AST 309N (Cosmic Catastrophies), Spring 2016, Exam 2, Form A

April 6, 2016

All multiple choice questions are worth 3.03 points. Mark the letter corresponding to the best answer on the scan-tron sheet and circle that letter on the exam.

1. Why do astronomers think Type Ia supernovae explode in binary star systems? A. all white dwarfs are in binary systems **B. a white dwarf must gain mass to trigger the explosion** C. accretion disks require a mass-losing star D. gravitational radiation requires two stars

2. To measure the total mass of two stars orbiting one another, astronomers must determine: A. the mass of one of the stars B. only the time to orbit C. only the distance between the two stars **D. both the period of the orbit and the separation of the two stars**

3. Which of the following is always true? A. a star with a smaller mass on the main sequence evolves more quickly than a star with a larger mass on the main sequence **B. the smaller Roche lobe surrounds the star with the smaller mass** C. the smaller Roche lobe surrounds the star with the smaller radius D. a white dwarf with larger mass has a larger radius than a white dwarf with a smaller mass

4. The Algol Paradox is that in the Algol binary star system: A. the evolved star has more mass than the less evolved star **B. the evolved star has less mass then the less evolved star** C. the red giant star is more massive than the main sequence star D. both stars are main sequence stars

5. The solution to the Algol Paradox is that: **A. the red giant transferred mass to the main sequence star** B. the main sequence star transferred mass to the red giant C. the red giant formed a white dwarf in its interior D. the red giant evolved more slowly

6. If two stars spiral closer together without gaining or losing mass: **A. the Roche lobe of the most massive star will get smaller** B. the Roche lobe of the least massive star will get larger C. the Roche lobe of the more massive star will get larger D. they must both be main sequence stars

7. If a binary star system contains a main sequence star and a white dwarf, which star was originally the least massive? **A. the main sequence star** B. the star that produced the white dwarf C. the currently most massive star D. the currently least massive star

8. Cataclysmic variables consist of a mass-losing star, a transfer stream of mass, a hot spot, a white dwarf and: A. a supernova B. an Algol star **C. an accretion disk** D. magnetic fields

9. When matter is transferred from a normal star to a white dwarf, an accretion disk forms because: A. the white dwarf has the larger Roche lobe **B. the stream of matter misses the white dwarf but orbits around it** C. the accretion disk extends beyond the Roche lobe of the white dwarf D. the inner Lagrangian point is closer to the white dwarf

10. The matter in an accretion disk must undergo friction because the matter further from the center: A. moves faster **B. moves slower** C. is colder D. is hotter

11. An accretion disk in a cataclysmic variable is expected to emit radiation best characterized as: A. hotter toward the outside B. cooler toward the inside **C. hotter toward the inside** D. the same temperature throughout

12. Two white dwarfs orbiting one another might arise from the evolution of a: A. red giant **B. classical nova** C. main sequence star D. Type Ia supernova

13. Classical novae are thought not to produce Type Ia supernovae because: A. the star transferring mass is a white dwarf B. the white dwarfs are measured to have masses near the Chandrasekhar limit C. the white dwarf gains mass in the nova eruption **D. the white dwarf loses mass in the nova eruption**

14. Gravitational radiation causes: **A. orbital separation to decrease** B. orbital separation to increase C. orbital velocity to decrease D. mass to be transferred in a cataclysmic variable

15. When two white dwarfs spiral together in a binary system, the one with the smaller mass will fill its Roche lobe first because it has the: A. largest Roche lobe **B. smallest Roche lobe** C. smallest radius D. largest separation

16. When a white dwarf fills its Roche lobe and begins to lose mass: A. the Roche lobe gets bigger, causing more mass loss **B. the radius of the white dwarf gets bigger, causing more mass loss** C. the Roche lobe gets smaller, decreasing the mass loss D. the radius of the white dwarf gets smaller, causing more mass loss

17. If two white dwarfs spiral together in a binary system, the one with the smaller mass: **A. is surely destroyed** B. has the larger Roche lobe C. has the smaller radius D. will become the one with the larger mass

18. If two white dwarfs spiral together in a binary system, they might make a Type Ia supernova if: A. the less massive white dwarf has the smaller radius B. the more massive white dwarf has the smaller Roche lobe C. the sum of the masses of the two white dwarfs is less than the Chandrasekhar mass **D. the sum of the masses of the two white dwarfs is more than the Chandrasekhar mass**

19. All expanding supernova material reaches about the same distance from the point of explosion by the time of peak light because that is where the material: A. undergoes radioactive decay **B. is transparent enough to shine brightly** C. is cold enough to shine brightly D. is hot enough to shine brightly

20. If the star that explodes is small, with a radius about that of a planet, all the heat from the explosion is converted to: **A. motion of expansion** B. light C. a plateau in the light curve D. nickel-56

21. The type of supernova that radiates the original heat of explosion at its brightest is a : A. Type Ia B. Type Ib C. Type Ic **D. Type II**

22. The type of supernova that does not need a source of radioactive energy to shine for months is: A. Type Ia B. Type Ib C. Type Ic **D. Type II**

23. The burning of silicon in a thermonuclear explosion originally makes nickel-56 rather than iron-56 because nickel-56: A. decays to cobalt-56 B. has less neutrons than protons **C. has equal numbers of neutrons and protons** D. has more neutrons than protons

24. Type Ia supernovae are brighter at maximum light than Type Ib supernovae because: **A. Type Ib make less Ni-56** B. Type Ia make less Ni-56 C. Type Ib have no hydrogen D. Type Ia evolve in binary systems

25. SN1987A exploded in: **A. an irregular galaxy** B. an elliptical galaxy C. our Milky Way Galaxy D. the spiral arm of a spiral galaxy

26. Where would be a good place to see SN1987A with a telescope now? A. Austin B. Moscow **C. Chile** D. New York City

27. Which happened first? **A. SN1987A exploded in the Large Magellanic Cloud** B. The Roman Empire C. Newtons theory of gravity D. the discovery of neutrinos

28. The detection of neutrinos from SN1987A means that the explosion: A. produced a black hole B. happened in a blue supergiant star **C. resulted from iron-core collapse** D. produced nickel-56

29. The aspect of SN 1987A that was caused by it being a blue rather than red supergiant was: A. nickel-56 was made in the explosion B. neutrinos were made in the explosion C. the explosion was asymmetric **D. the light curve was peculiar**

30. The original spike of light photographed by Rob McNaught within the first few hours after the detection of the explosion of SN 1987A represented: A. light from the radioactive decay of nickel-56 B. light from the newly-formed neutron star C. the arrival of the neutrinos from the collapsing core at the surface of the star **D. the arrival of the shock wave from the collapsing core at the surface of the star**

31. When Wheeler saw it, several months after the first light was detected, the light emitted by SN1987A was generated by energy from: A. a neutron star like that of the Crab Nebula B. neutrinos **C. radioactive decay of cobalt-56** D. radioactive decay of nickel-56

32. The rings around SN1987A: A. proved that neutrinos powered the explosion B. proved that a jet powered the explosion **C. were created by the star before it exploded** D. were created in the explosion

33. We have not detected a neutron star in SN1987A since its first light arrived at the Earth. This means: **A. a black hole might have formed** B. the neutron star is rapidly rotating C. the neutron star is highly magnetic D. there was never a neutron star

Extra Credit Questions: Write in this space on the exam. (One Point Apiece)

1. Bursts of radio radiation from space that last only a few thousandths of a second are known as:

1. **Fast Radio Bursts**

2. Name the astronaut who recently set the U.S. record for the longest stay in space.

2. **Scott Kelly**