***The Cosmic Perspective***

**Surveying the Stars**

15.1 Multiple-Choice Questions

1) Approximately, what basic composition are all stars born with?

A) half hydrogen, half helium, no more than 2 percent heavier elements

B) three-quarters hydrogen, one-quarter helium, no more than 2 percent heavier elements

C) 90 percent hydrogen, 10 percent helium, no more than 1 percent heavier elements

D) one-quarter hydrogen, three-quarters helium, no more than 2 percent heavier elements

E) 98 percent hydrogen, 2 percent helium

Answer: B

2) Since all stars begin their lives with the same basic composition, what characteristic most determines how they will differ?

A) location where they are formed

B) time they are formed

C) luminosity they are formed with

D) mass they are formed with

E) color they are formed with

Answer: D

3) What are the standard units for luminosity?

A) watts

B) joules

C) Newtons

D) kilograms

E) watts per second

Answer: A

4) A star's *luminosity* is the

A) apparent brightness of the star in our sky.

B) surface temperature of the star.

C) lifetime of the star.

D) total amount of light that the star will radiate over its entire lifetime.

E) total amount of light that the star radiates each second.

Answer: E

5) What are the standard units for apparent brightness?

A) watts

B) joules

C) Newtons

D) watts per second

E) watts per square meter

Answer: E

6) If the distance between us and a star is doubled, with everything else remaining the same, the luminosity

A) is decreased by a factor of four, and the apparent brightness is decreased by a factor of four.

B) is decreased by a factor of two, and the apparent brightness is decreased by a factor of two.

C) remains the same, but the apparent brightness is decreased by a factor of two.

D) remains the same, but the apparent brightness is decreased by a factor of four.

E) is decreased by a factor of four, but the apparent brightness remains the same.

Answer: D

7) Which of the following correctly states the luminosity-distance formula?

A) luminosity = 

B) apparent brightness = 

C) apparent brightness = luminosity × 4π × (distance)2

D) distance = 

Answer: B

8) Why do astronomers often measure the *visible-light apparent brightness* instead of the *total apparent brightness* of a star?

A) All stars put out most of their light in the visible range of the spectrum.

B) In order to measure the total apparent brightness of a star, you must measure its brightness in all wavelengths, and this is difficult to do. The only wavelengths you can measure from the surface of Earth are visible and radio wavelengths.

C) Most stars do not put out light in other ranges of the spectrum.

D) They are identical for most stars.

E) Astronomers are lazy.

Answer: B

9) Suppose you measure the parallax angle for a particular star to be 0.1 arcsecond. The distance to this star is

A) 10 light-years.

B) 10 parsecs.

C) 0.1 light-year.

D) 0.1 parsec.

E) impossible to determine.

Answer: B

10) Suppose that you measure the parallax angle for a particular star to be 0.5 arcsecond. The distance to this star is

A) 0.5 light-year.

B) 0.5 parsec.

C) 5 light-years.

D) 5 parsecs.

E) 2 parsecs.

Answer: E

11) The most distant stars we can measure stellar parallax for are approximately

A) 50 parsecs away.

B) 500 parsecs away.

C) 5,000 parsecs away.

D) halfway across the Milky Way Galaxy.

E) in the Andromeda Galaxy.

Answer: B

12) Which of the following statements about apparent and absolute magnitudes is *true*?

A) The magnitude system that we use now is based on a system used by the ancient Greeks over 2,000 years ago that classified stars by how bright they appeared.

B) A star with apparent magnitude 1 is brighter than one with apparent magnitude 2.

C) The absolute magnitude of a star is another measure of its luminosity.

D) A star's absolute magnitude is the apparent magnitude it would have if it were at a distance of 10 parsecs from Earth.

E) All of the above are true.

Answer: E

13) The spectral sequence sorts stars according to

A) mass.

B) surface temperature.

C) luminosity.

D) core temperature.

E) radius.

Answer: B

14) The spectral sequence in order of decreasing temperature is

A) OFBAGKM.

B) OBAGFKM.

C) OBAFGKM.

D) ABFGKMO.

E) BAGFKMO.

Answer: C

15) Why is the spectral sequence of stars not alphabetical?

A) The letters refer to the initials of the original discovers.

B) The original alphabetical labeling did not correspond to surface temperature and thus had to be reordered.

C) They were chosen to fit a mnemonic.

D) Because there is still uncertainty over what generates the energy in stellar cores.

E) Because it refers to stellar masses and these were difficult to measure accurately.

Answer: B

16) Which of the following statements about spectral types of stars is *true*?

A) The spectral type of a star can be used to determine its surface temperature.

B) The spectral type of a star can be used to determine its color.

C) A star with spectral type A is cooler than a star with spectral type B.

D) A star with spectral type F2 is hotter than a star with spectral type F3.

E) All of the above are true.

Answer: E

17) Which of the following persons reorganized the spectral classification scheme into the one we use today and personally classified over 400,000 stars?

A) Annie Jump Cannon

B) Williamina Fleming

C) Cecilia Payne-Gaposchkin

D) Henry Draper

E) Edward Pickering

Answer: A

18) Which of the following persons used the ideas of quantum mechanics to describe *why* the spectral classification scheme is in order of decreasing temperature?

A) Annie Jump Cannon

B) Williamina Fleming

C) Cecilia Payne-Gaposchkin

D) Henry Draper

E) Edward Pickering

Answer: C

19) Suppose you see two main-sequence stars of the *same spectral type*. Star 1 is dimmer in apparent brightness than Star 2 by a factor of 100. What can you conclude? (Neglect any effects that might be caused by interstellar dust and gas.)

A) Without first knowing the distances to these stars, you cannot draw any conclusions about how their true luminosities compare to each other.

B) The luminosity of Star 1 is a factor of 100 less than the luminosity of Star 2.

C) Star 1 is 100 times more distant than Star 2.

D) Star 1 is 100 times nearer than Star 2.

E) Star 1 is 10 times more distant than Star 2.

Answer: E

20) Which of the following terms is given to a pair of stars that appear to change positions in the sky, indicating that they are orbiting one another?

A) visual binary

B) eclipsing binary

C) spectroscopic binary

D) double star

E) none of the above

Answer: A

21) Which of the following terms is given to a pair of stars that we can determine are orbiting each other only by measuring their periodic Doppler shifts?

A) visual binary

B) eclipsing binary

C) spectroscopic binary

D) double star

E) none of the above

Answer: C

22) Which of the following best describes the axes of a Hertzsprung**-**Russell (H-R) diagram?

A) surface temperature on the horizontal axis and luminosity on the vertical axis

B) mass on the horizontal axis and luminosity on the vertical axis

C) surface temperature on the horizontal axis and radius on the vertical axis

D) mass on the horizontal axis and stellar age on the vertical axis

E) interior temperature on the horizontal axis and mass on the vertical axis

Answer: A

23) On a Hertzsprung**-**Russell diagram, where would we find stars that are cool and dim?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: B

24) On a Hertzsprung**-**Russell diagram, where would we find stars that are cool and luminous?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: A

25) On a Hertzsprung**-**Russell diagram, where would we find stars that have the largest radii?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: A

26) On a Hertzsprung**-**Russell diagram, where on the main sequence would we find stars that have the greatest mass?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: C

27) On a Hertzsprung**-**Russell diagram, where would we find red giant stars?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: A

28) On a Hertzsprung**-**Russell diagram, where would we find white dwarfs?

A) upper right

B) lower right

C) upper left

D) lower left

Answer: D

29) You observe a star in the disk of the Milky Way, and you want to plot the star on an H**-**R diagram. You will need to determine all of the following, *except* the

A) spectral type of the star.

B) distance to the star.

C) apparent brightness of the star in our sky.

D) rotation rate of the star.

Answer: D

30) On the main sequence, stars obtain their energy

A) from chemical reactions.

B) from gravitational contraction.

C) by converting hydrogen to helium.

D) by converting helium to carbon, nitrogen, and oxygen.

E) from nuclear fission.

Answer: C

31) The faintest star visible to the naked eye has an apparent visual magnitude of about

A) 10.

B) 6.

C) 1.

D) 0.

E) **-**6.

Answer: B

32) Which of the following is the most common type of main-sequence star?

A) an O star

B) an A star

C) an F star

D) an M star

E) a G star

Answer: D

33) Which of the following characteristics of stars has the greatest range in values?

A) mass

B) radius

C) core temperature

D) surface temperature

E) luminosity

Answer: E

34) A star of spectral type O lives approximately how long on the main sequence?

A) 1,000 years

B) 10,000 years

C) 10 million years

D) 100 million years

E) 1 billion years

Answer: C

35) A star of spectral type G lives approximately how long on the main sequence?

A) 1,000 years

B) 10,000 years

C) 1 million years

D) 100 million years

E) 10 billion years

Answer: E

36) Which of the following is true about low-mass stars compared to high-mass stars?

A) Low-mass stars are cooler and less luminous than high-mass stars.

B) Low-mass stars are hotter and more luminous than high-mass stars.

C) Low-mass stars are cooler but more luminous than high-mass stars.

D) Low-mass stars are hotter but less luminous than high-mass stars.

E) Low-mass stars have the same temperature and luminosity as high-mass stars.

Answer: A

37) Which of the following luminosity classes refers to stars on the main sequence?

A) I

B) II

C) III

D) IV

E) V

Answer: E

38) In a pulsating variable star, which characteristic of the star changes dramatically with time?

A) mass

B) core temperature

C) luminosity

D) energy-generation process

E) rotation rate

Answer: C

39) Why are Cepheid variables so important for measuring distances in astronomy?

A) They all have the same luminosity.

B) They all have the same period.

C) Their luminosity can be inferred from their period.

D) They are close enough to have a detectable parallax.

E) They are circumpolar like Polaris, the North Star.

Answer: C

40) Which of the following statements about an open cluster is *true*?

A) All stars in the cluster are approximately the same color.

B) All stars in the cluster are approximately the same age.

C) All stars in the cluster have approximately the same mass.

D) All stars in the cluster will evolve similarly.

E) There is an approximately equal number of all types of stars in the cluster.

Answer: B

41) Which of the following statements about a globular cluster is *true*?

A) All stars in the cluster are approximately at the same stage in evolution.

B) Most of the stars in the cluster are younger than 10 billion years old.

C) Most stars in the cluster are yellow or reddish in color.

D) All stars in the cluster have approximately the same mass.

E) There is an approximately equal number of all types of stars in the cluster.

Answer: C

42) Cluster ages can be determined from

A) main sequence fitting.

B) main sequence turnoff.

C) pulsating variable stars.

D) spectroscopic binaries.

E) visual binaries.

Answer: B

43) In order to understand star clusters, we need to be able to estimate their ages. What technique do scientists use for this?

A) radioisotope dating

B) counting the planets that have formed around the largest stars

C) finding the main-sequence turnoff point of the stars

D) calculating orbital parameters using Kepler's Laws

E) measuring its parallax

Answer: C

15.2 True/False Questions

1) The apparent brightness of a star depends only on its luminosity.

Answer: FALSE

2) If the distance between us and a star is doubled, the apparent brightness is decreased by a factor of four.

Answer: TRUE

3) The more distant a star, the smaller its parallax.

Answer: TRUE

4) We can measure stellar parallax for most stars in our galaxy.

Answer: FALSE

5) Spectral type, surface temperature, and color all describe the same basic characteristic of a star.

Answer: TRUE

6) Some stars are cool enough to have molecules in their atmosphere.

Answer: TRUE

7) We can measure the radii of stars in an eclipsing binary system, in addition to the masses.

Answer: TRUE

8) Two stars have the same spectral type. Star X is in luminosity class III, while Star Y is in luminosity class V. Therefore, Star X is larger in radius than Star Y.

Answer: TRUE

9) Two stars have the same luminosity. Star X is spectral type F, while Star Y is spectral type K. Therefore, Star X is larger in radius than Star Y.

Answer: FALSE

10) Two stars both lie on the main sequence. Star X is spectral type A, while Star Y is spectral type G. Therefore, Star X is more massive than Star Y.

Answer: TRUE

11) A 10-solar-mass star is about ten times more luminous than a 1-solar-mass star.

Answer: FALSE

12) Most stars on the main sequence fuse hydrogen into helium in their cores, but some do not.

Answer: FALSE

13) All stars spend approximately the same amount of time on the main sequence.

Answer: FALSE

15.3 Short Answer Questions

1) Earth is about 150 million km from the Sun, and the apparent brightness of the Sun in our sky is about 1,300 watts per square meter. Determine the apparent brightness we would measure for the Sun if we were located half Earth's distance from the Sun.

Answer: The Sun would appear four times brighter. So the apparent brightness would be 4 × 1,300 watts per square meter = 5,200 watts per square meter.

2) Earth is about 150 million km from the Sun, and the apparent brightness of the Sun in our sky is about 1,300 watts per square meter. Determine the apparent brightness we would measure for the Sun if we were located one-third of Earth's distance from the Sun.

Answer: The Sun would appear nine times brighter. So the apparent brightness would be 9 × 1,300 watts per square meter = 11,700 watts per square meter.

3) Earth is about 150 million km from the Sun, and the apparent brightness of the Sun in our sky is about 1,300 watts per square meter. Determine the apparent brightness we would measure for the Sun if we were located five times Earth's distance from the Sun.

Answer: The Sun would appear 1/25 times as bright. So the apparent brightness would be 1,300 ÷ 25 = 52 watts per square meter.

4) Which is brighter in our sky, a star with apparent magnitude 2 or a star with apparent magnitude 7? By how much is the star brighter?

Answer: A star with apparent magnitude 2 is 100 times brighter than a star with apparent magnitude 7. (Five magnitudes indicates a factor**-**of**-**100 difference; larger apparent magnitude stars are always fainter.)

5) Which has a greater luminosity, a star with absolute magnitude +4 or a star with absolute magnitude **-**6? By how much is it brighter?

Answer: A star with absolute magnitude **-**6 is intrinsically more luminous than a star with magnitude +4. The difference is 10 magnitudes, so the difference in luminosity is a factor of 100 for the first 5 magnitudes and a factor of 100 for the second 5 magnitudes, making an overall difference of a factor of 1002 = 10,000.

6) Two stars, Tom and Jerry, have the same spectral type. Tom is luminosity class V and Jerry is luminosity class I. Which star is bigger? Which star is more luminous? Which star has a hotter surface temperature? Explain your answers.

Answer: Tom is on the main sequence, while Jerry is a supergiant. They both have the same surface temperature since they have the same spectral type, but since Jerry is much more luminous, Jerry must be much bigger in size.

7) Two stars, Fred and Barney, are of the same size. Fred has spectral type F, while Barney has spectral type B. Which one is more luminous?

Answer: Barney has a hotter surface temperature than Fred. Since they have the same surface area, Barney is also more luminous.

8) Two stars, Betty and Wilma, are both on the main sequence. Betty is more luminous than Wilma. Which one has a hotter surface temperature? Which one is more massive? Which one is bigger? If they both formed at the same time, which one will evolve off the main sequence first?

Answer: Since they are both on the main sequence but Betty is more luminous than Wilma, Betty must be located higher up on the main sequence. Therefore, Betty has a hotter surface temperature, is more massive, and has a larger radius. Betty will also evolve faster than Wilma, and if they were formed at the same time Betty will turn off the main sequence first.

*Refer to the choices in the table for the following questions.*

 

9) Which star has the greatest luminosity?

Answer: B

10) Which star appears brightest in the sky?

Answer: C

11) Which star looks reddest in color?

Answer: B

12) Which star looks bluest in color?

Answer: C

13) Which star is emitting the most ultraviolet light per unit area?

Answer: A

14) Which star is the most distant?

Answer: B

15) Which star is most similar to the Sun?

Answer: D

16) Which star has the lowest surface temperature?

Answer: B

17) Which star has the highest surface temperature?

Answer: A

18) Which star has the largest radius?

Answer: B

*The following questions refer to the sketch of the H****-****R diagram below. Please choose the best answer in each case,* i.e*., choice (a) refers to the entire main sequence, while (c) and (d) refer to only small parts of the main sequence. If choice (c) or (d) offers a better answer to a particular question than (a), use the best choice. You may use the same choice more than once.*



19) Which group represents stars that are cool and dim?

Answer: d

20) Which group represents stars that are hot but dim?

Answer: b

21) Which group represents the most common type of stars?

Answer: d

22) Which group represents stars of the smallest radii?

Answer: b

23) Which group represents stars of the largest radii?

Answer: e

24) Which group includes the Sun?

Answer: a

25) Which group represents stars that are hot and very bright?

Answer: c

26) Which group represents stars that are extremely bright and emit most of their radiation as ultraviolet light?

Answer: c

27) Which group represents hydrogen-burning stars with the shortest lifetimes?

Answer: c

28) Which group represents hydrogen-burning stars with the longest lifetimes?

Answer: d

29) Which group includes stars that are burning elements *besides* hydrogen in their cores?

Answer: e

30) Which group represents stars burning *hydrogen* in their cores?

Answer: a

31) Which group includes stars that are burning *helium* in their cores?

Answer: e

32) Which group represents stars that have no nuclear fusion in their cores?

Answer: b

33) What is the importance of Cepheid variables in astronomy?

Answer: Cepheid variables have a period-luminosity relationship that allows us to determine their luminosity from measuring their periodic variations in brightness. Comparing the luminosity with the apparent brightness then gives us the distance to the star. In this way, we can determine distances to not just Cepheid stars but the clusters and even galaxies that they are associated with.

*The following questions refer to the representations below of H****-****R diagrams for different clusters of stars.*



34) Which cluster is the youngest?

Answer: D

35) Which cluster is the oldest?

Answer: C

36) Which cluster is 10 billion years old?

Answer: A

37) *Process of Science*: How do scientists estimate stellar luminosities?

Answer: They must find both the brightness of the star from Earth and its distance, and then use the inverse-square law.

38) *Process of Science:* Why is the classification of stellar spectral types not in alphabetical order?

Answer: Stars were first classified empirically, based on observed features (location and strength of absorption lines) in their spectra, without understanding what this actually corresponded to in terms of their physical properties. When astronomers understood what caused the spectral lines and that the classification was actually one of temperature, they reordered the classification (and eliminated some letters) to result in the OBAFGKM sequence that we use today.

39) *Process of Science:* What is a basic assumption that is made when we measure stellar masses by observing their orbits?

Answer: We assume that the stars move around each other under the force of gravity in exactly the same way as planets move around the Sun in our Solar System. That is, Newton's laws are equally valid in these distant stellar systems.

15.4 Mastering Astronomy Reading Quiz

1) What is the approximate chemical composition (by mass) with which all stars are born?

A) three quarters hydrogen, one quarter helium, no more than 2% heavier elements

B) half hydrogen and half helium

C) 98% hydrogen, 2% helium

D) 95% hydrogen, 4% helium, no more than 1% heavier elements

Answer: A

2) The total amount of power (in watts, for example) that a star radiates into space is called its

A) apparent brightness.

B) absolute magnitude.

C) luminosity.

D) flux.

Answer: C

3) According to the inverse square law of light, how will the apparent brightness of an object change if its distance to us triples?

A) Its apparent brightness will *increase* by a factor of 9.

B) Its apparent brightness will *decrease* by a factor of 9.

C) Its apparent brightness will *increase* by a factor of 3.

D) Its apparent brightness will *decrease* by a factor of 3.

Answer: B

4) Assuming that we can measure the apparent brightness of a star, what does the inverse square law for light allow us to do?

A) Determine both the star's distance and luminosity from its apparent brightness.

B) Determine the distance to the star from its apparent brightness.

C) Calculate the star's luminosity if we know its distance, or calculate its distance if we know its luminosity.

D) Calculate the star's surface temperature if we know either its luminosity or its distance.

Answer: C

5) If Star A is closer to us than Star B, then Star A's *parallax angle* is

A) smaller than that of Star B.

B) larger than that of Star B.

C) hotter than that of Star B.

D) fewer parsecs than that of Star B.

Answer: B

6) Ten parsecs is about

A) 150 million kilometers.

B) 10,000 seconds.

C) 10 parallax seconds of angle.

D) 32.6 light-years.

Answer: D

7) Star A has an apparent magnitude of 3 and Star B has an apparent magnitude of 5. Which star is brighter in our sky?

A) Star A

B) Star B

C) The two stars have the same brightness in our sky, but Star A is closer to us than Star B.

D) There is not enough information to answer the question.

Answer: A

8) From hottest to coolest, the order of the spectral types of stars is

A) OBAFGKM.

B) OBAGFKM.

C) ABFGKMO.

D) OMKGFBA.

E) ABCDEFG.

Answer: A

9) Our Sun is a star of spectral type

A) F.

B) M.

C) G.

D) S.

Answer: C

10) Astronomers can measure a star's mass in only certain cases. Which one of the following cases might allow astronomers to measure a star's mass?

A) The star is a member of a binary star system.

B) The star is of spectral type G.

C) The star is of spectral type A.

D) We know the star's luminosity and distance.

Answer: A

11) Which of the following terms is given to a pair of stars that we can determine are orbiting each other only by measuring their periodic Doppler shifts?

A) eclipsing binary

B) spectroscopic binary

C) visual binary

D) double star

Answer: B

12) The axes on a Hertzsprung-Russell (H-R) diagram represent

A) mass and luminosity.

B) luminosity and surface temperature.

C) luminosity and apparent brightness.

D) mass and radius.

Answer: B

13) On an H-R diagram, stellar radii

A) are greatest in the lower left and least in the upper right.

B) decrease from left to right.

C) are impossible to determine.

D) increase diagonally from the lower left to the upper right.

Answer: D

14) On an H-R diagram, stellar masses

A) can be determined for main-sequence stars but not for other types of stars.

B) are greatest in the lower left and least in the upper right.

C) decrease from upper left to lower right.

D) are impossible to determine.

Answer: A

15) On an H-R diagram, stellar masses

A) can be determined for main-sequence stars but not for other types of stars.

B) are greatest in the lower left and least in the upper right.

C) decrease from upper left to lower right.

D) are impossible to determine.

Answer: A

16) How is the lifetime of a star related to its mass?

A) More massive stars live slightly shorter lives than less massive stars.

B) More massive stars live much longer lives than less massive stars.

C) More massive stars live much shorter lives than less massive stars.

D) More massive stars live slightly longer lives than less massive stars.

Answer: C

17) Each choice below lists a spectral type and luminosity class for a star. Which one is a *red supergiant*?

A) spectral type M1, luminosity class V

B) spectral type O9, luminosity class I

C) spectral type G2, luminosity class V

D) spectral type M2, luminosity class I

Answer: D

18) What is the common trait of all main-sequence stars?

A) They are in the final stage of their lives.

B) They generate energy through hydrogen fusion in their core.

C) They are all spectral type G.

D) They all have approximately the same mass.

Answer: B

19) Suppose our Sun were suddenly replaced by a supergiant star. Which of the following would be true?

A) Earth would be inside the supergiant.

B) The supergiant's surface temperature would be much hotter than the surface temperature of our Sun.

C) Earth would fly off into interstellar space.

D) The supergiant would appear as large as the full Moon in our sky.

Answer: A

20) What is a white dwarf?

A) It is a main-sequence star of spectral type F, which tends to look white in color.

B) It is the remains of a star that ran out of fuel for nuclear fusion.

C) It is a type of star that produces energy by gravitational contraction.

D) It is a star that follows a period-luminosity relation.

Answer: B

21) Which of the following statements comparing open and globular star clusters is *not* true?

A) Open clusters are found only in the disk of the galaxy while globular clusters may be found both in the disk and the halo of the galaxy.

B) Stars in open clusters are relatively young while stars in globular clusters are very old.

C) Open and globular clusters each typically contain a few hundred stars.

D) For both open and globular clusters, we can assume that all the stars in a particular cluster are about the same age.

Answer: C

22) What do we mean by the *main-sequence turnoff point* of a star cluster, and what does it tell us?

A) It is the point in a star cluster beyond which main-sequence stars are not found, and it tells us the cluster's distance.

B) It is the spectral type of the hottest main-sequence star in a star cluster, and it tells us the cluster's age.

C) It is the luminosity class of the largest star in a star cluster, and it tells us the cluster's age.

D) It is the mass of the most massive star in the star cluster, and it tells us the cluster's size.

Answer: B

15.5 Mastering Astronomy Concept Quiz

1) All stars are born with the same basic composition, yet stars can look quite different from one another. Which two factors primarily determine the characteristics of a star?

A) its mass and its stage of life

B) its apparent brightness and its distance

C) its age and its location in the galaxy

D) its mass and its surface temperature

E) its apparent brightness and its luminosity

Answer: A

2) Based on the definition of apparent brightness, which units are appropriate for its measurement?

A) watts

B) joules

C) watts per square meter

D) Newtons

Answer: C

3) Star A is identical to Star B, except that Star A is twice as far from us as Star B. Therefore

A) both stars have the same luminosity, but the apparent brightness of Star B is twice that of Star A.

B) both stars have the same apparent brightness, but the luminosity of Star B is four times that of Star A.

C) both stars have the same luminosity, but the apparent brightness of Star A is four times that of Star B.

D) both stars have the same luminosity, but the apparent brightness of Star B is four times that of Star A.

Answer: D

4) A star with a parallax angle of 1/20 arcsecond is

A) 20 light-years away.

B) 1/20 parsec away.

C) 20 parsecs away.

D) 10 parsecs away.

Answer: C

5) The star Vega has an absolute magnitude of about 4 and an apparent magnitude of about 0. Based on the definitions of absolute and apparent magnitude, we can conclude that

A) Vega is nearer than 10 parsecs from Earth.

B) Vega has a parallax angle of 1/10 arcsecond.

C) Vega's luminosity is less than that of our Sun.

D) Vega's surface temperature is cooler than the Sun.

Answer: A

6) Which of the following statements about spectral types of stars is *not* generally true?

A) The spectral type of a star can be used to determine its surface temperature.

B) The spectral type of a star can be used to determine its distance.

C) The spectral type of a star can be used to determine its color.

D) The spectral type of a star can be determined by identifying lines in its spectrum.

Answer: B

7) Sirius is a star with spectral type A star and Rigel is a star with spectral type B star. What can we conclude?

A) Rigel has a higher core temperature than Sirius.

B) Sirius has a higher core temperature than Rigel.

C) Rigel has a higher surface temperature than Sirius.

D) Sirius has a higher surface temperature than Rigel.

Answer: C

8) To calculate the masses of stars in a binary system, we must measure their

A) spectral types and distance from Earth.

B) absolute magnitudes and luminosities.

C) luminosities and distance from Earth.

D) orbital period and average orbital distance.

Answer: D

9) Careful measurements reveal that a star maintains a steady apparent brightness at most times, except that at precise intervals of 73 hours the star becomes dimmer for about 2 hours. The most likely explanation is that

A) the star is a Cepheid variable.

B) the star is a member of an eclipsing binary star system.

C) the star is periodically ejecting gas into space, every 73 hours.

D) the star is a white dwarf.

Answer: B

*The sketch below shows groups of stars on the H-R diagram labeled (a) through (e). Note that (a) represents the entire main sequence while (c) and (d) represent only small parts of the main sequence.*



10) Which group represents stars that are *cool and dim*?

A) A

B) B

C) C

D) D

E) E

Answer: D

11) Which group represents stars of the *largest radii*?

A) A

B) B

C) C

D) D

E) E

Answer: E

12) Which group represents *the most common type of stars*?

A) A

B) B

C) C

D) D

E) E

Answer: C

13) Which group represents stars that are *extremely bright and emit most of their radiation as ultraviolet light*?

A) A

B) B

C) C

D) D

E) E

Answer: C

14) Which group represents stars with *the longest main-sequence lifetimes*?

A) A

B) B

C) C

D) D

E) E

Answer: D

15) Which group represents stars *fusing hydrogen in their cores*?

A) A

B) B

C) C

D) D

E) E

Answer: A

16) Which group represents stars that have *no ongoing nuclear fusion*?

A) A

B) B

C) C

D) D

E) E

Answer: B

17) You observe a star and you want to plot it on an H-R diagram. You will need to measure all of the following, *except* the star's

A) mass.

B) distance.

C) apparent brightness.

D) spectral type.

Answer: A

18) The approximate main-sequence lifetime of a star of spectral type O is

A) 10,000 years.

B) 3 million years.

C) 300 million years.

D) 10 billion years.

Answer: B

19) How did astronomers discover the relationship between spectral type and mass for main-sequence stars?

A) by using computer models of hydrogen fusion and stellar structure

B) by measuring stellar radii with very powerful telescopes

C) by comparing stars with the same spectral type but different luminosities

D) by measuring the masses and spectral types of main-sequence stars in binary systems

Answer: D

20) The choices below each describe the appearance of an H-R diagram for a different star cluster. Which cluster is the *youngest*?

A) The diagram shows main-sequence stars of spectral types G, K, and M, along with numerous giants and white dwarfs.

B) The diagram shows main-sequence stars of all the spectral types except O and B, along with a few giants and supergiants.

C) The diagram shows main-sequence stars of every spectral type except O, along with a few giants and supergiants.

D) The diagram shows no main-sequence stars at all, but it has numerous supergiants and white dwarfs.

Answer: C

21) The choices below each describe the appearance of an H-R diagram for a different star cluster. Which cluster is most likely to be *located in the halo* of our galaxy?

A) The diagram shows main-sequence stars of every spectral type except O, along with a few giants and supergiants.

B) The diagram shows main-sequence stars of spectral types G, K, and M, along with numerous giants and white dwarfs.

C) The diagram shows main-sequence stars of all the spectral types except O and B, along with a few giants and supergiants.

D) The diagram shows no main-sequence stars at all, but it has numerous supergiants and white dwarfs.

Answer: B