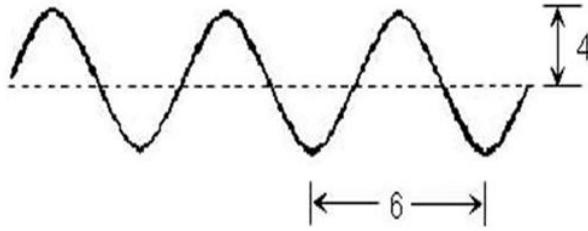


Show ALL work for full credit. Each problem 2 pts unless otherwise noted.

- 1) If a new wave arrives on shore every two seconds, then its frequency is 2 Hz.
- 2) As they move through space, the vibrating electrical and magnetic fields of a light wave must move perpendicular to each other.
- 3) As white light passes through a prism, the red (longer) wavelengths bend less than the blue (shorter) wavelengths, so forming the rainbow of colors.
- 4) Observations in the X-ray portion of the spectrum are routinely done from the surface of the Earth.
- 5) According to Wein's law, the higher the surface temperature of a star, the redder its color.
- 6) When an electron in a hydrogen atom drops from the second to the first excited energy state it emits a bright red emission line called hydrogen alpha.
- 7) The larger the redshift, the faster the distant galaxy is rushing toward us.
- 8) Spectroscopy of a star can reveal its temperature, composition, and line-of-sight motion.
- 9) Which of these is NOT a form of electromagnetic radiation?
 - A) DC current from your car battery
 - B) radio signals
 - C) ultraviolet causing a suntan
 - D) X-rays in the doctor's office
 - E) light from your camp fire
- 10) A wave's velocity is the product of the
 - A) amplitude times the frequency of the wave.
 - B) period times the energy of the wave.
 - C) frequency times the period of the wave.
 - D) amplitude times the wavelength of the wave.
 - E) frequency times the wavelength of the wave.

11) Consider this diagram. Which statement is true?



- A) The amplitude is 8 and the wavelength is 12.
 - B) The amplitude is 4 and the wavelength is 6.
 - C) The amplitude is 4 and the wavelength is 12.
 - D) The amplitude is 8 and the wavelength is 6.
 - E) The amplitude is 6 and the wavelength is 4.
- 12) Which of these is the same for all forms of electromagnetic (E-M) radiation in a vacuum?
- A) wavelength
 - B) amplitude
 - C) speed
 - D) frequency
 - E) photon energy
- 13) The two forms of electromagnetic (E-M) radiation that experience the least atmospheric opacity are
- A) visible light and infrared waves.
 - B) X and gamma radiation.
 - C) visible light and radio waves.
 - D) microwaves and radio waves.
 - E) ultraviolet and infrared waves.
- 14) What is true of a blackbody?
- A) It appears black to us, regardless of its temperature.
 - B) Its energy is not a continuum.
 - C) It has a complete absence of thermal energy.
 - D) Its energy peaks at the wavelength determined by its temperature.
 - E) If its temperature doubled, the peak in its radiation curve would be doubled in wavelength.
- 15) The total energy radiated by a blackbody depends on
- A) the square of its temperature.
 - B) the cube of its temperature.
 - C) the fourth power of its temperature.
 - D) the fourth root of its temperature.
 - E) the square root of its temperature.
- 16) In Bohr's model of the atom, electrons
- A) are not confined to specific orbits.
 - B) are spread uniformly through a large, positive mass.
 - C) can be halfway between orbits.
 - D) only make transitions between orbits of specific energies.
 - E) move from one orbit to the next orbit in many small steps.

- 17) The distance from a wave's crest to its undisturbed position is the _____.
- 18) In electromagnetic waves, the electric and magnetic fields vibrate _____ to each other.
- 19) Stars that appear blue or white in color are _____ than our yellow Sun.
- 20) Knowing the peak emission wavelength of a blackbody allows you to determine its _____.
- 21) A dense, hot body will give off a(n) _____ spectrum.
- 22) The common element discovered in the Sun's spectrum before it was found here is _____.
- 23) When an electron moves from a lower to a higher energy state, a photon is _____.
- 24) An electron has a _____ electric charge.
- 25) Why can't we be certain that the Andromeda Galaxy exists today?
- 26) What two regions of the electromagnetic spectrum are best utilized by ground-based astronomers, and why?
- 27) Explain how the Zeeman effect allows us to study stellar magnetic fields.
- 28) Explain what types of information can be obtained from a line spectrum.

29) If we increased the pressure in a gas, how will its spectral lines be affected?

30) How can Wein's law be used to determine the temperature of a star?

31) How can the Doppler effect be used to determine if a storm is forming into a tornado?

32) Explain how the Doppler effect has been used to detect invisible planets orbiting other Sun-like stars.