Astronomy 1504 Section 002
Astronomy 1514 Section 10
Midterm 2, Version 1
October 19, 2012

Choose the answer that best completes the question. Read each problem carefully and read through all the answers. Take your time. If a question is unclear, ask for clarification during the exam.
Mark your answers on the scantron sheet and on your copy of the exam. Keep your copy of the exam and check your grade with the posted answers on the course website and the grade posted on D2L. You will have 1 week to ask for corrections.

1. As a solar-mass, main sequence star, exhausts hydrogen in its core, it next becomes:
   a) a red giant star
   b) a white dwarf star
   c) a proto-star
   d) a supergiant star
   e) a neutron star

2. A star will experience a helium flash if:
   a) it is less massive than about 3 solar masses
   b) its has formed a helium core.
   c) the quantum mechanical (degeneracy) pressure dominates ordinary gas pressure.
   d) all of the above.

3. Which of the following is NOT TRUE about helium fusion?
   a) In the triple-alpha process, it takes 3 helium nuclei to form a carbon nucleus.
   b) Heavier nuclei are the result of this process.
   c) The sun will eventually experience a helium flash.
   d) Helium fusion is easier to achieve than the hydrogen fusion because although helium nuclei are heavier, the electrostatic repulsion is weaker.
4. The white dwarf that the sun will produce will be composed of:
   a) degenerate iron nuclei.
   b) carbon and oxygen nuclei and degenerate electrons.
   c) hydrogen nuclei and degenerate electrons.
   d) helium nuclei and normal electrons.

5. Most of the visible light we see coming from the sun originates from the:
   a) corona
   b) sunspots
   c) photosphere
   d) chromosphere

6. The proton-proton chain:
   a) produces energy in the core of the sun in the form of gamma-rays, positrons, and neutrinos.
   b) splits a helium nucleus to produce 4 hydrogen nuclei and energy.
   c) is the bond between protons when forming a atomic nucleus.
   d) combines two hydrogen nuclei to produce a single helium nucleus and energy.

7. Which of the following is the best explanation of the missing solar neutrinos?
   a) The sun is fusing helium but not hydrogen.
   b) Neutrinos may oscillate between three different flavors.
   c) Nuclear reactions do not produce neutrinos as fast as theory predicts
   d) The sun may contain matter we haven’t yet identified.

8. Parallax would be easier to measure if:
   a) the rotation of earth were slower.
   b) Earth’s orbit was larger.
   c) the stars were farther away.
   d) Earth moved faster along its orbit.

9. A star’s luminosity depends only on the star’s:
   a) temperature and diameter.
   b) temperature and distance.
   c) distance and diameter.
   d) apparent magnitude.
10. In the H-R diagram stars have just begun burning hydrogen to helium in their cores when they reach:
   a) The Horizontal Branch
   b) The Red Giant Branch
   c) The Birth Line
   d) The Death Line
e) The ZAMS

11. The star named Circini has the spectral type and luminosity class of O 8.5 V. Based on this information, which of the following are true?
I. Circini has a surface temperature less than the sun.
II. Circini has a diameter that is greater than that of the sun.
III. Circini is more luminous than the sun.
IV. Circini is located near the upper left hand corner in the HR diagram.
   a) II, III, & IV
   b) II & IV
   c) I & II
   d) I, II, & III

12. Which of the following statements is NOT correct about the interstellar medium?
   a) Almost all of the material in the interstellar medium is gas.
   b) The densest clouds of the interstellar medium are where new stars are born.
   c) Interstellar absorption lines and emission lines are indicators of the composition of the stars.
   d) Interstellar extinction is stronger in ultraviolet than infrared.

13. A protostar is:
   a) A dying star that has collapsed to about the size of Earth and is slowly cooling off.
   b) A collapsing cloud of dust and gas that will soon become a star.
   c) A small highly dense star composed almost entirely of tightly packed protons.
   d) none of the above.
14.  occurs when most of the material collapsing to form a protostar has fallen into a disk around the star, and a strong wind from the warm protostar ejects material from its poles.
   a) Hydrostatic equilibrium
   b) A bipolar outflow
   c) The proton-proton chain
   d) An emission nebula

15. Convection is important in stars because it:
   a) increases the temperature of the star.
   b) carries neutrinos to the surface of the star where they can escape.
   c) transports energy outward in the star and mixes the gases of the star.
   d) none of the above

16. Which of the following spectral class stars is coolest?
   a) L
   b) T
   c) G
   d) K

17. Just before a star becomes a white dwarf it is likely to produce:
   a) a black hole
   b) a planetary nebula
   c) a supernova
   d) a neutron star

18. We expect to find T-Tauri stars:
   a) in globular clusters
   b) in star forming regions
   c) in the galactic center
   d) all of the above

19. Which process in the interstellar medium does NOT resist compression?
   a) thermal energy
   b) turbulent motion
   c) shock waves
   d) interstellar magnetic fields
   e) all of the above
20. Which of these types of stars is the most common in the solar neighborhood?
   a) white dwarfs
   b) main sequence M stars
   c) A stars
   d) protostars
   e) red giants

21. Given two stars having the same temperature, which one will be dimmer?
   a) the cooler one
   b) the one with a lower mass
   c) the one with a smaller radius
   d) the black hole

22. Which type of star is the least massive?
   a) green dwarfs
   b) main sequence O stars
   c) neutron stars
   d) main sequence M stars
   e) main sequence F stars

23. A 0.5 M☉ star would use which process to burn hydrogen on the main sequence?
   a) the triple-alpha reaction
   b) the proton-proton cycle
   c) carbon burning
   d) the CNO cycle

24. We make use of the properties of gravity in binary systems to measure a star’s
   a) brightness
   b) mass
   c) distance
   d) luminosity

25. Which of these stars will take the longest time to form?
   a) 20 M☉ stars
   b) 10 M☉ stars
   c) 7 M☉ stars
   d) 2 M☉ stars
26. Most of the photons we receive from the sun are emitted by the:
   a) chromosphere
   b) interior
   c) photosphere
   d) corona

27. Sunspots appear dark because:
   a) they lack magnetic fields
   b) they are holes in the photosphere
   c) of optical illusion
   d) they are cooler than the surrounding photosphere

28. The solar granulation is evidence for:
   a) magnetic fields
   b) differential rotation
   c) convection
   d) solar flares
   e) prominences

29. Hydrostatic equilibrium of the sun is maintained by the balance between gravity and
   a) gas pressure
   b) quantum mechanical pressure
   c) ionization
   d) dark matter
   e) dark energy

30. Stars burn hydrogen to helium on the main sequence in order to produce:
   a) mass
   b) heat
   c) energy
   d) none of the above

31. For a star cluster, the position of the “main sequence turnoff” tells us
   a) the number of stars in the cluster
   b) the mass of the cluster
   c) the cluster age
   d) all of the above
   e) none of the above
32. The H-R diagram is:
   a) a plot of apparent magnitude vs. absolute magnitude for stars
   b) a plot of luminosity vs. temperature for stars
   c) a plot of temperature vs. color for stars
   d) a plot of mass vs. distance for stars

33. Stars spend 90% of their life, where in the HR diagram?
   a) on the supergiant branch
   b) on the main sequence
   c) on the Hayashi track
   d) on the subgiant branch
   e) on the white dwarf branch

34. When we refer to some stars as giants, we mean that they have increased their
    leaving the main sequence:
    a) temperatures
    b) masses
    c) radii
    d) Balmer lines
    e) Argon lines

35. The “quantum mechanical pressure” that is responsible for the Helium Flash is:
    a) dependent upon temperature
    b) dependent upon mass
    c) independent of temperature
    d) independent of mass

36. At the end of its life the sun will become a:
    a) white dwarf
    b) neutron star
    c) pulsar
    d) black hole
    e) main sequence star

37. The lifetime of the sun is about:
    a) one hundred thousand years
    b) ten million years
    c) three hundred million years
    d) three billion years
    e) ten billion years
38. Stars leave the main sequence because:
   a) they want to go to the center of the galaxy
   b) they have exhausted their hydrogen supply near the center
   c) they have exhausted their helium supply near the center
   d) their center becomes a black hole

39. The amount of energy produced per unit mass in the CNO cycle:
   a) is larger than in the p-p cycle
   b) is smaller than in the p-p cycle
   c) is exactly the same as in the p-p cycle
   d) all of the above
   e) none of the above

40. Why are hydrogen Balmer lines weak in M stars?
   a) They don’t have much hydrogen
   b) Most of the hydrogen is in the ground state
   c) Most of the hydrogen is in the second level
   d) Most of the hydrogen is ionized

41. A F6 star is moving toward the earth with a velocity of 10,000 km/s. Its spectral lines are:
   a) Not visible
   b) Shifted to the blue end of the spectrum
   c) Shifted to the red end of the spectrum
   d) Not shifted at all

42. O stars are hot stars around 20000 K. Which is not true of an O star?
   a) Most of the hydrogen will be ionized
   b) Most of the hydrogen will be neutral
   c) Most of the electrons will be not bound to the hydrogen atoms
   d) The Balmer lines will be weak

43. Which of these stars live the shortest?
   a) The Sun
   b) O stars
   c) M stars
   d) F stars

44. The helium flash occurs when:
   a) The helium core of a star begins helium burning, due to the fact that it is supported by quantum mechanical pressure
   b) When a Type Ia supernova goes off
   c) During a nova explosion
   d) In the formation of a planetary nebula
45. More massive stars use the CNO cycle instead of the p-p cycle on the main sequence because:
   a) It produces more energy per unit mass of fuel
   b) It produces carbon and oxygen right away
   c) It produces energy at a more rapid rate
   d) It uses the quantum mechanical pressure to produce the helium flash

46. The density of a neutron star is:
   a) about the same as an atomic nucleus.
   b) infinitely large.
   c) about the same as that of a white dwarf.
   d) about the same as that of the earth.

47. The _________ of a black hole is the radius from a black hole at which the escape velocity is approximately equal to the speed of light.
   a) Roche limit
   b) Schwarzschild radius
   c) Chandrasekhar limit
   d) Hubble radius

48. The Collapsar model explains:
   a) The formation of white dwarfs
   b) The formation of magnetars
   c) The formation of neutron stars
   d) The formation of some gamma ray bursters
   e) none of the above

49. For Cepheids the period-luminosity relation allows us to determine:
   a) Stellar distances
   b) Stellar mass
   c) Stellar age
   d) Stellar composition
   e) all of the above

50. In the “unified model of AGN” the difference between Seyfert I and Seyfert II galaxies is due to:
   a) a bigger giant molecular torus
   b) a more massive black hole
   c) different viewing angles
   d) a higher accretion rate
51. The evidence for “dark matter” in the Milky Way and other galaxies comes from:
   a) galactic rotation curves
   b) study of HII regions
   c) spectral analysis of Cepheid variables
   d) Doppler shift measurements of the galactic nucleus

52. Stars tend to pulsate as they age because they pass through which region of the HR diagram?
   a) Horizontal Branch
   b) Red Giant Branch
   c) Instability strip
   d) White Dwarf Branch

53. Astronomers recently measured the period of a star orbiting the center of our galaxy and concluded:
   a) The center of our galaxy is in a different place
   b) The star is orbiting a 3 million solar mass black hole
   c) The star is emitting X-rays
   d) The star is emitting synchrotron radiation

54. A likely explanation for the preponderance of elliptical galaxies in rich clusters is:
   a) Ellipticals are attracted to rich clusters
   b) Ellipticals are produced by the collisions of spirals
   c) Ellipticals are unrelated to spirals
   d) Spirals form from ellipticals

55. When galaxies collide:
   a) generally no stars will hit each other
   b) one or both of the galaxies will explode
   c) any gas and dust in them will cool off
   d) all of the above

56. The measurement of X-rays from clusters of galaxies strengthens our belief in:
   a) the big bang
   b) black holes
   c) dark matter
   d) the dark side
57. The two largest galaxies in the Local Group are:
   a) the Galaxy (Milky Way) and M31 (Andromeda)
   b) LMC and SMC
   c) M31 and M32
   d) the Galaxy and M32

58. The broad emission lines in active galactic nuclei are produced by:
   a) very hot stars
   b) cool gas clouds
   c) the black hole at the center
   d) rapidly moving gas clouds

59. The enormous amount of energy in QSOs probably arises from:
   a) nuclear fusion
   b) gravity
   c) matter-antimatter annihilation
   d) the force

60. Who first determined that the brightness of Cepheid variable stars is larger when the variation of their period is longer?
   a) Henrietta Leavitt
   b) John Glenn
   c) Carl Sagan
   d) Edwin Hubble

61. From our studies of galactic rotation curves and galaxy clusters we know that most of the matter in the universe is:
   a) Ordinary (baryonic) matter
   b) Dark Matter
   c) Hydrogen and Helium
   d) all of the above

62. We use the Period-Luminosity relation find distances to which variable stars?
   a) Mira Variables
   b) Cataclysmic Variables
   c) Cepheid Variables
   d) RR Lyrae Variables

63. The heavy elements in our bodies were formed:
   a) in a black hole
   b) in neutron stars
   c) in the interiors of stars
   d) in interstellar space
64. 21-cm radiation is produced by:
   a) cold hydrogen gas
   b) electrons spiraling in a magnetic field
   c) small dust grains
   d) the cooling big bang

65. The central engines of quasars are thought to be:
   a) supernova explosions
   b) nova explosions
   c) accretion onto a supermassive black hole
   d) nobody knows

66. In order to be a spiral galaxy, a galaxy must have:
   a) Hot gas
   b) Cool gas
   c) No gas
   d) A disk

67. The most massive nucleus that can be produced in normal stellar fusion
   is:
   a) helium
   b) hydrogen
   c) iron
   d) uranium

68. A pulsar is believed to be:
   a) a rotating neutron star
   b) a rotating black hole
   c) a rotating white dwarf
   d) a planetary nebula

69. Observationally, gamma-ray bursts have been associated with:
   a) novae
   b) supernovae
   c) neutron stars
   d) white dwarfs

70. The bending of light rays around the sun is explained by:
   a) Einstein’s theory of general relativity
   b) Newton’s gravity
   c) Kepler’s laws
   d) the heliocentric solar system
71. For a star cluster, the position of the “main sequence turnoff” tells us:
   a) the cluster age
   b) the number of stars in the cluster
   c) the mass of the cluster
   d) all of the above
   e) none of the above

72. When a black hole is formed the singularity is surrounded by:
   a) nothing
   b) an accretion disk
   c) an event horizon
   d) hair

73. The maximum mass of a neutron star is about:
   a) 1 solar mass
   b) 3 solar masses
   c) 10 solar masses
   d) there is no limit to the mass

74. Type Ia supernovae are caused by:
   a) the core-collapse of a massive star
   b) the thermonuclear explosion of a Chandrasekhar mass white dwarf
   c) accretion onto a neutron star
   d) accretion onto a black hole

75. SS 433 is our model for AGN and quasars. Which is NOT one of essential elements?
   a) a black hole
   b) an accretion disk
   c) magnetic fields
   d) rotation
   e) all of the above are elements of the microquasar model

76. Synchrotron Radiation is:
   a) The same as blackbody radiation
   b) Produced by thermal electrons
   c) Produced by relativistic electrons in a magnetic field
   d) all of the above

77. Pulsars are produced by:
   a) Planetary nebulae
   b) H II regions
   c) Globular clusters
   d) Core-collapse supernovae
78. Why are hot stars better than cool stars at forming H II regions?
   a) cool stars are surrounded by dust, rather than gas
   b) hot stars are more massive
   c) cool stars are too old
   d) hot stars emit more ultraviolet radiation

79. Rotation curves of galaxies show us that:
   a) Galaxies do not rotate like solid bodies
   b) They flatten at large radii
   c) There must be some unseen matter at large radii
   d) They are evidence for Dark Matter
   e) All of the above

80. The final burning phase in massive stars is the burning of _________ into iron and lasts only days:
   a) iron
   b) silicon
   c) carbon
   d) oxygen
   e) helium

-END OF TEST-