Astronomy 110
Homework #07
Assigned: 03/06/2007
Due: 03/13/2007

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. Measurements of the brightness of a distant star through three filters indicate that the star is brightest in U, less bright in B, and faintest in V. What conclusion can be drawn from this information, assuming no absorption of light between the star and Earth?
   A) This information is insufficient to allow a conclusion to be drawn about star surface temperature.
   B) The star has an intermediate temperature, close to the Sun.
   C) The star has a lower surface temperature than the Sun.
   D) The star has a higher surface temperature than the Sun.

2. What effect does interstellar dust have on the apparent color of a star seen through the dust?
   A) The dust makes the star look brighter than it really is, but leaves the color of the star unchanged.
   B) The dust makes the star look bluer than it really is.
   C) The dust makes the star look fainter than it really is, but leaves the color of the star unchanged.
   D) The dust makes the star look redder than it really is.

3. The chemical makeup of a star's surface is usually determined by
   A) spectroscopy of the light emitted by the star.
   B) examining the chemicals present in a meteorite.
   C) theoretical methods, considering evolution of the star.
   D) taking a sample of the star's surface with a probe.

4. The spectrum of a typical main sequence star shows us the photons coming from the hotter lower layers and passing through the cooler upper layers of the star's "surface" (photosphere). This spectrum has what features?
   A) A continuum with absorption lines
   B) A smooth continuum only
   C) A series of emission lines, mostly from hydrogen
   D) A continuum with emission lines

5. The spectral type of a star is most directly related to (and determines uniquely) its
   A) size or radius.
   B) absolute magnitude.
   C) luminosity.
   D) surface temperature.

6. The spectral class of the Sun is G2 and the star Enif is K2. From this information, we know that Enif is
   A) intrinsically fainter than the Sun.
   B) cooler than the Sun.
   C) intrinsically brighter than the Sun.
   D) hotter than the Sun.

7. For Balmer series lines to show up strongly in stellar spectra, significant numbers of hydrogen atoms have to have electrons in the $n = 2$ energy level. What does the appearance of such lines in a stellar spectrum indicate about conditions on the star surface?
   A) The temperature must be high enough to excite the electrons to this level but not high enough to ionize the atoms.
   B) Hydrogen gas always shows significant Balmer absorption whatever the surface temperature.
   C) To show absorption from this level, the temperature must be high enough to ionize the atoms.
   D) The temperature must be very low, so that few atoms are in an excited state.

8. Which of the following atoms or ions will produce strong absorption lines in the spectra of stars with relatively cool surface temperatures? (See Figure 19-12 in the text for a hint)
   A) TiO, molecules of titanium oxide
   B) He I, neutral helium
   C) Mg II, ionized magnesium
   D) Ca II, ionized calcium

9. A particular star has a radius half that of the Sun and a luminosity equal to 60% of that of the Sun. What is the star's surface temperature? (See Box 19-4, Freedman and Kaufmann, *Universe*, 7th ed.) The surface temperature of the Sun is 5800 K.
   A) 7220 K
   B) 6650 K
   C) 4660 K
   D) 3610 K

10. Where on the Hertzsprung-Russell (H-R) diagram do most local stars in our universe congregate?
    A) in the supergiant area
    B) in the giants area
    C) in the white dwarf area
    D) on the main sequence

11. Compared to a star in the middle of the diagram, a star in the lower left part of the H-R diagram is
    A) brighter.
    B) larger.
    C) cooler.
    D) smaller.

12. Betelgeuse (the bright red star in the constellation Orion) has a surface temperature of 3500 K and a luminosity 100,000 times that of the Sun. What is its approximate radius in terms of that of the Sun? (Hint: Use Fig. 19-14 of Freedman and Kaufmann, *Universe,* 7th ed.)
    A) the same
    B) 1000 times larger
    C) 100 times larger
    D) 10 times larger

13. The star Arcturus is classified as K2 III (See Figure 19-17 in the textbook), which means that it is a
    A) hot giant.
    B) cool giant.
    C) cool main sequence star.
    D) cool supergiant.

14. Two stars, one classified A4 V and the other A4 III, have the same apparent magnitude. There is **no** significant amount of absorption of starlight by interstellar material. From this information we know that the A4 V star is
    A) hotter than A4 III.
    B) farther from the Sun than A4 III.
    C) cooler than A4 III.
    D) closer to the Sun than A4 III.

15. The point around which two stars of unequal mass in a binary system appear to revolve is
    A) closest to the more massive star.
    B) halfway between the two star centers.
    C) at the center of the more massive star.
    D) closest to the less massive star.

16. Where do we find the most massive stars on the main sequence in an H-R diagram?
    A) upper left
    B) They all have approximately the same mass, because this is what defines the main sequence.
    C) lower right
    D) center, with lower mass stars on either side

17. The spectrum of a very distant star shows spectral absorption lines of ionized helium (He II) and absorption bands from titanium oxide molecules (TiO). What would be your conclusion about this star?
    A) The star must have an atmosphere containing both He II and TiO.
    B) There must be very hot interstellar gas between the star and Earth.
    C) There must be a very hot atmosphere containing helium gas overlying a much cooler stellar surface.
    D) It is the spectrum of a binary system, two stars close together, a hot star and a cooler companion.

18. What is the physical reason for the appearance of periodic splitting and recombining of spectral lines in the spectra of binary stars?
    A) distortion of atoms on one star by the gravitational force of the other star, leading to line splitting
    B) Zeeman splitting of spectral lines on one star by the magnetic field of the second star
    C) oscillations on the surfaces of the stars leading to Doppler-shifted lines
    D) Doppler shift of light from stars orbiting each other, moving toward and away from Earth during this orbital motion

19. Light intensity variations are detected from a star in which the intensity remains essentially constant, except for the periodic, short, and regular decreases by a fixed amount. What is the most likely explanation for this observation?
    A) periodic ejection of a shell of absorbing gas and dust from the star, followed by its dispersion into interstellar space
    B) eclipsing of one star by its companion in a binary star
    C) the passage of a black hole in front of the star's visible surface
    D) pulsation of size, temperature, and intensity of a variable star

20. Which of the following observations would **NOT** be an indication of a binary star system?
    A) motion of the "star" in a straight line against the background field of stars
    B) observation of the "star" image separating into two distinct images periodically
    C) spectral lines from the "star" appearing to move back and forth periodically in position
    D) The "star" appears to become periodically dimmer for a few hours at a time.