Astronomy

New York State
Science Olympiad

Regional Competition
2012

All items have the same point value, and are tie breakers in the order given.

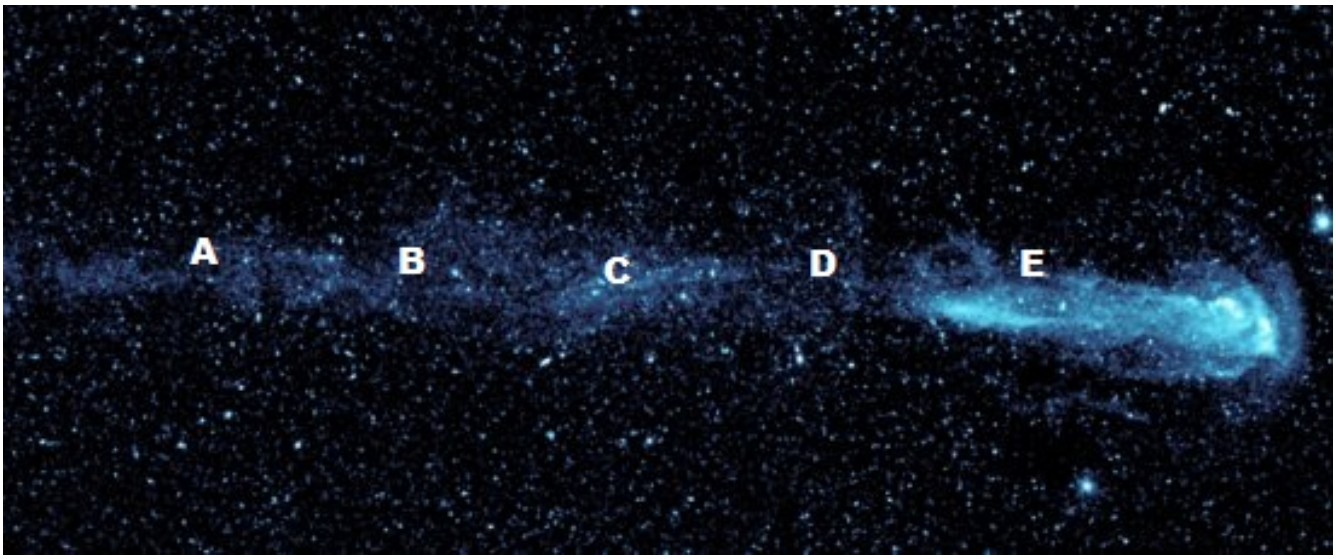
1. A binary star system has an orbital period of 83.47 years. Express this in the standard SI units of time, seconds. Express your answer in scientific notation.

2. A pair of binary stars have a mean separation of 18.92AU. Express this in the standard SI units of distance, meters. Express your answer in scientific notation.

3. What is the total mass of a binary system if the orbital period is 64.37 years, and the mean separation is 17.83AU? Express your answer in kg, and in scientific notation.

4. A binary star system (star A and star B) has a total mass of 3.804×10^{30}kg, and a mean separation of 6.24×10^{12}m. Star A has been determined to be 2.08×10^{12}m from the barycenter. What is the mass of star A? Express your answer in kg, and in scientific notation.

5. Another binary star system (stars A and B) has a total mass of 8.23×10^{30}kg. The mass of star A has been determined to be 5.19×10^{30}kg. What is the mass of star B? Express your answer in kg, and in scientific notation.



6 & 7. In alphabetical order, what are the two most common names for the object shown in the image above?

8. Which letter in the picture best approximates the location of material that was ejected from the surface of this star 20,000 years ago? (Local time frame of reference.)**.**

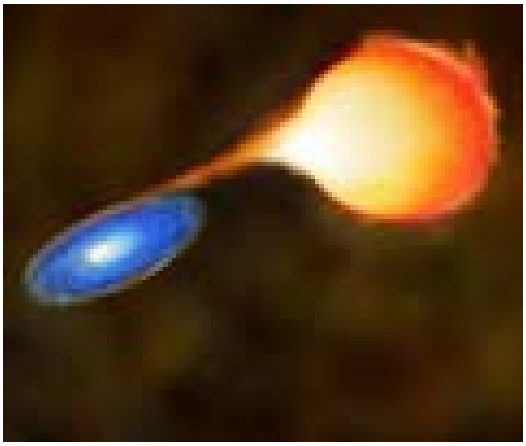
9. This image graphically displays this star's:

A. Kepler motion
B. proper motion
C. radial motion
D. space motion

10. This image shows

A. carbon in this visible.
B. hydrogen in the ultraviolet.
C. helium in the ultraviolet.
D. hydrogen in the x-ray.
E. helium in the x-ray.

11. Draw a dot with a circle around it on the chart in your answer packet representing the location of this object.



12. When pair of binary stars form simultaneously from the same gas and dust, one will virtually always leave the main sequence before the other. Why?

13. Prior to a type 1a supernova explosion, material transfers form one member of a binary pair to the other, as illustrated above. What type of star is shown on the left side of this illustration?

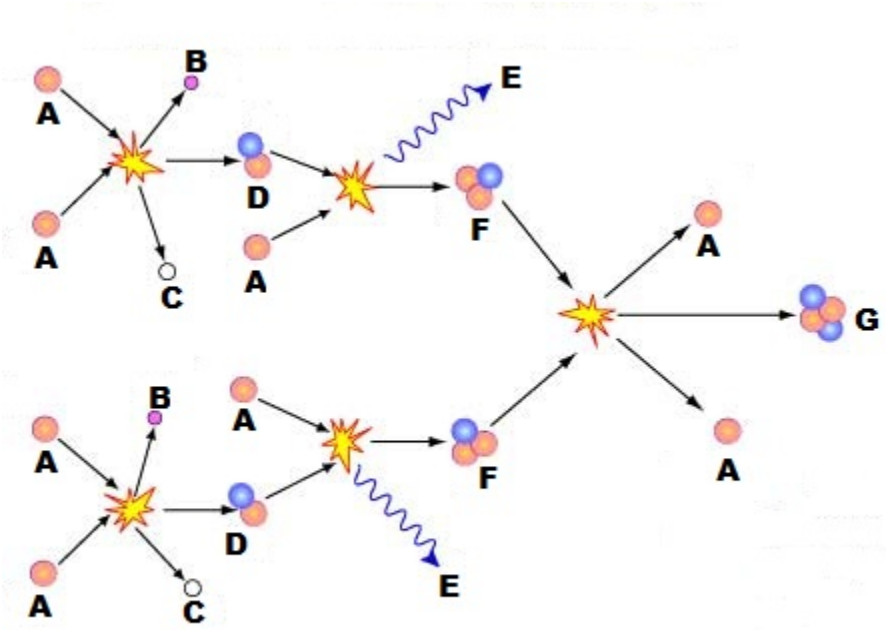
14. What type of star is shown on the right side of this illustration?

15. What is the name of the material spiraling around and into the left hand star?

16. Expressed in solar masses, a type 1a supernova will occur when the left hand star reaches what mass?

17. Expressed in kg, and in scientific notation, a type 1a supernova will occur when the left hand star reaches what mass?

18. This point at which a type 1a supernova occurs is named after and Indian astronomer who first predicted it in 1930. Correctly spelled, what is this point called.



19. The diagram above represents

A. carbon synthesis in white dwarf stars.
B. carbon synthesis in the core of red giant stars.
C. helium fission in the core of main sequence stars.
D. helium fusion in the core of main sequence stars.
E. lithium degeneration in type 1a super novae.

For questions 20 – 26 identify what each of the letters in the diagram above represents, selecting your answers from the list below:

^{12}C, ^{14}C, ^{1}H, ^{2}H, ^{3}H, ^{4}H, ^{1}He, ^{2}He, ^{3}He, ^{4}He, ^{6}Li, ^{7}Li, dalek, dilithium, gamma ray, microwave, neutrino, positron, quidditch

20. A

21 & 22. B and C (in either order)

23. D

24. E

25. F

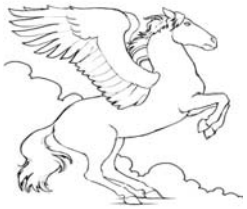
26. G

27. Which Sci Oly featured object is shown above?

28. It is

A. a supernova remnant.
B. an HII region.
C. an irregular galaxy.
D. an accretion disk.

29. This object is found in a constellation named after which of the following:

 A	 C
 B	 D

30. The following objects are listed in alphabetical order. List them in chronological order to represent the evolutionary stages of a star about the same mass as our sun.

black dwarf
GMC
main sequence
planetary nebula
protostar
red giant
white dwarf

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31 – 34. Fill in the blank spaces in the color index table below. Copy your answers for the numbered cells onto your answer sheet.

Star	B	V	Color Index
Alpha Crucis	*31*. _____	0.81	-0.25
Beta Crucis	1.15	1.3	*32*. _____
Gamma Crucis	3.22	1.63	*33*. _____
Delta Crucis	2.59	*34*. _____	-0.19

35. What is the name of the star in the chart above that is a red giant?

36. What is the name of the star in the chart above that has the highest surface temperature?

37. Based on the information that is in the chart above, what is the magnitude of Gamma Crucis?

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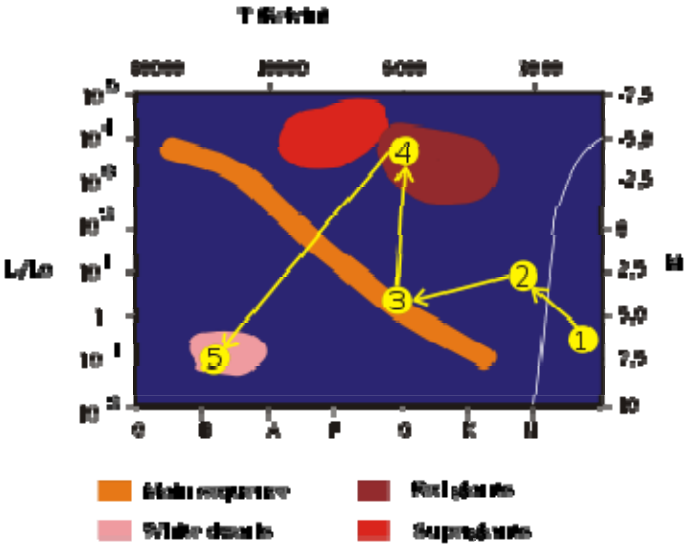
38. A certain star has a surface temperature of 6,000K. What is its peak wavelength expressed in angstroms.

39. What is the distance to a star, in pc, if its apparent magnitude is 0.14 and its absolute magnitude is -7.1?

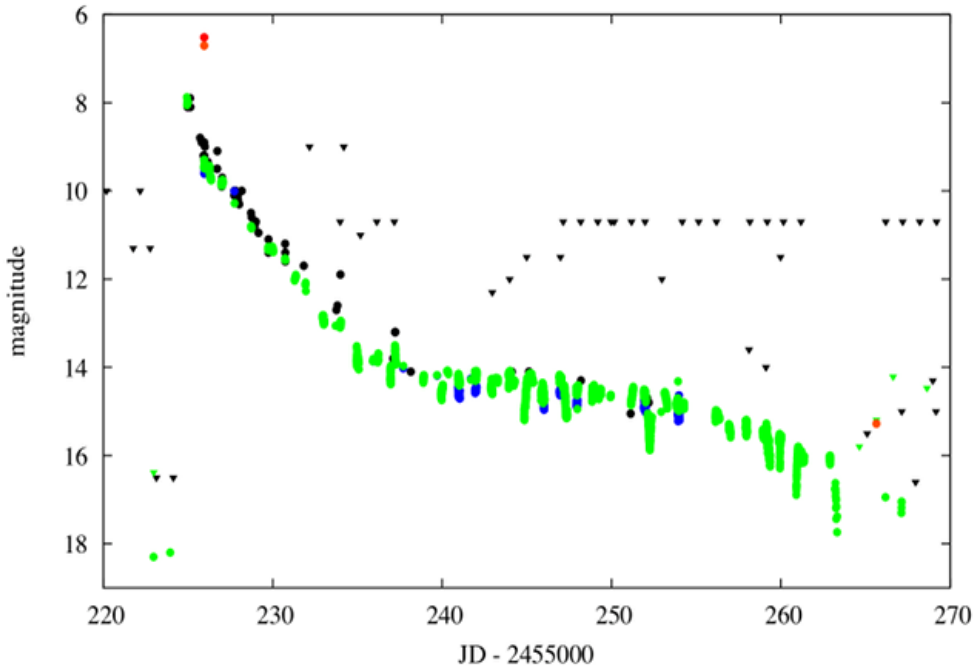


For each of the following Sci Oly featured objects, write the numbered region of the H-R diagram above that best matches it.

40. BP Psc

41. Sirius B

42. T Tauri



43. Which Sci Oly featured object is represented by the AAVSO light curve shown above?

44. On what date were these observations of its most recent outburst made?

45. If you were to make an observation of this object a 6:30pm EST, on February 4, 2012, which Julian Date should you record with your observation?

A. JD 2455863.697222
B. JD 2455961.979167
C. JD 2455962.479167
D. JD 2456147.927083