



28.1 Understanding Light Years

How far is it from Los Angeles to New York? Pretty far, but it can still be measured in miles or kilometers. How far is it from Earth to the Sun? It's about one hundred forty-nine million, six hundred thousand kilometers (149,600,000, or 1.496×10^8 km). Because this number is so large, and many other distances in space are even larger, scientists developed bigger units in order to measure them. An Astronomical Unit (AU) is 1.496×10^8 km (the distance from Earth to the sun). This unit is usually used to measure distances within our solar system. To measure longer distances (like the distance between Earth and stars and other galaxies), the light year (ly) is used. A light year is the distance that light travels through space in one year, or 9.468×10^{12} km.

EXAMPLES

1. Converting light years (ly) to kilometers (km)

Earth's closest star (Proxima Centauri) is about 4.22 light years away. How far is this in kilometers?

Explanation/Answer: Multiply the number of kilometers in one light year (9.468×10^{12} km/ly) by the number of light years given (in this case, 4.22 ly).

$$\frac{(9.468 \times 10^{12}) \text{ km}}{1 \text{ ly}} \times 4.22 \text{ ly} \approx 3.995 \times 10^{13} \text{ km}$$

2. Converting kilometers to light years

Polaris (the North Star) is about 4.07124×10^{15} km from the earth. How far is this in light years?

Explanation/Answer: Divide the number of kilometers (in this case, 4.07124×10^{15} km) by the number of kilometers in one light year (9.468×10^{12} km/ly).

$$4.07124 \times 10^{15} \text{ km} \div \frac{9.468 \times 10^{12} \text{ km}}{1 \text{ ly}} = \frac{4.07124 \times 10^{15} \text{ km}}{1} \times \frac{1 \text{ ly}}{9.468 \times 10^{12} \text{ km}} \approx 430 \text{ light years}$$

PRACTICE

Convert each number of light years to kilometers.

- 6 light years
- 4.5×10^6 light years
- 4×10^{-103} light years

Convert each number of kilometers to light years.

- 5.06×10^{16} km
- 11 km
- 11,003,000,000,000 km



Solve each problem using what you have learned.

7. The second brightest star in the sky (after Sirius) is Canopus. This yellow-white supergiant is about 1.13616×10^{16} kilometers away. How far away is it in light years?
8. Regulus (one of the stars in the constellation Leo the Lion) is about 350 times brighter than the sun. It is 85 light years away from the earth. How far is this in kilometers?
9. The distance from earth to Pluto is about 28.61 AU from the earth. Remember that an AU = 1.496×10^8 km. How many kilometers is it from Pluto to the earth?
10. If you were to travel in a straight line from Los Angeles to New York City, you would travel 3,940 kilometers. How far is this in AU's?
11. Challenge: How many AU's are equivalent to one light year?