AST1002 Spring 2018 Final Exam Review Questions

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Abstract

This is a set of review questions for the upcoming midterm exam on **April 19, 2018**. These questions are on the material covered from chapters 10 and 12 – 15. The questions that are in this review are very similar in style and difficulty to those that will be on the actual midterm. It will not be important to memorize facts for the exam (e.g. the mass of the Earth), but to know important definitions and to understand *why* things happen.

Definitions:

Very low mass	$M < 0.08M_\odot$	Chandraskhar Limit	$M < 1.3M_\odot$
Low mass	$M < 0.5M_\odot$	Tolman–Oppenheimer–Volkoff limit	$M < 3M_\odot$
Moderate mass	$M < 8M_\odot$		
Large mass	$M < 10M_\odot$		
Very large mass	$M > 25M_\odot$		

1. The evolution of a star is determined entirely by:
   (a) Mass
   (b) Mass and radius
   (c) Temperature
   (d) Mass and temperature
2. The Chandrasekhar limit is defined as:
   (a) The maximum mass of a white dwarf
   (b) The maximum mass of a neutron star
   (c) The maximum mass of a black hole
   (d) The maximum mass of a main sequence star
3. The Tolman–Oppenheimer–Volkoff limit is defined as:
   (a) The maximum mass of a white dwarf
   (b) The maximum mass of a neutron star
   (c) The maximum mass of a black hole
   (d) The maximum mass of a main sequence star

4. Some regions along the plane of the Milky Way appear dark because

   (a) Stars in that region are hidden by interstellar gas
   (b) Stars in that region are hidden by dark dust particles
   (c) Many brown dwarfs in those areas absorb light which they turn into heat
   (d) Many black holes absorb all light from those directions

5. The spectra of interstellar gas clouds show that they have the same basic composition as

   (a) Interstellar dust
   (b) Earth's atmosphere
   (c) Stars
   (d) Asteroids

6. Which of the following correctly lists the stages of the birth of a star:

   (a) Gas fragments → Pre-main sequence star → Red Giant → Main sequence star
   (b) Protostar → Red dwarf → Pre-main sequence star → Main sequence star
   (c) Gas fragments → Protostar → Pre-main sequence star → Main sequence star
   (d) Protostar → Gas fragments → Pre-main sequence star → Main sequence star

7. The end product of the evolution of a very low mass star is:

   (a) A brown dwarf
   (b) A red dwarf
   (c) A white dwarf
   (d) A neutron star

8. The end product of the evolution of a low mass star is:

   (a) A brown dwarf
   (b) A red dwarf
   (c) A white dwarf
   (d) A neutron star

9. The end product of the evolution of a moderate mass star is:

   (a) A brown dwarf
   (b) A red dwarf
   (c) A white dwarf
   (d) A neutron star

10. The end product of the evolution of a large mass star is:

    (a) A brown dwarf
    (b) A red dwarf
    (c) A white dwarf
    (d) A neutron star

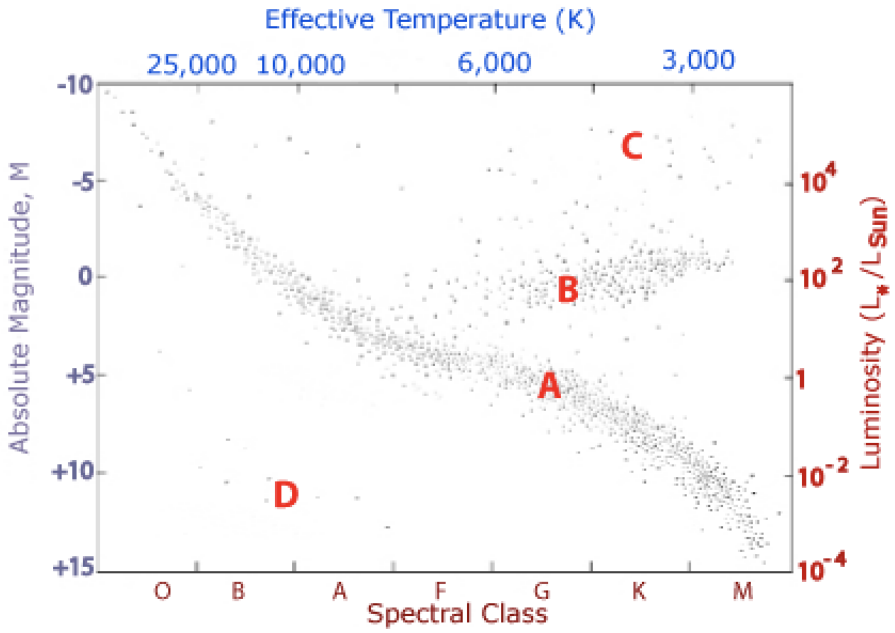
11. The lifetime of a star on the main sequence:

    (a) Increases with the mass of the star
    (b) Is independent of the mass of the star
    (c) Decreases with the mass of the star
    (d) None of the above

12. A solar mass star will evolve off the main sequence when

    (a) It completely runs out of hydrogen
    (b) It expels a planetary nebula to cool off and release radiation
    (c) It explodes as a violent nova
    (d) It builds up a core of inert helium

13. Identify the regions of the HR diagram:



    (a) A: White dwarfs, B: Main sequence, C: Giants, D: Supergiants
    (b) A: Main sequence, B: Giants, C: Supergiants, D: White dwarfs
    (c) A: Main sequence, B: White dwarfs, C: Red dwarfs, D: Giants
    (d) A: Main sequence, B: Giants, C: Red dwarfs, D: White dwarfs

14. A brown dwarf:

    (a) Isn't a technically a star, because fusion never occurs within the core
    (b) Is a fully convective star
    (c) Is a type of main sequence star
    (d) Is a type of white dwarf

15. A red dwarf, which is fully convective, burns hydrogen:

    (a) In its core first, before fusion moves to outer layers as the star expands
    (b) Evenly throughout the star, since convection takes helium outward and hydrogen inward
    (c) It doesn't burn hydrogen; it initially burns helium
    (d) It doesn't burn hydrogen, because it's not technically a star

16. A black hole forms when:

    (a) The gravitational pressure is matched by thermal pressure
    (b) The gravitational pressure is matched by electron degeneracy pressure
    (c) The gravitational pressure is matched by neutron degeneracy pressure
    (d) The gravitational pressure isn't matched by any outward pressure

17. The event horizon of a black hole is defined as:

    (a) The point at which the escape velocity is equal to the speed of light
    (b) The point at which you need to move at the speed of light just to stay still
    (c) The center of the black hole
    (d) The point at which the density of the black hole becomes infinite

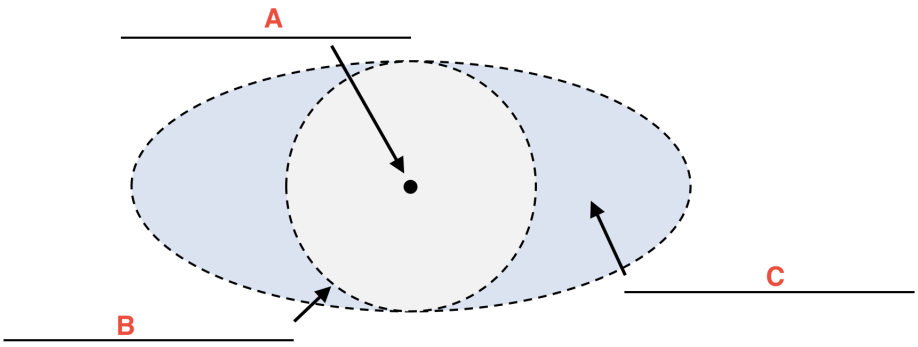
18. Which of the following particles can escape from within the event horizon of a black hole?

    (a) Neutrinos
    (b) Electrons
    (c) Protons
    (d) None of the above

19. Fill in the blanks: A neutron star must have a main sequence mass of _____ and have a left-over mass after a supernova of _____.

    (a) Between $0.5M_\odot - 8M_\odot$, less than $1.3M_\odot$
    (b) Between $8M_\odot - 10M_\odot$, less than $1.3M_\odot$
    (c) Between $8M_\odot - 10M_\odot$, between $1.3M_\odot - 3M_\odot$
    (d) Between $10M_\odot - 25M_\odot$, between $1.3M_\odot - 3M_\odot$

20. Label the major features of a rotating (Kerr) black hole:



(a) A: Singularity, B: Event horizon, C: Ergosphere
(b) A: Event horizon, B: Singularity, C: Ergosphere
(c) A: Singularity, B: Ergosphere, C: Event horizon
(d) A: Event horizon, B: Ergosphere, C: Singularity

21. How does the theory of general relativity explain gravity?

(a) A long-distance force between two objects with mass
(b) A long-distance force between two objects with electric charge
(c) A long-distance force between any two objects
(d) Due to the curvature of spacetime

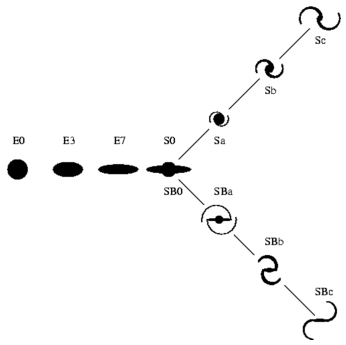
22. If light from a distant star passes close to a massive body, the light beam will:

(a) Bend towards the star due to gravity
(b) Continue moving in a straight line
(c) Change color to a shorter wavelength
(d) Slow down

23. Why do scientists describe the theory of general relativity as "incomplete"?

(a) It does not explain why light bends near a dense object
(b) It does not incorporate a description of matter on a very small scale
(c) It does not agree with the expansion of the universe
(d) The gravity waves it predicts have not been observed

24. The Hubble Tuning Fork diagram is given below. Which of the following galaxies are consider "young" galaxies on the Tuning Fork diagram?



(a) Elliptical galaxies
(b) Spiral galaxies
(c) Barred spiral galaxies
(d) None of the above

25. The feature that distinguishes an elliptical galaxy from a spiral galaxy is:

(a) A central bar
(b) A galactic core
(c) Spiral arms
(d) A galactic disk

26. Which of the following options describe the star content of the three different types of galaxies?

(a) Elliptical: many stars, Spiral: no stars, Barred Spiral: many stars
(b) Elliptical: no stars, Spiral: no stars, Barred Spiral: many stars
(c) Elliptical: no stars, Spiral: many stars, Barred Spiral: many stars
(d) Elliptical: many stars, Spiral: many stars, Barred Spiral: no stars

27. What provides the majority of the gravitational pressure needed to hold a galaxy together?

(a) Stars near the galactic center
(b) A supermassive black hole at the center
(c) A solar mass black hole at the center
(d) Stars on the spiral arms of the galaxy

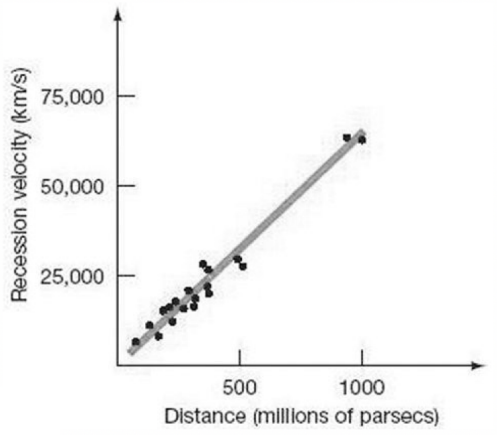
28. What is dark matter?

(a) Neutrinos
(b) An unknown source of the "missing mass" in galaxies
(c) Brown dwarfs
(d) Interstellar dust

29. Where in a spiral galaxy does stellar evolution occur?

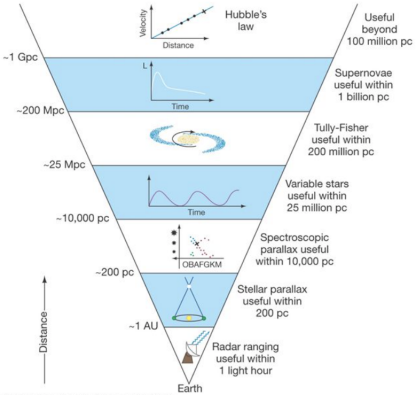
    (a) Near the galactic center
    (b) On the spiral arms
    (c) In front of the spiral arms
    (d) Behind the spiral arms

30. According to Hubble's Law, shown below, a galaxy with a velocity of 25,000 km/s will be:



    (a) 100 million parsecs away
    (b) 400 million parsecs away
    (c) 700 million parsecs away
    (d) 1000 million parsecs away

31. The cosmological distance ladder is shown below. Which method did Edwin Hubble use to first prove that galaxies existed as their own "island universes"?



    (a) Stellar parallax
    (b) Spectroscopic parallax
    (c) Variable stars
    (d) Hubble's law

32. Hubble's law was used to demonstrate:

    (a) The universe was static
    (b) The universe was expanding
    (c) The universe was contracting
    (d) None of the above

33. Where is the center of the universe?

    (a) There is no center
    (b) Near the Earth, which is why everything is moving away from us
    (c) Near the center of the Milky Way, which is why everything is moving away from us
    (d) None of the above

34. The Copernican Principle states, essentially:

    (a) The Earth is at the center of the universe
    (b) The Sun is at the center of the universe
    (c) Human beings are not special in the eyes of the universe
    (d) Human beings are special in the eyes of the universe

35. In a universe where the **only** long-distance force was gravity, which of the following would inevitably occur:

    (a) The universe would continue expanding forever at a constant rate
    (b) The universe would continue expanding forever, but at a progressively slower rate
    (c) The universe would continue expanding for a while, but would eventually collapse back in on itself
    (d) The universe would never expand to begin with if gravity were the only long-distance force

36. Which of the following is a natural conclusion about the beginning of the universe based on Hubble's law?

    (a) All galaxies began at rest at the same location as one another
    (b) All galaxies began where they are at their current velocities
    (c) Some galaxies began at rest at the same location, while other galaxies began near where they currently are
    (d) None of the above

37. What is the currently-accepted state of the expansion of the universe?

    (a) The universe's expansion is slowing down
    (b) The universe is expanding at a constant rate
    (c) The universe's expansion is speeding up
    (d) The universe isn't expanding

38. What is dark energy?

    (a) The unknown source of energy that counteracts gravity in the universe
    (b) The source of dark matter in the universe
    (c) The energy responsible for slowing down the expansion of the universe
    (d) None of the above

39. Normal matter – which is responsible for making atoms, molecules, and everything we see – accounts for what percentage of the universe's total energy content?

    (a) 5%
    (b) 10%
    (c) 28%
    (d) 67%

40. Dark energy accounts for what percentage of the universe's total energy content?

    (a) 5%
    (b) 10%
    (c) 28%
    (d) 67%