

B - Reach for the Stars - December 19 SO Practice - 12-19-2020

1. (1.00 pts) The primary factor determining the stages in the life cycle of a star is:

- A) temperature
- B) chemical composition
- C) density
- D) mass
- E) none of the above

2. (2.00 pts) Stars typically originate in:

(Mark ALL correct answers)

- A) giant molecular clouds
- B) galactic centers
- C) stellar nurseries
- D) supernova explosions
- E) none of the above

3. (2.00 pts) A protostar is:

(Mark ALL correct answers)

- A) a very young star
- B) a very old star
- C) is smaller in size during main sequence phase
- D) is larger in size during main sequence phase
- E) none of the above

4. (1.00 pts) Stars spend the majority of their lives on the main sequence.

- True
- False

5. (1.00 pts) All stars fuse Hydrogen into Helium during the main-sequence phase.

- True
- False

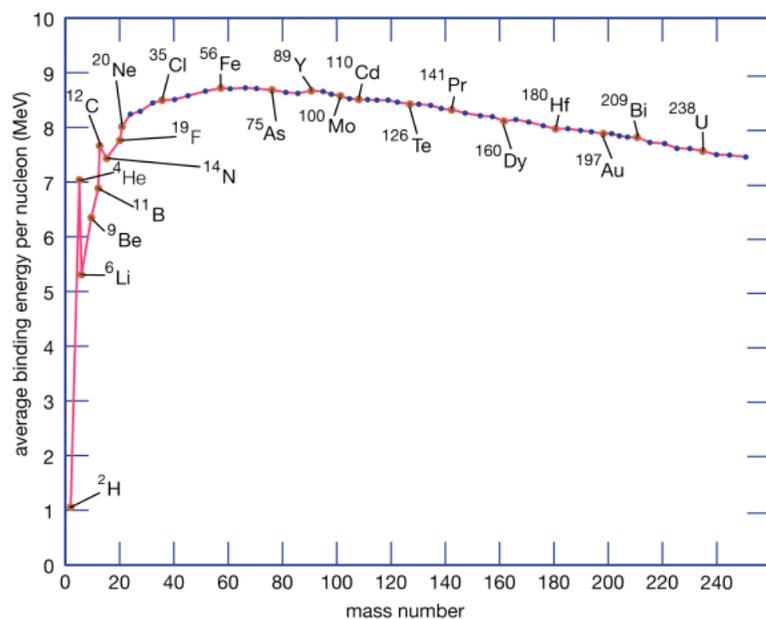
6. (2.00 pts) Low-mass stars fuse Hydrogen to Helium via the _____ process, while high-mass stars fuse via the _____ process

Choices: Krebs cycle, proton-proton chain, rapid neutron capture, CNO cycle

proton-proton chain

CNO cycle

Questions 7-10 are related to the image below.



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7. (1.00 pts) The number on the x-axis represents:

- A) the number of protons in an atomic nucleus
- B) the total number of protons and neutrons in an atomic nucleus
- C) the number of electrons in a non-ionized atom
- D) the number of neutrons in the atomic nucleus
- E) none of the above

8. (1.00 pts) The number on the y-axis represents:

- A) the minimum energy required to split up the atomic nucleus into its components
- B) the minimum energy required to remove all the electrons from the shells
- C) the minimum energy required to convert all protons into neutrons in an atomic nucleus
- D) the minimum energy required to convert all neutrons into protons in an atomic nucleus
- E) none of the above

9. (2.00 pts) The element with lowest nuclear binding energy is _____ and the one with the highest nuclear binding energy is _____.

hydrogen

iron

10. (4.00 pts) What can you conclude about the core fusion process in stars from the above diagram?

Expected Answer: Fusion is the process that powers active or main sequence stars and other high-magnitude stars, where large amounts of energy are released. A fusion process that produces nuclei lighter than iron-56 or nickel-62 will generally release energy. These elements have relatively small mass per nucleon and large binding energy per nucleon. Fusion of nuclei lighter than these releases energy (an exothermic process), while fusion of heavier nuclei results in energy retained by the product nucleons, and the resulting reaction is endothermic. However, once iron is reached, fusion is halted since iron is so tightly bound that no energy can be extracted by fusion. Iron can fuse, but it absorbs energy in the process and the core temperature drops.

11. (3.00 pts) Which of the following stages will a solar-mass star go through?

(Mark ALL correct answers)

- A) red giant
- B) red supergiant
- C) supernova
- D) planetary nebula
- E) white dwarf

12. (3.00 pts) Which of the following stages will a heavy star likely go through?

(Mark ALL correct answers)

- A) red giant
- B) red supergiant
- C) supernova
- D) planetary nebula
- E) white dwarf

13. (1.00 pts) A white dwarf may undergo a supernova explosion.

- True False

14. (1.00 pts) A neutron star is primarily composed of neutron degenerate matter.

- True False

15. (1.00 pts) The end-stage of heaviest stars is a black hole.

- True False

16. (1.00 pts) Black holes can not be seen. They can only be inferred through their interactions with other matter.

- True False

17. (2.00 pts) Edwin Hubble's galaxy classification scheme includes:

(Mark ALL correct answers)

- A) elliptical galaxies
- B) spiral galaxies
- C) lenticular galaxies

- D) irregular galaxies

18. (2.00 pts) Gérard de Vaucouleurs improved on the original classification by elaborating on:

(Mark **ALL** correct answers)

- A) elliptical galaxies
 B) spiral galaxies
 C) lenticular galaxies
 D) irregular galaxies

19. (1.00 pts) Spiral galaxies generally contain older stars and less gas.

- True False

20. (2.00 pts) Which of these features are NOT generally seen in lenticular galaxies?

(Mark **ALL** correct answers)

- A) a bright central bulge
 B) an extended disk-like structure
 C) prominent spiral arms
 D) large-scale star-formation activity

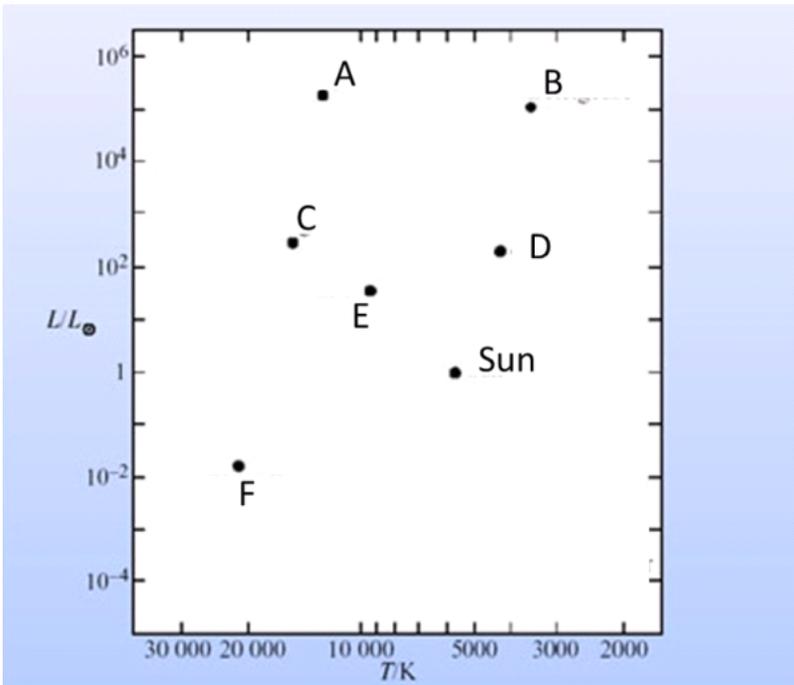
21. (1.00 pts) The Milky Way galaxy is classified as:

- A) elliptical galaxy
 B) spiral galaxy
 C) lenticular galaxy
 D) irregular galaxy

22. (1.00 pts) A spiral galaxy may develop a bar towards the end of its life cycle.

- True False

Questions 23-30 are related to the image below.



23. (1.00 pts) This type of figure is commonly known as _____ diagram.

Hertzsprung–Russell

24. (1.00 pts) The x-axis represents _____ and y-axis represents _____.

- A) temperature, luminosity
- B) temperature, absolute magnitude
- C) spectral class, luminosity
- D) spectral class, absolute magnitude
- E) none of the above

25. (3.00 pts) Labels A-C in the diagram correspond to three of the stars listed below. Match the labels with the correct names.
 Choices: Rigel A, Rigel B, Sirius A, Sirius B, Betelgeuse, Aldebaran

Label A: _____, Label B: _____, Label C: _____

Rigel A

Betelgeuse

Rigel B

26. (3.00 pts) Labels D-F in the diagram correspond to three of the stars listed below. Match the labels with the correct names.
 Choices: Rigel A, Rigel B, Sirius A, Sirius B, Betelgeuse, Aldebaran

Label D: _____, Label E: _____, Label F: _____

Aldebaran

Sirius A

Sirius B

27. (1.00 pts) Which star burns brightest in the absolute sense?

- A) Star A
- B) Star B
- C) Star D
- D) Star F
- E) Cannot tell from the given information

28. (1.00 pts) Which star is the hottest?

- A) Star A
- B) Star B
- C) Star D
- D) Star F
- E) Cannot tell from the given information

29. (1.00 pts) Which star appears brightest in the night sky?

- A) Star A
- B) Star B
- C) Star D
- D) Star F
- E) Cannot tell from the given information

30. (1.00 pts) Which star has the largest size?

- A) Star A
- B) Star B
- C) Star D
- D) Star F
- E) Cannot tell from the given information

31. (2.00 pts) Which of these factors influence the luminosity of a star?

(Mark ALL correct answers)

- A) distance from observer
- B) size of star
- C) temperature of star
- D) location of other stars in its neighborhood
- E) none of the above

32. (2.00 pts) Which of these factors influence the apparent brightness of a star?

(Mark ALL correct answers)

- A) distance from observer
- B) size of star
- C) temperature of star
- D) location of other stars in its neighborhood
- E) none of the above

33. (2.00 pts) When is the apparent magnitude of a star equal to its absolute magnitude?

Expected Answer: The star's absolute magnitude will be equal to the apparent magnitude that the object would have if it were viewed from a distance of exactly 10 parsecs (32.6 light-years) away.

34. (2.00 pts) Star A and Star B have the same radius, but Star A is 256 times as luminous.

From this information, one can deduce that Star _____ is _____ times hotter than the other star.

| | |
|---|---|
| A | 4 |
|---|---|

35. (2.00 pts)

For the same two stars described in previous question, the energy received at Earth from Star A is 4 times that of Star B. Given this information, one can deduce that Star ____ is _____ times more distant from the other star.

| | |
|---|---|
| A | 8 |
|---|---|

36. (2.00 pts) Which physical laws did you use to answer the previous two questions?

(Mark ALL correct answers)

- A) Kepler's third law
- B) Inverse square law
- C) Wien's displacement law
- D) Stefan-Boltzmann law
- E) None of the above

37. (4.00 pts) Explain how x-rays and infrared radiation are each useful for observing star-forming regions.

Expected Answer: X-rays are high energy emissions. X-ray observations have proven useful for studying young stars, since X-ray emission from these objects is about 100–100,000 times stronger than X-ray emission from main-sequence stars. X-ray is a useful wavelength for seeing the stellar populations within molecular clouds. Early stages of a star's life can be seen in infrared light, which penetrates the dust more easily than visible light. The radiation from the protostar and early star has to be observed in infrared astronomy wavelengths, as the extinction caused by the rest of the cloud in which the star is forming is usually too big to allow us to observe it in the visual part of the spectrum.

Questions 38-42 are based on the spectral images below.

RA=208.88508, DEC= 0.18999, MJD=51942, Plate= 301, Fiber=431

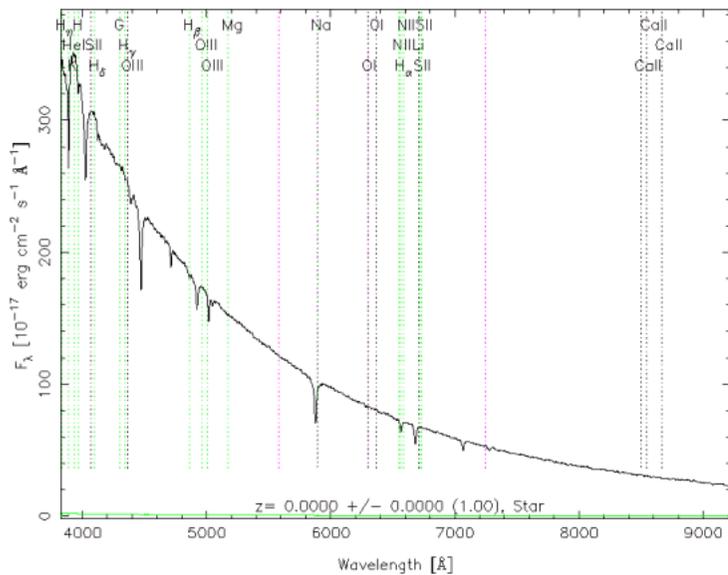


Image A

RA=224.53599, DEC= 0.15418, MJD=51990, Plate= 310, Fiber=356

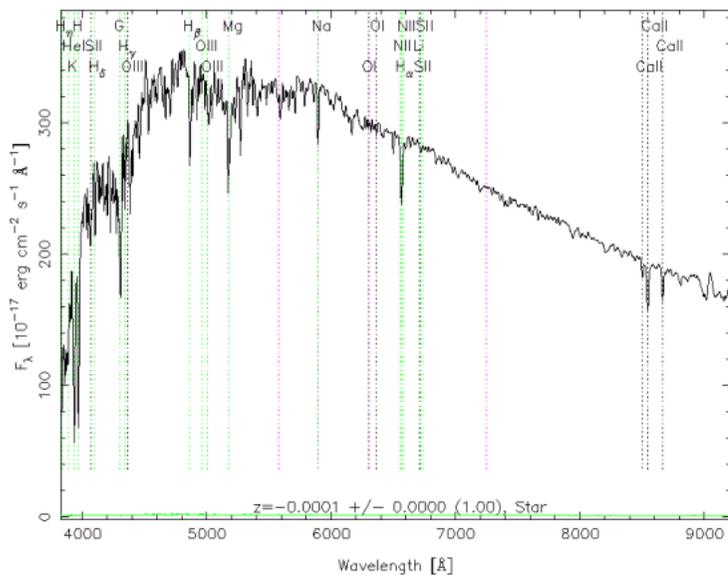
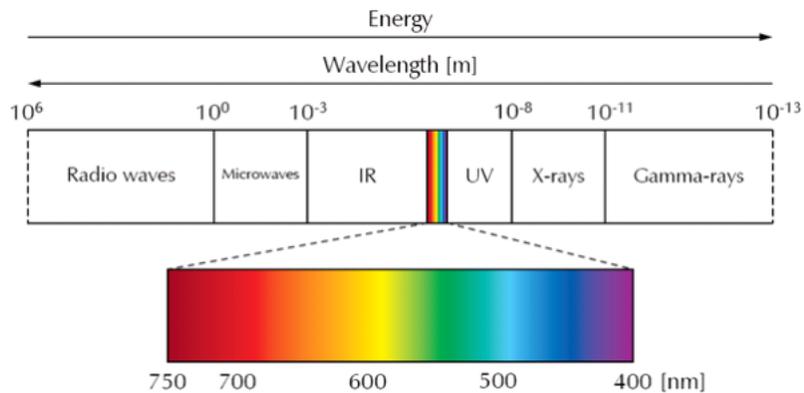


Image B

42. (1.00 pts) Looking at the EM spectrum below, what color would you expect Star B to appear in the night sky?



- A) Blue
- B) Green
- C) Yellow
- D) Red
- E) Not in visible spectrum

43. (1.00 pts) Which of these wavelengths will show prominently in Spitzer space telescope images?

- A) 1 millimeter
- B) 1 micron
- C) 1 nanometer
- D) 1 picometer
- E) none of the above

44. (1.00 pts) Which of these wavelengths will show prominently in Chandra x-ray observatory images?

- A) 1 millimeter
- B) 1 micron
- C) 1 nanometer
- D) 1 picometer
- E) none of the above

45. (1.00 pts) Which of these wavelengths will show prominently in Cosmic Background Explorer images?

- A) 1 millimeter
- B) 1 micron
- C) 1 nanometer

- D) 1 picometer
- E) none of the above

46. (2.00 pts) Which constellations are visible in the image below?



(Mark ALL correct answers)

- A) LMC
- B) SMC
- C) Dorado
- D) Tucana
- E) 30 Doradus

47. (2.00 pts) The DSOs in the previous image are classified as _____ type of galaxies.

barred spiral

48. (1.00 pts) These galaxies have both been greatly distorted by tidal interaction with the Milky Way.

- True
- False

49. (2.00 pts) Identify the DSO in the image below.



(Mark **ALL** correct answers)

- A) NGC 4038/4039
- B) Baby Boom galaxy
- C) Antennae galaxies
- D) LMC and SMC
- E) None of the above

50. (2.00 pts) The image above was taken in _____ part of EM spectrum.

(Mark **ALL** correct answers)

- A) radio
- B) infrared
- C) optical
- D) ultraviolet
- E) x-ray

51. (4.00 pts) Explain briefly what kind of activities may have produced the peculiar shape of the DSO in the previous image.

Expected Answer: The Antennae Galaxies are a pair of interacting galaxies in the constellation Corvus. They are currently going through a starburst phase, in which the collision of clouds of gas and dust, with entangled magnetic fields, causes rapid star formation. The nuclei of the two galaxies are joining to become one giant galaxy.

52. (2.00 pts) Identify the DSO shown in the image below.



(Mark ALL correct answers)

- A) M104
- B) M42
- C) Sombrero galaxy
- D) Baby Boom galaxy
- E) none of the above

53. (2.00 pts) This is a _____ [type] galaxy with a _____ [object] at the center.

spiral

black hole

54. (2.00 pts) The chief site of star formation in the galaxy pictured above is in the massive _____, which is composed chiefly of _____ [element] gas and dust.

dust lane

Hydrogen

55. (1.00 pts) Identify the DSO shown in the image below.

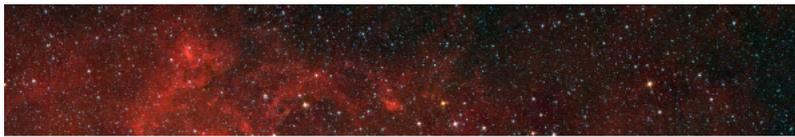


- A) M104
- B) M60
- C) M42
- D) M31
- E) None of the above

56. (1.00 pts) This galaxy was the fastest-moving galaxy included in Edwin Hubble's 1929 paper concerning the relationship between recession speed and distance.

- True
- False

57. (1.00 pts) Identify the DSO shown in the image below.



- A) Orion Nebula
- B) Lagoon Nebula
- C) Rho Ophiuchi cloud complex
- D) Dragonfish nebula
- E) None of the above

58. (1.00 pts) The stars in the DSO heat up the surrounding gas, giving off light in _____ part of the EM spectrum.

- A) visible
- B) infrared
- C) radio
- D) ultraviolet
- E) none of the above

59. (1.00 pts) Identify the DSO shown in the image below.



- A) Orion Nebula
- B) Lagoon Nebula
- C) Rho Ophiuchi cloud complex
- D) Dragonfish Nebula
- E) None of the above

60. (1.00 pts) This object can be seen with the naked eye, and is a popular target of amateur photographers.

- True False

61. (2.00 pts) The cluster of stars shown in the image below belongs to a DSO shown in one of the previous images. Which question has the image for the corresponding DSO?

- A) Question 49
- B) Question 52
- C) Question 57
- D) Question 59
- E) None of the above

62. (1.00 pts) Which part of the EM spectrum is the above image taken in?

- A) visible
- B) infrared
- C) ultraviolet
- D) x-ray
- E) none of the above

63. (3.00 pts) Identify the stars in the image below. Star A: _____, Star B: _____, Star C: _____.
Note: This image is taken on a summer evening at Duluth, MN.

Vega

Deneb

Altair

64. (1.00 pts) Star B belongs to the constellation:

- A) Aquila
- B) Cygnus
- C) Lyra
- D) Orion
- E) None of the above

65. (3.00 pts) Identify the stars in the image below. Star A: _____, Star B: _____, Star C: _____.
Note: This image is taken on a winter night somewhere in continental US.

Procyon

Sirius

Rigel

66. (1.00 pts) Which of the labels does not apply to a star?

- A) D
- B) E
- C) F
- D) None of the above

67. (1.00 pts) Which previous question carries a beautiful image of the same DSO (that is marked with a label in the image in Question 65)?

- A) Question 49
- B) Question 52
- C) Question 57
- D) Question 59
- E) None of the above

68. (1.00 pts) Which of the labeled stars in Question 65 has the highest temperature?

- A) Star B
- B) Star C
- C) Star E
- D) Star F
- E) None of the above
- F)

69. (1.00 pts) Which of the labeled stars in Question 65 appears the brightest in the night sky?

- A) Star B
- B) Star C
- C) Star E
- D) Star F
- E) None of the above

70. (1.00 pts) Which of the labeled stars in Question 65 has the lowest temperature?

- A) Star B
- B) Star C
- C) Star E
- D) Star F
- E) None of the above

71. (1.00 pts)

The animated image below shows a 4 hour time lapse video of star trails seen on the northern hemisphere. The object at the center of the star trail is _____.

Polaris (also accept North S

72. (4.00 pts) Explain why the central object remains almost stationary but every other star moves with time in the previous image.

Expected Answer: Polaris is the star in the center of the star field; it shows essentially no movement. Earth's axis points almost directly to Polaris, so this star is observed to show the least movement. The other stars appear to trace arcs of movement because of Earth's spin on its axis.

Congratulations on completing the test!