Time traveller

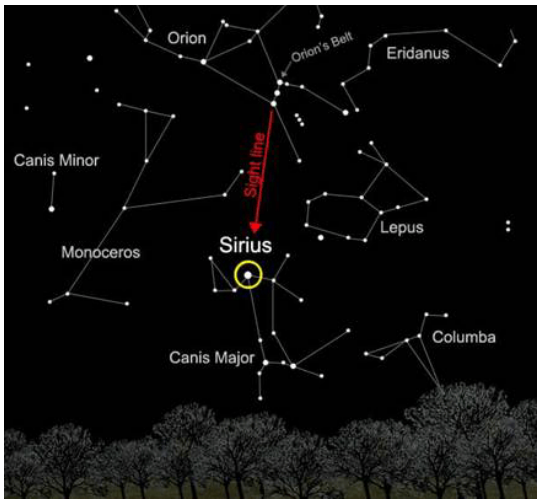
Introduction

Distances in astronomy are often very difficult to comprehend because they are so large. For example, the distance from the star Sirius to Earth is 84 320 000 000 000 km. This distance is too large for most people to imagine or understand. There are ways to make such large numbers more manageable. For instance, it is easier to understand and work with 15 years than it is with 5 475 days, even though they both represent the same amount of time. A 'Year' is a much larger unit than a 'Day'. The same type of thing can be done with distances using a measurement called a 'Light Year' (abbreviated to l.y.).

A light year is defined as the distance that a light beam will travel in one year. To calculate how far 1 l.y is in km, we use the fact that the speed of light is 300 000 km per second. To calculate a light year, we multiply the number of seconds in a year by 300,000 and we get 9 461 000 000 000 km. This is the same as travelling around the world 236 million times. Using this unit, the distance to the star Sirius is now a more manageable 9 l.y.

The light year is also important because it tells us about the time lag involved in communicating over the large distances involved in astronomy. It takes time for light to reach us from a distant star so when we look at the night sky, we are looking into the past. For example, we see the star Sirius as it was 9 years ago. Since radio signals also travel at the speed of light, this has implications for communication with space craft.

This activity introduces the concept of 'Light Years' as a standard astronomical distance unit. It can be used as a mathematical follow-up to a solar system scale model, and as an introduction to the stars or constellations. Students will walk heel-to-toe for one minute, measure the distance they walked and use that as an analogy for the distance that light travels in a specified time. This distance is then called a 'student minute'. The students will need approximately 20 to 30 metres for this activity.



Sirius, the closest star visible with the naked eye
Image credit: NASA/JPL www.jpl.nasa.gov

Time Traveller worksheet

Introduction

A light year is defined as the distance that a light beam will travel in one year. To calculate how far one Light Year is in km, we use the fact that light travels 300 000 km per second. The number of seconds in a year is 31,557,600. To calculate a light year, we multiply the number of seconds in a year by 300 000 and we get 9 461 000 000 000 km. This is the same as travelling around the world 236 million times! In the following activity, you will measure the distance you can walk for one minute and calculate a new unit called the 'student minute'.

What you need

- A watch with a second hand or a stop watch
- A long metric tape (30m) or a trundle wheel
- A calculator

What to do

In pairs:

1. Find a large space you can use either inside or outside (approx. 20 to 30 metres).
2. Starting at one end of the space you have chosen, walk heel-to-toe for exactly one minute. When you stop, mark your position.
3. Measure how far you walked to the nearest metre, and record this distance in the table below.
4. Repeat steps 2 and 3 three more times.
5. Calculate the average of the three measurements and record it in the table.

The average you calculated is the distance you can walk heel-to-toe in one minute. We will call that distance a 'student minute'.

Trial	Distance Walked
Trial 1	metres
Trial 2	metres
Trial 3	metres
Average (1+2+3)/3	metres
My student minute is…	metres

Questions

1. Are all student minutes the same?
2. How are student minutes similar to a light year?
3. How many metres in 3 student minutes?
4. How many of your student minutes are there in 5000 metres?
5. If you could not travel any faster than your heel-to-toe walking pace, how long would it take you to travel:
   a) 5000m?
   b) 1km?
   c) 500km?
   d) to the moon?
6. Find out the speed that a rocket would need to travel to reach the Moon and how long it would take to get there travelling at this speed.
7. How far is 'Sirius', the brightest star in our sky, from Earth in light years?
8. How far away are the second and third brightest stars from Earth in light years?