

Name \_\_\_\_\_

Do not forget to write your name and fill in the bubbles with your student number, **leaving the last bubble blank**, and fill in test form A on the answer sheet. Write your name above as well. You have 55 minutes. For each question, mark the best answer. The formulas you may want are:

$$d = \frac{3.26 \text{ ly}}{p} \quad \frac{L}{L_{\odot}} = \left(\frac{T}{T_{\odot}}\right)^4 \left(\frac{R}{R_{\odot}}\right)^2 \quad L = 4\pi d^2 B$$

- How does the composition of most stars differ from that of the Sun?
  - Most stars have lots of helium; the Sun has little
  - Most stars have little helium; the Sun has lots
  - Most stars have lots of hydrogen; the Sun has little
  - Most stars have little hydrogen; the Sun has lots
  - Actually, the composition of the Sun is pretty similar to most stars
- What is the name of the force that holds the nucleus together?
  - Gravity
  - Electric forces
  - The strong force
  - Magnetism
  - The weak force
- Since main sequence stars are often Cepheid variable stars, how come we can't ALWAYS use this method for measuring the distance to main sequence stars?
  - Only the highest mass main sequence stars are Cepheids, and they are very rare
  - Only the lowest mass main sequence stars are Cepheids, and they are very dim
  - Although technically most main sequence stars are Cepheids, their luminosity variation is too small to notice
  - Only stars primarily composed of helium can be Cepheids, and this is very uncommon for main sequence stars
  - The question is a trick question, since in fact, Cepheid variable stars are NOT main sequence stars
- In which of the following stages of a star's life is it the smallest?
  - Main sequence
  - Horizontal branch
  - Protostar
  - White Dwarf
  - Molecular Cloud
- What information would tell us what the outer layers of the star Betelgeuse is made from?

- A) Measuring interstellar winds from Betelgeuse
  - B) The color of Betelgeuse
  - C) The luminosity of Betelgeuse
  - D) High-quality images of the surface of Betelgeuse
  - E) A detailed spectrum from Betelgeuse
6. List the three spectral types A2, A5, B3 in order from hottest to coldest
- A) A2, B3, A5
  - B) A5, B3, A2
  - C) B3, A2, A5
  - D) A5, A2, B3
  - E) B3, A5, A2
7. How many hydrogen nuclei are consumed to produce a typical helium nucleus in nuclear burning (fusion) in the Sun?
- A) 2
  - B) 4
  - C) 6
  - D) 8
  - E) 9 or more
8. Which of the following methods has proven most productive in discovering planets around other stars?
- A) Take a picture of the star and look for the planet
  - B) Look for variations in the pulses coming from a pulsar
  - C) Look for changes in the Doppler shift caused by the star alternately moving towards and away from you
  - D) Look for a dip in the brightness of a star as the planet passes in front of it
  - E) Watch for the way the star moves from side to side in response to the gravity of the planet
9. How do high mass stars (say, 20 solar masses), end their life?
- A) Type I supernova (technically, type Ia)
  - B) Type II supernova
  - C) Planetary nebula
  - D) Molecular cloud
  - E) Horizontal branch
10. How can you get a pretty good idea of how old a cluster of stars is?
- A) Plot them on a Hertzsprung-Russell diagram, and see where the distribution “turns off” of the main sequence
  - B) Watch them over time, and see which stars “turn off”, or cease nuclear burning
  - C) Measure what fraction of them have died, becoming different types of stellar corpses
  - D) Card them; few stars have fake ID’s
  - E) Measure the amount of heavy elements (such as carbon and oxygen) are in the stars
11. Star A and Star B look equally bright, but star B is actually four times farther away than star A. How do their luminosities compare?
- A) Star A is 16 times more luminous than star B

- B) Star A is 4 times more luminous than star B
  - C) Star B is 2 times more luminous than star A
  - D) Star B is 4 times more luminous than star A
  - E) Star B is 16 times more luminous than star A
12. To calculate the luminosity of a star, we would have to know the
- A) Temperature and distance
  - B) Temperature and radius
  - C) Radius and distance
  - D) Brightness and radius
  - E) Brightness and temperature
13. Which of the followings is a difference between a type I supernova and a type II supernova?
- A) Type I supernovae come from white dwarfs; Type II come from high-mass stars (only)
  - B) Type I leave behind a neutron star; Type II leaves behind no star (only)
  - C) Type II can only occur in binary star systems (only)
  - D) All of the above are true
  - E) None of the above are true
14. Approximately how many planets have been discovered orbiting another star?
- A) none                      B) 2                      C) 13                      D) 47                      E) 248
15. Which method of measuring distance could probably be used to measure the distance to any nearby star, such as alpha Centauri?
- A) Cepheid Variable Stars
  - B) Radar Distancing
  - C) Parallax
  - D) Spectroscopic parallax
  - E) None of these methods work
16. Suppose we have a white dwarf that is in a close binary system with a giant star. What sort of events could this lead to?
- A) An X-ray binary (only)
  - B) A type I supernova (only)
  - C) A nova (only)
  - D) A nova or a type I supernova
  - E) A nova or an X-ray binary
17. A star is observed to have a parallax angle of 0.2 arc-seconds. How far away is the star?
- A) 0.65 light-years
  - B) 0.061 light-years
  - C) 1.53 light-years

- D) 16.3 light-years
  - E) There is insufficient information to solve this problem
18. What evidence do we have that comes directly from the core of the Sun, indicating nuclear fusion is occurring?
- A) Photons (particles of light)
  - B) Neutrinos
  - C) The gravitational effects of the Sun
  - D) The magnetic field of the Sun
  - E) The solar wind
19. Which of the following cannot undergo nuclear burning (fusion) to produce power?
- A) Iron
  - B) Carbon
  - C) Oxygen
  - D) Helium
  - E) Hydrogen
20. What event triggers the transition of a star from the red giant phase to the horizontal branch phase?
- A) Helium begins burning at the core
  - B) Hydrogen starts burning at the core
  - C) Carbon and Oxygen start burning at the core
  - D) The hydrogen at the core runs out
  - E) The helium at the core runs out
21. An X-ray pulsar probably consists of what two stars?
- A) Neutron star and main sequence star
  - B) Neutron star and giant star
  - C) Black hole and main sequence star
  - D) Black hole and neutron star
  - E) White dwarf and black hole
22. During which of the following stages is hydrogen not burning to helium anywhere in a star?
- A) Main sequence (only)
  - B) Red Giant (only)
  - C) Protostar (only)
  - D) Red Giant and Protostar
  - E) All of these are burning hydrogen to helium, somewhere in the star
23. In which layer of the Sun do sunspots occur?
- A) The core
  - B) The radiative zone
  - C) The convective zone
  - D) The photosphere
  - E) The chromosphere

24. What is the current best guess for the main source of gamma ray bursters, powerful blasts of gamma rays from space?
- A) The collapse of a very massive star to a black hole
  - B) The collision of two black holes in space
  - C) The ignition of hydrogen in a massive star
  - D) Energy beamed from a rapidly rotating neutron star
  - E) The final stages of the death of a low-mass star
25. Suppose in a given molecular cloud, you form two stars, X and Y. X is about ten times more massive than star Y. How will their lifetimes compare?
- A) Star X will live a lot longer than star Y
  - B) Star Y will live a lot longer than star X
  - C) Since they were born at about the same time, they will die at about the same time
  - D) There is insufficient information to answer this question
  - E) I have no idea; please mark this one wrong
26. Why can't we use the method of spectroscopic parallax to get the distance to Pluto?
- A) Spectroscopic parallax works for stars, specifically main sequence stars, not Pluto
  - B) Spectroscopic parallax can only work for limited distance, and Pluto is beyond that distance
  - C) Pluto is so small and far away that you can't get a spectrum from it, which is required for spectroscopic parallax
  - D) Spectroscopic parallax requires a source that is at a constant distance, and Pluto gets closer or farther because of its eccentric orbit
  - E) Spectroscopic parallax would work, it is just less accurate than other methods
27. Which of the following describes a solar prominence?
- A) A region of the Sun with high magnetic field
  - B) A large amount of gas escaping suddenly from the Sun
  - C) An arch of gas following magnetic fields lines outside the Sun
  - D) The speckled appearance of the Sun due to slightly hotter/colder regions
  - E) A region above the Sun where there is no atmosphere
28. Why are there no stars lighter than about 0.08 times the mass of the Sun?
- A) Lots of interstellar fatty foods
  - B) An object this small has insufficient mass to shrink to the size of a star
  - C) Nearby stars will invariable absorb such a small object
  - D) These objects are never hot enough for nuclear burning, and hence don't qualify as a star

- E) Actually, such stars do exist, they are just so dim and rare that they are hard to discover
29. When we refer to “electron degeneracy pressure,” what are we talking about?
- A) Pressure caused by electrons being repulsed by protons and neutrons, since you can't have two objects at the same place at the same time
  - B) The electric repulsion of electrons, since they have the same charge
  - C) Social pressure felt by electrons to exhibit “degenerate” behavior like smoking, drinking, etc.
  - D) Pressure caused by electrons being at very high temperature, according to the ideal gas law
  - E) Pressure caused by the quantum mechanical tendency for electrons to avoid each other
30. Suppose a star is orbiting around an invisible companion, such as a black hole. How could you tell?
- A) The spectral lines would alternately shift towards the red and the blue end over time
  - B) The star would alternately look hotter and cooler, depending on which way it was moving
  - C) Typical images of the star would show an oblong shape caused by tidal distortion of the star
  - D) The luminosity would steadily rise and fall, depending on how fast the star is moving
  - E) The star would emit streams of gas, which could be detected from the Earth
31. What does the spectrum from the vast majority of stars look like?
- A) It is a continuous spectrum, with light covering all wavelengths
  - B) It is continuous, but there is a lot more light at the red end
  - C) It is continuous, but there is a lot more light at the blue end
  - D) It is continuous except for some dark lines, wavelengths that are missing
  - E) It consists of a series of bright lines with virtually nothing in between
32. Which of the following might describe the diameter of the Sun during its asymptotic giant stage?
- A) About the size of Forsyth County (the county we are in)
  - B) About the size of North Carolina
  - C) About the size of the Earth
  - D) About the size of the Sun
  - E) About the size of the Earth's orbit around the Sun

33. Which of the following descriptions best describes a planetary nebula?
- A) A cloud of gas and dust from which a star and perhaps some planets form
  - B) A huge, cool cloud of gas from which many stars will ultimately form
  - C) A cloud of gas ejected from a dying low-mass star like the Sun
  - D) The leftover gas and dust from a type II supernova explosion
  - E) A spherical collection of almost pure neutrons