Galaxies and Stars

1. To an observer on Earth, the Sun appears brighter than the star Rigel because the Sun is
   A) hotter than Rigel       B) more luminous than Rigel
   C) closer than Rigel      D) larger than Rigel

2. Light and other forms of electromagnetic radiation are given off by stars using energy released during
   A) nuclear fusion        B) conduction
   C) convection            D) radioactive decay

3. Base your answer to the following question on The reaction below represents an energy-producing process.

\[
\begin{align*}
\text{Hydrogen} & + \text{Hydrogen} & \rightarrow & \text{Helium} & + \text{Energy} \\
\text{(lighter element)} & \text{(lighter element)} & & \text{(heavier element)}
\end{align*}
\]

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   A) in the Sun by fusion
   B) when water condenses in Earth’s atmosphere
   C) from the movement of crustal plates
   D) during nuclear decay

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Base your answers to questions 5 and 6 on the graph below, which shows changes in the Sun’s magnetic activity and changes in the number of sunspots over a period of approximately 100 years. Sunspots are dark, cooler areas within the Sun’s photosphere that can be seen from Earth.

5. Which graph best represents the relationship between the number of sunspots and the amount of magnetic activity in the Sun?

A) \[ \text{Amount of Magnetic Activity} \] \[ \text{Number of Sunspots} \]

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C) \[ \text{Amount of Magnetic Activity} \] \[ \text{Number of Sunspots} \]

D) \[ \text{Amount of Magnetic Activity} \] \[ \text{Number of Sunspots} \]

6. The graph indicates that years having the greatest number of sunspots occur

A) randomly and unpredictably
B) precisely at the beginning of each decade
C) in a cyclic pattern, repeating approximately every 6 years
D) in a cyclic pattern, repeating approximately every 11 years
7. During a total solar eclipse one might view

A) sun spots
B) the sun's corona
C) the sun's solar winds
D) nothing of the sun, since it is totally blocked by the moon

8. What celestial phenomenon most affects radio communication and other electrical atmospheric changes for us on earth?

A) solar eclipses
B) solar flares
C) meteorites entering the atmosphere
D) lunar eclipses

9. As the sun ages it will be composed of

A) more hydrogen and less helium
B) more helium and less hydrogen
C) more oxygen and less carbon
D) less oxygen and more carbon

10. The "fuel" of the sun is

A) hydrogen
B) helium
C) oil and various hydrocarbons
D) oxygen

11. The most observable phenomena in the "Solar Cycle" is the appearance of

A) solar eclipses
B) sun spots
C) solar storms
D) black holes

12. Sun spots are believed to be most closely related to the sun's

A) corona
B) period of rotation
C) magnetic field
D) changing size

13. Most of the radiant energy released by the sun results from the process of

A) nuclear fission
B) nuclear fusion
C) combustion
D) electrical generation
14. Approximately how many times larger is the diameter of the sun compared to the earth?
   A) 10 times   B) 100 times
   C) 1000 times  D) 10,000 times

15. The most abundant element on the sun is
   A) hydrogen   B) helium   C) carbon   D) oxygen

16. Which star is cooler and less luminous than the Sun?
   A) Proxima Centauri   B) Pollux
   C) Rigel   D) 40 Eridani B

17. Which two stars are most similar in luminosity?
   A) Betelgeuse and Barnard's Star
   B) Procyon B and Proxima Centauri
   C) Polaris and the Sun
   D) Alpha Centauri and Sirius

18. Which statement describes the general relationship between the temperature and the luminosity of main sequence stars?
   A) As temperature decreases, luminosity increases.
   B) As temperature decreases, luminosity remains the same.
   C) As temperature increases, luminosity increases.
   D) As temperature increases, luminosity remains the same.

19. The star Algol is estimated to have approximately the same luminosity as the star Aldebaran approximately the same temperature as the Rigel. Algol is best classified as a
   A) main sequence star   B) red giant star
   C) white dwarf star   D) red dwarf star

20. Compared with our Sun, the star Betelgeuse is
   A) smaller, hotter, and less luminous
   B) smaller, cooler, and more luminous
   C) larger, hotter, and less luminous
   D) larger, cooler, and more luminous
21. Which list shows stars in order of increasing temperature?
   A) Barnard’s Star, Polaris, Sirius, Rigel
   B) Aldebaran, the Sun, Rigel, Procyon B
   C) Rigel, Polaris, Aldebaran, Barnard’s Star
   D) Procyon B, Alpha Centauri, Polaris, Betelgeuse

22. Compared to the temperature and luminosity of the star Polaris, the star Sirius is
   A) hotter and more luminous       B) hotter and less luminous
   C) cooler and more luminous       D) cooler and less luminous

23. Which star has a higher luminosity and a lower temperature than the Sun?
   A) Rigel                        B) Barnard’s Star
   C) Alpha Centauri              D) Aldebaran

24. Which star’s surface temperature is closest to the temperature at the boundary between Earth’s mantle and core?
   A) Sirius                  B) Rigel       C) the Sun       D) Betelgeuse

25. Which two stars have the most similar luminosity and temperature?
   A) Betelgeuse and Barnard’s Star   B) Rigel and Betelgeuse
   C) Alpha Centauri and the Sun     D) Sirius and Procyon B
Base your answers to questions 26 through 28 on the diagram below, which shows two possible sequences in the life cycle of stars, beginning with their formation from nebular gas clouds in space.

The Life Cycles of Stars

26. According to the diagram, a star like Earth’s Sun will eventually
   A) explode in a supernova       B) become a black hole
   C) change into a white dwarf   D) become a neutron star

27. Stars like Earth’s Sun most likely formed directly from a
   A) nebula     B) supernova    C) red giant    D) black dwarf

28. According to the diagram, the life-cycle path followed by a star is determined by the star’s initial
   A) mass and size       B) temperature and origin
   C) luminosity and color   D) luminosity and structure

29. Which star color indicates the hottest star surface temperature?
   A) blue     B) white     C) yellow     D) red
30. The graph below represents the brightness and temperature of stars visible from Earth.

Which location on the graph best represents a star with average brightness and temperature?

A) A  B) B  C) C  D) D

31. Measurements indicate that a certain star has a very high luminosity (100,000 times that of our sun) and yet has a temperature that is cooler than the sun. What can you conclude about this observation?

A) It could be a main sequence star.  
B) **It may be quite large.**  
C) This is a typical characteristic of stars.  
D) There must be an error in measurement.

32. Compared to other stars, the sun is

A) among the hottest stars  
C) very unique
B) among the smallest stars  
D) **about average in all respects**

33. Which of the following stars is least bright?

A) the sun  
C) **a white dwarf**
B) a blue supergiant  
D) a red giant

34. Compared to the sun a white dwarf star is

A) hotter and larger  
C) cooler and larger
B) **hotter and smaller**  
D) cooler and smaller
35. The apparent brightness of an object such as a star does not depend on
   A) **how fast the star is moving**  
   B) the strength of the light emanating from the star  
   C) the distance from us to the star  
   D) the amount and kind of obstacles between us and the star

36. Compared to our sun, the star Polaris is
   A) **brighter**  
   B) smaller  
   C) cooler  
   D) hotter

37. If we plot many stars on an H-R diagram, all with the same luminosity but different temperatures, they
   A) would all lie on the main sequence  
   B) would be all over the diagram  
   C) **would form a horizontal line**  
   D) would form a vertical line

38. Compared to the sun, stars near the top of the H-R diagram are always
   A) about the same brightness  
   B) **over 10,000 times brighter**  
   C) much redder  
   D) much hotter

39. Which of the following is the same for all stars along a horizontal line on an H-R diagram?
   A) temperature  
   B) diameter  
   C) mass  
   D) **luminosity**

40. *Barnard's Star* has a surface temperature of about
   A) 300 °C  
   B) **3000 °C**  
   C) 5000 °C  
   D) 10,000 °C

41. In the H-R diagram, 90 percent of all stars fall
   A) in the Red Dwarf region.  
   B) in the Supergiant region.  
   C) among the White Dwarfs.  
   D) **on the Main Sequence.**
42. Two stars of the same color are plotted on an H-R diagram. Star A is more luminous than star B. Which one of the following statements could explain this?
   A) Star A is hotter than star B.
   B) Star A is more distant than star B.
   C) Star A appears brighter in the sky than star B.
   D) Star A is larger than star B.

43. What factor below usually determines whether a star will be on the main sequence?
   A) age
   B) mass
   C) size
   D) distance from our sun.

44. We know that red giant stars are larger in diameter than the sun because
   A) they are more luminous but have the same temperature
   B) they are less luminous but have the same temperature
   C) they are hotter but have the same luminosity
   D) they are cooler but have the same luminosity

45. In order to position a star on an H-R diagram you must know at least the star's
   A) color and apparent brightness
   B) color, apparent brightness and distance
   C) apparent brightness and age
   D) color and distance

46. The region of the H-R diagram occupied by most stars is the
   A) main sequence region
   B) red giant region
   C) white dwarf region
   D) quasar region

47. The vertical axis of an H-R diagram relates to the
   A) the color of the star
   B) the actual visual brightness of the star
   C) the apparent brightness of the star compared to our sun
   D) the speed of the star
48. The smallest stars on a H-R diagram are found
   A) at the upper left end of the main sequence
   B) at the lower right end of the main sequence
   C) at the upper right corner of the H-R diagram
   D) at the lower left corner of the H-R diagram

49. Red giant stars have greater luminosity than our sun mainly because they are
   A) hotter  B) farther away  C) larger  D) older

50. Which of the following stars is hottest?
   A) a red giant  B) a white dwarf
   C) the sun  D) a red dwarf

51. What type of star is Polaris?
   A) White Dwarf  B) Supergiant
   C) Red Giant  D) Main Sequence

52. Small cool stars would most likely appear to be
   A) blue  B) red  C) yellow  D) white

53. Which star has the greatest size?
   A) Sun  B) Alpha Centauri
   C) Betelgeuse  D) Procyon

54. Which star has the greatest luminosity?
   A) Barnard's star  B) Procyon
   C) Alpha Centauri  D) Rigel

55. Which factor does not affect a star's absolute magnitude (Luminosity)?

56. A Red giant star would most likely have a temperature of
   A) 5,000°C  B) 10,000°C  C) 20,000°C  D) 30,000°C
57. The coolest stars appear
   A) white     B) red     C) yellow     D) blue

58. An astronomer can estimate the temperature of a star by observing its
   A) size   B) shape   C) color   D) brightness

59. According to the graph, the Sun is classified as a
   A) main sequence star with a temperature of approximately 4,000ºC and a luminosity of 100
   B) main sequence star with a temperature of approximately 6,000ºC and a luminosity of 1
   C) white dwarf star with a temperature of approximately 10,000ºC and a luminosity of 0.01
   D) blue supergiant star with a temperature of approximately 20,000ºC and a luminosity of 700,000
60. Compared to the terrestrial planets, the Jovian planets in stage 5 have
   - **A) larger diameters**
   - **B) higher densities**
   - **C) shorter periods of revolution**
   - **D) longer periods of rotation**

61. Approximately how long ago did stage 4 end and stage 5 begin?
   - **A) 1 billion years**
   - **B) 5 billion years**
   - **C) 20 billion years**
   - **D) 100 billion years**
62. Which process was occurring during some of these stages that resulted in the formation of heavier elements from lighter elements?
   A) conduction             B) radiation
   C) radioactive decay      D) nuclear fusion

63. Base your answer to the following question on the diagram below represents possible stages in the life cycle of stars.

   Which star has the greatest probability of producing a supernova explosion?
   A) Barnard's Star          B) Betelgeuse
   C) Procyon B               D) Sun

64. By which process do stars convert mass into great amounts of energy?
   A) nuclear fusion          B) heat transfer
   C) gravitational pull      D) radioactive decay

65. Which object forms by the contraction of a large sphere of gases causing the nuclear fusion of lighter elements into heavier elements?
   A) comet                   B) planet    C) star          D) moon
66. Base your answer to the following question on the diagram below, which shows an inferred sequence in which our solar system formed from a giant interstellar cloud of gas and debris. Stage A shows the collapse of the gas cloud, stage B shows its flattening, and stage C shows the sequence that led to the formation of planets.

From stage B to stage C, the young Sun was created

A) when gravity caused the center of the cloud to contract
B) when gravity caused heavy dust particles to split apart
C) by outgassing from the spinning interstellar cloud
D) by outgassing from Earth’s interior

67. Compared to other groups of stars, the group that has relatively low luminosities and relatively low temperatures is the

A) Red Dwarfs
B) White Dwarfs
C) Red Giants
D) Blue Supergiants

68. Compared to the surface temperature and luminosity of massive stars in the Main Sequence, the smaller stars in the Main Sequence are

A) hotter and less luminous
B) hotter and more luminous
C) cooler and less luminous
D) cooler and more luminous

69. Which star is cooler and many times brighter than Earth’s Sun?

A) Barnard’s Star
B) Betelgeuse
C) Rigel
D) Sirius
70. Compared to the sun, Polaris is
A) hotter and less luminous
B) cooler and more luminous
C) the same temperature and larger
D) hotter and larger

71. At which phase of its evolutionary life is a white dwarf star?
A) the late phase for small mass star
B) the remains of a larger star's explosion
C) in the main sequence phase
D) early phases, soon after a star's formation

72. The probable fate of our sun is
A) to expand as a red giant, undergo a nova outburst and end as a white dwarf
B) to shrink to a white dwarf then eventually expand to a red giant
C) become hotter and expand into a blue supergiant
D) to become a black hole

73. What factor from the choices below determines whether a star will evolve into a white dwarf, a neutron star, or a black hole?
A) mass
B) percentage of helium
C) percentage of carbon
D) apparent brightness

74. When a star less massive than our sun consumes all of its nuclear fuel it will then become a
A) white dwarf
B) nova
C) supernova
D) black hole

75. According to our present theories of stellar evolution, our sun will change next into
A) a white dwarf
B) a black hole
C) a supernova
D) a red giant

76. What are the two most abundant elements in a main sequence star?
A) carbon and hydrogen
B) hydrogen and helium
C) helium and carbon
D) carbon and heavy metals
77. Which stars are the youngest?
   A) Supergiant   B) White dwarf  C) Blue star   D) Red Dwarfs

78. The explosion of a massive star near the end of its life is known as a
   A) nova   B) pulsar   C) supernova   D) nebula

79. By using a spectroscope an astronomer can
   A) measure the size of a star
   B) measure the altitude of a star
   C) identify elements in the atmosphere of a star
   D) measure the diameter of a star

80. Stars are believed to undergo evolutionary changes over millions of years. The
    flowchart below shows stages of predicted changes in the Sun.

   Stage 1  
   Sun
   
   Stage 2  
   Red giant
   
   Stage 3  
   White dwarf

   According to this flowchart, the Sun will become
   A) hotter and brighter in stage 2, then cooler and dimmer in stage 3
   B) cooler and dimmer in stage 2, then hotter and brighter in stage 3
   C) hotter and dimmer in stage 2, then cooler and brighter in stage 3
   D) cooler and brighter in stage 2, then hotter and dimmer in stage 3
81. The diagram below represents the shape of the Milky Way Galaxy.

![Diagram of the Milky Way Galaxy]

The Milky Way Galaxy is best described as
A) elliptical     B) irregular     C) circular     D) spiral

82. The Milky Way galaxy is best described as
   A) a type of solar system
   B) a constellation visible to everyone on Earth
   C) a region in space between the orbits of Mars and Jupiter
   D) a spiral-shaped formation composed of billions of stars

83. Which celestial feature is largest in actual size?
   A) the Moon
   B) Jupiter
   C) the Sun
   D) the Milky Way

84. The diagram below represents a side view of the Milky Way Galaxy.

![Diagram of the Milky Way Galaxy]

(Not drawn to scale)

At approximately which position is Earth’s solar system located?
A) A  B) B  C) C  D) D
**Answer Key**

**Galaxies and Stars**

1. C
2. A
3. A
4. J
5. A
6. D
7. B
8. B
9. B
10. A
11. B
12. C
13. B
14. B
15. A
16. A
17. B
18. C
19. A
20. D
21. A
22. B
23. D
24. C
25. C
26. C
27. A
28. A
29. A
30. B
31. B
32. D
33. C
34. B
35. A
36. A
37. C
38. B
39. D
40. B
41. D
42. D
43. A
44. A
45. A
46. A
47. B
48. B
49. C
50. C
51. D
52. B
53. C
54. D
55. C
56. A
57. B
58. C
59. B
60. A
61. B
62. D
63. B
64. A
65. C
66. A
67. A
68. C
69. B
70. C
71. B
72. A
73. A
74. A
75. D
76. B
77. C
78. C
79. C
80. D
81. D
82. D
83. D
84. B