

Astronomy 1504/1514 Section 10  
Midterm 1, Version 1  
February 12, 2010

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 difference between  $^{12}\text{C}$  and  $^{13}\text{C}$  is:
  - a) a neutron
  - b) a proton
  - c) an electron
  - d) a neutrino
  - e) a positron
2. The first step in the proton-proton cycle:
  - a) involves fusing 2 protons to make a deuterium nucleus
  - b) produces a neutrino
  - c) produces a positron
  - d) all of the above
3. The intrinsic brightness of the sun may be specified either by its absolute magnitude or by its \_\_\_\_\_.
  - a) apparent magnitude
  - b) bolometric magnitude
  - c) color index
  - d) luminosity
  - e) intensity
4. Hydrostatic equilibrium of the sun is maintained by the balance between gravity and
  - a) gas pressure
  - b) quantum mechanical pressure
  - c) ionization
  - d) anti-gravity

5. The constituents of nuclei are:
- a) protons and neutrons
  - b) protons and electrons
  - c) protons and neutrinos
  - d) neutrinos and electrons
6. When the electron is removed from an atom of neutral hydrogen the new atom is called:
- a) neutral hydrogen or H I
  - b) ionized hydrogen or H II
  - c) doubly ionized hydrogen or H III
  - d)  $H^-$
7. The apparent magnitude of Barnard's star is 7.5. The star Luyten 726-8A appears 100 times fainter than Barnard's star. Its apparent magnitude is:
- a) 3.5
  - b) 2.5
  - c) 12.5
  - d) 750.0
8. Another way of saying one billion years is:
- a)  $10^2$  yr
  - b)  $10^3$  yr
  - c)  $10^6$  yr
  - d)  $10^8$  yr
  - e)  $10^9$  yr
9. The  $H_\alpha$  line in neutral hydrogen, H I, is caused by the transition of the electron between which levels?
- a) The ground state ( $n=1$ )  $\rightarrow$  first excited state ( $n=2$ )
  - b) The second level ( $n=2$ )  $\rightarrow$  second excited state ( $n=3$ )
  - c) The third level ( $n=3$ )  $\rightarrow$  third excited state ( $n=4$ )
  - d) The second level ( $n=2$ )  $\rightarrow$  third excited state ( $n=4$ )
  - e) All of the above
10. 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) emitting a photon
  - c) having a collision with a free electron
  - d) all of the above

11. Compared with ultraviolet light, radio waves:
- a) Have higher energy
  - b) Move more slowly
  - c) Aren't made of photons, but of sound
  - d) Have higher frequency
  - e) Have longer wavelength
12. Among the choices below the longest wavelength photons are:
- a) infrared
  - b) radio
  - c) x-rays
  - d) visible
  - e) ultraviolet
13. Given 2 telescopes: an 8 inch reflector, or a 1 meter refractor, which would be able to see the dimmest objects
- a) The reflector
  - b) The refractor
  - c) It depends on the magnification
  - d) Can't tell since the reflector doesn't have chromatic aberration, but it is smaller than the refractor
14. The spectrum of an ordinary star is
- a) a purely continuous spectrum
  - b) a continuous spectrum with superimposed absorption lines (absorption spectrum)
  - c) a continuous spectrum with superimposed emission lines
  - d) an emission line spectrum
15. If astronomers want to learn the chemical composition of stars (what elements they are made of), they would put what instrument on their telescope?
- a) A photometer
  - b) A spaceship
  - c) A computer
  - d) A spectrograph
  - e) A photograph

16. Which of the following produces an emission line spectrum:
- a) Hot, dense gas
  - b) Hot, thin gas
  - c) A stellar atmosphere
  - d) A hot, glowing solid
17. Which of the following spectral class stars is coolest?
- a) O
  - b) B
  - c) F
  - d) M
18. Why are hydrogen Balmer lines weak in O stars?
- a) They don't have much hydrogen
  - b) Most of the hydrogen is in the ground state
  - c) Most of the hydrogen is in the second level
  - d) Most of the hydrogen is ionized
19. A G3 star is moving away the earth with a velocity of 10,000 km/s. Its spectral lines are:
- a) Not visible
  - b) Shifted to the red end of the spectrum
  - c) Shifted to the blue end of the spectrum
  - d) Not shifted at all
20. Astronomers put telescopes on the tops of mountains in dry remote locations because:
- a) They want to get away from light pollution
  - b) The want to get as high as they can where the atmosphere is thinner and seeing is better
  - c) They want to minimize the amount of water vapor to work in the infrared
  - d) all of the above
21. The Light Gathering Power of a telescope depends on:
- a) The magnification of the eyepiece
  - b) The area of the mirror or lens
  - c) Whether it is a reflector or a refractor
  - d) The focal length of the mirror or lens

22. Molecular lines dominate the spectra of:
- a) hot stars
  - b) cool stars
  - c) medium priced stars
  - d) the sun
23. If the distance between two bodies were suddenly doubled, the gravitational attraction (force) would:
- a) increase by a factor of two
  - b) decrease by a factor of two
  - c) decrease by a factor of four
  - d) increase by a factor of four
24. The radius of the earth is approximately 7000 kilometers. The radius of the sun is about one hundred times larger. Therefore the radius of the sun, expressed in kilometers, is about
- a)  $10^4$
  - b)  $10^6$
  - c)  $7 \times 10^5$
  - d)  $7 \times 10^{10}$
25. "Seeing" refers to:
- a) the vibration of a telescope due to winds
  - b) the blurring of stellar images due to turbulence in the earth's atmosphere
  - c) the brightness of the night sky
  - d) the visual inspection of the spectrum of a star
26. The force that prevents my hand from going through the table is:
- a) The strong force
  - b) The weak force
  - c) The electromagnetic force
  - d) Gravity
27. The source of energy in the core of the sun is from:
- a) Nuclear Fission
  - b) Nuclear Fusion
  - c) Gravity
  - d) The electromagnetic force
  - e) Hydrostatic Equilibrium

28. Order the transitions in the Balmer series from longest wavelength to shortest wavelength (red to blue)

- a)  $Ly_\alpha$ ,  $Ly_\beta$ ,  $Ly_\gamma$
- b)  $Ly_\gamma$ ,  $Ly_\beta$ ,  $Ly_\alpha$
- c)  $H_\alpha$ ,  $H_\beta$ ,  $H_\gamma$
- d)  $H_\gamma$ ,  $H_\beta$ ,  $H_\alpha$

29. The two major "windows" (regions of transparency) of our atmosphere are the \_\_\_\_ windows:

- a) radio and infrared
- b) radio and visual (or optical)
- c) ultraviolet and visual
- d) x-ray and radio

30. Which of these has the highest frequency?

- a) ultraviolet radiation
- b) radio waves
- c) infrared radiation
- d) gamma rays

31. In the demonstration with the bagel in class, when the string cut through the bagel, the bagel:

- a) continued to move in a circle
- b) went outwards due the centrifugal force
- c) continued in a straight line
- d) none of the above

32. Of NASA's great observatories, which one includes an optical telescope?

- a) Chandra X-ray Observatory
- b) Compton Gamma Ray Observatory
- c) Spitzer Space Telescope
- d) Hubble Space Telescope
- e) James Webb Space Telescope

33. M stars are cool stars around 4000 K. Which is *not* true of an M star?

- a) Most of the hydrogen will be ionized
- b) Most of the hydrogen will be neutral
- c) Most of the electrons will be in the ground state of hydrogen
- d) The Balmer lines will be weak

34. In spectroscopic notation, doubly ionized carbon would be written

- a) C I
- b) C II
- c) C III
- d) C IV
- e) C V

35. The pressure-temperature thermostat in the center of the sun:

- a) Makes the sun occasionally blow up
- b) Regulates the rates of nuclear reactions
- c) Often goes haywire
- d) Will prevent the sun from ever dying

-END OF TEST-