

Answer Key for Exam B

1 point each

Choose the answer that **best** completes the question. Read each problem carefully and read through all the answers. Take your time. If a question is unclear, ask for clarification during the exam.

Mark your answers on the scantron sheet and on your copy of the exam. Keep your copy of the exam and check your grade with the posted answers on the course website and the grade posted on D2L. You will have 1 week to ask for corrections.

1. The Exam Version listed at the top is:
 - (a) Version A
 - (b) Version B
 - (c) Version C
 - (d) Version D

2. A A0 star is moving toward the earth with a velocity of 3,000 km/s. Its spectral lines are:
 - (a) Not visible
 - (b) The same for all observers
 - (c) Shifted to the red end of the spectrum
 - (d) Shifted to the blue end of the spectrum
 - (e) Not shifted at all

3. Which telescope would collect 100 times more light than a 1-meter telescope?
 - (a) 100-meter telescope
 - (b) 30-meter telescope
 - (c) 50-meter telescope
 - (d) 10-meter telescope

4. What is the relationship between the color of an object and wavelength?
 - (a) The wavelength is not related to the color
 - (b) The color is determined by the wavelength region where the object is brightest
 - (c) All colors of light have the same wavelength
 - (d) Wavelength depends on brightness and not color

5. The light-year is a unit of:
- (a) time.
 - (b) speed.
 - (c) distance.
 - (d) energy.
6. Our universe is approximately _____ years old.
- (a) 14 million
 - (b) 14 trillion
 - (c) 14 billion
 - (d) 14 thousand
7. Which of the following causes the biggest problem in detecting infrared photons from an astronomical object?
- (a) smog
 - (b) carbon dioxide
 - (c) light pollution
 - (d) water vapor
8. One of the central assumptions in astronomy is that the physical laws of nature:
- (a) change when objects move at high speed.
 - (b) change throughout the age of the universe.
 - (c) depend on the mass of the objects involved.
 - (d) are the same everywhere in the universe.
9. The Doppler shift can be used to determine the _____ of an object.
- (a) energy
 - (b) radial velocity
 - (c) temperature
 - (d) no radiation
10. Which of the following is FALSE?
- (a) Everyone on Earth observes the same phase of the Moon on a given night.
 - (b) The phases of the Moon cycle with a period of approximately 1 month.
 - (c) In some phases, the Moon can be observed during the day.
 - (d) The observed phase of the Moon changes dramatically over the course of a single night.

11. Approximately how many feet are in 4 meters?
- (a) 1.3
 - (b) 4
 - (c) 8
 - (d) 12
12. All stars denoted on the celestial sphere are:
- (a) equidistant from Earth.
 - (b) actually planetary bodies of the solar system.
 - (c) at varying distances from Earth.
 - (d) not in the Milky Way galaxy.
13. If x and y have an inverse relationship it means:
- (a) If x gets bigger than y gets bigger
 - (b) If x gets smaller than y gets bigger
 - (c) If x gets bigger than y gets smaller
 - (d) If x gets smaller than y gets smaller
 - (e) Both (b) and (c) above are correct
14. How do the wavelength and frequency of red light compare to the wavelength and frequency of blue light?
- (a) Red light has a longer wavelength and higher frequency than does blue light.
 - (b) Red light has a longer wavelength and lower frequency than does blue light.
 - (c) Red light has a shorter wavelength and higher frequency than does blue light.
 - (d) Red light has a shorter wavelength and lower frequency than does blue light.
15. It is possible for electrons in a hydrogen atom to move from one level to the next (either up or down) by:
- (a) absorbing a photon
 - (b) colliding with a free electron
 - (c) emitting a photon
 - (d) all of the above
16. Before CCDs were invented, what was the device most commonly used for imaging with optical telescopes?
- (a) Polaroid cameras
 - (b) high-speed film
 - (c) photographic glass plates
 - (d) video cameras

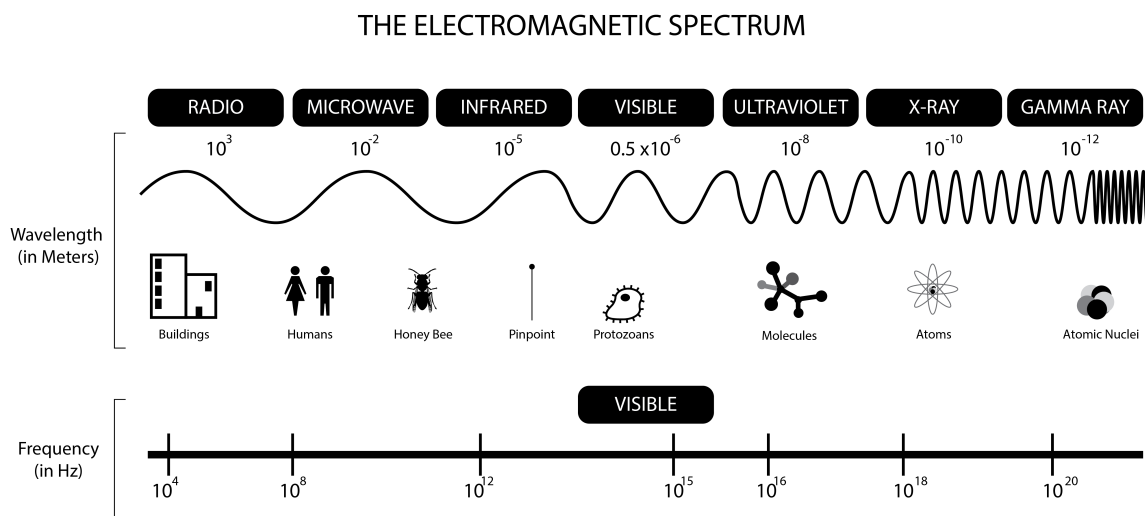
17. If an event were to take place on the Sun, how long would it take for the for us to know about it?
- (a) 8 minutes
 - (b) 1 second
 - (c) 11 hours
 - (d) 1 day
18. The shortest day of the year for a person living in the Northern Hemisphere is the:
- (a) summer solstice (June 21).
 - (b) winter solstice (December 21).
 - (c) vernal equinox (March 20).
 - (d) autumnal equinox (September 22).
19. The angular resolution of a ground-based telescope is usually set by:
- (a) diffraction.
 - (b) the focal length.
 - (c) refraction.
 - (d) atmospheric seeing.
20. Solar and lunar eclipses are rare because the Moon's orbital plane is tipped by:
- (a) 5.2° relative to the plane defined by Earth's equator.
 - (b) 5.2° relative to Earth's orbital plane.
 - (c) 23.5° relative to the plane defined by the Earth's equator
 - (d) 23.5° relative to Earth's orbital plane.
21. The speed of light is about:
- (a) 20 km/s.
 - (b) 30,000 km/s.
 - (c) 300,000 km/s.
 - (d) 5 million km/s.
22. Neap tide occurs when the Moon is in the first or third quarter phase and results in:
- (a) smaller than usual tides.
 - (b) no tides.
 - (c) larger than usual tides.

23. The distance to the nearest, large, spiral galaxy, Andromeda, is 2.5 million light-years. How long does it take light to travel from us to Andromeda?
- (a) 360 years
 - (b) 4.5 billion years
 - (c) 1.2 thousand years
 - (d) 2.5 million years
24. On which day of the year does the Sun reach its northern-most point in the sky?
- (a) vernal equinox
 - (b) autumnal equinox
 - (c) summer solstice
 - (d) winter solstice
25. Write 0.00000037 in scientific notation.
- (a) 3.7×10^{-7}
 - (b) 3.7×10^{-4}
 - (c) 3.7×10^6
 - (d) 3.7×10^7
26. Which of the following produces an absorption line spectrum:
- (a) Hot, dense gas
 - (b) Hot, thin gas
 - (c) A stellar atmosphere
 - (d) A hot, glowing solid
27. The Balmer series of neutral hydrogen, H I involves transitions of the electron between:
- (a) The ground state ($n=1$) and the continuum
 - (b) The second level ($n=2$) and higher excited states ($n > 3$)
 - (c) The third level ($n=3$) and higher excited states ($n > 4$)
 - (d) The the ionization of hydrogen $H \rightarrow H^+ + e$
 - (e) All of the above
28. As wavelength increases, the energy of a photon _____ and its frequency _____.
- (a) increases; decreases
 - (b) decreases; decreases
 - (c) increases; increases
 - (d) decreases; increases

29. Earth's rotational axis precesses in space and completes one revolution every:
- (a) 200 years.
 - (b) 26,000 years.
 - (c) 1,800 years.
 - (d) 51,000 years.
30. At what time does a third quarter Moon rise? (Hint: A third quarter Moon occurs approximately 3 weeks after a new Moon.)
- (a) 12 midnight
 - (b) 6 A.M.
 - (c) 12 noon
 - (d) 6 P.M.
31. Roughly how often does a high tide occur?
- (a) once every 6 hours
 - (b) once every 12 hours
 - (c) once every 18 hours
 - (d) once every 24 hours
32. Scientific notation allows us to:
- (a) write very large and very small numbers in a convenient way.
 - (b) talk about science in an easy way.
 - (c) change easy calculations into hard calculations.
 - (d) explain science to engineers.
33. The ecliptic plane is defined by the motion of _____ in the sky.
- (a) the Moon
 - (b) Polaris
 - (c) the Sun
 - (d) the stars
34. Cameras that use adaptive optics provide higher spatial resolution images primarily because:
- (a) they operate above Earth's atmosphere.
 - (b) they capture infrared light, which has a longer wavelength than visible light.
 - (c) deformable mirrors are used to correct the blurring due to Earth's atmosphere.
 - (d) composite lenses correct for chromatic aberration.

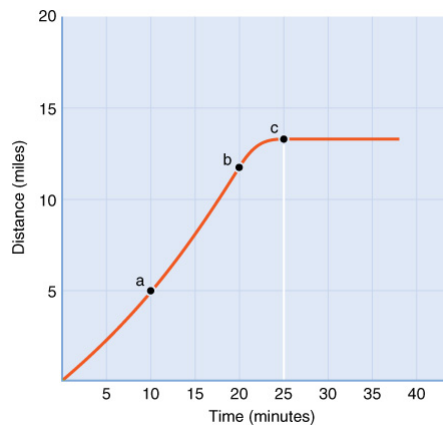
35. No matter where you are on Earth, stars appear to rotate about a point called the:
- (a) zenith.
 - (b) meridian.
 - (c) celestial pole.
 - (d) equinox.
36. How does the speed of light traveling through a medium (such as air or glass) compare to the speed of light in a vacuum?
- (a) It is the same as the speed of light in a vacuum.
 - (b) It is always less than the speed of light in a vacuum.
 - (c) It is always greater than the speed of light in a vacuum.
 - (d) Sometimes it is greater than the speed of light in a vacuum, and sometimes it is less, depending on the medium.
37. When an electron is removed from a neutral atom, the atom is said to be
- (a) ionized.
 - (b) recombined.
 - (c) quantized.
 - (d) collisionally excited.
38. If the star Polaris has an altitude of 35° , then we know that:
- (a) our longitude is $+55^\circ$.
 - (b) our longitude is $+35^\circ$.
 - (c) our latitude is $+55^\circ$.
 - (d) our latitude is $+35^\circ$.
39. Which of the following is FALSE?
- (a) A scientific theory is an undisputed fact.
 - (b) If continual testing of a hypothesis shows it to be valid, it may become an accepted theory.
 - (c) A hypothesis must always have one or more testable predictions.
 - (d) A scientific theory may eventually be proved wrong when scientists acquire new data.
40. The density of stars can be determined by using:
- (a) imaging
 - (b) photometry
 - (c) computers
 - (d) spectroscopy
 - (e) photography

41. We observe different phases of the Moon because:
- (a) the Moon passes through different portions of the Earth's shadow during its orbit.
 - (b) some parts of the Moon reflect and other parts absorb sunlight.
 - (c) the orbital position of the Moon determines which portion and how much of the lunar surface is illuminated by sunlight.
 - (d) the Moon emits light in some places and only reflects light in other places.
42. Using the figure below, which type of electromagnetic wave has a frequency of approximately 2×10^{18} Hz?



- (a) X-rays
 - (b) microwave
 - (c) infrared
 - (d) radio
43. When the Northern Hemisphere experiences summer, the Southern Hemisphere experiences:
- (a) spring.
 - (b) fall.
 - (c) summer.
 - (d) winter.

44. The direction directly overhead of an observer defines his or her:
- (a) meridian.
 - (b) circumpolar plane.
 - (c) celestial pole.
 - (d) zenith.
45. Which of the following lists different types of electromagnetic radiation in order of increasing wavelength?
- (a) radio waves, infrared, visible, ultraviolet, X-rays
 - (b) gamma rays, ultraviolet, visible, infrared, radio waves
 - (c) gamma rays, X-rays, infrared, visible, ultraviolet
 - (d) X-rays, infrared, visible, ultraviolet, radio waves
 - (e) radio waves, ultraviolet, visible, infrared, gamma rays
46. Describe the motion of the object in the graph.



- (a) It moves at a constant speed then slows down
 - (b) It stays still for a while and then accelerates to a constant speed
 - (c) It accelerates, then decelerates and comes to a stop
 - (d) It moves at a constant speed
 - (e) It accelerates, then decelerates and then moves at a constant speed
47. Ultraviolet radiation is hard to observe primarily because:
- (a) Earth's atmosphere easily absorbs it.
 - (b) no space-based telescopes operate at ultraviolet wavelengths.
 - (c) only the lowest-mass stars emit ultraviolet light.
 - (d) very few objects emit at ultraviolet wavelengths.

48. In order to do spectroscopy we run light through a slit. Which of the following is FALSE?

- (a) the light will be dispersed over the surface of the detector, according to its wavelength
- (b) some of the light will be lost
- (c) We need larger telescopes to do spectroscopy than imaging
- (d) We can do spectroscopy in poor seeing, since we don't need to resolve images.

(e) all of the above are true

49. During which lunar phase do solar eclipses occur?

- (a) new
- (b) full
- (c) first quarter
- (d) third quarter

50. The speed of a light wave:

- (a) is altered by a refractive medium.
- (b) is reduced whenever reflection occurs.
- (c) is not altered by reflection or refraction.
- (d) is not altered by refraction.

51. **Extra Credit, You can figure this out from the Marching Band Analogy. You can only improve your score with this question.**

Which properties of light changes in a refractive medium?

- (a) wavelength
- (b) wavelength and speed
- (c) frequency, speed, and wavelength
- (d) speed
- (e) nothing changes