Assignment 7

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

1. Why are astronomers much more interested in the luminosity of a star than its apparent brightness?
   a. because luminosity can be measured exactly, but apparent brightness can only be roughly estimated
   b. because the luminosity tells us how bright a star really is, while apparent brightness only tells us how bright it happens to look from Earth
   c. because the luminosity also tells us what elements the star is made of, while apparent brightness cannot tell us a star's chemical make-up
   d. because luminosity can tell us how bright it is inside the star, while apparent brightness only tells us about its outside layers
   e. you can't fool me, there is no difference between luminosity and apparent brightness; they are merely different terms for the same property of a star

2. Using a good pair of binoculars, you observe a section of the sky where there are stars of many different apparent brightnesses. You find one star that appears especially dim. This star looks dim because it is:
   a. very far away
   b. very low luminosity
   c. radiating most of its energy in the infrared region of the spectrum
   d. partly obscured by a cloud
   e. it could be more than one of the above; there is no way to tell which answer is right by just looking at the star

3. Which of the following looks the brightest in the sky?
   a. a star with magnitude 10
   b. a star with magnitude 1
   c. a star with magnitude 6
   d. a star with magnitude -1
   e. you can't fool me, all of the above look equally bright from Earth

4. When an astronomer rambles on and on about the luminosity of a star she is studying, she is talking about:
   a. what color the star is
   b. the total amount of mass in the star
   c. the star's apparent size (the size seen from Earth)
   d. how much energy the star gives off each second
   e. the elements she can see in the star's spectrum
5. Which color star is likely to be the hottest?
   a. red
   b. green
   c. blue-violet
   d. yellow
   e. orange

6. Two stars have the same luminosity, but star B is three times farther away from us than star A. Compared to star A, star B will look
   a. three times brighter
   b. nine times brighter
   c. nine times fainter
   d. three times fainter
   e. just as bright as A

7. Which of the following types of star is the coolest (has the lowest surface temperature)?
   a. O
   b. A
   c. M
   d. F
   e. G

8. A team of astronomers takes spectra of thousands of different stars in different parts of the sky. The spectra show significant differences. The main reason the spectra of the stars do not all look alike is that their stars
   a. are located in many different regions of the Milky Way
   b. have different temperatures
   c. are made of significantly different elements
   d. sometimes have atmospheres and sometimes do not
   e. change their spectra as they evolve, and so young stars have very different spectra from older ones

9. If hydrogen is the most common element in the universe, why do we not see the lines of hydrogen in the spectra of the hottest stars?
   a. in the hottest stars, hydrogen nuclei are forced to break apart into smaller nuclei
   b. in the hottest stars, all hydrogen in the star has quickly fused into helium
   c. in the hottest stars, hydrogen can quickly combine with oxygen to make H₂O, whose spectrum consists of completely different lines
   d. in the hottest stars, the hydrogen atoms experience a huge Doppler shift, which moves the lines in the spectrum to a completely unrecognizable place
   e. in the hottest stars, hydrogen atoms are ionized, and so there are no electrons to produce lines in the spectrum
10. Astronomers arrange the stars into groups called *spectral classes (or types)* according to the kinds of lines they find in their spectra. These spectral classes are arranged in order of:
   a. decreasing surface temperature
   b. increasing mass
   c. increasing amount of hydrogen
   d. decreasing distance from us
   e. you can't fool me, there is no order to the spectral types (that's why the letters are not in alphabetical order)

11. At an astronomical conference, an astronomer gives a report on a star that has recently begun to interest astronomers because of hints that it may have a planet around it. In his report the astronomer gives the average speed with which this star is moving away from the Sun. How did the astronomer measure this speed?
   a. by seeing how the luminosity of the star has been decreasing as it moves farther and farther away
   b. by seeing the whole star become much redder than it used to be
   c. by measuring the diameter of the star (which is easy to do) and noticing that it is getting smaller and smaller
   d. by looking at the Doppler shift in the lines of the star's spectrum
   e. the astronomer must be making up stories to impress his colleagues; there is no way to measure the speed with which stars move away or toward us.

12. A graduate student has spent a whole year doing a careful analysis of the spectrum of a star. While she has found lines from many elements, there was not a trace of the element helium in the spectra she has been analyzing. From this she can now conclude:
   a. there is most likely no helium anywhere in the star
   b. all the helium must be in the core of the star; there is none of it in the outer regions
   c. since helium shows lines only in hot stars, this star must be relatively cool
   d. since helium is the kind of element that quickly bonds with others, all the helium in this star must be in the form of molecules
   e. the student was not surprised, because NO star ever shows any lines of helium

13. An astronomer whose secret hobby is riding merry-go-rounds has dedicated his career to finding the stars that rotate the most rapidly. But the stars are all very far away, so none of them can be seen to spin even when he looks through the largest telescopes. How then can he identify the stars that rotate rapidly?
   a. all stars that rotate show a huge Doppler shift toward the blue end of the spectrum
   b. stars that rotate have a significantly lower luminosity than stars that do not rotate
   c. stars that rotate have much wider lines in their spectra than stars that do not
   d. stars that rotate bring the light atoms (like hydrogen) spinning up to their surfaces; so they can be identified by the elements they contain
   e. this astronomer better spend some more time enjoying his hobby, because he is not doing well at his job; there is no way we know about today to identify stars that rotate
14. Which of the following statements about spectroscopic binary stars is FALSE?
   a. visually we can only see one star
   b. some of the lines in the spectrum are double, with the spacing changing over time
   c. an analysis of the ways the lines in the spectrum change allows us to calculate the star's distance directly
   d. we can use the spectrum to determine the sum of the masses of the two stars
   e. we can often use the changes in the positions of the spectral lines to measure the radial velocity of the stars in the system

15. Some objects in space just don't have what it takes to be a star (just like many hopefuls in Hollywood don't.) Which of the following is a "failed star", an object with too little mass to qualify as a star?
   a. a brown dwarf
   b. an M type dwarf
   c. an O-type star
   d. the Sun
   e. any star with high proper motion

16. Two stars that are physically associated (move together through space) are called
   a. double stars
   b. main sequence stars
   c. brown dwarf pairs
   d. first contact stars
   e. binary stars

17. Which of the following characteristics of a single star (one that moves through space alone) is it difficult to measure directly?
   a. its apparent brightness
   b. its temperature
   c. its chemical composition
   d. its mass
   e. you can't fool me, all of these are quite easy to measure directly

18. I am measuring the spectrum of the stars in a spectroscopic binary system. When one of the stars is moving toward the Earth in its orbit, we observe
   a. that the lines in its spectrum get brighter
   b. that the lines in its spectrum merge with the lines of the other star
   c. that it is no longer possible to learn what elements are in the star
   d. that the lines in its spectrum show a blue-shift
   e. none of the above
19. Stars that do not have what it takes to succeed as a star (i.e. do not have enough mass to fuse hydrogen into helium at their centers) are called:
   a. extras
   b. red giants
   c. spectroscopic stars
   d. brown dwarfs
   e. main sequence stars

20. Which of the following has the smallest mass?
   a. a brown dwarf
   b. a planet
   c. the Sun
   d. the smallest mass star that can still have fusion of hydrogen to helium in its core
   e. you can't fool me, all the above have roughly the same mass

21. Stars on the main sequence obey a mass-luminosity relation. According to this relation,
   a. the lower the mass, the higher the luminosity
   b. if you double the mass, you get double the luminosity
   c. luminosity is proportional to mass to the fourth power (luminosity increases strongly with mass)
   d. bright stars have more mass around them in the form of planets, comets, and asteroids
   e. the brightest stars are made of such light materials they hardly have any mass at all

22. For what type of star can astronomers measure the diameter with relative ease?
   a. visual double stars
   b. white dwarf stars
   c. main sequence stars
   d. eclipsing binary stars
   e. any star that is not a brown dwarf

23. Ninety percent of all stars (if plotted on an H-R diagram) would fall into a region astronomers call:
   a. the supergiant region
   b. the main sequence
   c. the white dwarf region
   d. the visual region
   e. the twilight zone

24. An H-R Diagram plots the luminosity of stars against their:
   a. mass
   b. diameter
   c. surface temperature
   d. age
   e. location in the sky
25. A white dwarf, compared to a main sequence star with the same mass, would always be:
   a. larger in diameter
   b. smaller in diameter
   c. the same size in diameter
   d. younger in age
   e. less massive

26. A team of astronomers discovers one of the most massive stars ever found. If this star is just settling down in that stage of its life where it will be peacefully converting hydrogen to helium in its core, where will we find it on the H-R diagram?
   a. among the supergiants, in the upper right
   b. a little bit below the Sun on the main sequence
   c. among the most brilliant of the white dwarfs, in the lower left
   d. near the very top of the main sequence, in the upper left
   e. it could be anywhere on the diagram; we would need more information to determine its place

27. Stars that lie in different places on the main sequence of the H-R diagram differ from each other mainly by having different:
   a. compositions
   b. internal structure
   c. masses
   d. radial velocities
   e. ways that they formed

28. One of your good friends who is on a diet asks you to point out the stars with the smallest mass on an H-R diagram that you are studying. Where are you sure to find the stars with the lowest mass on any H-R diagram?
   a. among the white dwarfs
   b. among the stars at the top left of the main sequence
   c. among the stars at the bottom right of the main sequence
   d. among the supergiants
   e. stars with low mass can be located anywhere at all in the H-R diagram

29. Astronomers identify the main sequence on the H-R diagram with what activity in the course of a star's life?
   a. forming from a reservoir of cosmic material
   b. fusing hydrogen into helium in their cores
   c. letting go of a huge outer layer
   d. dying
   e. you can't fool me; so many stars are on the main sequence that there is no special stage in a star's life that can be identified with it
30. A type of star cluster that contains mostly very old stars is
   a. a globular star cluster
   b. a stellar association
   c. a galaxy
   d. an HII region
   e. an open cluster

31. A star that is quite hot and has a very small radius compared to most stars is called
   a. a main-sequence star
   b. an O-type star
   c. a red giant
   d. a white dwarf
   e. an M-type star

32. The apparent brightness of stars in general tells us nothing about their distances (i.e. we cannot assume that
   the dimmer stars are farther away.) In order for the apparent brightness of a star to be a good indicator of its
   distance, all the stars would have to be:
   a. at the same distance
   b. the same composition
   c. the same luminosity
   d. by themselves instead of in binary or double-star systems
   e. a lot farther away than they presently are

33. As astronomers use the term, the parallax of a star is
   a. one half of the Doppler shift due to its radial velocity
   b. always equal to 1 AU
   c. one half the angle that a star shifts when seen from opposite sides of the Earth's orbit
   d. the time it takes a Cepheid variable star to go through one cycle of its brightness changes
   e. the time it takes for a star to move one second of arc of proper motion

34. How far away would a star with a parallax of 0.2 arcsec be from us?
   a. 2 parsecs
   b. 5 parsecs
   c. 0.2 parsecs
   d. 0.5 parsecs
   e. we need more information to answer this question

35. A science fiction writer needs an environment for her latest story where stars are as crowded together as
    possible. Which of the following would be a good place to locate her story?
   a. in a small open cluster
   b. in a stellar association
   c. in the outer regions of a spiral galaxy's disk
   d. in a globular cluster
   e. in a popular Hollywood restaurant
36. The oldest structures in our Galaxy turn out to be
   a. HII regions
   b. giant molecular clouds
   c. open clusters
   d. stellar associations
   e. globular clusters

37. An astronomy student, for her PhD, really needs to estimate the age of a cluster of stars. Which of the following would be part of the process she would follow?
   a. measure the Doppler shift of a number of the stars in the cluster
   b. search for x-rays coming from the center of the cluster
   c. plot an H-R diagram for the stars in the cluster
   d. count the number of M type stars in the cluster
   e. search for planets like Jupiter around the stars in the center of the cluster

38. On an H-R diagram of a cluster of stars, which characteristic of the diagram do astronomers use as a good indicator of the cluster's age?
   a. the number of M stars on the main sequence
   b. the lowest luminosity star that is visible in the cluster
   c. the point on the main sequence where stars begin to "turn off" -- to move toward the red giant region
   d. how high up on the main sequence M type stars are found
   e. the coolest surface temperature for a star that they can measure
Assignment 7
Answer Section

MULTIPLE CHOICE

1. ANS: B
3. ANS: D
5. ANS: C
7. ANS: C
9. ANS: E
11. ANS: D
13. ANS: C
15. ANS: A
17. ANS: D
19. ANS: D
21. ANS: C
23. ANS: B
25. ANS: B
27. ANS: C
29. ANS: B
31. ANS: D
33. ANS: C
35. ANS: D
37. ANS: C