



Learning About Light years

As we have studied about galaxies we learned that our galaxy is very large and that other galaxies are very far away. We have also learned that the closest star to our Sun is called Proxima Centauri and it is also very far away.

Take a look at the data table below. Predict how long it would take you traveling in the airplane and in a space ship to reach the destinations.

Destination	Traveling in an airplane going 1186 kph (600mph)	Traveling in a space ship going 39,895 kph (25,000mph)
Sun		
Proxima Centauri		
Center of our galaxy		

When you measure distances on Earth, you use units such as meters or kilometers. The distance to most stars, however, is so large that these units are not practical. Scientists had to come up with a different way of measuring distances.

Astronomers knew that nothing in the known universe travels any faster than light. So they decided to determine how far light travels in a year. A beam of light from the Sun or from a flashlight travels at 300,000 km per second. This is known as the speed of light.

In one year, light travels almost 9.5 trillion kilometers. So one light year equals to 9.5 trillion kilometers or about 6 trillion miles. This is what astronomers decided to use to measure distances in space and they called it a light year.



Let's see how fast light travels from the Sun to the Earth. Do you remember how to cancel zeros in a division problem? Use that method for the problems below. Then use a calculator for the rest.

1. The Earth is 150,000,000 km from the Sun. Light travels at 18,000,000 km per minute. How long does it take for light from the Sun to reach Earth?

2. The closest star to our Sun is Proxima Centauri. It is 39,700,000,000,000 km from the Sun. Light travels at 9,460,800,000,000 km per year. How long does it take light from the Sun to reach Proxima Centauri?

Watch the video "*How Astronomers Measure Distance*" and write down 1 idea you learned on the lines below.



As you can see, these are really big numbers and difficult to work with! If you were an astronomer would you like to have to use these numbers every day? Probably not! That's why astronomers came up with a new unit for the distances in the universe. Astronomers don't use kilometers or miles for distances - they use the unit light year (ly). A light year is the distance light travels in a year and so is a measure of distance. This might be confusing because a year is a measurement of time. Astronomers also use light-seconds and light-minutes. Your calculations above should have revealed that the Sun is 8.33 light-minutes from Earth and Proxima Centauri is 4.19 ly from the Sun.

As we have calculated in the previous activities stars are millions and millions of kilometers away from Earth. For us to see a star's light it has been traveling a long time. Since Proxima Centauri is 4.2 light years away from us it's light has been traveling for 4.2 years. If it exploded 3 years ago we would not see the explosion for another 1.2 years! So, in a sense, when we look at the stars we are looking at the past. We have accomplished time travel!

Complete the chart below. The first one has been done for you.

Star	Distance from Earth	Time light has been traveling
Sol	8.33 light-minutes	8.33 minutes
Sirius A	8.6 light years	
Ross 154	9.68 light years	
Center of the Galaxy	26,400 light years	

- Work with your partners to read and answer the following questions.
1. Imagine a planet with people like us on it that is 15 light years away from Earth. They have developed a powerful telescope that allows them to see what is happening on Earth. If they were looking through their telescope today what year would it be on Earth?

 2. Would they be able to see you? _____
 3. Why or why not? _____
 4. On another planet in the year 2010 they are looking at Earth and watching George Washington crossing the Delaware River in 1776. How many light years away is this planet from Earth? _____
 5. Would the people on a planet circling the star Ross 154 (no, we don't know if there really is any intelligent life there) have been able to see your first birthday party? _____
 6. Why or why not? _____
 7. A scientist wants to travel to the center of the Milky Way Galaxy. It is 26,400 light years from Earth? Would the scientist ever reach his destination? _____
 8. Why or why not? _____

Answers for Teacher Do Not Copy!

Destination	Traveling in an airplane going 1186 kph (600mph)	Traveling in a space ship going 39,895 kph (25,000mph)
Sun	17 yr 8 months	4 months
Proxima Centauri	4.8 million years	114,155 years
Center of our galaxy	Never get there before plane disintegrated from old age	Never get there before space ship disintegrated from old age

1. The Earth is 150,000,000 km from the Sun. Light travels at 18,000,000 km per minute. How long does it take for light from the Sun to reach Earth?

$$\frac{150,000,000 \text{ km}}{18,000,000 \text{ km/min}} = \frac{150}{18} = 8.33 \text{ minutes}$$

2. The closest star to our Sun is Proxima Centauri. It is 39,700,000,000,000 km from the Sun. Light travels at 9,460,800,000,000 km per year. How long does it take light from the Sun to reach Proxima Centauri?

$$\frac{39,700 \text{ km}}{94608 \text{ km/year}} = 4.19 \text{ years}$$

1. Imagine a planet with people like us on it that is 15 light years away from Earth. They have developed a powerful telescope that allows them to see what is happening on Earth. If they were looking through their telescope today what year would it be on Earth? _____

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Subtract 15 from the current year. Yes, if the student is 15 years old they would be able to see the student as a baby. No, if the student is not yet 15 they would not have been born yet.

4. On another planet in the year 2010 they are looking at Earth and watching George Washington crossing the Delaware River in 1776. How many light years away is this planet from Earth? *2010 - 1776 = 234 ly*

5. Would the people on a planet circling the star Ross 154 (no, we don't know if there really is any intelligent life there) have been able to see your first birthday party?

6. Why or why not? _____

Ross 154 is 9.68 light years from Earth. Yes, they would be able to see their first birthday party because 8th grade students are usually over the age of 9.68 years.

7. A scientist wants to travel to the center of the Milky Way Galaxy. It is 26,400 light years from Earth? Would the scientist ever reach his destination? _____

8. Why or why not? _____

No, because even if he could travel the speed of light it would take him 26,400 years to reach the center of the galaxy. He would be long dead.

Name _____ period _____

EXIT TICKET

Learning about Light-years

1. Which distance would a light-year be most appropriate for measuring?

- A. From Texas to Alaska
- B. From Earth to the Sun
- C. From the Sun to Proxima Centauri

2. Why do astronomers use the unit light-year?

- A. They want their own unit
- B. The numbers with other units are too large
- C. Gravity affects all the other numbers

3. If a star is 10 light-years away from Earth, how long has it's light been traveling to reach Earth?

- A. 10 years
- B. 100 years
- C. 100 years

4. If you were in a space ship that could travel the speed of light how long would it take you to reach the Sun, which is 8.3 light-minutes from the Earth?

- A. 8.3 seconds
- B. 8.3 minutes
- C. 8.3 hours

5. If a star that is 45 light years away from us went supernova, how long would it take until we see the explosion?

- A. 45 years
- B. 90 years
- C. 45 seconds

Name _____ period _____

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