Astronomy 110
Homework #09
Assigned: 04/03/2007
Due: 04/10/2007

Name: (Answer Key)

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. There are several mechanisms that can trigger star formation in a cold, dark nebula. In each of these the key to star formation is
   A) to bathe the cold, dark nebula in ultraviolet radiation and sweep away some of the colder material.
   B) to compress the gas and dust so that gravitation will overcome the gas pressure.
   C) to heat the gas so that gas pressure will overcome gravitation.
   D) to subject the dark nebula to an intense magnetic field so that supersonic jets will form.

2. What places a limit on the lifetime of a star?
   A) loss of the mass of the star into space by stellar winds
   B) amount of available nuclear fuel it contains
   C) collisions between stars in a galaxy are sufficiently frequent that all stars will eventually be destroyed in this way.
   D) buildup of spin as it evolves and contracts means that the star will eventually spin apart

3. Why are the majority of stars in the sky in the main-sequence phase of their lives?
   A) This is the longest-lasting phase in each star's life.
   B) Most stars die at the end of the main-sequence phase.
   C) This is the only phase that is common to all stars.
   D) Most stars in the sky were created at about the same time, so they are all in the same phase of their lives.

4. If you were to look at one kilogram of material taken from the surface of the Sun and 1 kilogram taken from the center, which of the following statements would be true of these two 1 kilogram masses?
   A) The kilogram from the surface would contain more hydrogen than the one from the center.
   B) Neither of them would contain any hydrogen.
   C) They both would contain the same amount of hydrogen.
   D) The kilogram from the surface would contain less hydrogen than the one from the center.

5. The evolution of a star is controlled mostly by its
   A) initial mass.
   B) location in the galaxy.
   C) surface temperature.
   D) chemical composition.

6. If you were able to return to the Earth 1 million years into the future, which of the following views of the sky would be most likely?
   A) All the present stars, both blue and red, would be visible, but nearby stars would have moved in position.
   B) The sky would be very much as it is now.
   C) Nearby stars would have moved in position, and many blue stars would no longer be visible.
   D) A few red stars would be missing because they would have evolved, but stars would be the same and in the same positions as today.

7. What makes a red giant star so large?
   A) The helium-rich core has expanded, pushing the outer layers of the star outward.
   B) The star has many times more mass than the Sun.
   C) Red giants are rapid rotators, and centrifugal force pushes the surface of the star outward.
   D) The hydrogen-burning shell is heating the envelope and making it expand.

8. In the approximately five billion years since the Sun began its main sequence phase, its radius has increased by 6% and its surface temperature has increased by 5%. How has its luminosity changed?
   A) decreased by 10%
   B) decreased by 5%
   C) increased by 37%
   D) increased by 43%

9. The majority of the elements heavier than hydrogen and helium in the universe are believed to have originated in
   A) the original Big Bang.
   B) the central cores of stars.
   C) HII regions, under the action of Hα light.
   D) giant molecular clouds.

10. Under what conditions does electron degeneracy occur?
    A) when electrons become crowded too closely together
    B) when thermonuclear reactions release more electrons than protons
    C) when electrons and positrons annihilate, releasing energy
    D) when ultraviolet light from hot, young O and B stars ionizes the interstellar medium

11. The study of stars in clusters has helped astronomers to understand
    A) the reason for differences in surface temperatures of stars.
    B) the mechanism of mass loss in stars.
    C) the action of nuclear fusion in stars.
    D) stellar evolution—the development of stars with time.

12. Within a globular cluster (which tend to be billions of years old), what would you expect to find in the population of stars?
    A) a full range of stars from bright blue to dim red, with no bright red giant stars but significant amounts of dust and gas
    B) a full mixture of bright blue supergiant and red giant stars, in addition to white dwarfs and dim red stars
    C) mainly white dwarf stars surrounded by the remnant dust and gas from the planetary nebular stages of dying stars but no faint red stars, red giants, or bright blue stars
    D) many red giants, white dwarfs, and dim red stars but no bright blue stars or dust and gas

13. The age of a cluster of stars can be judged by the
    A) total number of stars within the cluster.
    B) amount of radioactive elements detected on star surfaces.
    C) turnoff point on the main sequence of its H-R diagram.
    D) number of novae per year occurring within the cluster.

14. The stars at the turnoff point in the H-R diagram of the Hyades star cluster have a lower luminosity than those at the turnoff point in the cluster M41. From this information, we can say with certainty that
    A) the Hyades cluster is farther away than M41.
    B) the Hyades cluster is older than M41.
    C) the Hyades cluster has more stars in it than M41.
    D) the Hyades cluster is younger than M41.

15. Stars are formed from interstellar matter. Why are stars in open clusters metal-rich, whereas stars in globular clusters are metal-poor?
    A) Globular clusters have "burned" their heavy elements over their longer lifetime.
    B) Globular cluster stars are so widely spaced, that they have not interacted and collided to produce the supernova explosions that generate metals.
    C) Supernova explosions have blasted away the heavy elements in older globular cluster stars, leaving behind the metal-poor cores.
    D) Open clusters are young, and stars have been formed from material in which stellar evolution and supernova explosions in earlier stars have enriched heavy metal concentrations steadily with time.

16. The period of variability of a Cepheid variable star, which is easily measured, is directly related to which stellar parameter, thereby providing a reliable method for the measurement of distance to stars?
    A) velocity away from Earth
    B) luminosity
    C) surface magnetic field
    D) surface temperature

17. What is the last nuclear burning stage in the life of a low-mass star like the Sun?
    A) fusion of hydrogen nuclei to form helium
    B) fusion of silicon nuclei to form iron
    C) fusion of iron nuclei with protons and neutrons to form heavy elements
    D) fusion of helium nuclei to form carbon and oxygen

18. Which of the energy-transporting processes in a star's interior also plays a role in moving heavy elements from their production region to the star's surface and from there into outer space?
    A) Transport is not necessary because heavy elements are produced at the star's surface by fusion reactions in the late evolutionary phases of a star.
    B) radiative diffusion, by radiation pressure
    C) conduction
    D) convection

19. During its lifetime the Sun will experience all of the following energy sources *except*
    A) Kelvin-Helmholtz gravitational contraction.
    B) hydrogen burning.
    C) helium burning.
    D) carbon burning.

20. The final life stage of the Sun involves
    A) a supernova explosion.
    B) creation of a planetary nebula and a white dwarf remnant.
    C) creation of a giant molecular cloud.
    D) collapse into a neutron star.

Answer Key

1. B
2. B
3. A
4. A
5. A
6. C
7. D
8. C
9. B
10. A
11. D
12. D
13. C
14. B
15. D
16. B
17. D
18. D
19. D
20. B