

**Physics 2151**  
**Stellar Astronomy and Astrophysics**  
**Final Examination**  
**Fall 2005 - 2006**

**Time: 2 hours**

Name: \_\_\_\_\_

MUN No. \_\_\_\_\_

**Section A: Answer the questions in section A by circling the letter corresponding to the correct answer.(30 points)**

- 1) **The Andromeda “nebula” is:**
  - a) not visible from Newfoundland
  - b) a globular cluster
  - c) a super nova remnant
  - d) a galaxy in the local group
  
- 2) **A white dwarf is approximately the size of:**
  - a) a grapefruit
  - b) St. John’s
  - c) Earth
  - d) The solar system
  
- 3) **At the end of its active life the sun will end up as a:**
  - a) neutron star
  - b) white dwarf
  - c) black hole
  - d) quasar
  
- 4) **The Chandrasekhar Limit is:**
  - a)  $0.4 M_{\odot}$
  - b)  $1.4 M_{\odot}$
  - c)  $2.4 M_{\odot}$
  - d)  $3.0 M_{\odot}$
  
- 5) **Stars are forming right now:**
  - a) in globular clusters
  - b) in open clusters
  - c) in association with black holes
  - d) only in very distant galaxies
  
- 6) **When you compare a star that has an apparent magnitude of -1 with one that has an apparent mag. of 6 :**
  - a) the - 1 mag star will appear dimmer than the 6 mag star
  - b) the - 1 mag star will appear brighter than the 6 mag star
  - c) both stars will appear to have the same brightness
  - d) both will be easy to see with the unaided eye
  
- 7) **The distance modulus for star A is much greater than that for Star B. Star A is:**
  - a) nearer to Earth than Star B
  - b) further away from Earth than Star B
  - c) the same distance from Earth as Star B
  - d) the distance modulus is not related to distance but is used to measure mass

- 8) **The age of the universe is thought to be:**  
a) 13.6 million years  
b) 13.6 billion years  
c) infinite  
d) not possible to estimate
- 9) **The Hubble Constant is approximately:**  
a) 1.4 km/s/MPc  
b) 72 km/s/MPc  
c) 100 M $\odot$   
d) 300 M $\odot$
- 10) **A black body at a temperature  $T_1$  radiates energy at all wavelengths. If the temperature of the black body is raised to a higher temperature  $T_2$ , then:**  
a) at each wavelength, more energy is radiated at  $T_2$  than at  $T_1$   
b)  $\lambda_{\text{max}}$ , the wavelength at which the most energy is radiated, is shorter at  $T_2$  than at  $T_1$   
c)  $\lambda_{\text{max}}$ , the wavelength at which the most energy is radiated, is shorter at  $T_1$  than at  $T_2$   
d) both choices a) and b) are correct
- 11) **The distances to globular clusters can be measured using:**  
a) the Hubble law  
b) Stellar parallax  
c) The period luminosity relationship of Cepheids  
d) Eclipsing binaries
- 12) **Interstellar reddening:**  
a) is the apparent change in colour of a star because of dust between the star and the observer  
b) is the red shift of a star  
c) is the colour change a star experiences as it becomes a red giant  
d) is caused by diffraction in the optics of the telescope
- 13) **Compared with stars of spectral type O, the sun:**  
a) is less massive and evolves more slowly  
b) is less massive and evolves more quickly  
c) is more massive and evolves more slowly  
d) is more massive and evolves more quickly
- 14) **The primary energy source for most main sequence stars is:**  
a) gravitational attraction  
b) conversion of H to He  
c) conversion of He to C  
d) conversion of C to heavier elements
- 15) **Quasars have the following properties:**  
a) they are strong radio emitters  
b) they have greatly red shifted spectral lines  
c) they are relatively close to the local group  
d) both a) and b) are correct.
- 16) **The intensity of light reaching the Earth is called the:**  
a) solar luminosity  
b) solar constant  
c) solar-Boltzman constant  
d) solar flux

- 17) **Hydrostatic equilibrium is the equilibrium between:**  
a) hydrogen and carbon  
b) water, hydrogen and carbon  
c) gravity and outward pressure  
d) water and electric (static) charge
- 18) **A Neutron star is approximately the size of:**  
a) a grapefruit  
b) St. John's  
c) Earth  
d) The solar system
- 19) **The core temperature of a star in the Hydrogen burning stage is:**  
a) 5 000 K  
b) 15 000 K  
c) 500 000 K  
d) 15 000 000 K
- 20) **A planetary nebula:**  
a) produces an absorption spectrum  
b) produces an emission spectrum  
c) is contracting to form a planet  
d) is contracting to form a star
- 21) **The mass-luminosity relationship for main sequence stars states that:**  
a) high mass is related to low luminosity  
b) high mass is related to high luminosity  
c) luminosity is constant for all masses  
d) luminosity is independent of mass
- 22) **Individual stars form from collapsing gas clouds. A high mass cloud will:**  
a) take more time to collapse than a low mass clouds  
b) take less time to collapse than a low mass clouds  
c) take the same time to collapse as a low mass clouds  
d) collapse time is not related to mass
- 23) **Hydrogen burning for a sun-like star lasts approximately:**  
a) one million years  
b) 10 million years  
c) one billion years  
d) ten billion years
- 24) **In the most massive stars the heaviest element that will be produced in the core will be:**  
a) helium  
b) oxygen  
c) silicon  
d) iron
- 25) **Each time a form of nuclear fuel is exhausted in the core of a star, the star:**  
a) returns to the main sequence  
b) returns to the red giant stage  
c) returns to the white dwarf stage  
d) explodes as a supernova
- 26) **If the sun were suddenly replaced by a one solar mass black hole, the gravitational force on the Earth would:**  
a) double  
b) become so strong that the Earth would be sucked into the black hole  
c) decrease because black holes cause gravity at large distances to disappear  
d) remain the same

- 27) **The event horizon:**  
 a) is believed to be a singularity  
 b) marks the inner boundary of a planetary nebula  
 c) has a radius equal to the Schwarzschild radius  
 d) is a crystalline layer
- 28) **All Novae are thought to involve a :**  
 a) neutron star  
 b) black hole  
 c) supergiant  
 d) white dwarf
- 29) **Ignoring the effect of gravity, the reciprocal of the Hubble constant ( $1/H_0$ ) is:**  
 a) the velocity of near-by galaxies  
 b) the largest possible mass of a white dwarf  
 c) the distance to the local group  
 d) the age of the universe
- 30) **Stars within a cluster differ from each other primarily in:**  
 a) distance  
 b) age  
 c) mass  
 d) chemical composition

**Section B: Answer any five of the following by writing short notes or listing points. In some cases a drawing will help illustrate your answer. (Total value 20 points). Use the answer book supplied.**

1. What Evidence do we have for the Big Bang ?
2. Discuss how this equation is used: 
$$z = \frac{\lambda_{\text{obs}} - \lambda_{\text{rest}}}{\lambda_{\text{rest}}}$$
3. How do we determine stellar mass ?
4. What is the critical density of the universe and how will it affect the ultimate fate of the universe ?
5. Outline the Hubble classification of galaxies.
6. How do we detect black holes ?
7. The view that many texts show of a large gravitational source (eg a star or black hole) is actually a two dimensional space-time drawing. Why are such drawings used and how can they be used to show the path of a beam of light as it passes near a star ?

**Section C: Write an essay on *one* of the following topics (10 points). Use the answer book supplied**

1. Discuss our attempts to measure the size of the universe. You should discuss such topics as stellar parallax, variable stars, main sequence fitting, the Tully-Fisher relationship and the Hubble Law.
2. Outline the history of a very large star from its origin as a protostar to its final stage as a black hole. You should include a short discussion of the proportion of its life history spent in the various stages of its evolution and use an HR diagram to illustrate your answer.