

# USAAAO Practice Round 2015

This round consists of 20 multiple-choice problems to be completed in 50 minutes. You may only use a scientific calculator and a table of constants during the test.

1. Light from distant galaxies appears to be:
  - a. Shifted to longer wavelengths
  - b. Shifted to shorter wavelengths
  - c. Increased in energy
  - d. Increased in intensity
  - e. Completely polarized
  
2. Given a star of 70 solar masses and 20 solar radii, what type of star is this?
  - a. Main Sequence
  - b. Giant
  - c. Dwarf
  - d. Neutron Star
  - e. Supergiant
  
3. The Sun has three major zones in its interior. What are these three zones, listed from center of the Sun outward?
  - a. Core, Mantle, Crust
  - b. Core, Convective Zone, Radiative Zone
  - c. Core, Radiative Zone, Convective Zone
  - d. Convective Zone, Radiative Zone, Chromosphere
  - e. Radiative Zone, Convective Zone, Core
  
4. The latitude and longitude of LA are 34.05 degrees N and 118.25 degrees W, respectively. A star at which of the following declinations never rises over the horizon in LA?
  - a. 60 degrees
  - b. 45 degrees
  - c. 0 degrees
  - d. -45 degrees
  - e. -60 degrees
  
5. The semi-major axis of an asteroid in the asteroid belt is 3 AU. What is its orbital period, in years?
  - a. 9
  - b. 5.2
  - c. 27
  - d. 2.1
  - e. 3.0

6. What object is left at the middle of a planetary nebula, and what is the largest mass at which this object can exist?
  - a. White dwarf, 1.4 solar masses
  - b. White dwarf, 3.0 solar masses
  - c. Neutron star, 1.4 solar masses
  - d. Neutron star, 3.0 solar masses
  - e. Solar system, 3.0 solar masses
  
7. The mean orbital velocity of Jupiter is 13.1 km/s, its mass is  $1.9 \times 10^{27}$  kg, and its orbit has a semi-major axis of  $7.9 \times 10^8$  km. What is its angular momentum, in SI units (Joule-seconds)?
  - a.  $9.0 \times 10^{42}$
  - b.  $2.6 \times 10^{47}$
  - c.  $1.6 \times 10^{55}$
  - d.  $2.0 \times 10^{43}$
  - e.  $2.5 \times 10^{35}$
  
8. In a distant solar system, two planets, A and B, orbit a central main sequence star, like our sun. A day on Planet A lasts 20 Earth hours, and there are 240 such days in a year on Planet A. Likewise, a day on Planet B lasts 38 hours, and there are 220 such days in a year on Planet B. What is the synodic period with respect to these two planets, in Earth years?
  - a. 1.1
  - b. 1.2
  - c. 1.3
  - d. 1.4
  - e. 1.5
  
9. Which of the Solar System planets causes the "Kirkwood Gaps" found in the asteroid belt?
  - a. Earth
  - b. Jupiter
  - c. Saturn
  - d. Uranus
  - e. Neptune
  
10. Calculate the escape velocity from a planet with twice the mass and 1/3 the radius of Earth.
  - a. 9.2 km/s
  - b. 11.2 km/s
  - c. 13.7 km/s
  - d. 21.2 km/s
  - e. 27.4 km/s

11. Two neutron stars, each with a mass of 3 solar masses, merge to form a black hole. Assuming no mass is lost, find the radius of the black hole.
- 2.2 km
  - 4.4 km
  - 8.8 km
  - 17.7 km
  - $6.6 \times 10^{10}$  km
12. What size telescope is needed to resolve Hellas Planitia (a 2,300 km wide crater) on Mars through a v-band filter (effective wavelength = 550 nm) when Mars is 54.6 million km from Earth?
- 34.8 mm
  - 26.1 mm
  - 15.9 mm
  - 10.6 mm
  - 7.7 mm
13. Fifteen minutes after sunset, you look west and see the moon rising. What phase is the moon in?
- New
  - First Quarter
  - Waxing Gibbous
  - Full
  - Waning Crescent
14. When taking the spectrum of a galaxy with redshift  $z=1$ , the H-alpha line ( $\lambda=656$  nm) appears at what wavelength?
- 32.6 nm
  - 326 nm
  - 656 nm
  - 1312 nm
  - 6563 nm
15. Which of the following Messier objects is grouped incorrectly with its type and constellation?
- M4, globular cluster, Scorpius
  - M27, spiral galaxy, Sagittarius
  - M42, emission nebula, Orion
  - M57, planetary nebula, Lyra
  - M87, elliptical galaxy, Virgo

16. Star X has an apparent magnitude of 5.7 and is located 26.3 pc from the Sun. If there are 2.0 magnitudes of extinction to Star X, what is its luminosity?
- 1.6 solar luminosities
  - 8.0 solar luminosities
  - 9.8 solar luminosities
  - 19.6 solar luminosities
  - 25.6 solar luminosities
17. In a nearby star system, two stars are seen to orbit each other every 8 years. At their closest, the stars are 2" apart. At their furthest, they are 18" apart. If a parallax of 0.5" is observed for the star system, what is its combined mass in solar masses? Assume an inclination of 90 degrees.
- 0.5
  - 1
  - 2
  - 4
  - 8
18. The Triangulum Galaxy has coordinates (RA: 1.564h, Dec: 30.660°). Which answer is closest to the local time at which it reaches its maximum elevation above the horizon on the night of September 18-19? Ignore daylight savings.
- 11:54 pm
  - 12:21 am
  - 12:48 am
  - 1:15 am
  - 1:42 am
19. The peak wavelength of radiation from a certain star is 644 nm. If the absolute magnitude of this star is -0.17, what is its radius?
- 13.4 solar radii
  - 16.5 solar radii
  - 17.8 solar radii
  - 19.8 solar radii
  - 20.5 solar radii
20. Jupiter has a mass of  $1.9 \times 10^{27}$  kg and a semimajor axis of 5.2 AU. Assume someone "out there" can resolve star positions to 10 microarcseconds. What is the maximum distance from the Sun at which the planet Jupiter could be discovered by observing the wobble of the Sun?
- 5 pc
  - 15 pc
  - 50 pc
  - 150 pc
  - 500 pc