Astronomy C

Rank: _____

Points: _____

Science Olympiad North Regional Tournament at the University of Florida

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Write all answers on the provided answer sheets. **Only answers on the answer sheets will be graded.** If a question requests work, please show your work and your final answer on the corresponding answer sheet. Work on other sheets of paper will not be looked at or considered during grading. In addition, **write your team name and team number on all pages of the answer sheets.**

When answering the multiple choice questions, please write just one letter on the answer sheet.

The number of points each question is worth is listed in parenthesis after each question and on the answer sheet.

This test is 32 questions and is composed of 120 points. There are 3 tiebreakers. Answers to the tiebreakers **will** count towards calculating raw score. Tiebreakers are denoted by a * on the test and answer sheet. There are no penalties for either getting a question wrong or skipping it entirely. Partial credit is possible on some, but not all questions.

When submitting the exam, submit all materials (test, answer sheet, images, and any scratch paper). You may separate the pages of this test and write on it, but remember, any writing/work that is to be graded must be on the answer sheets.

You have 50 minutes for this test; **writing after time is called will result in disqualification**.

Good luck!

1. What is the main difference between H I and H II regions? (4 pts)
2. Order the following spectral classes from hottest to coolest: A, B, F, K, M (2 pts)
3. What type of galaxy do H II regions rarely form in, and explain why. (2 pts for galaxy, 4 for explanation)
4. Give an upper bound to the luminosity of a red supergiant. (2 pts)
5. What spectral class(es) are red supergiants usually classified as? Which Yerkes class are red supergiants classified under? (2 pts)
6. Give an alternative name for luminous blue variables. (2 pts)
7. Name one important use of Cepheid stars. (2 pts)
8. What is the name of the limit that provides a lower bound on the masses of stars that form stellar black holes? (2 pts)
9. Type Ib, Ic, and II supernovae have similar causes. What differentiates them in terms of their spectra, and what causes this difference? (2 pts for difference, 4 pts for explanation)
10. * Explain what happens when a type II supernova occurs, starting from core collapse. (8 pts, tiebreaker 1)
11. Which of the following processes can occur in stars in the main sequence phase? (4 pts)

    A: Proton-proton B: Triple alpha C: CNO cycle D: A, B E: A, C

    F: B,C G: A, B, C H: None of A, B, C
12. What kind of stars appear in the area where C is in Image 1? (2 pts)
13. Suppose star A is a Classical Cepheid and star B is a W Virginis variable, and that stars A and B have the same period. Approximately what is the positive difference in magnitudes between them? (2 pts, answer a positive number)
14. What differentiates AG Carinae from other luminous blue variables? (2 pts)

15. As time passes, what fate will Alpha Orionis eventually meet and explain why? (2 pts for saying what will eventually happen, 4 pts for saying why)

16. Identify the object in Image 2 and the part of the EM spectrum in which the picture was taken. (2 pts for identification of object, 4 pts for EM spectrum part)

17. Identify the object in Image 3 and the part of the EM spectrum in which the picture was taken. (2 pts for identification of object, 4 pts for EM spectrum part)

18. What is unique about the object at the center of the SNR in Image 4? (4 pts)

19. * Which of the following could produce something resembling Image 5? (4 pts, tiebreaker 3)
    A. S Doradus B. AG Carinae C. HR 5171A D. Alpha Orionis E. None of the above
    F. A and B G. A and C H. A and D I. B and C J. B and D
    H. C and D I. A, B, C J. A, B, D K. A, C, D L. B, C, D
    M. A, B, C, D

20. Suppose stars A and B are in a binary system, and the ratio of the mass of star A to the mass of star B is 5/6. If the total distance between A and the center of mass of the system is 25 AU, determine the distance between the 2 stars in AU. (2 pts)

21. Suppose an object that is 10 parsecs away from Earth has an apparent magnitude of 0. What is the absolute magnitude of the object? (2 pts)
22. * Suppose that the temperature of a certain star is 2898 K, and that its observed max wavelength emission is 1010 nm. Determine the proper distance to this star in parsecs, assuming that the star's radial velocity and its real velocity have the same value. Please show work for this question. (2 pts for some answer, 6 pts for work; tiebreaker 2).
23. What is the absolute magnitude of the sun, given that it is 1 AU away and has an apparent magnitude of -26.78? (2 pts)
24. Suppose a Classical Cepheid has an apparent magnitude of 21 and a period of 22 days. Determine the absolute magnitude of the star, and show work. (2 pts for answer, 4 pts for work)
25. Determine the luminosity of the star in #24 in terms of solar lumens. Again, show work.(2 pts for answer, 4 pts for work).
26. State Kepler's Third Law (either in terms of words or the equation) (2 pts)
27. Name a mechanism besides exceeding the Chandrasekhar limit that can lead to core collapse, and elaborate how that mechanism will lead to core collapse. (2 pts for naming, 4 pts for elaboration)
28. What kind of stars can cause supernova imposters? (2 pts)
29. How is it known that M82 X-2 is a pulsar instead of a black hole? (2 pts)
30. What is unusual about Wolf-Rayet star spectra? (2 pts)
31. What differentiates type II-L and II-P supernovae? (4 pts, 2 pts for each)
32. What are unique about type IIb and IIn supernovae? (4 pts, 2 pts for each)

ANSWER SHEET Team Number:

(/4) 1.

(_/2) 2.

(__/6) 3.

(__/2) 4.

(__/2) 5.

(__/2) 6.

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(__/8) 10.

(__/4) 11.

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Team Number:

(__/2) 13.

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Team Number:

(__/2) 23.

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Team Number:

(__/2) 26.

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(___/4) 31.

(___/4) 32.