

Test2 Spring 2024 Version C  
Formulae

$$L_{ap} = \frac{R^2}{d^2} \sigma T^4 \quad T = \frac{2.9 \times 10^6}{\lambda_{max}} \quad R_{Sch} = 3M$$

$$L_{MS} = M^{3.5} \quad t_{MS} = \frac{1 \times 10^{10}}{M^{2.5}} \text{ (in years)}$$

Constants

$$\sigma = 5.67 \times 10^{-8} \text{ W/m}^2 \quad 1 \text{ pc} = 3.1 \times 10^{16} \text{ m} = 3.26 \text{ ly} \quad c = 3 \times 10^8 \text{ m/s}$$

Multiple Choice: *Choose the letter for the best answer.*

- 1) What stage of evolution is our Sun currently at?  
D) Main Sequence.
  
- 2) Why do stars evolve?  
A) They have limited fuel, which makes them use other sources.
  
- 3) What is the fate of our Sun?  
C) It will end up as a white dwarf.
  
- 4) Stars are roughly made of  
A) Mostly H, then He, with a smidge of everything else.
  
- 5) Which method has detected the most exoplanets?  
B) Transit
  
- 6) What produced all the oxygen we breathe?  
A) Supernovas  
B) Planetary nebulas  
D) Both A & B
  
- 7) On Figure 2, HR diagram #2, what is the region labeled D?  
C) Main Sequence.
  
- 8) About what fraction of stars have planets?  
D) Nearly all (90%)
  
- 9) What is the size of the Schwarzschild radius of a 15 solar mass black hole?  
C) 45 km.
  
- 10) The most common type of exoplanets discovered are  
B) Have masses between Earth's and Neptune's with short orbits.

For Questions 11 - 14: A gas cloud collapses to form 4 stars (so they are at the same distance and begin the main sequence at the same time). Star A is 45 solar masses, Star B is 1.4 solar

masses, Star C is 9 solar masses, and Star D is 0.5 solar masses.

11) How will star B end?

A) White dwarf.

12) How will star A end?

C) Black hole.

13) Which star remains on the main sequence the longest?

D) Star D

14) Which star is the brightest on the main sequence?

A) Star A

15) What is the temperature of a star if the peak of its spectrum is 550 nm?

B) 5300 K.

16) On Figure 2, HR diagram #2, what is the region labeled C?

A) White dwarf.

Questions 17 through 22 have to do with Figure 1; the color star cluster image.

17) Which star is the hottest?

C) Star D

18) Which star in the image is the brightest?

A) Star A

19) If Star E is in a (not eclipsing) binary, what can I learn from that?

A) Mass.

20) Stars A and C in the image have the same color. What else do I know?

C) Star A is larger than Star C.

21) If Star C and Star D in the image are at the same distance and have the same apparent luminosity, what else do we know about these two stars?

B) Star C is larger than Star D.

22) Since the stars are in a cluster, I can assume that....

A) they are at the same distance.

B) they are the same age.

C) they formed from the same cloud of gas.

D) A, B, and C are all true.

23) Next to each step of stellar evolution put its energy source: fusion ( $H \rightarrow He$ ), fusion ( $He \rightarrow C$ ), gravity, electron degeneracy pressure, neutron degeneracy pressure.

Protostar- gravity,

Main sequence- fusion ( $H \rightarrow He$ ).

Horizontal branch- fusion ( $He \rightarrow C$ ).

Neutron star- neutron degeneracy pressure..

24) Put stars B, C, D, and E in order from hottest to coolest.

D, E, B, C

25) Put the lettered regions of HR diagram #2 in evolution order from first to last.

D, A or B, C