

Section 1

Astronomy 150

Fall 2009

Midterm

Test Form A

1. **DO NOT OPEN THIS EXAM UNTIL INSTRUCTED TO DO SO.**
2. Write the multiple-choice answers on your Scantron form.
3. Make sure to mark your test form, name, and NetID on your form. I do not need anything else.
4. Answer *ALL* of the questions. There is no penalty for guessing.
5. Don't get stalled on any one question.
6. Choose the **best** answer for each problem.

DO NOT FORGET TO FILL IN "TEST FORM" A

1. Which of the following stars will supernova and turn into a neutron star?
 - A) 0.5 solar mass
 - B) 5 solar mass
 - C) 100 solar mass
 - D) 1 solar mass
 - E) 10 solar mass

2. CMEs happen about once per week on average. Why isn't the power grid in danger every week?
 - A) Most just make pretty aurora.
 - B) Most are dead inside.
 - C) Most don't hit the Earth.
 - D) Most don't have strong enough magnetic fields.
 - E) Most don't have enough mass.

3. What does the spectra of the Sun look like?
 - A) A few discrete colors, which depend upon the gas.
 - B) We don't know. We can't observe the Sun; it's too bright.
 - C) A continuous rainbow of color.
 - D) A continuous rainbow of color with some colors reduced in brightness (look dark) due to the specific elements in the gas.
 - E) A continuous rainbow of color with a few discrete colors brighter than the rest.

4. What causes sunspots?
 - A) Differences in the temperature of the surface of the Sun due to differences in the rate of spin.
 - B) Magnetic field lines popping through the Sun's surface.
 - C) GRBs.
 - D) These things happen in young stars. They will clear with time.
 - E) Comet impacts on the Sun.

5. Right before a supernova, what is happening to the core?
 - A) Nothing.
 - B) Collapsing at 10% the speed of light.
 - C) Burning silicon into iron.
 - D) Collapsing into a white dwarf.
 - E) Collapsing into a supernova.

6. What is a planetary nebula?
 - A) A molecular cloud clump that will likely form a planetary system.
 - B) The glowing remains of a high-mass star. It is the outer envelope that is cast off right before a supernova.
 - C) The remains of a disk around a planet. A good example would be the rings around Saturn.
 - D) A round nebula that formed when the planets formed from dense gas in the Solar System.
 - E) The glowing remains of a low-mass star. It is the envelope that is cast off as a low-mass star turns into a white dwarf.

7. Gamma Ray Bursts were first detected
 - A) by looking at supernova explosions.
 - B) by the USSR.
 - C) by satellites looking for atomic weapons tests.
 - D) by amateur astronomers.
 - E) by balloon based experiments.

8. If we could sustain fusion in the lab we could meet humankind's energy needs forever! Why is it so difficult to achieve this, when stars do it every day?
 - A) Need to develop new physics.
 - B) Need a strong nuclear force field, which requires high gravity fields, nearly impossible to make on Earth.
 - C) Need to destroy the material with antimatter, which is very difficult to make on Earth.
 - D) Need freaky high temperature and pressure, which are hard to make on Earth, to overcome the natural repulsion of protons.
 - E) Need exotic mass particles, neutrinos, which don't exist on Earth, to glue the protons together.

9. What makes a pulsar beamed?
 - A) Stellar quakes.
 - B) Spin.
 - C) Explosions.
 - D) Magnetic fields.
 - E) Lighthouses.

10. As the Sun evolves on the main sequence, what is the best mitigation technique?
 - A) Use asteroids to move the Sun farther away.
 - B) Use an asteroid to transfer orbital energy from Jupiter to Earth, moving the Earth outward.
 - C) Use asteroids to crash into the Sun, cooling it.
 - D) Terraform Venus and move there.
 - E) Use a few small asteroids to gravity assist the Earth outward.

11. What is the simplest way to mitigate a big CME impact from killing anyone?
 - A) There is nothing we can do.
 - B) Monitoring the Sun with satellites to predict a space storm.
 - C) Moving the Earth outward to minimize impacts; they drop off squared.
 - D) Moving the Earth inward to get a better location.
 - E) Nuclear tactical weapons to the solar surface to create off axis CMEs.

12. As the Sun becomes an asymptotic giant branch star, what is happening in the central core of the Sun?
 - A) We don't know, but it makes the Sun red.
 - B) Hydrogen burning.
 - C) Helium burning.
 - D) TNT burning.
 - E) Nothing is burning in the core; fusion has stopped.

13. As the Sun ages over the next billion years, what will happen to it?
 - A) It will run out of hydrogen in the core and turn into a red giant.
 - B) It will turn into a white dwarf.
 - C) It will still be on the main sequence, so nothing.
 - D) It will get slightly bigger and brighter
 - E) It will turn into a planetary nebula.
14. Since fusion is over, what supports a white dwarf from collapsing?
 - A) Heat.
 - B) Electron degeneracy.
 - C) Atomic degeneracy.
 - D) Neutron degeneracy.
 - E) Molecular degeneracy.
15. What is the evidence that the Sun is powered by fusion?
 - A) The detection of a 5800 K blackbody from the Sun.
 - B) The detection of x-rays from the Sun.
 - C) The detection of neutrinos from the Sun.
 - D) The detection of radioactive iron in layered sea rocks.
 - E) The detection of gamma-rays from the Sun.
16. If one looks at the distribution of GRBs on the sky, it would look
 - A) Like a funny but sometimes rude shape.
 - B) Like the Milky Way Galaxy, but in gamma-rays.
 - C) Evenly distributed around the sky.
 - D) Lopsided, with more on one side than the other.
 - E) Like the Solar System.
17. What is an indirect effect of a nearby supernova?
 - A) Destruction of the Moon.
 - B) Destruction of the Sun.
 - C) Destruction of the Martian atmosphere.
 - D) Destruction of the Earth's ozone layer.
 - E) Destruction of the Earth's atmosphere.
18. Why does Leslie keep saying that we are star stuff?
 - A) We are just stuff, like stars.
 - B) We are made up of the elements that were forged in the interior of stars.
 - C) We also use fusion as a power source.
 - D) We are made up of small bits and pieces of stars.
 - E) Because he's nuts.
19. At the heart of any GRB are the following:
 - A) black hole, neutron star, and pulsar.
 - B) black hole and planets.
 - C) black hole, accretion disk, and jet.
 - D) black hole with an isotropic jet.
 - E) black hole, magnetic fields, and planetary nebula.

20. When the Sun is in the Red Giant phase, what is fusing?
- A) Hydrogen into helium in the core.
 - B) Hydrogen into helium in a shell around the core.
 - C) Silicon into iron in the core.
 - D) Nothing.
 - E) Helium into carbon in the core.
21. Why is the Sun yellow in color?
- A) Because of its spectral lines.
 - B) Because of its radius.
 - C) Because of its distance.
 - D) Because of the amount of helium in the core.
 - E) Because it is 5800 K.
22. Why are hypernova so bright?
- A) They are supernova on steroids.
 - B) They are isotropic.
 - C) They are beamed.
 - D) They are the biggest, most massive stars.
 - E) They are far away.
23. Which of the following would **not** happen if a nearby (~7000 light years) hypernova happened with its beam toward Earth?
- A) Ozone layer devastated.
 - B) Create a huge influx of muons (heavy electrons) that could sterilize half the planet.
 - C) Create reddish-brown smog (nitrogen dioxide) that reflects light from the Sun back into space from gamma-ray interaction with atmosphere.
 - D) Create an electromagnetic pulse that would destroy electronics.
 - E) Create a gravitationally instability in the Earth's atmosphere that would likely cause instant and multiple instances of hurricanes.
24. Two stars are formed at the same time. One is a 1 solar mass star and the other is a 2 solar mass star. Which one turns into a white dwarf first?
- A) It is impossible to know without specifying the temperature and spin of the two stars.
 - B) It is impossible to know without specifying the distance.
 - C) The 2 solar mass star.
 - D) The 1 solar mass star.
 - E) The 2 solar mass star will not turn into a white dwarf. It is massive enough to turn into a neutron star.
25. What would happen to the Earth if the Sun collapsed into a black hole?
- A) Fall in directly
 - B) Slowly spiral away
 - C) Stay in its orbit
 - D) Fly away in a straight line, like cutting the string.
 - E) Slowly spiral in

26. Which of the following is not a possible end-state of stellar evolution?
- A) Pulsar
 - B) Black Hole
 - C) White Dwarf
 - D) Red Dwarf
 - E) Neutron Star
27. You are transported back in time to 3 billion years ago. What do you notice?
- A) The Moon isn't there.
 - B) You can't breathe.
 - C) The Earth is all ocean.
 - D) The Earth's oceans are devoid of life.
 - E) The Sun is red.
28. When the Sun is on the main sequence, it is near the center of the HR diagram. When the Sun is a Red Giant, which way does it move on the HR diagram?
- A) Down and to the right.
 - B) Straight up.
 - C) Up and to the left.
 - D) Up and to the right.
 - E) Down and to the left.
29. What causes a high-mass star to leave the main sequence?
- A) A shell around the core begins to burn hydrogen while the core is still burning hydrogen.
 - B) Runs out of helium in the core.
 - C) Runs out of hydrogen in the core.
 - D) Just gets tired of the main-sequence media and lifestyle.
 - E) Runs out of silicon in the core.
30. On the HR diagram, where do we find very large and very cool stars?
- A) Bottom right.
 - B) Exact middle.
 - C) Upper left.
 - D) Upper right.
 - E) Bottom left.
31. On Oct 9th 2009, NASA impacted the Moon to look for
- A) life.
 - B) aliens.
 - C) carbon dioxide.
 - D) oxygen.
 - E) water.
32. What supports a neutron star from collapsing?
- A) Pressure from fusion
 - B) Neutron degeneracy pressure
 - C) Pressure from CNO fusion
 - D) Gravity pressure
 - E) Electron degeneracy pressure

33. When the Sun is a Red Giant, the Earth may or may not be swallowed. Why might the Earth not be swallowed?
- A) As the Sun gets bigger the Earth is thrown out of the Solar System.
 - B) Orbital interaction between the Earth, Venus, and Mars will cause the planets to move outward over the next 5 billion years.
 - C) Incorrect, the Sun will swallow the Earth.
 - D) The Sun will lose mass in a stellar wind, causing the Earth to move outward.
 - E) The Sun's core is supported by electron degeneracy, so the expansion rate is unknown.
34. The most recent supernova that occurred in our Galaxy was how long ago?
- A) Today, one per day.
 - B) Last century.
 - C) Over 400 years.
 - D) Yesterday.
 - E) 1987
35. What is a possible mitigation for a nearby supernova?
- A) A large light blocking satellite.
 - B) Move all stars to more than 100 light years.
 - C) Destroy all stars within 100 light years.
 - D) Move the Earth to behind the Sun for protection.
 - E) Nothing.