

Name: KEY

PHYSICS 2220 - QUIZ #11 - SPRING 2009

1. A space traveler takes off from Earth and moves at speed $0.9999c$ toward the star Arcturus, which is 36 light years distant as measured by an observatory on Earth.
- a. How much time will have elapsed by Earth clocks when the traveler reaches Arcturus?

$$\begin{aligned}\Delta t_{\text{moving}} &= \frac{\text{distance}}{\text{speed}} = \frac{36 \text{ ly}}{(0.9999)(1 \text{ ly/yr})} \\ &= \boxed{36.0036 \text{ yrs}}\end{aligned}$$

- b. How much older will the traveler be when she reaches Arcturus than when she started the trip?

$$\begin{aligned}\Delta t_{\text{rest}} &= \Delta t_{\text{moving}} \sqrt{1 - \frac{v^2}{c^2}} \\ &= (36.0036 \text{ yrs}) \sqrt{1 - \left(\frac{0.9999c}{c}\right)^2} \\ &= \boxed{0.509 \text{ year}}\end{aligned}$$