Question

The distance to Polaris, the North star, is approximately $6.44*10^{18}$ m. **a.** If Polaris were to burn out today, how many years does it take to see it disappear? **b.** How long does it take sunlight to reach Earth? **c.** How long does it take a microwave signal to travel from Earth to the Moon and back? (The distance from Earth to the Moon is $3.84*10^{5}$ km.)

Solution

a. Velocity of light is $c = 3*10^{8}$ m/s. $l = 6.44*10^{18}$ m. So we obtain:

$$t = \frac{l}{c} = \frac{6.44 * 10^{18}}{3 * 10^{8}} s \approx 2.15 * 10^{10} s \approx 5.972 * 10^{6}\ hours = 248\,840\ days \approx \boldsymbol{682\ years}$$

Answer: t ≈ 682 years.

b. Distance from Sun to Earth $l = 150*10^{9}$ m.

$$t = \frac{l}{c} = \frac{150 * 10^{9}}{3 * 10^{8}} s = 500\ s = \boldsymbol{8\ minutes\ and\ 20\ second}$$

Answer: t = 500 s =8 minutes and 20 second.

c. $l = 3.84*10^{8}$ m.

$$t = \frac{2 * l}{c} = \frac{2 * 3.84 * 10^{8}}{3 * 10^{8}} s = \boldsymbol{2.56\ s}$$

Answer: t = 2.56 s