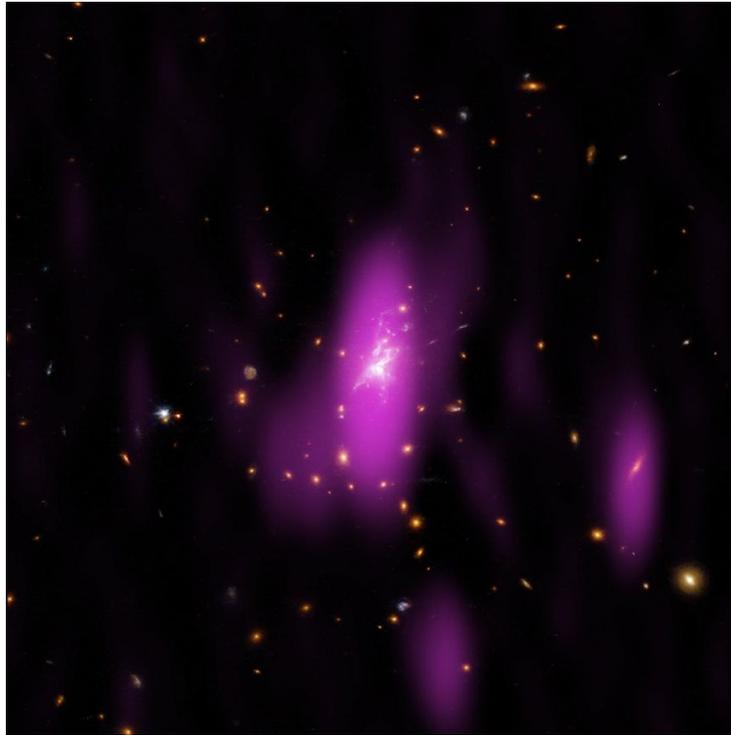


Astronomy C

Captains Tryouts 2019

Raleigh Charter High School



Written by anna1234

Name: _____

Instructions:

- 1. These constants will be used throughout the test:**
 - a. $1 \text{ Parsec} = 3.1 \times 10^{16} \text{ meters}$
 - b. **Mass of the sun** = $1.989 \times 10^{30} \text{ kg}$, **Radius of sun** = $6.96 \times 10^8 \text{ m}$, **Temperature of sun** = 5800 K
 - c. **Absolute Magnitude of the Sun** = 4.83
 - d. **Hubble's Constant** = 65 km/s/Mpc
 - e. **Absolute Magnitude of Type 1a supernova** = -19.3
2. This test will be scored out of 84 points, and 50 minutes should be allowed to complete it.
3. No partial credit will be given. Math questions will have a range of acceptable answers.
4. Tiebreaker questions are in the following order: 35c, 20, 6b, 38c, 12, 19, 13

Good Luck :)

Section A: DSOs (___ / 30)

Refer to the Image Sheet to answer the following questions.

- Match the image number to each DSO listed:
 - M100
 - Antennae Galaxies
 - ESO 137-001
 - Chandra deep field south
 - Abell 400
- According to Hubble's tuning fork, what classification of galaxy is image 5?
- Which image number shows the closest starburst galaxy to earth?
- The following questions refer to IC 10:
 - Which image number shows IC 10?
 - What wavelength is the image of IC 10 in?
 - What type of binary systems are heavily abundant in IC 10?
- The following questions refer to 47 Tucanae:
 - Which image number shows 47 Tucanae?
 - What kind of cluster is 47 Tucanae?
 - What unique about the orbit of the binary system 47 Tuc X9 ?
- The following questions refer to image 6:
 - Which DSO is shown in image 6?
 - This DSO lacks which wavelength in the EM spectrum?
- The following questions refer to M51a/NGC 5195:
 - Which image number shows M51a/NGC 5195?
 - What is the cause of the "cross" or "X-like" feature in NGC 5195?
 - What is the cause of NGC 5195's distortion?
 - M51a is what kind of active galaxy?
- The merger of the two galaxies in image 8 will result in a _____ galaxy.
- The following questions refer to image 9:
 - Which DSO is shown in image 9?
 - What kind of Active Galaxy is image 9?
 - What is the cause of this object's emissions of x-ray and radio waves?
 - What is the cause of the dark strip that's seen across image 9?

Section A: DSOs (___ / 30)

Refer to the Image Sheet to answer the following questions.

- 10.** The following questions refer to the phoenix cluster:
 - (10a)** Which image number is the phoenix cluster?
 - (10b)** What effect does the phoenix cluster have on cosmic background radiation?

- 11.** The following questions refer to image 15:
 - (11a)** Which DSO is shown in image 15?
 - (11b)** What type of supernova is shown in image 15?

- 12.** In 2017, the gravitational waves produced by the merger of two neutron stars were detected in the galaxy depicted in which image number?

- 13.** S-stars are stars that orbit the DSO in which image?

Section B: Miscellaneous (___ / 20)

14. Classical cepheids are typically found in what type of star cluster?
15. What is the mechanism for variability in an RR Lyrae Variable?
16. The upper mass limit of $1.44 M_{\odot}$ for a white dwarf is known as the _____ limit.
17. Name the unit of energy that is roughly equal to the energy released by a supernova, and is equal to 10^{51} ergs.
18. As two neutron stars spiral closer together, what kind of waves do they emit?
19. ULXs typically approach (and may even exceed) which limit of luminosity ?
20. An abrupt change in the rotational period of a pulsar is known as a _____.
21. If an old pulsar in a binary system shows a sudden increase in rotational period, it's known as a _____ pulsar.
22. The emission of a microquasar is strong in what wavelength?
23. A black body produces a _____ spectrum.
24. What kind of compact remnant would a star of $1.5 M_{\odot}$ likely become?
25. Which population of stars is, on average, younger and more luminous?
26. Population 2 stars are more concentrated in _____ galaxies.
27. Anything heavier than the element _____ is considered to be a metal.
28. If a T Tauri star is contracting while decreasing in luminosity and remaining the same temperature, it is following the _____ track.
29. What is the name of the mass at which the force of gravity overcomes gaseous pressure in gas clouds?
30. Name one possible cause for the increased star formation seen in starburst galaxies.
31. One explanation for the flattened shape in rotation curves of galaxies is the presence of _____ .
32. When a larger galaxy merges with a smaller galaxy, it's known as a _____ merger.
33. What is thought to form when two stellar mass black holes collide?

Section C: Math (___ / 34)

34. Main sequence star Altair has a temperature of 8000 Kelvin and a radius of 1.148×10^9 m.

(34a) What is Altair's spectral class?

(34b) What is the luminosity of Altair in solar luminosities?

(34c) Given that the absolute magnitude of the sun is 4.83, what is the absolute magnitude of Altair?

(34d) If the apparent magnitude of Altair is 0.77, how far away is it in parsecs?

(34e) What is the parallax of Altair in arcseconds?

(34f) What is Altair's peak wavelength in nm?

(34g) Given that Altair has a mass of $1.79M_{\odot}$, what is its surface gravity in m/s^2 ?

35. The following questions refer to a spiral galaxy located in the Virgo Cluster. This galaxy has a mass of $2 \times 10^{11} M_{\odot}$ and a redshift of 0.00524.

(35a) Calculate the galaxy's recessional velocity in km/s.

(35b) Calculate the galaxy's distance in Mpc.

(35c) What would the orbital velocity of a star located 2.53×10^{20} m away from the center of this Galaxy in km/s?

(35d) Bonus: Which DSO is this question referring to?

36. The following questions refer to image 15:

(36a) What type of supernova is displayed in image 15?

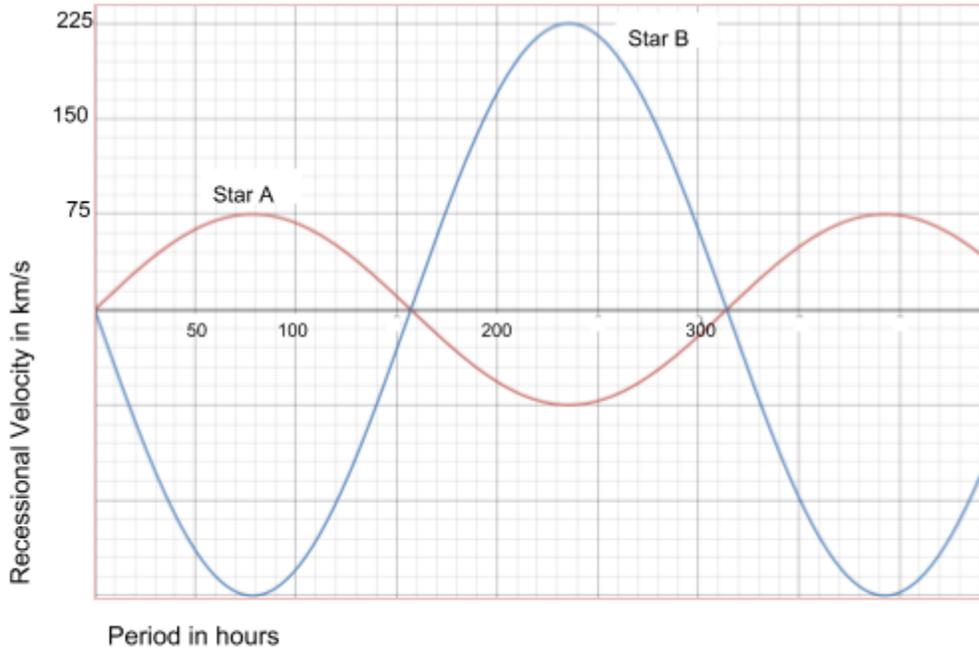
(36b) What is the peak apparent magnitude of this supernova?

(36c) How far away did this supernova take place in parsecs?

37. If an RR Lyrae variable star has an apparent magnitude of 7.3, how far away is it in parsecs?

Section C: Math (___ / 34)

38. The following questions refer to the graph below:



(38a) Determine the period of the system in days.

(38b) Determine the recessional velocity of the system in km/s.

(38c) Given that the separation of the system is 0.3 AU, what is the combined mass of the system in solar masses?