Astronomy 110
Homework #08
Assigned: 03/13/2007
Due: 03/20/2007

Name:

Directions: Listed below are twenty (20) multiple-choice questions based on the material covered by the lectures thus far. Choose the correct response from those listed, **along with at least a one (1) sentence justification for your answer**. Alternate justification techniques include math calculations and labeled sketches. Each question is worth 5 points: 2 for the letter response and 3 for the justification. Collaboration with your peers is permitted, but all justifications must be in your own words. If you are unsure about a question, make an educated guess, and justify your guess (which can include why you can rule out certain choices from the list). If you get stuck, **please seek assistance from your peers, the TA, or the professor**. Note: It may be helpful to place your answers on a separate sheet of paper and staple it to this assignment sheet.

WARNING: Please **DO NOT** copy material word for word from sources such as textbooks, a peer's notes, online references (i.e. Google or Wikipedia), etc in any responses to homework, quiz, or exam questions. Ideas should be expressed in your own words. Not only does this protect you from illegal acts of plagiarism and/or accusations of cheating, but it also aids your future studying by having ideas expressed in a way that you, personally, can best understand. If for some reason you MUST quote text from a source in your answer, properly reference your quote.

1. The star Ross 128 has a parallax of 0.301 arcsec, a radial velocity of 13 km/s, and a proper motion of 1.40 arcsec per year. At what **TOTAL** velocity does Ross 128 travel through space, relative to the Sun? (Hint: recall from mathematics that: total V = sqrt[$V_{radial}^2 + V_{perpendicular}^2$])
   A) 655 km/s or 2.36 million km/hr (1.47 million mph!)
   B) 22 km/s or 79,200 km/hr (49,500 mph!)
   C) 72 km/s or 259,200 km/hr (162,000 mph!)
   D) 26 km/s or 93,600 km/hr (58,500 mph!)

2. Star A is 180 times more luminous than the Sun, whereas star B is 370 times more luminous than the Sun. If A is 3 times as bright in the sky as B, how far away is A compared to B? (Hint: the inverse-square law can be used here)
   A) A is 0.40 times as far away as B.
   B) A is 1.21 times as far away as B.
   C) A is 0.83 times as far away as B.
   D) A is 0.17 times as far away as B.

3. The star Regulus, in the constellation Leo, appears brighter through a blue filter than it does through a yellow filter. Suppose a second star is found that has the same brightness as Regulus through the blue filter but is brighter than Regulus through the yellow filter. From this information, we can say conclusively that the second star has
   A) the same temperature but a lower luminosity.
   B) the same temperature but a higher luminosity.
   C) a higher temperature.
   D) a lower temperature.

4. Which of the following four spectral classifications represents the coolest stellar surface temperature?
   A) K
   B) A
   C) B
   D) G

5. A particular star has 12 times the radius of the Sun and only 60% of the Sun's surface temperature. What is the star's luminosity, in solar units ($L_\odot$)? (See Box 19-4, Freedman and Kaufmann, *Universe,* 7th ed.)
   A) 51.8 $L_\odot$.
   B) 18.7 $L_\odot$.
   C) 22.6 $L_\odot$.
   D) 7.2 $L_\odot$.

6. What is the size of a star in the upper right part of the Hertzsprung-Russell diagram compared to one in the middle of the diagram?
   A) It is fainter.
   B) It is hotter.
   C) There are no stars in the upper right part of the diagram.
   D) It is larger.

7. Two stars, one classified A4 V and the other F8 V, have the same apparent brightness. There is no significant amount of absorption of starlight by interstellar material. From this information we know that
   A) the A4 V star is closer to the Sun than F8 V.
   B) the A4 V star is smaller than F8 V.
   C) the A4 V star is farther from the Sun than F8 V.
   D) both stars are at the same distance from Sun.

8. Observations of binary stars provide a unique opportunity for astronomers to determine which important scientific parameter?
   A) expansion rate of the Universe
   B) stellar masses
   C) the speed of light in deep space
   D) the temperature of stars

9. What condition is necessary for us to see eclipses of stars in binary star systems?
   A) One of the stars must be much bigger than the other.
   B) The stars must have very similar surface temperatures.
   C) The line of sight from Earth to the star system must be in or very close to the orbital plane of the stars.
   D) The line of sight from Earth to the star system must be very close to the perpendicular to the orbital plane of the stars.

10. Using an “order-of-magnitude” calculation (i.e. using just powers of 10), what is a rough estimate for the orbital speed of the Earth? Be sure to show your calculation. (Hint: go ahead and assume a circular orbit.)
    A) 10 cm/s
    B) 1 m/s
    C) 10 km/s
    D) 1000 km/s

11. The space between stars is now known to contain
    A) large quantities of dust that absorb light but no gas, either atomic or molecular.
    B) gas (made up of atoms and molecules) and dust particles.
    C) a perfect vacuum.
    D) variable amounts of gas but no dust.

12. What process makes an emission nebula glow?
    A) electric currents caused by the flow of ionized gas, heating dust particles
    B) free electrons emitting light as they pass close to, and are accelerated by, positively charged ions
    C) light emitted when electrons jump between energy states in hydrogen atoms
    D) high-energy electrons spiraling along magnetic field lines

13. The blue color of a reflection nebula is produced by
    A) light emitted by the gas cloud that is Doppler-shifted as the cloud moves rapidly toward us.
    B) the continuum emission of very hot gas and dust.
    C) emission from specific transitions in hydrogen gas.
    D) selective scattering from very small dust grains.

14. The effect of interstellar dust on starlight is
    A) to dim and redden distant stars by preferentially scattering their blue light.
    B) to scatter the red light from stars preferentially, making them appear more blue than expected.
    C) almost nonexistent, because light does not interact with dust.
    D) to make stars appear less bright than expected by absorbing light about equally at all wavelengths.

15. The major source of energy in the pre–main-sequence life of the Sun was
    A) gravitational.
    B) nuclear fusion.
    C) chemical burning of carbon atoms.
    D) nuclear fission.

16. The lowest mass that a protostar can have and still become a star is what? (**Bonus Point:** Why are smaller objects unable to become stars?)
    A) about half a solar mass.
    B) slightly less than 1/100 of a solar mass.
    C) slightly less than 1/10 of a solar mass.
    D) 8/10 of a solar mass.

17. At what stage of its evolutionary life is the Sun?
    A) pre–main-sequence—variable star
    B) main-sequence—middle age
    C) post–main-sequence—red giant (cool) phase
    D) just before supernova stage (perhaps 5 years)—late evolutionary stage

18. What is happening in a star that is on the main sequence on the Hertzsprung-Russell diagram?
    A) The star is slowly shrinking and heating up as it slides up the main sequence from bottom right to top left in the H-R diagram.
    B) Nuclear reactions have ceased, and the star is simply cooling down.
    C) The star is generating internal energy by helium fusion, creating carbon.
    D) The star is generating internal energy by hydrogen fusion, creating helium.

19. Herbig-Haro objects (bright and variable regions within nebulae) are now thought to be the result of what? (Note: One of the astronomers after whom these objects are named, George Herbig, currently works at the UH Institute for Astronomy.)
    A) the initial condensation of matter into a protostar, producing an infrared and visible glow
    B) intense jets of material ejected from a young star, hitting parts of the nebula
    C) brightening of the gas surrounding a massive star as the precursor to a supernova explosion
    D) the hot atmosphere of a star as it is ejected in the dying phases of the star's life

20. Where in the universe would you look for a protostar?
    A) in globular clusters of stars
    B) near black holes
    C) in dense dust and gas clouds
    D) in the empty space between galaxies