BROCK UNIVERSITY

Test 1: June 2017
Course: ASTR 1P02
Examination date: 17 June 2017
Time of Examination: 13:00 – 13:50

Number of pages: 10
Number of students: 366
Time limit: 50 min
Instructor: S. D'Agostino

Answer all questions on the scantron sheet provided. No aids permitted except for a non-programmable calculator. Each question is worth 1 mark. Total number of marks: 50.

DO NOT WRITE YOUR ANSWERS ON YOUR QUESTION PAGE. DOING SO WILL RESULT IN AN ASSIGNED GRADE OF ZERO.

1. The cool, early phase of a star is called a

   (a) pre-star.
   (b) juvenile star.
   (c) protostar.
   (d) proton star.

2. Main-sequence stars are in hydrostatic equilibrium, which means the inward gravitational forces are balanced by outward forces due to

   (a) magnetic flux.
   (b) hydrostatic fusion.
   (c) neutrino convection.
   (d) gas pressure.

3. For a star in hydrostatic equilibrium, an important way in which energy is transported in the star's interior is

   (a) nuclear fission.
   (b) nuclear fusion.
   (c) conduction.
   (d) fluorescence.
   (e) [None of the above.]

4. In the Sun, the convective zone is

   (a) near the surface of the Sun.
   (b) near the core of the Sun.
   (c) about mid-way between the core and the surface of the Sun.
   (d) throughout the entire Sun.
   (e) [The Sun has no convective zone.]

5. The processes that produce radiant energy in the Sun can be summarized as ________ hydrogen nuclei combine to produce a helium nucleus and energy is released.
   (a) 2
   (b) 3
   (c) 4
   (d) 5
   (e) [None of the above.]

6. As a contracting protostar heats up, if the core temperature reaches ________ then fusion of hydrogen into helium begins and the protostar becomes a main-sequence star.
   (a) 10 thousand degrees K
   (b) 10 million degrees K
   (c) 10 billion degrees K
   (d) 10 trillion degrees K

7. High temperatures and pressures are required to produce nuclear reactions because this helps
   (a) convince atomic nuclei to get to know each other.
   (b) atomic nuclei attract each other.
   (c) to overcome the electrical repulsion between atomic nuclei.
   (d) to overcome the gravitational attraction between atomic nuclei.

8. A vast number of photinos is produced in the Sun's
   (a) core.
   (b) atmosphere.
   (c) convective zone.
   (d) conductive zone.
   (e) [The Sun does NOT produce photinos.]

9. As a main-sequence star evolves, steadily converting hydrogen to helium in its core, the core of the star gradually
   (a) becomes cooler and contracts.
   (b) becomes cooler and expands.
   (c) becomes hotter and expands.
   (d) becomes hotter and contracts.
   (e) [There is no change in the core temperature and size.]

10. As a main-sequence star evolves, steadily converting hydrogen to helium in its core, the outer layers of the star gradually
    (a) become cooler and contract.
    (b) become cooler and expand.
    (c) become hotter and expand.
    (d) become hotter and contract.
    (e) [There is no change in the temperature and size of the outer layers.]

11. The Sun began its life as a
    (a) hot, agitated cloud of gas.
    (b) white dwarf.
    (c) red giant.
    (d) neutron star.
    (e) [None of the above.]

12. Heat flows from a star's core to its surface because
    (a) the star's core is hotter than its surface.
    (b) of the star's high core gravity.
    (c) of the star's high core mass.
    (d) of the star's high core electron flux.

13. For a low-mass main-sequence star, hydrogen is fused into helium mainly by
    (a) the triple-alpha process.
    (b) the CNO cycle.
    (c) the proton-proton chain.
    (d) the Krebs cycle.

14. For a high-mass main-sequence star, hydrogen is fused into helium mainly by
    (a) the triple-alpha process.
    (b) the CNO cycle.
    (c) the proton-proton chain.
    (d) the Krebs cycle.

15. Main-sequence stars with masses less than 0.4 solar masses are
    (a) brown dwarfs.
    (b) red dwarfs.
    (c) yellow dwarfs.
    (d) white dwarfs.

16. An important way that astronomers measure distances to other galaxies is using
    (a) planetary nebulae.
    (b) Cepheid variable stars.
    (c) Type IIB quasars.
    (d) the method of galactic halos.
    (e) the method of giant molecular clouds.

17. The mass of Star A is much greater than the mass of Star B, and they are both main-sequence stars. The rate at which Star A consumes its hydrogen fuel is ________ the rate at which Star B consumes its hydrogen fuel.
    (a) greater than
    (b) about the same as
    (c) less than
    (d) [Not enough information is given.]

18. Small, dark clouds called Bok globules are found in and near
    (a) black holes.
    (b) pulsars.
    (c) star-forming regions of space.
    (d) type Ia supernovae.

19. A planetary nebula is a cloud of gas and dust surrounding
    (a) a Jovian planet.
    (b) a terrestrial planet.
    (c) an exoplanet.
    (d) a dwarf planet.
    (e) [None of the above.]

20. The formation of "heavy elements" (nucleosynthesis) occurs primarily during
    (a) the collapse of galactic nuclei after a collision.
    (b) the core collapse of a high-mass star.
    (c) the collapse of a T-Tauri star as it reaches the main sequence.
    (d) the collapse of a planetary nebula.
21. The distances to the most distant galaxies are measured using
    (a) Type Ia supernovae.
    (b) Type II supernovae.
    (c) Cepheid variables.
    (d) T Tauri stars.
22. Red dwarfs have been observed to finish consuming all of their available hydrogen fuel
    (a) about once per month.
    (b) about once per decade.
    (c) about once per century.
    (d) about once per thousand years.
    (e) [This has never been observed.]
23. Degenerate matter is found
    (a) in the atmosphere of a low-mass main-sequence star.
    (b) in most cool, low-density, giant molecular clouds.
    (c) in the core of a white dwarf.
    (d) in the spectrum of a type Ia supernova.
    (e) only in laboratories on Earth.
24. An accretion disk is formed from
    (a) the core collapse of a red giant.
    (b) gas flowing from a companion star towards a white dwarf.
    (c) clumping in a planetary nebula.
    (d) clumping in a giant molecular cloud.
25. Most of the energy produced in Type II supernovae explosions is carried away by
    (a) neutrons.
    (b) protons.
    (c) radio waves.
    (d) visible light.
    (e) [None of the others.]

26. The surface temperature of a white dwarf is typically
    (a) less than the Sun's surface temperature.
    (b) about the same as the Sun's surface temperature.
    (c) greater than the Sun's surface temperature.

27. The density of a white dwarf is typically
    (a) about the same as the Sun's density.
    (b) about the same as the Earth's density.
    (c) greater than a neutron star's density.
    (d) greater than the Sun's density.
    (e) [None of the others.]

28. In a white dwarf, equilibrium is maintained by a balance of
    (a) core temperature and core mass.
    (b) core temperature and core pressure.
    (c) electron degeneracy pressure and gravity.
    (d) electronegativity pressure and electron degeneracy pressure.
    (e) electronegativity pressure and gravity.

29. If the mass of a neutron star were to suddenly increase to greater than about ________, then it would collapse into a black hole.
    (a) 3 solar masses
    (b) 30 solar masses
    (c) 300 solar masses
    (d) 3,000 solar masses

30. When a type Ia supernova explodes, it leaves behind
    (a) a white dwarf as a central remnant.
    (b) a neutron star as a central remnant.
    (c) a black hole as a central remnant.
    (d) no central remnant.
    (e) [Either (b) or (c) could occur.]

31. When a type II supernova explodes, it leaves behind
    (a) a white dwarf as a central remnant.
    (b) a neutron star as a central remnant.
    (c) a black hole as a central remnant.
    (d) no central remnant.
    (e) [Either (b) or (c) could occur.]

32. Neutron stars typically
    (a) have smaller diameters and are less dense than white dwarfs.
    (b) have smaller diameters and are more dense than white dwarfs.
    (c) have larger diameters and are less dense than white dwarfs.
    (d) have larger diameters and are more dense than white dwarfs.

33. Type Ia supernovae
    (a) have hydrogen spectral lines in their spectra.
    (b) do not have hydrogen spectral lines in their spectra.

34. Type II supernovae
    (a) have hydrogen spectral lines in their spectra.
    (b) do not have hydrogen spectral lines in their spectra.

35. Binary pulsars emit ________ that can be used to test ________ .
    (a) electromagnetic waves / Planck's theory of black body radiation
    (b) gravitational waves / Einstein's theory of general relativity
    (c) magnetohydrodynamic waves / Alfven's theory of plasma oscillations
    (d) shock waves / Mach's theory of ultrasonic oscillations

36. In an X-ray binary star, the object emitting the X-rays is
    (a) a main-sequence star.
    (b) a neutron star.
    (c) a red dwarf.
    (d) a white dwarf.

37. As the 20th century began, astronomers generally believed that the Sun was located near the centre of a wheel-shaped star system that they estimated had a diameter of
    (a) about 15 light-years.
    (b) about 15,000 light-years.
    (c) about 15,000,000 light-years.
    (d) about 15,000,000,000 light-years.

38. That the Milky Way is made up of an enormous number of individual stars was confirmed by Galileo in 1609, but was first suggested by
    (a) Xander Bogaerts in 200 BCE.
    (b) Pliny the Elder in 1185.
    (c) Tycho Brahe in 1583.
    (d) William and Caroline Herschel in 1785.
    (e) [None of the above.]

39. The first reasonably good approximation for the size of the Milky Way was determined by
    (a) Svetožar Gligorić.
    (b) Stephen Hawking.
    (c) Theodore Roosevelt.
    (d) Vera Rubin.
    (e) Harlow Shapley.

40. The first reasonably good approximation for the size of the Milky Way was determined by measuring the distances to
    (a) giant molecular clouds.
    (b) globular star clusters.
    (c) pulsars.
    (d) comets.

41. Early 20th-century astronomers observed that the Milky Way's globular star clusters appeared to be centred at a point many thousands of light-years away in the direction of the constellation
    (a) Aries.
    (b) Gemini.
    (c) Leo.
    (d) Sagittarius.

42. One way astronomers deduce the mass of the Milky Way is to study
    (a) the orbital motions of stars in the galaxy.
    (b) the motions of stars within globular clusters.
    (c) the periods of eclipsing binary pulsars.
    (d) the spectra of white dwarfs in different sectors of the galaxy.

43. The number of stars in the Milky Way is approximately
    (a) 100 thousand.
    (b) 100 million.
    (c) 100 billion.
    (d) 100 trillion.
44. Density wave theory is currently the most popular accepted explanation for the formation and evolution of the Milky Way's
    (a) central bulge.
    (b) halo.
    (c) dark matter.
    (d) spiral arms.
45. Population I stars are typically found in the Milky Way's
    (a) halo and bulge, have eccentric orbits, and have relatively low heavy-element content.
    (b) halo and bulge, have eccentric orbits, and have relatively high heavy-element content.
    (c) spiral arms, have approximately circular orbits, and have relatively high heavy-element content.
    (d) spiral arms, have approximately circular orbits, and have relatively low heavy-element content.
46. Population II stars are typically found in the Milky Way's
    (a) halo and bulge, have eccentric orbits, and have relatively low heavy-element content.
    (b) halo and bulge, have eccentric orbits, and have relatively high heavy-element content.
    (c) spiral arms, have approximately circular orbits, and have relatively high heavy-element content.
    (d) spiral arms, have approximately circular orbits, and have relatively low heavy-element content.
47. The Milky Way rotates in such a way that
    (a) the rotation rate is nearly the same at all points of the galaxy.
    (b) the central parts of the galaxy rotate faster than the outer parts.
    (c) the central parts of the galaxy rotate slower than the outer parts.
    (d) [The Milky Way does not rotate.]

48. The Milky Way's disk contains most of its
    (a) younger stars.
    (b) middle-aged stars.
    (c) older stars.
    (d) dead stars.

49. According to current theories of the Milky Way's evolution, the shape of the Milky way is predicted to become ________ as it evolves.
    (a) flatter.
    (b) rounder.
    (c) more twisty.
    (d) separated into different parts.
    (e) [None of the above.]

50. There is so much interstellar dust in the Milky Way's disk that
    (a) inhabitants of the Ophiuchus sector suffer from respiratory problems.
    (b) the nucleus of the Milky Way can't be observed at radio wavelengths.
    (c) the nucleus of the Milky Way can't be observed at visual wavelengths.
    (d) the nucleus of the Milky Way can only be observed using neutrinos.