**Astronomy Assessment and TPS Questions:**

**Luminosity, Temperature, and Size**

1. Rigel is much more luminous than Sirius B. Rigel and Sirius B have the same temperature. Which star has the greater surface area?
   1. Rigel
   2. Sirius B
   3. The have the same surface area.
   4. There is insufficient information to answer this question.
2. Enzo star gives off the same amount of energy as Ferdinand star. But Enzo star is much, much hotter than Ferdinand star. Which star has the greater surface area?
3. They have the same surface area
4. Enzo
5. Ferdinand
6. There is insufficient information to answer this question.
7. Java Star gives off much more light than Cola Star. Java and Cola are the same size. Which star has the higher temperature?
   1. Java
   2. Cola
   3. They have the same temperature.
   4. There is insufficient information to answer this question
8. If the stars Betelgeuse and Rigel were to have the same luminosity but the temperature of Betelgeuse is cooler than Rigel, which star has the greater surface area?
   1. Betelgeuse
   2. Rigel
   3. They are the same size.
   4. There is insufficient information to answer this question.
9. Imagine you are observing two stars. One star is hot and small and the other star is cooler and larger. Which star is more luminous?
   1. the hotter star
   2. the larger star
   3. They have the same luminosity.
   4. There is insufficient information to answer this question.

Imagine you are comparing the five stars (A-E, shown below) of different sizes and temperatures. The temperature of each star is indicated by a shade of gray (as shown at right), such that the lighter the shade of gray, the higher the temperature of the star.

A

B

C

D

E

Low

Med

High

1. Which of the following is the most correct ranking for the luminosity of these stars from greatest to least?
2. A > B = C = E > D
3. E = A > C > D = B
4. B > C > E > D > A
5. A > E > C > B > D
6. D > B > C > E > A

Imagine you are comparing the four stars shown at right. The temperature of each star is indicated by a shade of gray (as shown at right), such that the lighter the shade of gray, the higher the temperature of the star.

1. How many of the stars could have the same luminosity as the star shown at right
2. only one
3. two
4. three or more
5. none

Star A has an absolute magnitude of +2.0 and belongs to spectral class B8. Star B has an absolute magnitude of +11.2 and belongs to spectral class O9. Use this information to answer the following two questions.

1. Which star is brighter?
   1. Star A
   2. Star B
   3. They have the same brightness.
   4. There is not enough information to determine this.
2. Which star has the greater surface temperature?
   1. Star A
   2. Star B
   3. They have the same temperature.
   4. There is not enough information to determine this.
3. The star Rigel is about 100,000 times as luminous as the Sun and belongs to spectral type B8. The star Sirius B is about 1/3000 times as luminous as the Sun and also belongs to spectral type B8. Which star has the greatest surface temperature?
   1. Rigel
   2. Sirius B
   3. They have the same temperature.
   4. There is insufficient information to determine this.
4. Consider the information given below about the lifetime of three main sequence stars A, B, and C.

* Star A will be a main sequence star for 45,000 million years.
* Star B will be a main sequence star for 70 million years.
* Star C will be a main sequence star for 2 million years.

Which of the following is a true statement about these stars?

* 1. Star A has the greatest mass.
  2. Star B has the greatest mass.
  3. Star C has the greatest mass.
  4. Stars A, B and C all have approximately the same mass.
  5. There is insufficient information to determine this

1. Which of the following statements is always true of any two stars (including Red Giants and White Dwarfs) that have the same absolute magnitude?
2. They have the same temperature.
3. They have the same luminosity.
4. They have the same spectral type.
5. They have the same surface area.
6. They have the same mass.
7. A blue giant star of spectral type K9 and a red main sequence star of the same spectral type have the same
8. luminosity.
9. temperature.
10. absolute magnitude.
11. size.
12. Main sequence stars with high masses also have
    * + 1. high luminosities.
        2. low luminosities.
        3. the same luminosity as stars with small masses.
        4. There is no relationship between mass and luminosity for main sequence stars.
13. Nismo star is a G spectral type star that is 1000 times more luminous than the Sun. Nopi star has the same absolute magnitude as the Sun and belongs to spectral type G. Which star has the greatest surface temperature?
14. Nismo
15. Nopi
16. They have the same temperature.
17. There is insufficient information to determine this.
18. Enzo star gives off the same amount of energy as Ferdinand star. But Enzo star is much much hotter than Ferdinand star. Which star has the greater surface area?
    1. Enzo
    2. Ferdinand
    3. They have the same surface area
    4. There is insufficient information to answer this question.

Use the graph at right, showing the Luminosity versus Temperature of objects A - E, to answer the next two questions.

Temperature (K)

Luminosity (solar units)

20,000 10,000 5,000

***A***

***D***

10,000

100

10

1

.1

.01

.001

.0001

1,000

***C***

***B***

***E***

1. Which object(s) is giving off just as much energy as object “B”.
   1. object D
   2. object C
   3. Both D and C
   4. Neither D or C
   5. None of the above
2. Which of the following is the correct ranking for the size of the objects A-E, from largest to smallest.
   1. E=A>C=B>D
   2. D=B>C>A=E
   3. D>B=C>A>E
   4. E>A>C=B>D
   5. None of the above
3. A blue main sequence star of spectral type B9 and a white dwarf star of the same spectral type have the same
4. luminosity.
5. temperature.
6. absolute magnitude.
7. mass.
8. You observe a very large and very luminous star in the constellation Orion. On the same night you observe another star in Orion (about the same distance away) that is much smaller but has the same luminosity. Which star has the higher temperature?
   1. the larger star
   2. the smaller star
   3. They have the same temperature.
   4. There is insufficient information to determine this.
9. If the stars Betelgeuse and Rigel were to have the same luminosity but the temperature of Betelgeuse is cooler than Rigel, which star has the greater surface area?
   1. Betelgeuse
   2. Rigel
   3. They are the same size.
   4. There is insufficient information to answer this question.
10. Two stars are exactly the same size, but Star A is four times as luminous as star B. If the temperature of star B is 3000 K, then the temperature of star A is closest to
    1. 3000 K
    2. 4500 K
    3. 6000 K
    4. 12000 K
11. The star Asthtar is the size of our Sun and at a temperature of 6000K, while Procyon is ½ the diameter of our Sun but 12000 K. Which star is more luminous?
    1. Both are the same
    2. Ashtar is more luminous
    3. Procyon is more luminous
    4. There is insufficient data to determine this.
12. Rigel is much more luminous than Sirius B. Rigel and Sirius B have the same temperature. Which star has the greater surface area?
    1. Rigel
    2. Sirius B
    3. the same
    4. There is insufficient information to answer this question.
13. Two stars A and B are exactly the same size, but the surface temperature of star A is 5000 K, while the surface temperature of star B is 10,000 K. How does the luminosity of the brighter star B compare to star A?
    1. If the same size, then the stars are the same luminosity.
    2. B is twice as luminous as A
    3. B is 4 times as luminous as A
    4. B is 16 times as luminous as A
    5. There is insufficient information to answer this question.

Goofy Star has an absolute magnitude of +8.0 and belongs to spectral type K. Daffy Star has an absolute magnitude of -2.0 and belongs to spectral type K. Use this information to answer the following two questions.

1. Which of the following is true about the color of the two stars?
2. Goofy Star would appear blue.
3. Daffy Star would appear blue.
4. They would both appear the same color.
5. There is not enough information to determine this.
6. Which star has the largest surface area?
   1. Goofy Star
   2. Daffy Star
   3. They have the same surface area.
   4. There is not enough information to determine this.
7. Which of the following would give off the most energy?
   1. red star half the size (diameter) of the Sun
   2. a red star 10 times the size (diameter) of the Sun
   3. a blue star half the size (diameter) of the Sun
   4. a blue star 10 times the size (diameter) of the Sun

Use the graph at right, to answer the following three questions. Note that Stars A, B and C are Main Sequence stars.

Spectral Type

Absolute Magnitude

O B A F G K M

***D***

***B***

-5

0

5

10

15

***E***

***C***

***A***

1. How many of the stars (A-D) are giving off the same amount of energy as Star E?
   1. Only one star
   2. Two stars
   3. Three stars
   4. All four stars
   5. None of the above
2. Which of the following is the correct ranking for the size of the Stars A-E, from largest to smallest?
   1. E=D=A>B>C
   2. A>D>E>B>C
   3. E>D>A>B>C
   4. A>D=B>E=C
   5. E>D=B>A>C
3. Which of the following is the correct ranking for the temperature of the Stars A-E, from hottest to coolest?
   1. A>D=B>E=C
   2. E>D>A>B>C
   3. E=C>B=D>A
   4. A=D=E>B>C
   5. None of the above
4. A red giant star of spectral type K9 and a main sequence star of the same spectral type also have the same
   1. brightness.
   2. temperature.
   3. absolute magnitude.
   4. size.
   5. Age.
5. Star A is hotter than Star B. Star B gives off much more light than Star A. Which star is larger?
   1. Star A
   2. Star B
   3. They are the same size.
   4. There is insufficient information to determine this.
6. Use the graph at right to answer the following question. Which of the following is the correct ranking for the size of Objects A-C, from largest to smallest?
   1. A>C=B

Temperature (K)

Total Energy Output

20,000 10,000 5,000

***A***

10,000

100

10

1

.1

.01

.001

.0001

1,000

***C***

***B***

* 1. B=C>A
  2. A=C>B
  3. A>C>B
  4. B>C=A

1. Which of the following is always true for an object that is very luminous?
   1. It has to be big
   2. It has to be hot
   3. Both A and B are correct
   4. None of the above are always true
2. In general, increasing the \_\_\_\_\_\_\_ of a star will affect its luminosity more than increasing its \_\_\_\_\_\_\_\_
3. distance from the sun, area
4. distance from the sun, surface temperature
5. surface temperature, area
6. area, surface temperature
7. Stars X and Y have the same luminosity. However, Star X is much smaller than Star Y. What can you conclude about the two stars?
   1. Star X has a higher surface temperature than Star Y
   2. Star Y has a higher surface temperature than Star X
   3. Star X is brighter than Star Y
   4. Star Y is brighter than Star X
8. Compare Star A and Star B below. Which star is bigger?

* Star A is really luminous but very cold
* Star B is just as luminous as Star A and extremely hot
  1. Star A is bigger than Star B
  2. Star B is bigger than Star A
  3. The stars are the exact same size
  4. You cannot tell because the two stars could potentially be the same size but you would need to calculate it.

1. Compare Star A and Star B below. Which star is more luminous?

* Star A is really far away, but it is really big, and has a very cold temperature
* Star B is relatively close, it is extremely tiny, with a very hot temperature
  1. Star A is more luminous than Star B
  2. Star B is more luminous than Star A
  3. The stars cannot be compared because their distances differ
  4. You cannot tell because the two stars could have the same luminosity

1. If Phoebe Star has a luminosity of 1 and a temperature of 20,000 degrees (K) and Foil Star has a luminosity of 1,000 and a temperature of 10,000 degrees (K) what is true of their surface areas?
   1. Phoebe Star has a larger surface area
   2. Foil Star has a larger surface area
   3. Phoebe Star and Foil Star have the same surface area
   4. There is insufficient information to answer this question
2. Happy Star is the same size as Angry Star. But Angry Star is 10,000 degrees (K) hotter than Happy Star. Which star has the greatest luminosity?
   1. Happy Star
   2. Angry Star
   3. They have the same luminosity
   4. There is insufficient information to answer this question
3. Laffy Star and Taffy Star are the same size. Laffy Star has a luminosity of 1 and Taffy Star has a luminosity of 1,000. How do their temperatures compare?
   1. Laffy Star is hotter than Taffy Star
   2. Laffy Star is cooler than Taffy Star
   3. They are the same temperature
   4. There is insufficient information to answer this question
4. How does the luminosity of a 4 foot girl with a fever compare to that of a 6 foot man without a fever?
   1. The girl definitely has a greater luminosity because she has a higher temperature
   2. The man definitely has a greater luminosity because he is larger
   3. It is possible that they have the same luminosity
5. The temperature and surface area of 5 stars (A-E) are given below. Which of the following is the correct ranking of the luminosity of stars A-E from greatest (brightest) to least (dimmest)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Star | A | B | C | D | E |
| Surface Area | 2 | 2 | 4 | 4 | 8 |
| Temperature | 1000K | 2000K | 3000K | 2000K | 4000K |

* 1. A>D>B>C>E
  2. E>B>C>D>A
  3. E>C>D>B>A
  4. E>C>B>D>A
  5. None of the above rankings are correct

Temperature (K)

Luminosity (solar units)

20,000 10,000 5,000

***A B***

***C D D***

10,000

100

10

1

.1

.01

.001

.0001

1,000

Consider the Hertzsprung-Russell (HR) diagram shown above which relates the luminosity (in solar units) to the temperature for four stars (A - D).

1. Use the graph above to answer this question. When comparing two stars, the information in the diagram allows you to make conclusions about their relative sizes (for example, you can tell if Star A or Star C is the bigger star). Which of the following is the only pair whose relative sizes you cannot determine?
   1. A and B
   2. C and D
   3. C and B
   4. A and D
   5. The bigger star can be determined in each of these pairs