

Quiz Oct 31 2012 Chapter 11

11-1. A nova is believed to occur when which of the following pairs of stars are in a binary system?

- a) white dwarf, main sequence star **X**
- b) white dwarf, neutron star
- c) neutron star, red giant
- d) a pair of supergiants

11-2. What is the most dense element formed in the cores of any stars?

- a) helium
- b) lead
- c) iron **X**
- d) carbon

11-3. Which type of star is not fusing anything in its core?

- a) main sequence
- b) giant
- c) supergiant
- d) neutron star **X**

11-4. A pulsar is best described as a:

- a) a rapidly rotating white dwarf
- b) a rapidly rotating neutron star **X**
- c) an expanding and contracting white dwarf
- d) an expanding and contracting neutron star

11-5. White dwarves are composed primarily of:

- a) helium
- b) neutrons
- c) carbon and oxygen **X**
- d) iron

11-6. The diameter of a white dwarf is closest to which of the following?

- a) about 1 A.U.
- b) about the diameter of the Sun
- c) about the diameter of the Earth **X**
- d) about 10 kilometers

11-7. The Sun will end its “life” as a(n):

- a) supernova.
- b) nova.
- c) planetary nebula. **X**

- 11-8. Cosmic rays are best described by which of the following?
- a) gamma rays in space
 - b) x-rays in space
 - c) ultraviolet radiation in space
 - d) high speed particles in space **X**
- 11-9. Explosions on the surfaces of white dwarves in binary star systems are called:
- a) novas **X**
 - b) supernovas
 - c) flares
 - d) planetary nebulas
- 11-10. Rotating neutron stars with off-axis magnetic fields are called:
- a) white dwarves
 - b) pulsars **X**
 - c) quasars
 - d) nebulae
- 11-11. A $15 M_{\odot}$ main sequence star will eventually shed mass as a:
- a) supernova. **X**
 - b) nova.
 - c) planetary nebula.
 - d) Cepheid
- 11-12. A one solar mass star will
- a) go through a red giant phase and end its life as a white dwarf. **X**
 - b) not go through a red giant phase and end its life as a white dwarf.
 - c) go through a red giant phase and end its life as a black hole.
 - d) not go through a red giant phase and end its life as a black hole.
- 11-13. White dwarfs usually have surface temperatures well above 10,000 K, yet they have extremely low luminosity. Why is this?
- a) They are very far away.
 - b) They have a very large surface area.
 - c) They emit most of their radiation in the far infrared.
 - d) They have a very small surface area. **X**
- 11-14. An asymptotic giant branch (AGB) star is a
- a) red giant burning helium in its core.
 - b) red supergiant burning helium in its core.
 - c) red supergiant burning helium in a shell around its core. **X**
 - d) red giant that has just finished fusing helium and no longer has any nuclear fusion occurring in it.
- 11-15. White dwarfs are not referred to as stars because
- a) they do not produce energy by nuclear fusion. **X**

- b) they are not luminous enough to qualify as a star.
- c) we do not know how they produce their energy.
- d) they do not contain any hydrogen.

11-16. Elements heavier than iron are produced by nuclear reactions

- a) in a white dwarf.
- b) during a supernova explosion of a massive star. X
- c) in the shells around the core of a high mass star.
- d) in the core of a massive star just before it explodes as a supernova.

11-17. A neutron star is

- a) left behind after a Type I supernova explosion.
- b) created if a star stops burning hydrogen and contracts.
- c) created if a star stops burning helium and contracts.
- d) left behind after a Type II supernova explosion. X

11-18. The rotation rate of neutron stars

- a) is constant.
- b) is slowing down in all cases. X
- c) is slowing down for isolated pulsars, but can be speeding up for pulsars in binary systems if mass transfer occurs.
- d) is speeding up for all pulsars.

11-19. Helium fusion takes place in the core of a red giant star. These fusion reactions produce

- a) iron.
- b) hydrogen.
- c) lithium and carbon.
- d) carbon and oxygen. X
- e) beryllium and carbon.

11-20. Main sequences stars in which of the following mass ranges form black holes

- a) $0.08M_{\odot} < M < .4M_{\odot}$
- b) $.4M_{\odot} < M < 8M_{\odot}$
- c) $8M_{\odot} < M < 25M_{\odot}$
- d) more than $25 M_{\odot}$ X

11-21. Which of the following happens near (but outside) a black hole?

- a) photons turn redder as they leave the vicinity of the black hole X
- b) photons speed up as they fall in towards the black hole
- c) time speeds up
- d) objects are compressed in all directions

11-22. Where is the singularity in a Kerr black hole?

- a) in a ring at its Schwarzschild radius
- b) in a shell at its Schwarzschild radius

- c) in a ring inside its Schwarzschild radius X
- d) in a point at its center

11-23. What three properties of matter are retained by black holes from their pre-black hole stages?

- a) charge, mass, chemical composition
- b) mass, angular momentum, chemical composition
- c) charge, color, chemical composition
- d) charge, mass, angular momentum X

11-24. The event horizon of a black hole is best described as:

- a) the location of a non-rotating black hole's singularity
- b) the location of a rotating black hole's singularity
- c) the boundary between the black hole and the rest of the universe X
- d) the inner edge of the black hole's chromosphere

11-25. Which of the following describes the current theory of mass loss by black holes?

- a) black holes cannot decrease mass
- b) black holes lose mass by emitting photons from their interiors
- c) black holes lose mass by creating particles outside themselves X
- d) black holes lose mass by accreting matter from binary companions and then exploding that matter off their surfaces

11-26. A friend takes a ride on a spaceship to a distant star and returns to Earth. You and your friend were the same age when your friend left on the spaceship. When your friend returns she

- a) will be the same age as you.
- b) will be younger than you. X
- c) will be older than you.
- d) could be older or younger than you depending on the speed during the journey.

11-27. According to general relativity, when a beam of light bends as it passes close to a massive object

- a) the massive object exerts a force on the photons.
- b) the photons exert a force on the massive object.
- c) the gravitational field of the massive object changes the optical properties of the space around it.
- d) it follows the curved space surrounding the massive object. X

11-28. The event horizon is the

- a) distance from the center of a black hole to the point at which the escape velocity equals the velocity of light. X
- b) radius of the solid matter part of a black hole.
- c) inner radius of an accretion disc.
- d) outer radius of an accretion disc.

11-29. Cygnus-X is believed to be composed of what objects?

- a) A black hole and a B type star X
- b) A black hole and a G type star
- c) A neutron star and a B type star
- d) A black hole and a neutron star

11-30. What critical test must a nonluminous compact object pass before it is determined to be a black hole?

- a) It must emit X-rays.
- b) It must have an accretion disc.
- c) It must have a mass greater than 3 solar masses. X
- d) It must be an isolated object with no companion star.

11-31. According to experiments, the speed of light

- a) is the same for all observers independent of whether they or the light source are moving. X
- b) appears to be faster than 3×10^8 m/s if you are moving toward the light source.
- c) appears to be slower than 3×10^8 m/s if the light source is moving toward you.
- d) is 6×10^8 m/s if the relative motion between the source and the observer is 3×10^8 m/s.
- e) is infinite.

Chapter 11 Thought/Writing Questions

11-32. Explain how a nova occurs

11-33. Under what conditions could a $6 M_{\odot}$ star undergo a supernova?

11-34. How is the ergoregion surrounding a rotating black hole different than the space farther from the hole?

11-35. How do the singularities of non-rotating and rotating black holes differ?

Misconception-Based Questions

11-36. True or False: A pulsar is a star that expands and contracts.

- a) True
- b) False X

11-37. True or False: Cosmic rays are a form of electromagnetic radiation

- a) True
- b) False X

11-38. Explain how a black hole is not black. That is, explain how a black hole evaporates.

11-39. Is a black hole a giant vacuum cleaner in space that sucks up everything around it? Justify your answer.