Summer 2014 **Astronomy - Test 3** **Test form A**

Name _____

Do not forget to write your name and fill in the bubbles with your student number, and fill in test form A on the answer sheet. Write your name above as well. You have 50 minutes. For each question, mark the best answer. The formulas you may want are:

$$d = \frac{3.26 \text{ ly}}{p} \qquad \frac{L}{L_\odot} = \left(\frac{T}{T_\odot}\right)^4 \left(\frac{R}{R_\odot}\right)^2 \qquad L = 4\pi d^2 B$$

1. The age of a cluster of stars is normally determined by
   A) Counting the number of white dwarfs in the cluster
   B) Measuring the number of giant stars
   C) Radioactive dating of material from the stars
   D) Counting the number of still living stars
   E) Measuring the "turnoff point" where stars leave the main sequence

2. Why is it that hot plasma ejected from the Sun generally follows looping shapes?
   A) It is simply feeling the effects of gravity
   B) It is following magnetic field lines
   C) It is passing through holes drilled in the corona previously
   D) It is following lines of fusion that lead from the Sun back to the Sun
   E) The rotation of the Sun causes it to fall back along these shapes

3. What can make the spectral lines from a star shift to slightly different wavelengths?
   A) Motion of the star/Doppler shift
   B) High pressure
   C) High temperature
   D) Small changes in the composition of the star
   E) None of the above

4. By studying the position of a star using satellites, it is found to have a parallax angle of 0.200 arc-seconds. How far away is this star?
   A) 0.0613 ly B) 0.652 ly C) 1.53 ly D) 3.26 ly E) 16.30 ly

5. Which two pieces of information would allow me to deduce the luminosity of a star?
   A) Temperature and mass
   B) Distance and mass
   C) Temperature and distance
   D) Distance and brightness
   E) Brightness and temperature

6. What causes the gas in a planetary nebula to glow? What is the source of power?

A) Fusion occurring in the gas of the planetary nebula
B) Chemical reactions in the nebula
C) Magnetic fields from the star sweeping through the nebula
D) The gravitational attraction of the nebula to itself
E) Ultraviolet light coming from the dying star at the heart of the nebula

7. During which stage of a star is there helium at the core of the star, but the helium is not undergoing nuclear fusion?
   A) Main sequence
   B) Protostar
   C) Double shell burning
   D) Core helium burning
   E) Red giant

8. Which of the following spectral class stars would have the highest surface temperature?
   A) B7 B) B3 C) A2 D) A8 E) F5

9. On the Hertzsprung-Russell diagram, the hottest stars are on the
   A) Left B) Right C) Top D) Bottom E) Middle

10. List the three most common components of the Sun in order from most abundant to least abundant
    A) Carbon, helium, hydrogen
    B) Carbon, hydrogen, helium
    C) Helium, carbon, hydrogen
    D) Helium, hydrogen, carbon
    E) Hydrogen, helium, carbon

11. The Sun is currently a main sequence star. What stage comes next for the Sun?
    A) Double shell burning
    B) Core helium burning
    C) Red giant
    D) Planetary nebula
    E) Protostar

12. How is the heat generated in the center of the Sun transported to the surface?
    A) Radiation throughout – electromagnetic waves carry it everywhere
    B) Convection throughout – the circulation carries the heat out
    C) Conduction throughout – the atoms colliding with each other carry the heat
    D) Radiation in the center, convection on the outside
    E) Convection in the center, radiation on the outside

13. How can we deduce the composition of stars?
    A) From the stellar wind from the stars

B) By the chemical reactions we see occurring in stars' atmospheres
C) From the combination of absorption lines we see in the spectrum
D) From the average density of the star
E) From theory; there is no way of actually measuring it

14. According to Kirchoff's Laws, how could you create a continuous spectrum?
A) A hot, thick gas
B) A cool, thick gas
C) A hot, thin gas
D) A cool, thin gas
E) A hot, thick gas with a thin, cooler gas in front of it

15. Which of the following is <u>not</u> a type of dead star?
A) Neutron star
B) Protostar
C) White dwarf
D) Black hole
E) Actually, all of these are dead stars

16. What causes the dark spots (sunspots) on the surface of the Sun?
A) Regions of dark material, principally carbon
B) Clouds floating above the surface of the Sun, blocking our view of it
C) Strong magnetic fields that interfere with circulation and make cool spots
D) Regions where nuclear reactions are suppressed
E) Lensing effects that bend the light away from these regions

17. When the Sun undergoes fusion to make helium, how many hydrogen atoms are consumed?
A) 1 B) 2 C) 3 D) 4 E) 5 or more

18. The Sun will end its life as
A) Neutron star
B) Protostar
C) White dwarf
D) Black hole
E) None of the above

19. A typical neutron star is about the same size as
A) Sun B) Jupiter C) Earth D) Manhattan E) Baseball

20. Which of the following is the hottest layer of the outside of the Sun?
A) Photosphere B) Corona C) Thermosphere D) Heliosphere E) Chromosphere

21. Suppose a binary star system is producing very regular pulses of X-ray energy. What types of stars are probably in this star system?
A) Giant star and neutron star

B) Giant star and black hole
C) Giant star and white dwarf
D) Main sequence star and neutron star
E) Main sequence star and white dwarf

22. High mass stars "burn" hydrogen to helium to carbon and oxygen … to iron. Why doesn't it burn iron to get heavier elements?
A) The temperature isn't high enough for iron to burn to heavier elements
B) The temperature is too high to burn iron to heavier elements
C) Burning iron to heavier elements doesn't produce any additional energy
D) Iron is the heaviest element on the periodic table, so it can't go to heavier things
E) Iron produces such strong magnetic fields that it resists further fusion

23. The force that holds the nucleus together is called the _____ force
A) Strong B) Electric C) Magnetic D) Gravitational E) Weak

24. Why is it easier to judge the masses of stars when they are binaries?
A) When they occasionally collide, we can study how they bounce off of each other, and measure their masses
B) The sharing of gas that is common in close binaries gives important clues to the mass
C) The orbit of the stars can tell us their respective masses
D) When one star passes in front of the other, we can see the effects of the mass
E) The tidal distortion in each star tells us the mass of the other star

25. Why is there a minimum mass for stars, about 0.08 solar masses?
A) Anything smaller than this cannot gravitationally be pulled together
B) An object smaller than this never gets hot enough for nuclear fusion, and hence would not be a star
C) A star smaller than this would still be in the protostar stage
D) Stars smaller than this undergo very violent interactions, and would essentially destroy themselves
E) Although such objects could occur, they would be so rare that we ignore them

26. Which of the following was <u>not</u> a method for making black holes that was discussed?
A) Very high mass star supernova
B) White dwarf supernova
C) Accretion of matter onto a neutron star
D) Merger of neutron stars
E) Actually, all of these are ways to produce black holes

27. There are examples of binary stars where the star that looks farther in its evolution (older) has less mass than its companion. How is this possible?
A) The stars were born at different times, and later became a binary
B) The older star was just the one that finished forming first in the binary

C) The interaction of the two stars causes the truly older star to age the younger one, making the younger one look older
D) The older star probably originally had more mass, but transferred some of it to the younger star, which is now more massive
E) The presence of two stars makes estimates of how far the star has evolved unreliable

28. Which kind of star is the most common type of star?
A) Giant B) Supergiant C) Main sequence D) Black hole E) Neutron star

29. Why does the Sun exhibit the phenomenon called "limb darkening," where the edge of the Sun looks dimmer than the part in the middle?
A) The rotation of the Sun causes the hotter parts of the Sun to be near the equator, and the cooler parts near the poles
B) It is a reflection phenomenon, so that when we look at the center, we see the reflection of the Earth, making it look hotter
C) The sunspots, which are generally cooler, tend to congregate near the edges of the Sun
D) The nuclear reactions of the Sun tend to make the light go straight out, rather than in all directions, so it looks brighter in the middle
E) We see deeper into the Sun when we look straight on, therefore seeing the hotter layers underneath

30. What is the mechanism that causes a low mass star like the Sun to convert into a planetary nebula and eventually die?
A) Mass loss causes it to lose all its outer layers
B) All of the hydrogen and helium in the star is completely consumed
C) The core exceeds the Chandrasekhar mass and the star implodes
D) The temperature gradually falls until fusion stops
E) The star gradually expands until it rejoins the molecular cloud it formed from

31. What does it mean when we say that the Earth is made of star stuff?
A) The substances that make up the Earth (oxygen, silicon, iron, etc.) were almost exclusively made in earlier generations of stars
B) The same molecular cloud that formed the Earth also formed the Sun, which is a star
C) Most of the material of the Earth was emitted by the Sun, a star
D) The Earth was formed by passing stars after the Sun formed
E) All famous actors (stars) live on Earth

32. The number of sunspots on the Sun rises and falls with a cycle of about
A) 11 days B) 25 days C) 11 months D) 11 years E) Many centuries

33. During which stage is a star probably going to obtain its maximum size?
A) Main sequence

B) Red giant
C) White dwarf
D) Double shell burning
E) Core helium burning