Physics 1061. Stars and Galaxies

REVIEW. Stellar Evolution Name:_____

(See previous PDFs on The Sun and Stellar Properties)

1. T or F. When a giant molecular cloud collapses, it fragments and forms no more than 10 stars.

2. The objects (protostars) that collapse to form a main sequence star are located _____ that star on the HR diagram.

   (a) straight below (b) straight above (c) below and to the right of (d) above and to the right of (e) below and to the left of

3. A star that has just arrived on the zero age main sequence has just recently

   (a) escaped its birth cluster
   (b) cleared away all of its surrounding nebulosity
   (c) become detectable in the infrared
   (d) begun fusing He to carbon
   (e) begun fusing H to Helium

4. Circle the *two* factors that promote the rapid collapse of a gas cloud into a star.

   (a) magnetic fields
   (b) gravity
   (c) rotation
   (d) heat / pressure
   (e) H_2 dissociation (bond breaking)

5. Circle the *three* factors that inhibit the rapid collapse of a gas cloud into a star.

   (a) magnetic fields
   (b) gravity
   (c) rotation
   (d) heat / pressure
   (e) H_2 dissociation (bond breaking)

6. The stages 4-6 of pre main sequence evolution in which the protostar shrinks from about 100 $R_\odot$ to 1 $R_\odot$ is called the _____ _____.

   (a) Hayashi track
   (b) protoplanetary disk
   (c) post-Main Sequence evolutionary track
   (d) railroad track

(e) zero age main sequence

7. The onset of He burning in a (low to medium-mass) stellar core is called the _____ _____.

8. T or F. All elements on the periodic chart are increased in abundance by stellar processes.

9. Stars that were less than 8 solar masses when on the main sequence will ultimately become a stellar remnant called a

   (a) brown dwarf
   (b) white dwarf
   (c) neutron star
   (d) black hole
   (e) pulsar

10. T or F. Massive stars evolve off of the main sequence more quickly (compared to the Sun) but then take longer to become a stellar remnant.

11. What are the 7 main spectral types in order from hot to cold?

12. Stars that are fusing hydrogen into helium in their cores are located on which part of the H-R diagram?

    (a) Hayashi Track (protostars) (b) main sequence (c) giant branch
    (d) instability strip (e) horizontal branch

13. Stars that are fusing helium into carbon in their cores are located on which part of the H-R diagram?

    (a) Hayashi Track (protostars) (b) main sequence (c) giant branch
    (d) instability strip (e) horizontal branch

14. The asymptotic giant branch (AGB) is where you find stars that are fusing He into C not at the core but in _____ .

15. The type of star (or stellar remnant) with the smallest diameter is a _____ star?

    (a) O type (b) white dwarf (c) neutron (d) M type (e) brown dwarf

16. What are the three main phases of the ISM, in order of increasing temperature and decreasing density? The phases include HI, H_2, HII.
    1) coldest: _____
    2) medium: _____
    3) hottest: _____

17. The age of a cluster of stars can be determined by plotting them on a(n) _____ and looking for the main-sequence turn-off.

(a) position-velocity diagram (b) period-luminosity diagram (c) color-temperature diagram (d) H-R diagram (e) Venn diagram

18. Most of the elements with nuclei heavier than that of iron are created in the rare event called a _____.

19. Two stars can have the same initial mass and yet follow different evolutionary track's on the HR diagram if they have different _____.

20. (2pts) Give <u>four</u> of the eight properties listed below for our Sun.

Spectral Type _____	Mass (in kg) _____
Surface Temperature (K) _____	Age (in yrs) _____
Absolute Magnitude, M _____	Lifetime (in yrs) _____
Apparent Magnitude, m _____	Core temperature (K) _____

21. What temperature is needed to fuse helium into carbon?

(a) 5,800 K
(b) 100,000 K
(c) 15 million K
(d) 100 million K
(e) one billion K

22. A star spends most of its life:

(a) as a protostar.
(b) as a main sequence star.
(c) as a planetary nebula.
(d) as a red giant or supergiant.
(e) as a T Tauri variable star.

23. Just as a low-mass main sequence star runs out of fuel in its core, it actually becomes brighter. How is this possible?

(a) He fusion gives more energy than H fusion does, based on masses.
(b) Its outer envelope is stripped away and we see the brilliant core.
(c) The core contraction added to hydrogen shell-burning provide more power output.
(d) It explodes.
(e) It immediately starts to fuse helium.

24. The "helium flash" occurs at what stage in stellar evolution?

(a) when the T Tauri bipolar jets shoot out
(b) in the middle of the main sequence stage

(c) red giant

(d) horizontal branch

(e) planetary nebula

25. Can a star become a red giant more than once?

(a) Yes.

(b) No, it loses too much mass the first time.

(c) No, it becomes a planetary nebula only once.

(d) No, it explodes then collapses to a white dwarf.

(e) No, there are no recurrent supernovae.

26. The order of evolutionary stages of a star like the Sun would be Main Sequence, giant, planetary nebula, and finally:

(a) hypernova.

(b) neutron star.

(c) white dwarf.

(d) nova.

(e) black hole.

27. Which of these will the Sun probably become in the very distant future?

(a) T Tauri star

(b) supernova

(c) protostar

(d) planetary nebula

(e) nova

28. What is a planetary nebula?

(a) the bipolar jets ejected by a T Tauri variable

(b) a planet surrounded by a glowing shell of gas

(c) the disc of gas and dust surrounding a young star that will soon form a solar system

(d) the ejected envelope, often bipolar, of a red giant surrounding a stellar core remnant

(e) a type of young, medium mass star

29. (6pts) Draw an HR Diagram and include the following:

- (2pts) Axes labeled and units shown
- Position of the Sun

- The main sequence
- a dot representing a white dwarf
- a dot representing a red supergiant

30. Which of the following best describes the evolutionary track followed in the HR diagram for the most massive stars?

    (a) vertically upward, along the left edge of the diagram

    (b) diagonally to lower right, then vertical, then horizontally left

    (c) horizontally right, diagonally to lower left, then horizontally right

    (d) horizontally right

    (e) horizontally right, then forms a clockwise loop

31. The main-sequence turnoff of a cluster of stars plotted on the HR Diagram will appear at lower luminosities for _____ clusters. (older, younger)

32. The typical age of a globular cluster is about

    (a) 10 million years (b) 200 million years (c) one billion years (d) 12 billion years (e) 20 billion years

33. (T or F) In order to age-date a star cluster, we need theoretical models of stellar evolution as well as the HR diagram.

34. (T or F) The smallest red dwarf stars on the main sequence have not had enough time (since the big bang) to evolve off of the main sequence.

35. (T or F) The Sun should brighten and enlarge in the next 5 billion years.