Name:

## The Scale of Things or What is a light-year?

"Space," says Douglas Adams' The Hitchhiker's Guide to the Galaxy, "Is big. Really big. You just won't believe how vastly hugely mind-bogglingly big it is. I mean, you might think it's a long walk down the road to the chemist, but that's just peanuts to space."

We are used to measuring distances in feet or miles (or better in meters and kilometers). The distance to the nearest star besides the sun is approximately $4x10^{13}$ kilometers. Astronomers, like most people, like to make things convenient when possible and therefore dislike dragging around big numbers in scientific notation. That format makes it harder to compare distances and so forth.

So to make the numbers representing those distances to stars more manageable in size, we would like a smaller number to represent the big distance. That means we need a larger unit of distance. For comparison note that there are many more feet (52,800 feet) than miles in a 10 mile interval.

To get an idea of how we can approach this lets work through the following:

1)Assume we live in a world where the speed limit for cars is 60 mph.(Show your calculations below each line, showing how the units cancel (or don't).
In one minute at the speed limit you will travel how far?_____miles

In 13 minutes at the speed limit you will travel how far?_____miles

Based on these results we could define a unit of distance called the "car-speed-limit-minute" representing the **distance** a car traveling at the speed limit travels in one minute and this would be_____ mile.

2) Astronomers have two big distance units. The light-year is the one that most non-astronomers are aware of and it is based on similar arguments. (We'll talk about the other one--the parsec--in a little bit). Physicists have measured that the speed of light is always approximately 300000 km per second.
In one second, how much distance will a beam of light cover? _____km

In 13 seconds, how much distance will a beam of light cover?_____km

Based on these results we define a unit of distance called the "light-speed-second" (shortened to "light-second") representing the distance light travels in one second and this would be_____ km.

3) Even a light-second is not a very big distance, in astronomical terms (note that the average distance from the Earth to the Moon is a smidge over a light-second at 384,000 km). To represent the really big distances in astronomy we need to imagine light traveling for longer times. Hence the light-year, defined (of course) as the **distance** that light will cover traveling for a time of 1 year.

So how far is that? Write out below all the factors and express your answer as 1 light-year = (some number) km.

Use this conversion factor to express the distance to the nearest star in light-years (note: the abbreviation for light-year is ly)