PHYS241000 普通天文學一 General Astronomy (I) Final Exam 1.05.2021

True/False (40 points, 5 point for each question)

1. (T) The location of a star in the H-R diagram indicates its temperature and intrinsic brightness.
2. (F) The thermal motions of the atoms in a gas cloud can make it collapse to form a protostar.
3. (F) Reflection nebulae look blue because they are reflecting light from a very hot source.
4. (T) Hydrostatic equilibrium refers to the balance between weight and pressure.
5. (T) Cepheid variables can be used to determine distances because their absolute magnitude can be determined from their period.
6. (F) A star begins fusing hydrogen to helium the moment it leaves the main sequence.
7. (T) Theory predicts that neutron stars may not exceed 3 solar masses.
8. (T) If the accretion disk around a black hole emits x-rays outside the event horizon, then the x-rays can escape.

Multiple Choice (40 points, 5 point for each question)

9. Star A with surface temperature 10000K is less luminous Star B with surface temperature 3000 K. Why?

$J = \epsilon \sigma A \cdot T^4 = \epsilon \sigma 4\pi R^2 \cdot T^4$

a. Star A is smaller than Star B.
b. Star A is less dense than Star B.
c. Star B is closer to Earth.
d. Star B is farther from Earth.
e. A cool star cannot be more luminous than a hot star.

10. What's the right sequence from high to low density?

a. The HII intercloud medium, hot coronal gas, HI clouds, and molecular clouds.
b. The HI clouds, HII intercloud medium, molecular clouds, and hot coronal gas.
c. The molecular clouds, HI clouds, HII intercloud medium, and hot coronal gas.
d. The hot coronal gas, HII intercloud medium, HI clouds, and molecular clouds.

e. None of these choices are correct.

11. High-mass protostars evolve into main-sequence stars:

a. more slowly than low-mass protostars because their stronger gravity slows their collapse.

b. more slowly than low-mass protostars because their higher core temperature slows their collapse.

c. more quickly than low-mass protostars because their stronger gravity speeds up their collapse.

d. more quickly than low-mass protostars because their higher core temperature speeds up their collapse.

e. at the same rate as low-mass protostars.

12. Why do higher mass stars live shorter lives on the main sequence than lower mass stars?

a. Higher mass stars burn through their nuclear fuel faster.

b. Lower mass stars don't get their energy from that same nuclear fusion source as higher mass stars.

c. Higher mass stars have less hydrogen fuel to burn.

d. Lower mass stars spend a longer time evolving to the main-sequence.

e. All of the above are false.

13. A Type Ia supernova is believed to occur when

a. the core of a massive star collapses.

b. the cores of massive stars expands.

c. carbon fusion occurs.

d. a white dwarf exceeds the Chandrasekhar limit.

e. neutrinos in a massive star become degenerate and form a shock wave that explodes the star.

14. A supernova remnant is expanding in radius at the rate of 0.5 arcseconds per year. Doppler shifts show that the velocity of expansion is 5700 km/sec. How far away is the supernova remnant?

a. 1140 pc

b. 11,400 km

c. 5700 pc

d. 24 pc

e. 2400 pc

15. The density of a neutron star is
    a. about the same as that of a white dwarf.
    b. about the same as that of the sun.
    c. about the same as an atomic nucleus.
    d. about the same as a water molecule.
    e. smaller than expected because the magnetic field is so strong.

16. As material flows into a black hole
    a. the material will experience time dilation.
    b. the material will become longer
    c. the material will increase in mass.
    d. a and b
    e. a, b, and c

Brief Essay (40 points, 10 point for each question)

17. Explain how can we use the H-R diagram to estimate the age of a cluster of stars.

18. Write done the stages the Sun will go through in the future.

19. A main sequence star with enough mass will evolve into a giant star. Why the radius of such stars expand?

20. The apparent visual magnitude is 0 mag for Vega. Use Fig 1, 2, and 3 to calculate the distance of Vega in the unit of pc.

Hint: Distance modulus $m_V - M_V = -5 + 5 \log_{10}(d\ [pc])$

102

PHYS241000 普通天文學一 General Astronomy (I), Final Exam, Answer Sheet

Name: 李宜翰 ID number: 109022109.

True/False

1	2	3	4	5	6	7	8
T	F	F	T	T	F	T	T

40/40

Multiple Choice

9	10	11	12	13	14	15	16
a	e	C	a	d	a.	C	d

30/40

Brief Essay

32/40

17. In a cluster of stars, there are many different mass stars. The evolving velocities of different mass stars is variable: high masses stars evolve into supergiant more quickly, low masses stars evolve into giant more slowly. So we can use this property to estimate the age of a cluster of stars.

which shell? +4

18. Our Sun is a main sequence star right now, About five billion years later, the hydrogen in the core will be all fueled into helium, so the core would collapse but the hydrogen shell will keep fueling and expand into a red giant. Then the density and temperature of core is high enough to fuel helium into carbon, the shell will start to collapse till all the helium is fueled into carbon. the shell will become planetary nebula, and the core will become a white dwarf. +10

19. Because the shell outside is keep burning, so the heat pressure keep push the shell to expand but the gravity of the core is not strong enough to pull the whole shell back. Only the produce of the burning reaction would fall into the core and make the density of the core much denser. +8

20. From fig. 1 we can know that the absorption line of Vega is approximately at 4200, 4400, 4900 and 6600 (Å), so find a type of star have the some absorption line at fig. 2 which is A1 type. Then use H-R diagram to find the absolute magnitude of A1, which is approximately 2, and the visual magnitude is 0.

$\Rightarrow 0-2 = -5+5\log d$

$\log d = \frac{2}{5}$, $d = 10^{\frac{2}{5}} = 2.512 \times 10^{\frac{1}{5}} \approx 2.512 \times 1.6$

+10 $\approx$ 4 (pc) = 13.08 (ly) #