - d. a few centimeters per century
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25. On Earth, the majority of earthquakes occur

- a. in the centers of tectonic plates (e.g., North American continent).
 - b. along regions of greatest thermal stress in arctic and antarctic regions.
 - c. along the zone of maximum tidal stress around the equator.
 - d. along the boundaries of major tectonic plates.
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26. The lunar maria appear smooth because they are

- a. regions where craters have been obliterated by crustal deformation caused by hot spots and volcanic lava flow from the underlying molten mantle.
 - b. ancient sea beds, now dry, dating back to when the Moon had a denser atmosphere and rainfall was abundant.
 - c. ancient lava flows that occurred soon after the end of an early period of intense bombardment and that have had relatively few impacts since then.
 - d. recent lava flows, occurring within the last billion years, that have obliterated earlier craters.
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27. Sometimes high tides are higher than at other times. What name is given to the highest high tides?

- a. Yule tides
 - b. rip tides
 - c. spring tides
 - d. neap tides
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28. Neap tides occur

- a. twice a month, at full and new Moon.
 - b. once a month, at new Moon.
 - c. twice a month, at first quarter and third quarter Moon.
 - d. once a month, at first quarter Moon.
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29. An Earth-based telescopic view of Venus shows

- a. evidence of ice-covered polar caps and huge dust storms.
 - b. a smooth, dark surface with few mountain ranges.
 - c. a completely cloud-shrouded planet with high atmospheric wind speeds.
 - d. a crater-covered surface of reddish color.
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30. Tomorrow's weather report for Venus would be

- a. hot and humid, with clear skies.
 - b. overcast and very hot.
 - c. cold and clear.
 - d. snow.
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31. Olympus Mons is a

- a. long-lived anticyclone, or spot, on Jupiter.
 - b. volcano on Mars.
 - c. mountain on Venus.
 - d. valley on the Moon.
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32. The polar caps on Mars are most probably made up of

- a. water and carbon dioxide ices.
 - b. sulfur dioxide and sulfur compounds.
 - c. light-colored dust, blown there by the Martian dust storms.
 - d. volcanic outflows of light-colored lava and dust similar to that produced by Earth-based volcanoes (such as Mount St. Helens).
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33. The Oort cloud is

- a. another name for the asteroid belt.
 - b. a random distribution of short-period comets extending from inside the orbit of Jupiter to approximately the orbit of Neptune.
 - c. a flat or donut-shaped distribution of distant comets around the Sun, extending out about 500 AU.
 - d. a spherical distribution of distant comets around the Sun, extending out about 50,000 AU.
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34. Comet tails are the result of

- a. interplanetary material streaming into the comet because of its gravity.
 - b. interplanetary dust collected by the comet as it moves in its orbit.
 - c. melting and evaporation of ices from the comet core.
 - d. sunlight glinting on the central icy comet core.
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35. What causes a meteor shower?

- a. If Earth happens to be near a comet when it breaks up, we will see a shower as debris enters Earth's atmosphere.
 - b. Earth passes through the orbit of a comet. If the comet happens to be nearby, the normal ejecta from the nucleus will cause a shower.
 - c. Earth passes through the tail of a comet.
 - d. Earth passes through the orbit of a former comet. The debris strewn through this orbit enters our atmosphere and causes showers.
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36. How far away is the nearest star beyond the Sun?

- a. about 4 ly away
 - b. about 1/10 ly away
 - c. about 1/4 ly away
 - d. between 1 and 2 ly away
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37. The most straightforward way to determine the distance to a nearby star involves the measurement of the

- a. Zeeman effect of spectral lines in the star's spectrum.
 - b. star's parallax.
 - c. ratio of the star's apparent and absolute magnitudes.
 - d. star's spectrum.
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38. A particular star has an angle of parallax of 0.1 arcsec. What is the distance to this star?

- a. about 0.1 ly
 - b. about 10 ly
 - c. about 3.3 ly
 - d. about 33 ly
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39. What are the two physical parameters of stars that are plotted in the Hertzsprung-Russell diagram?

- a. radius and mass
 - b. luminosity and mass
 - c. luminosity and surface temperature
 - d. mass and surface temperature
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40. The luminosity of a star is

- a. its brightness if it were at a distance of 10 pc (32.6 ly) from Earth.
 - b. its total energy output into all space.
 - c. another name for its color or surface temperature.
 - d. its brightness as seen by people on Earth.
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