

1. The planet Neptune is 4.5×10^7 km from the Sun, and Earth is 1.5×10^6 km. How many times farther is Neptune from the Earth? (In other word, what is the ratio of the Neptune-Sun distance to the Earth-Sun distance?)
- .033 (1/30)
 - .333 (1/3)
 - 3
 - 30
 - something else

Show the reasoning/math behind your choice:

Divide 4.5×10^7 km by 1.5×10^6 km and you will get 30.

2. Based on your choice for #1, how many times greater is the *intensity* of solar radiation at the Earth than at Neptune? (Recall that intensity = power per unit area.)

Using the inverse square law, the ratio $I_{earth} / I_{Neptune}$ is $\frac{1/R_{Earth}^2}{1/R_{Neptune}^2} = \frac{R_{Neptune}^2}{R_{Earth}^2} = (30)^2 = 900$

An alternative would be to calculate $(4.5 \times 10^7 \text{ m})^2$ etc.

3. An astronomer is studying a constellation with three stars. Star Alpha is red, Beta is blue, and Gamma is green-yellow. The ranking of the temperatures of the stars from largest to smallest is (circle the correct answer, no reasoning required):
- Alpha, Beta, Gamma
 - Alpha, Gamma, Beta
 - Beta, Gamma, Alpha**
 - Beta, Alpha, Gamma
 - Gamma, Beta, Alpha
 - Gamma, Alpha, Beta

Explain briefly:

According to the Wien displacement law, for radiating blackbodies, shorter wavelengths correspond to greater temperatures. Since red is the longest wavelength, it is the lowest temperature. Green is greater, blue is greatest.

4. A star is getting colder. If the temperature of the star *decreases* from 5600 K to 2800 K, the radiation you receive will become
- 1/2 as intense.
 - 1/4 as intense.
 - 1/8 as intense.
 - 1/16 as intense.
 - more intense.
 - None of the above

Explain briefly or show work:

The temperature is less by a factor of 1/2. The Stefan-Boltzmann law predicts that intensity varies as T^4 . So the intensity will be less by a factor of $(1/2)^4$ or 1/16.