

Stars, Galaxies & the Universe (29:50)

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Exam #2 - Fall 2010

Wednesday, October 20th

FORM B - SOLUTIONS

1. Why do sunspots on the solar surface appear dark?
 - (a) it is an optical illusion – they are really the same brightness as the solar surface
 - (b) they are hotter regions than the surrounding bright solar surface
 - (c) they are located deeper within the Sun than the bright solar surface
 - (d) they are cooler regions than the surrounding bright solar surface**
 - (e) they are highly magnetized and therefore appear dark

2. *Approximately* how much **longer** is the Sun expected to burn hydrogen into helium?
 - (a) another 5 years
 - (b) another 50,000 years
 - (c) another 5 billion years**
 - (d) another 10 billion years
 - (e) there is not enough information to figure this out

3. What “radiates” in the Van Allen Radiation Belts?
 - (a) photons from the solar wind that are trapped
 - (b) charged particles (cosmic rays) from the solar wind that are trapped**
 - (c) the Earth’s atmosphere
 - (d) vibrating molecules that are trapped by these belts
 - (e) iron atoms

For questions 4-8, use the choices to best match the statements below.

Note: choices (a) – (c) may be used more than once and/or not at all.

4. Star that has the longest main sequence lifetime. **(c)**
5. Star that has the shortest main sequence lifetime. **(a)**
6. Star that has a surface temperature of ~6000 K. **(b)**
7. The coolest main sequence star. **(c)**
8. The star that will become a neutron star. **(a)**

- (a) 10 solar mass star
- (b) 1 solar mass star
- (c) 0.5 solar mass star

9. Which of the following is evidence that **convection** occurs on the solar surface?
- (a) the presence of sunspots on the photosphere
 - (b) the Van Allen Radiation Belts
 - (c) the Corona has a temperature of 2 million K
 - (d) the Sun has limb brightening at the edge of the photosphere
 - (e) the presence of granulation on the solar photosphere**
10. The *planets* in our solar system formed out of
- (a) the gas, rock and ice “debris” in the protostar’s disk**
 - (b) a supermassive black hole
 - (c) the gas in a giant molecular cloud
 - (d) a planetary nebula
 - (e) a brown dwarf star
11. Which of the following lists the sizes (i.e., radius) of the three stellar corpses in order of **decreasing size**?
- (a) black hole, neutron star, white dwarf
 - (b) black hole, white dwarf, neutron star
 - (c) red giant, white dwarf, brown dwarf
 - (d) white dwarf, neutron star, black hole**
 - (e) neutron star, black hole, white dwarf
12. The variations in brightness of a Red Giant star are due to what physical process?
- (a) expansion and contraction of the star due to instabilities between gravity and pressure**
 - (b) accretion and subsequent explosion of mass onto an unseen, compact companion
 - (c) changes in the Earth's atmosphere which “blur” the image of such a bright star
 - (d) shockwaves from violent iron fusion occurring in the core of this type of star
 - (e) the periodic eclipsing of its surface by a cooler companion star
13. Which of the following is the right timescale for the brightness variations in Red Giants?
- (a) 1-10 minutes
 - (b) 1 millisecond
 - (c) 1-100 years
 - (d) 1-100 days**
 - (e) 1-100 million years
14. The “Crab” Nebula is an example of a
- (a) planetary nebula
 - (b) dark nebula
 - (c) pulsar
 - (d) supernova remnant**
 - (e) nearby galaxy

15. Protostars are known to be bright objects in the infrared part of the spectrum. What is the source of energy in the protostar as it collapses?

- (a) hydrogen to helium fusion
- (b) helium to carbon fusion
- (c) combustion
- (d) release of gravitational energy**
- (e) convection

16. Where on an H-R diagram would a protostar be located?

- (a) below and to left of the main sequence
- (b) above and to the right of the main sequence**
- (c) in the upper left corner, along the main sequence
- (d) in the right corner, below the main sequence
- (e) at the position of the Sun

17. Which of the following is the best description of solar rotation?

- (a) The Sun rotates like a solid body, with a period of 26 days at all latitudes
- (b) The Sun rotates fastest at the poles and slowest at the equator
- (c) The Sun rotates fastest at the equator and slowest at the poles**
- (d) The Sun's rotation varies from 20 days at the S pole to 40 days at the N pole
- (e) The Sun's rotation varies from 25 to 35 days depending on solar cycle

18. When an object becomes a black hole

- (a) it sucks all matter toward it.
- (b) it collapses to such a small size that no light can escape from it.**
- (c) it fuses hydrogen into helium until it has used up all matter.
- (d) all matter is destroyed.
- (e) it becomes theoretical.

19. On an H-R diagram, stars in the upper left hand corner are

- (a) hot and dim
- (b) cool and luminous
- (c) hot and luminous**
- (d) cool and dim
- (e) protostars

20. In the Sun's **radiative** layers,
- (a) hot gas rises and cooler gas sinks.
 - (b) photons pass instantly through because they interact with nothing in this layer.
 - (c) photons get trapped by interacting and giving energy to atoms in this layer.**
 - (d) nuclear fusion occurs.
 - (e) helium is converted into iron.
21. Which of the following is **NOT** true for white dwarfs (WD)?
- (a) a 1.2 solar mass WD is smaller in radius than a 1.0 solar mass WD
 - (b) WDs are supported by electron degeneracy pressure
 - (c) a WD is found at the center of a supernova remnant**
 - (d) the Sun will become a WD
 - (e) a WD can not be more massive than 1.4 solar masses
22. What is the best explanation of the bending of a beam of light (a photon) as it passes close to a massive object like the Sun using Einstein's view of gravity?
- (a) The gravitational field interacts with the electromagnetic field of the photon to bend its path.
 - (b) The gravitational field of the massive object changes the refractive index of the nearby space, which causes the path of the photon to be bent.
 - (c) The photon travels across and must follow the curved spacetime surrounding the massive object.**
 - (d) The photon follows the magnetic field lines of the Sun, and therefore is bent.
 - (e) The photon is pulled in gravitationally to the massive object.
23. Which of the following statements is **correct** concerning the Sun?
- (a) It is a post-main sequence star
 - (b) It is converting helium to hydrogen in the core
 - (c) The interior transports energy only by convection
 - (d) The photosphere is cooler than the chromosphere**
 - (e) Solar neutrinos are produced in the Sun's envelope
24. Which telescope would you use to detect the pulsed signature of a pulsar?
- (a) Chandra X-ray Observatory
 - (b) Spitzer Infrared Space Observatory
 - (c) The Arecibo Radio Telescope in Puerto Rico**
 - (d) Keck Optical Observatory in Hawaii
 - (e) University of Iowa's Rigel Robotic Telescope
25. The Main Sequence is an astronomical term for
- (a) the phase of a star's life before it begins to produce its own energy
 - (b) a sequence of events that happen to a star after it has exhausted its nuclear fuel
 - (c) a region in the upper right hand part of the H-R diagram
 - (d) the phase in a star's life when it fuses hydrogen to helium in its core**
 - (e) the physical relationship between the flux of a star and its luminosity