ASTRONOMY 100, Section 1, Fall 2001

Third Hour Exam; Nov. 16, 2001; Form A

1. On November 18, we expect to see the Leonid meteor shower at 4 am. During this meteor shower, we will see shooting stars given rise to by?
   (A) exploding asteroid. (B) exploding star. (C) exploding comet
   (D) interstellar dust. *(E) comet dust.*

2. The object that is responsible for the Leonid meteor shower has an orbital period of 33 years. Where is it at aphelion?
   (A) Asteroid Belt *(B) Kuiper Belt* (C) Oort Cloud
   (D) Proxima Centauri (E) Orion Nebula.

3. The coldest interstellar medium has
   (A) molecular hydrogen. (B) neutral atomic hydrogen.
   (C) ionized hydrogen. (D) ionized helium.
   (E) X-ray emission.

4. The two most abundant elements in the interstellar medium are
   (A) hydrogen and deuterium. *(B) hydrogen and helium.*
   (C) deuterium and helium. (D) oxygen and carbon.
   (E) iron and silicon.

5. The two most abundant elements in the Sun are
   (A) hydrogen and deuterium. *(B) hydrogen and helium.*
   (C) deuterium and helium. (D) oxygen and carbon.
   (E) iron and silicon.

6. The iron in your blood was produced in
   (A) the beginning of the Universe. (B) in the corona of the Sun.
   (C) the core of the Sun. *(D) the core of massive stars.*
   (E) terrestrial planets.

7. Limb darkening of the Sun is caused by
   (A) large amounts of sunspots. *(B) cooler upper photosphere.*
   (C) cloud coverage on the Sun. (D) magnetic field lines.
   (E) telescope defects.

8. The granules on the solar surface are
   (A) sand dunes on the crust. (B) magnetic activities in the chromosphere.
   (C) magnetic activities in the photosphere. (D) convection cells in the chromosphere.
   (E) convection cells in the photosphere.

9. The Sun currently generates energy by
   (A) contracting and releasing gravitational energy.
   (B) fusing helium into hydrogen in the corona.
   (C) fusing hydrogen into helium in the photosphere.
   (D) fusing hydrogen into helium in the core.
   (E) fusing helium into carbon and oxygen in the chromosphere.

10. The main sequence is NOT a sequence of
    (A) age. (B) temperature. (C) luminosity. (D) color. (E) mass.

11. The spectral types from the hottest to the coolest are:
    (A) ABFGKMO *(B) OBAFGKM* (C) OBAMKGF
    (D) MKGFABO (E) don't know

12. The magnitude of a star tells us
    (A) the size of the star. (B) the temperature of the star.
    (C) the color of the star. *(D) the brightness of the star.*
    (E) all of the above.

13. The spectrum of the sun shows absorption lines superposed on continuous radiation (blackbody radiation). The continuous radiation is emitted by
    (A) the corona. (B) the chromosphere. *(C) the photosphere.*
    (D) the core. (E) all of the above.

14. The absorption lines in the Sun's spectrum are formed in
    (A) the corona. (B) the chromosphere. *(C) the photosphere.*
    (D) the core. (E) all of the above.

15. Star A and star B have the same luminosity, but star A is hotter than star B. Star B must be ____ than star A.
    (A) smaller *(B) larger* (C) bluer (D) older (E) don't know.

16. The parallax of a star can be used to determine the star's
    (A) radial velocity. (B) proper motion. (C) size. (D) temperature. *(E) distance.*

17. Observations of the orbital motion of binary stars can be used to determine
    (A) the luminosity of a star. (B) the magnetic field of a star.
    (C) the temperature of a star. *(D) the mass of a star.*
    (E) the age of a star.

18. Among all stars in the Galaxy, the most popular stars are
    (A) O stars. (B) G stars. *(C) M stars.* (D) white dwarfs. (E) all the same.

19. Which of the following type of star has the shortest lifetime on the main sequence?
    (A) O star (B) A star (C) B star (D) K star (E) M star.

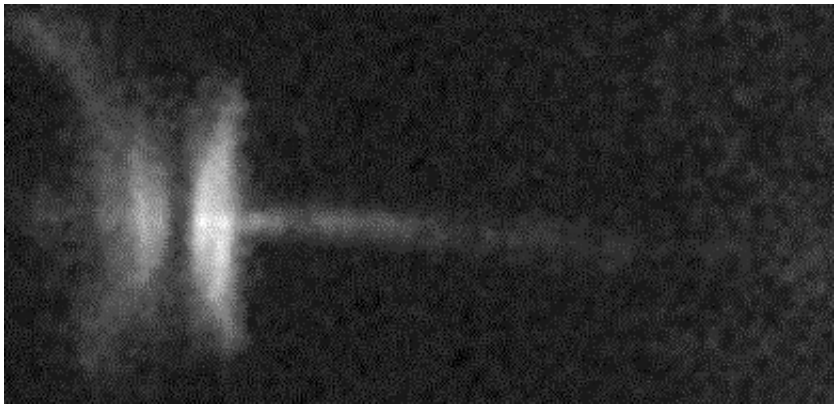
20. A cloud contracts when its ___ is greater than its ___.
    (A) magnetic field, gravity (B) pressure, magnetic field
    (C) pressure, gravity (D) gravity, magnetic field
    (E) gravity, pressure

21. When core of the Sun contracts when its ___ is greater than its ___.
    (A) magnetic field, gravity (B) pressure, magnetic field
    (C) pressure, gravity (D) gravity, magnetic field
    (E) gravity, pressure

Two HR diagrams of clusters are shown. The main sequence in the left diagram terminates at A0, and the main sequence in the right diagram terminates at B0. The A stars in the left diagram are brighter than the A stars in the right diagram.

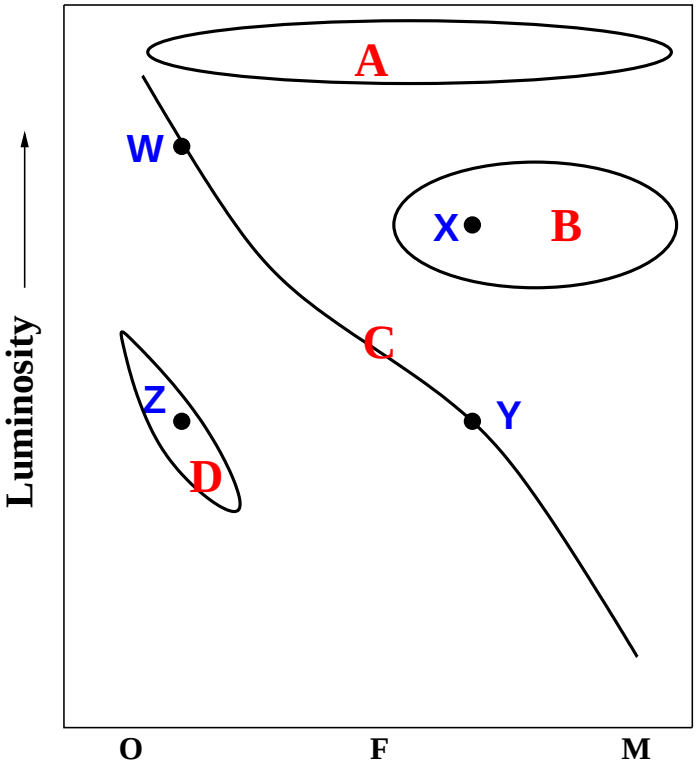
22. Above are the HR diagrams of two clusters. Which cluster is older?
    (A) left (B) right (C) the same (D) don't know (E) don't care

23. Above are the HR diagrams of two clusters. Which cluster is at a larger distance from us?
    (A) left *(B) right* (C) the same (D) don't know (E) don't care



24. The above figure shows a picture of a disk and jet around a
    (A) black hole. (B) neutron star. (C) Death Star.
    (D) white dwarf. *(E) T Tauri star.*

25. The "gap" in the middle is caused by
    (A) magnetic field. (B) a real lack of material. *(C) obscuration by dust.*
    (D) coronal gas. (E) cloud in the sky.



Questions 26-44 use the diagram shown above. The letters A, B, C, and D mark four regions in the diagram, while E is "none of the above". The letters W, X, Y, and Z are stars marked by the filled circles.

26. Star Y has a mass of 1 $M_\odot$, so its spectral type is
(A) F5 II (B) F5 V (C) G0 II *(D) G2 V* (E) G2 II

27. The core of star Y burns
(A) hydrogen. (B) helium. (C) deuterium. (D) carbon. (E) nothing.

28. How long does it take star Y to exhaust this fuel at its core and go to region B?
(A) 10^3 yr. (B) 10^6 yr. (C) 10^8 yr. *(D) 10^{10} yr.* (E) 10^{12} yr.

29. Stars in region B are called
(A) red supergiants. *(B) red giants.* (C) red dwarfs. (D) He giants. (E) red variables.

30. Stars in region B go through "helium flash", which means
(A) a violent ejection of He-rich material.
(B) a brief brightening of He emission lines.
(C) a violent ignition of He-burning in the core.
(D) a gentle ignition of H-burning on the surface.
(E) all of the above

31. Star Y goes to region D at the end of its evolution. Stars in region D are called
(A) neutron stars. (B) black holes. (C) red dwarfs.
(D) white dwarfs. (E) T Tauri stars.

32. Before star Y reaches region D, it loses its surface material and forms a
(A) emission nebula. (B) reflection nebula. *(C) planetary nebula.*
(D) supernova remnant. (E) Herbig-Haro object.

33. The core of a star in region D has a C/O core, but has no thermonuclear burning because
(A) the density is too high. (B) the angular momentum is too high.
(C) the temperature is not high enough. (D) the magnetic field is too weak.
(E) all of the above.

34. The core of star W burns
(A) hydrogen. (B) helium. (C) deuterium. (D) carbon. (E) nothing.

35. When star W has exhausted hydrogen in its core, it moves into region A. The star could be a
(A) red supergiant. (B) luminous blue variable. (C) Wolf-Rayet star.
(D) blue supergiant. *(E) any of the above.*

36. A star in region A has a/an ___ core just before the supernova explosion.
(A) hydrogen (B) helium (C) oxygen *(D) iron* (E) carbon/oxygen

37. The energy produced in a supernova explosion comes from
(A) magnetic energy. *(B) gravitational energy.* (C) thermonuclear burning.
(D) chemical reactions. (E) electric energy.

38. 99% of the energy produced in a supernova explosion is in the form of
(A) photons. (B) kinetic energy. (C) magnetic energy.
(D) neutrinos. (E) heat energy.

39. The final fate of star W is
(A) a neutron star or a black hole. (B) a white dwarf.
(C) a white dwarf or a brown dwarf. (D) a T Tauri star.
(E) any one of the above.

40. The pressure at the core of star Z is provided by
(A) H-burning. (B) He-burning. (C) C/O-burning.
(D) degenerate electrons. (E) degenerate neutrons.

41. Star Y is ___ than star Z.
(A) brighter (B) fainter (C) hotter *(D) cooler* (E) better

42. Star W is ___ than star Z.
(A) brighter (B) fainter (C) hotter (D) cooler (E) better

43. Star X is ___ than star Y.
(A) larger (B) fainter (C) hotter (D) cooler (E) better

44. Star W is ___ than star Y.
(A) hotter (B) brighter (C) more massive (D) shorter lived *(E) all of the above*

45. See picture of the Horsehead Nebula. (1) is
(A) an emission nebula. (B) a reflection nebula. (C) a planetary nebula.
(D) a dust cloud. (E) a supernova remnant.

46. See picture of the Horsehead Nebula. (2) is
(A) an emission nebula. *(B) a reflection nebula.* (C) a planetary nebula.
(D) a dust cloud. (E) a supernova remnant.

47. See picture of the Horsehead Nebula. (3) is
(A) an emission nebula. (B) a reflection nebula. (C) a planetary nebula.
(D) a dust cloud. (E) a supernova remnant.

48. See picture of the Horsehead Nebula. The spectral type of the star in (2) is
(A) A *(B) B* (C) F (D) M (E) L

49. Stars viewed through a dark cloud would appear
(A) warmer and brighter. (B) dirtier and dimmer. (C) bluer and brighter.
(D) dimmer and bluer. *(E) redder and dimmer.*

50. In a hydrogen atom, when the electron flips its spin from parallel to opposite the proton's spin
(A) an Hα photon at 6563 Å is emitted. *(B) a 21-cm line photon is emitted.*
(C) an Hα photon at 6563 Å is absorbed. (D) a 21-cm line photon is absorbed.
(E) a gamma ray is emitted.