**Astronomy Assessment and TPS Questions:**

**Stellar Evolution**

1. In a main sequence star, gravitational collapse is balanced by
2. convection of stellar material from the core.
3. pressure caused by photons produced during nuclear fusion.
4. solid material at the stellar core.
5. pressure from coronal mass ejections from the core.
6. interior cooling of the star.
7. The atoms in the plastic of your chair were formed
	1. in our Sun.
	2. by a star existing prior to the formation of our Sun.
	3. at the instant of the Big Bang.
	4. approximately 100 million years ago.
	5. in a distant galaxy in a different part of the early universe
8. Which of the following lists, in the correct order, a possible evolutionary path for a star?
	1. Main Sequence Star, Red Giant, Planetary Nebula, White Dwarf
	2. Main Sequence Star, Red Giant, Neutron Star, White Dwarf, Nothing
	3. Main Sequence Star, Red Giant, Type I Supernova, Black Hole
	4. Main Sequence Star, Red Giant, Type II Supernova, Planetary Nebula, Neutron Star
	5. Main Sequence Star, Red Giant, Planetary Nebula, Black Hole
9. Which of the following lists, in the correct order, a possible evolutionary path for a star?
	1. Main Sequence Star, Red Giant, Type II Supernova, Black Hole
	2. Main Sequence Star, Red Giant, Neutron Star, White Dwarf, Nothing
	3. Main Sequence Star, Red Giant, Type I Supernova, Black Hole
	4. Main Sequence Star, Red Giant, Type II Supernova, Planetary Nebula, Neutron Star
	5. Main Sequence Star, Red Giant, Planetary Nebula, Black Hole
10. The eventual fate of our Sun is to
11. collapse into black hole.
12. form a neutron star.
13. become a steadily cooling white dwarf.
14. explode as a type Ia supernova, leaving no remnant.
15. An isolated star with twice the mass of the Sun will
	1. become a steadily cooling white dwarf.
	2. collapse into black hole.
	3. form a neutron star.
	4. explode as a type Ia supernova, leaving no remnant.
16. A main sequence isolated star with twice the mass of the Sun will eventually
17. become a steadily cooling white dwarf.
18. collapse into black hole.
19. form a neutron star.
20. explode as a Type Ia supernova, leaving no remnant.
21. Black holes are formed by
	1. a lack of any light in a region of space.
	2. supernovae from the most massive stars.
	3. supernovae from white dwarfs stars.
	4. collapsed dark nebulae.
22. A three solar mass star will have a main sequence lifetime that is:
23. the same as the Sun
24. one third as long as the Sun
25. three times longer than the Sun
26. less than a third as long as the Sun
27. more than three times longer than the Sun
28. Our Sun will eventually become a white dwarf in five to six billion years. The Sun’s current diameter is about 100 times the diameter of a typical white dwarf. A white dwarf’s diameter then is most similar to which of the following?
	1. The diameter of the Moon.
	2. The diameter of the Earth.
	3. The diameter of the Moon’s orbit around the Earth.
	4. The radius of the Moon’s orbit around the Earth.
29. A main sequence star with 5 times the mass of the Sun may eventually
	1. produce a type I Supernova if it has a companion star.
	2. produce a Nova if it has no companion star.
	3. produce an M spectral type main sequence star if it has no companion star
	4. produce a White Dwarf only if it has a companion star
	5. none of the above statements are correct
30. A main sequence star with 25 times the mass of the Sun may eventually
	1. produce a type II Supernova only if it has a companion star
	2. produce a black hole only if it has a companion star
	3. produce a Neutron Star only if it has no companion star
	4. more than one of the above statements is correct
	5. none of the above statements are correct
31. Neutron stars result from
	1. white dwarf binaries.
	2. collisions of stars.
	3. black hole evaporation.
	4. supernova explosions.
32. Consider the information given below about the lifetime of three main sequence stars A, B, & C.
* Star A will be a main sequence star for 45,000 million years.
* Star B will be a main sequence star for 70 million years.
* Star C will be a main sequence star for 2 million years.

Which of the following is a true statement about these stars?

* 1. Star A has the greatest mass.
	2. Star C has the greatest mass.
	3. Stars A, B, and C all have approximately the same mass.
	4. None of the above
1. The most plausible trigger to initiate the collapse of a region of gas and dust where a star will form is
	1. the spontaneous collapse of the material.
	2. the absorption of infrared radiation from nearby stars.
	3. a shockwave from the explosion of a nearby massive star.
	4. both b and c above.
2. Star A has a mass of 5 solar masses and Star B has a mass of 10 solar masses. How will the fusion rate of Star A compare to the fusion rate of Star B?
	1. Star A’s fusion rate will be more than two times slower than that of Star B.
	2. Star A’s fusion rate will be two times slower than that of Star B.
	3. Star A’s fusion rate will be the same as that of Star B.
	4. Star A’s fusion rate will be two times faster than that of Star B.
	5. Star A’s fusion rate will be more than two times faster than that of Star B.
3. For a white dwarf to become a nova, it is necessary for it to
4. have a companion
5. become a black hole.
6. have begun life as a high-mass star.
7. expand into a giant.
8. Which of the following lists, in the correct order, a possible evolutionary path for a star?
	1. Red Giant, Neutron Star, White Dwarf, nothing
	2. Red Giant, Type I Supernova, Black Hole
	3. Red Giant, Type II Supernova, Planetary Nebula, Neutron Star
	4. Red Giant, Planetary Nebula, White Dwarf
	5. Red Giant, Planetary Nebula, Black Hole
9. What is the next phase in the life of a star after the main sequence phase?
	1. Giant
	2. White Dwarf
	3. Supernova
	4. Planetary Nebula
	5. None of the above
10. All main sequence stars will at one point become \_\_\_\_\_\_\_\_.
	1. Giants
	2. white dwarfs
	3. neutron stars
	4. black holes
	5. none of the above
11. What is the amount, in solar masses, that distinguishes a large mass star from a small mass star?
	1. 4
	2. 6
	3. 8
	4. 10
	5. 12
12. Stars that are less than 8 times as massive as the Sun are considered to be
	1. high mass stars.
	2. low mass stars.
	3. B spectral types.
	4. main sequence stars.
13. Which of the following is a later stage that every Main Sequence star experiences in its evolution, regardless of its mass?
	1. Giant
	2. Black hole
	3. White dwarf
	4. Supernova Type II
14. Black holes are formed by
	1. supernova of low-mass stars.
	2. cooled white dwarves.
	3. lack of light in regions of space.
	4. supernova of the highest mass stars.
15. Which of the following is not a possible final stage in a star’s life?
	1. white dwarf
	2. black hole
	3. neutron star
	4. planetary nebula
	5. Type I supernova
16. When a star has a companion, it can gather material from its companion through a process called \_\_\_\_\_\_\_\_\_.
	1. Suction
	2. Accretion
	3. Stealing
	4. compression
17. Which of the following is true for novas?
	1. They occur with all white dwarfs
	2. They occur only when a white dwarf has a companion star
	3. They occur when a star has a large mass
	4. They occur with all neutron stars
	5. They occur only when a neutron star has a companion star
18. Which of the following can cause either a nova or a type I supernova?
	1. When a red giant ejects its outer layers to form a planetary nebula
	2. When a neutron star steals material from a nearby companion star
	3. When a white dwarf steals material from a nearby companion star
	4. When a large mass red giant forms a neutron star
	5. When a black hole steals material from a nearby companion star
19. What is the eventual death of the largest mass stars?
	1. White dwarf
	2. Black dwarf
	3. Red Giant
	4. Black Hole
	5. More than one is correct
20. Which of the following is the correct order for the sequence of stages a star must undergo before becoming a white dwarf?
	1. Main sequence, red giant, planetary nebula, neutron star, white dwarf
	2. Main sequence, red giant, supernova, white dwarf
	3. Main sequence, red giant, planetary nebula, white dwarf
	4. Main sequence, red giant, neutron star, supernova, white dwarf
21. A star with a mass 100 times greater than the Sun will become what?
	1. A white dwarf
	2. A back hole
	3. A neutron star
22. If our Sun quadrupled in mass, what would it become when it died?
	1. A black hole
	2. A white dwarf
	3. A neutron star
23. Which of the following is impossible for a black hole to do?
	1. Emit any form of light
	2. Undergo a Type II supernova
	3. Bend space and time
	4. Be detected
24. An O spectral type main sequence star and a G spectral type main sequence star will both experience which of the following stages during their deaths?
	1. Type II Supernova
	2. Red Giant
	3. Planetary Nebula
	4. Neutron Star
	5. More than one of the above
25. The Sun and an M spectral type main sequence star will both experience which of the following stages during their deaths?
	1. Type II Supernova
	2. Red Giant
	3. Planetary Nebula
	4. Neutron Star
	5. All of the above
26. If a white dwarf has a companion star, which of the following stages can occur more than once?
	1. Supernova Type I
	2. Supernova Type II
	3. Red Giant
	4. Planetary Nebula
27. How massive must a star be to become a neutron star?
	1. at least as massive as the Sun
	2. at least 1/8 the mass of the Sun
	3. at least 8x the mass of the Sun
	4. at least 16x the mass of the Sun
	5. none of the above
28. Which of the following main sequence stars will not end up as a white dwarf?
	1. The Sun
	2. A star with ¼ the mass of the Sun
	3. A star with half the mass of the Sun
	4. A star with 5 times the mass of the Sun
	5. A star with 10 times the mass of the Sun
29. A type II supernova is associated with:
	1. low mass stars with a companion star.
	2. neutron stars.
	3. black holes.
	4. Both B and C.
	5. Both A and B.
30. A *very* massive O-type main sequence star could become which of the following?
	1. white dwarf
	2. neutron star
	3. black hole
	4. an x-ray source
	5. more than one of the above
31. Rank black holes, white dwarfs, and neutron stars in order of density, from least to greatest:
	1. white dwarfs < neutron stars < black holes
	2. black holes < neutron stars < white dwarfs
	3. neutron stars < white dwarfs < black holes
	4. white dwarfs < black holes < neutron stars
	5. black holes < white dwarfs < neutron stars
32. Which of the following lists, in the correct order, the possible evolutionary path for a star of 5 solar masses?
	1. Main Sequence Star, Red Giant, Planetary Nebula, White Dwarf
	2. Main Sequence Star, Red Giant, Neutron Star, White Dwarf, Nothing
	3. Main Sequence Star, Red Giant, Type I Supernova, Black Hole
	4. Main Sequence Star, Red Giant, Type II Supernova, Planetary Nebula, Neutron Star
	5. Main Sequence Star, Red Giant, Planetary Nebula, Black Hole
33. How many of the below evolutionary stages are possible for a star of 100 solar masses?
* White Dwarf
* Red Giant
* Planetary Nebula
* Black Hole
* Neutron Star
	1. Two
	2. Three
	3. Four
	4. Five
	5. None
1. Which of the following are possible events in the lifetime of a 60 solar mass star without a companion?
	1. Planetary Nebula, G Spectral class Main Sequence Star, Red Giant
	2. O Spectral class Main Sequence Star, Black hole, Planetary Nebula
	3. O Spectral class Main Sequence Star, Black hole, Supernova Type II
	4. G Spectral class Main Sequence Star, Black hole, Supernova Type II

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| Letter | Life Stage |
| A | Planetary nebula |
| B | Black hole |
| C | Nova |
| D | White dwarf |
| E | Type II supernova |
| F | Nothing left |
| G | Neutron star |
| H | Type I supernova |
| I | X-ray source |
| J | Accretion of material |
| K | Red giant |
| L | Black dwarf |

1. Using the choices provided in the table above, what is the correct order of occurrence in the life of a very massive O-type star that is part of a binary system?
	1. K-E-B-F
	2. K-E-B-I
	3. K-H-B-I
	4. K-H-B-L
	5. K-E-G-I
2. Using the choices provided in the table above, what is the correct order of occurrence in the life of a star 9 times more massive than the Sun?
	1. K-H-G
	2. K-A-D-L
	3. K-A-D
	4. K-E-G
	5. K-E-B
3. Using the choices provided in the table above, what is the correct order of occurrence in the life of a star with 0.8 solar masses that is not part of a binary system?
	1. K-A-D-J-H-F
	2. K-A-D-L
	3. K-A-D-F
	4. K-A-D-J-C-D-L
4. Using the choices provided in the table above, what is the correct order of occurrence in the life of a star with 3 solar masses that has a nearby companion star?
	1. K-A-D-J-H-F
	2. K-A-D-L
	3. K-A-D-J-C-D-L
	4. K-A-D-J-H-D-L
	5. More than one of the above