

SCIENCE OLYMPIAD
— AT THE —
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Astronomy C Test

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

Score: _____

DO NOT write on this packet, only responses recorded on the answer sheet will be scored. POINTS WILL BE DEDUCTED for writing of this packet.

Part 1- Stellar Evolution and Galaxies

1. Name and describe the process which is responsible for changes undergoing in Cepheid variables? [4]
2. What is the typical spectral class associated with RR Lyrae variables?[1]
3. What is the main difference between an RR Lyrae variable and a classical cepheid? [1]
4. What characteristic of RR Lyrae variables makes them useful as standard candles for measuring galactic and extragalactic distances? [2]

For questions 5-9, refer to image G.

5. At which location(s) would one find a T-Tauri variable?[1]
6. At which location(s) would one find an RR Lyrae star?[1]
7. At which location(s) would one find a type I cepheid?[1]
8. At which location(s) would one find a type II cepheid?[1]
9. At which location(s) would one find a δ Scuti variable?[1]
10. Stellar mass black holes have _____ densities than supermassive black holes. [1]
11. Which classifications of galaxies has/have similar star populations in their halo and disk?[2]
 - a. Sa and Sb
 - b. Sa and Sc
 - c. Sb and Sd
 - d. Sc and Sd
12. What is the name of the nomenclature most commonly used to classify galaxies?[2]
 - a. New General Catalog
 - b. Hubble Sequence
 - c. Cosmological distance ladder
 - d. Messier classification
13. Which of the following best explains the range of star ages within galaxies?[2]
 - a. Hierarchical Clustering
 - b. Primordial Collapse
 - c. Secular Evolution
 - d. Monolithic Collapse
14. Which of the following can be described as a blackbody radiator?[2]
 - a. A star core
 - b. Gas
 - c. A stellar atmosphere
 - d. A galaxy
15. In large disk galaxies, light profiles follow an exponential _____ with radius.[1]

16. Starburst galaxies are best observed in _____. [1]
 - a. Radio
 - b. Infrared
 - c. Visible light
 - d. Ultraviolet
17. What is the absolute magnitude of a G2 star?[1]
18. What is the metallicity of globular clusters? Why is this so?[2]
19. In galactic clusters, what is thought to be responsible for maintaining the high temperature of the intracluster medium? [3]
20. What type of galaxies are found in the edges of regular galaxy clusters? [2]

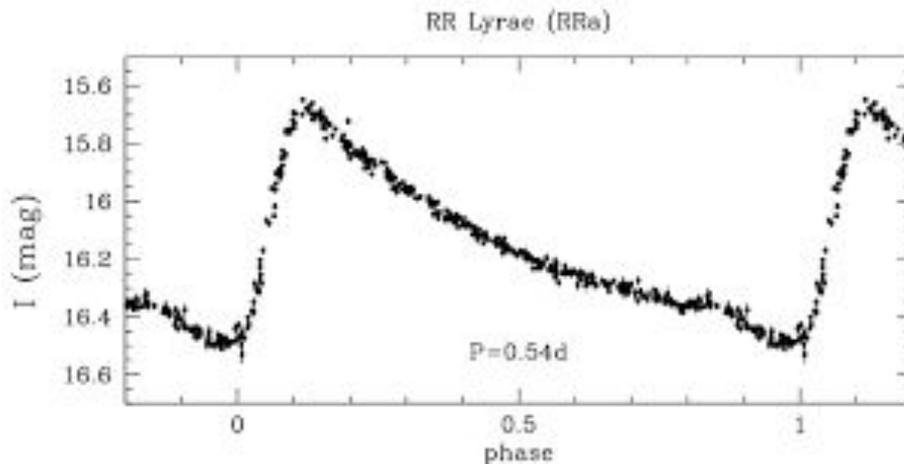
Part 2- DSOs

21. Identify an image of the starburst galaxy discovered in 1774. [1]
22. Explain what is thought to be causing this intense star formation activity in the previously identified galaxy. [2]
23. Name the satellite launched in 1983 to search for starburst galaxies. [2]
24. Which image shows a globular cluster in the Milky Way? [1]
25. A binary system composed of the closest white dwarf to a black hole was observed in a globular cluster. Name the binary system and cluster. [2]
26. Identify the image of the galaxy where SN2014j took place. [1]
27. What supernova type is SN2014j? [1]
28. Identify an image of Sagittarius A*.[2]
29. What is this object believed to be?[2]
30. The orbital path of a star near Sagittarius A* was used to determine its nature. Name the star.[3]
31. This image combines two separate images taken by the Chandra and the Hubble telescopes in different wavelengths. What two wavelengths were utilized? [4; Tiebreaker #2]
32. What is the name of the galaxy cluster with the highest known rate of star formation? [1]
33. In the Phoenix cluster, narrow filaments of what wavelength can be observed extending from the cluster's center? [2]
34. Surrounding these filaments in the Phoenix cluster, there are cavities where decreased emission of the previously named wavelength has been observed. Describe the formation of these cavities. [5; Tiebreaker #1]
35. Image H shows a composite image of galaxy SPT 0346-52. Which letter(s) represent this galaxy on the image?[3]
36. What is thought to be the cause of the large amount of infrared radiation emitted by this object? [3]

37. It was originally theorized that the infrared radiation emitted by SPT 0346-52 was due to the accretion of matter by a supermassive black hole, however, this theory was disproved by the lack of this/these type(s) of radiation. [4]
38. Imagine C shows a portion of the Abell 400 galaxy cluster. Which letter is NGC 1128?[2]
39. Identify an image of the radio source 3C 75 in NGC 1128. [2]
40. Describe what is causing this radio source. [4]

Part 3- Calculation and Interpretation

41. How far away is an object with a parallax angle of 0.065 arcseconds? Round your answer to 4 significant digits. [2]
42. A star with a spectral type F6 has an apparent magnitude of 2.7. How far away is the object in parsecs? Give your answer in 2 significant digits. [2]
43. In 2014 a supernova SN2014j was observed. It had an apparent magnitude of 10.5. Estimate the distance to the event. [2]



44. An RR Lyrae variable with the light curve shown above has a period of 0.54 days. How far is this object in parsecs? [3]

For questions 45-47 reference image F

45. State the relationship between the objects which share a common line of best fit. [2]
46. What is the difference, regarding distance, between objects towards the top right of the TF graph and those towards the bottom left? [3]
47. What is the relationship between the size of a spiral galaxy and its rotational velocity? [2]
48. The H_{α} absorption line of a galaxy was observed to have a wavelength of 6662.8 \AA . Calculate the recessional velocity of the galaxy in km/s. Round your answer to 1 decimal place. [3]
49. Based on your answer to the previous question, how far away would the galaxy be in megaparsecs? [3]