Name:

1 pt At the present time at the center of the sun, fusion converts hydrogen into

1. **A**◯carbon
   B◯neon.
   C◯helium
   D◯oxygen

1 pt The temperature of the center of the sun is about

2. **A**◯10 million K.
   B◯10 billion K.
   C◯200 million K.
   D◯6000 K.

1 pt The sun will use up its hydrogen in

3. **A**◯5 million years.
   B◯1 billion years.
   C◯5 billion years.
   D◯trillions of years.

1 pt The sun has been shining for about

4. **A**◯5 billion years.
   B◯1 billion years.
   C◯5 million years.
   D◯trillions of years.

1 pt There is more helium in the center of the sun than the surface primarily because

5. **A**◯the helium displaced the carbon.
   B◯the heavy helium sunk.
   C◯helium is being made there.
   D◯helium is repelled by hydrogen.

1 pt If I shine a flashlight toward the sun, the light goes as far as the ___ without being absorbed.

6. **A**◯photosphere
   B◯corona
   C◯solar wind
   D◯convection zone

1 pt The carbon in the photosphere of the sun was made in

7. **A**◯the center of the sun.
   B◯the photosphere of the sun.
   C◯some other star.
   D◯a comet.

1 pt In addition to the losses in the solar wind, the sun loses 5 million tons of mass every second. Which region is losing mass?

8. **A**◯Chromosphere.
   B◯Convection zone.
   C◯Core.
   D◯Photosphere.

1 pt If a giant hand doubled the mass of the sun, the new sun would be (1) hotter and (2) slightly bigger. (1) & (2) are

9. **A**◯false & true.
   B◯true & false.
   C◯true & true
   D◯false & false.

1 pt Compared to a main sequence star of spectral class G, a main sequence star of spectral class F is

10. **A**◯hotter and more massive.
    B◯cooler and more massive.
    C◯hotter and less massive.
    D◯cooler and less massive.

1 pt In which of these stages does the sun spend the longest time?

11. **A**◯Giant.
    B◯Giant and main sequence stages last the same time.
    C◯Planetary nebula.
    D◯Main sequence.

1 pt Has the sun ever been or will be a star like Vega, an A main-sequence star? Same question for Aldebaran, a K giant?

12. **A**◯No for Vega. Yes for Aldebaran.
    B◯Yes for Vega. No for Aldebaran.
    C◯No for Vega. No for Aldebaran.
    D◯Yes for Vega. Yes for Aldebaran.

1 pt If a giant hand moved Vega twice as far as it is, it moves (1) down and (2) right on the HR diagram. True or false?

13. **A**◯FF
B◯FF
C◯FT
D◯TF

1 pt A dwarf star has twice the mass and 8 times the luminosity as the sun. Compared with the sun, it will live

14. **A**◯for the same amount of time.
B◯2 times as long.
C◯1/4 as long.
D◯8 times as long.

1 pt A star cluster has M, F, G, and K main-sequence stars and K and M giants. After a few billion years, a single type of star will be gone. What type will be gone?

15. **A**◯G dwarfs
B◯K giants
C◯M giants
D◯F dwarfs

1 pt S1: If the temperature in the center of the sun increases, the electrons move faster. S2: If the temperature in the center of a white-dwarf increases, the electrons move faster. S1 and S2 are

16. **A**◯TF
B◯FT
C◯TT
D◯FF

1 pt In a degenerate gas, the pressure increases if (1) the temperature increases, (2) if the space for the gas increases. Clauses (1) and (2) are

17. **A**◯TF
B◯TT
C◯FF
D◯FT

1 pt S1: A white dwarf is about the same size as the earth. S2: A neutron star is about the same size as Michigan. Statements S1 and S2 are

18. **A**◯FT
B◯TT
C◯FF
D◯TF

1 pt In order of occurence, the sun will be

19. **A**◯main-sequence star, planetary nebula, giant.
B◯planetary nebula, main-sequence star, giant.
C◯giant, main-sequence star, planetary nebula.
D◯main-sequence star, giant, planetary nebula.
E◯giant, planetary nebula, main-sequence star.

1 pt When the sun first runs out of hydrogen in the center, (1) it burns helium and (2) it becomes hotter in the center. Clause (1) and (2) are

20. **A**◯FT
B◯FF
C◯TF
D◯TT

1 pt In 1054, Chinese astronomers saw a supernova in the constellation Cancer. Now it is a neutron star and a supernova remnant. What was that star burning a year before the explosion?

21. **A**◯only iron.
B◯hydrogen, helium, neon, as well as other elements.
C◯only hydrogen, helium, & iron.
D◯only neon.

1 pt The oxygen and calcium nuclei in your bones were made most likely in

22. **A**◯plants.
B◯the sun.
C◯a massive star that exploded as a supernova.
D◯rocks.

1 pt S1: The sun will become supernova. S2: The sun will become a white dwarf. Statements S1 and S2 are

23. **A**◯TF
B◯TT
C◯FF
D◯FT

1 pt Spica, which has 12 times the mass of the sun, will become

24. **A**◯a supernova.
B◯a white dwarf.
C◯a supernova and then a white dwarf.
D◯neither a supernova nor a white dwarf.

1 pt The last supernova that was visible to the naked eye was in

25. **A**◯1054
B◯1987
C◯1604
D◯2004

1 pt Suppose star A and star B are both main sequence stars. The luminosity of Star A is 100 times less than that of star B. Which answer is always true?

26. **A**◯Star A is farther away.
B◯Star A is closer.
C◯Star A is cooler.
D◯Star A is hotter.

1 pt Suppose the temperature of star A and star B are the same. The luminosity of Star A is 100 times less than that of star B. Which answer is always true?

27. **A**◯Star A is smaller.
B◯Star A is closer.
C◯Star A is bigger.
D◯Star A is farther away.

1 pt Stars A and B in the Pleiades star cluster have the same temperature. The luminosity of Star A is 100 times less than that of star B. Star A is on the main sequence. Which answer is always true?

28. **A**◯Star B is a giant.
B◯Star B is a lot older.
C◯Star A is a lot older.
D◯Star B is a white dwarf.

1 pt S1: A new binary star is found. S2: The mass of the main-sequence star is 4 times the mass of the sun. S3: The giant has the same mass as the sun. Recall that the stars in a binary system formed at the same time. What is surprising about this discovery?

29. **A**◯S2 & S3 together
B◯S1 & S3 together
C◯Nothing
D◯S1 & S2 together

1 pt Having an iron core causes a massive star to explode because iron

30. **A**◯has many neutrons.
B◯fuses to produce uranium.
C◯is the most stable element.
D◯is very heavy.

1 pt When will the earth first become too hot for humans?

31. **A**◯In 5 Byr.
B◯In 1000 yr.
C◯In 1 Myr.
D◯In 1-4 Byr.

1 pt The maximum mass for a white dwarf is 1.4 times the mass of the sun. The reason for this limit is:

32. **A**◯Electrons cannot move faster than light.
B◯Carbon can ignite at higher masses.
C◯Oxygen can ignite at higher masses.
D◯Electrons condense.

1 pt The size (Schwartzschild radius) of a black hole having the same mass as the sun is about the size of

33. **A**◯the earth.
B◯the MSU campus.
C◯Michigan.
D◯the BMPS building.

1 pt Some X-ray sources are black holes because

34. **A**◯black hole suck up the other types of light
B◯X-rays can escape from a black hole.
C◯material falling toward a black hole is heated to high temperature.
D◯X-rays are not absorbed by the black hole.

1 pt Which system contains a black hole?

35. **A**◯Betelgeuse
B◯Sirius
C◯Crab nebula
D◯Cygnus X1