YUSO 2017 Astronomy

Answer Key

Part I: Multiple Choice (1 pt each)

1. b  14. d  27. e  40. a
2. b  15. a  28. a  41. a
3. a  16. b  29. c  42. b
4. b  17. a  30. c  43. a
5. a  18. d  31. a  44. b
6. e  19. a  32. e  45. b
7. d  20. d  33. c  46. a
8. e  21. e  34. b  47. e
9. c  22. b  35. b  48. c
10. b  23. d  36. a  49. d
11. a  24. b  37. e  50. a
12. b  25. c  38. b  51. e
13. b  26. d  39. a

Part II: DSO Identification (2 pts per subsection)

1. Henize 3-1357 or Stingray Nebula
   a. Hubble Space Telescope
   b. Ara
   c. Oxygen
   d. Nitrogen
   e. Hydrogen

2. Sirius or Sirius A & B
   a. Canis Major
   b. Sirius A
   c. -2.9
   d. A
   e. 20 A.U

3. HM Cancri
   a. 5.4 minutes or 321.5 sec
   b. Cancer
   c. 08h 06m 23.20s; +15° 27' 30.20"

4. M15 or NGC 7078
   a. Pegasus
   b. Charles Messier
   c. 13.2 billion years old
   d. 112
   e. 9
5. SNR G1.9+0.3  
   a. Sagittarius  
   b. About 27,700 – 28,000 ly  
   c. There was a dusty region of our galaxy that blocked visible light from reaching earth  
   d. When was it discovered?  
   e. G1.9+0.3 exhibits an extremely asymmetric pattern.  
   f. Synchrotron radiation  

6. #3  
7. Stingray nebula  
8. NGC 7078 or M15  
9. NGC 2440; nearly 400,000 degrees Fahrenheit or 200,000 degrees Celsius  
10. M7 IIIe  
11. Tycho’s SNR or G120.1+01.4 or SN 1572  
12. SN 2011fe or Messier 101  
13. SNR 0509-67.5  
14. Ripples in space-time will be given off.  
15. SS Cygni  
16. NGC 2392  
17. Henize 3-1357  
18. Alpha Centauri system  
19. Sirius B; 1930; Subrahmanyan Chandrasekhar

Part III: Short answer (2 pts each)  
1. OBAFGKM  
2. A & B  
3. M  
4. Temperature of the star’s outer atmosphere; chemical composition of the star’s outer layers  
5. The orbits of planets are ellipses  
6. A line from a planet to the Sun sweeps over equal areas in equal intervals of time.  
7. A planet’s orbital period squared is proportional to its average distance from the Sun cubed.  
8. Main-sequence star  
9. Solar masses  
10. Lower right to upper left  
11. A  
12. the width of their spectral lines.  
13. quasars  
14. using radio waves to get a pulse reflection, parallax, cepheids, brightness, red shifts

Part IV: Math (3 pts per subsection)  
*Award full points if answer is within 0.1 of the correct answer.*  
1)  
   a. 14.7 years  
   \[ P^2 = a^3 \]  
   \[ \sqrt{a^3} = 14.7 \text{ years} \]  
   b. It takes the same amount of time.  
   c. Elliptical
2)  
   a. 55.4 AU \[ X_{cm} = \frac{(1.00\,V(0) + (12.0)\,(60.0))}{(1.00 + 12.0)} = 55.4 \text{ AU} \]

   b. 4.62 AU \[ X_{cm} = \frac{(1.00\,V(0) + (12.0)\,(60.0))}{(1.00 + 12.0)} = 4.62 \text{ AU} \]

   c. 9.92 \times 10^7 \text{ years} \[ T = 2\pi \sqrt{\frac{(60)^3}{(6.7 \times 10^{11})}} \times (13) = 9.92 \times 10^7 \text{ years} \]

   d. 1.4 solar masses

   e. 81 times more

   f. It’s 1.27 times greater

   g. Star C&D because the combined mass is greater than A&B.

3)  
   a. 7.24 \times 10^8 \text{ pc} \[ d_{pc} = 10^4 \left(\frac{204.153 \pm 5}{5}\right) = 7.24 \times 10^8 \text{ pc} \]

   b. 2.36 \times 10^3 \text{ ly} \[ \frac{7.24 \times 10^8 \text{ pc}}{1 \text{ ly}} \times \frac{3.08 \times 10^{16} \text{ m}}{9.46 \times 10^{15} \text{ m}} = 2.36 \times 10^3 \text{ ly} \]

Part V: Tiebreaker Questions

Instructions: Break ties in order of tiebreaker questions.

Ex. If Team 1 has answered 2 and 4 correctly, and Team 2 has answered 1 and 3 correctly, Team 2 wins by tie-breaker

1. A distant ninth planet of our solar system.
2. About 2.03 \times 10^9 pennies (± 0.1 x 10^9)
3. About 2.03 \times 10^7 dollars (± 0.1 x 10^7)
4. Stars are considered black bodies. The color of a blackbody lies on the Planckian locus. The Planckian locus does not pass through green, indigo or violet wavelengths. Stars emit a range of light but the wavelengths of light peak in one color. So a star’s blackbody curve can peak at green or purple wavelengths but it’s also emitting yellow, blue, red, and/or orange wavelengths. The mixture of wavelengths appears white to human eyes.