



SCIENCE OLYMPIAD
— AT THE —
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Astronomy C Answer Key

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

Score: _____

Part 1: Stellar Evolution and Galaxies

1. Kappa mechanism/Eddington valve [1pt]; doubly ionized helium ion is more opaque [2pts]; expands, cools, contracts, and becomes brighter [1pt].
2. A, F; either, or both acceptable for full credit [1]
3. Their period of pulsation. [1]
4. The quantifiable relationship between their period of pulsation and absolute magnitude; The period-luminosity relationship [1]
5. B [1]
6. A [1]
7. C [1]
8. E [1]
9. D [1]
10. Higher [1]
11. D/ Sc and Sd [2]
12. B/Hubble Sequence [2]
13. A/ Hierarchical Clustering [2]
14. A/ Star core [2]
15. Decline [1]
16. B/Infrared [1]
17. 5.0 [1]
18. Low [1pt]; because they are old [1pt]
19. supermassive black holes [3]
20. spiral galaxies [2]

Part 2: Deep Space Objects

21. B [1]
22. gravitational interactions; merger; with M81 [2]
23. IRAS [2]
24. D [1]
25. 47 Tucanae [1pt]; X9 [1pt]
26. B [1]
27. Ia [1]
28. A [2]
29. Supermassive blackhole [1]
30. S2 [3]

31. X-ray and Infrared [4]
32. Phoenix Cluster [2]
33. X-ray [2]
34. gas is displaced/moved [2pt]; by jets of high-energy particles [1pt]; originating/emanating from a supermassive black hole [1pt]; in the central galaxy [1pt]
35. A, C, D; [1pt for each]
36. intense star formation [3]
37. X-ray, and radio [4; two for each]
38. E
39. E
40. 1pt for **two supermassive blackholes**; 1pt for a **binary system** composed of two supermassive blackholes; 1pt: are spiraling towards each other; 1pt: and will eventually merge.

Part 3: Calculations and Interpretations 1 point will be deducted for each answer without work shown.

41. 15.38 parsecs [2]
42. 5.5 pc [2]
43. 10^7 ; 10,000,000pc; 9120108.4pc for -19.3 as m [2]
44. 50615.25pc [3]
45. They belong to the same galactic cluster [2]
46. Those towards the top right are closer than those towards the bottom left [3]
47. larger spiral galaxies have a higher rotational velocity [2]
48. 4568.05 km/s [3]
49. 61.73-65.26 Mpc [3]

Total: 100pts