

# LESSON

## 4

# How do astronomers measure distances?

How far away from school do you live? A few miles, maybe? How thick is this book? A centimeter or so. You use different measurements all the time. The unit you use (centimeters, meters, kilometers, miles) depends upon what you are measuring.

The distances measured by astronomers are big. VERY BIG. Astronomers have special units they use to measure distances.

Our sun is far away — about 150 million kilometers away.

Think of it! You would need to fly around the Earth more than 1,800 times to go that distance.

Astronomers call the distance to the sun an **astronomical** [as-truh-NOM-ih-kul] **unit** (AU). So one AU equals about 150,000,000 kilometers. Jupiter is 778,300,000 kilometers away or a little more than 5 AU away from the sun. So Jupiter is about five times as far from the sun as Earth is. It is much easier to use AUs than kilometers.

An AU is very large. However, the distances between stars are even larger. Much larger. The closest star to the sun is about 42,000,000,000,000 kilometers away. That is 282,000 AU, and that is the closest star. Other stars are much farther. Some stars are so far away that even AUs are too small. The distances between stars are measured in light-years. What is a light-year?

A **light-year** is the distance that light travels in one year.

Let's see what this means.

- Light travels about 300,000 kilometers (186,000 miles) every second.
- There are 31,536,000 seconds in a year.
- If you multiply the seconds in a year by the speed of light, you find out how far light travels in one year.

How far is it? Nearly 10 trillion (10,000,000,000,000) kilometers (6 trillion miles). This is one light-year.

Ten trillion kilometers! Wow! That's equal to 125 million trips around the world.

## HOW FAR AWAY ARE THE PLANETS

---

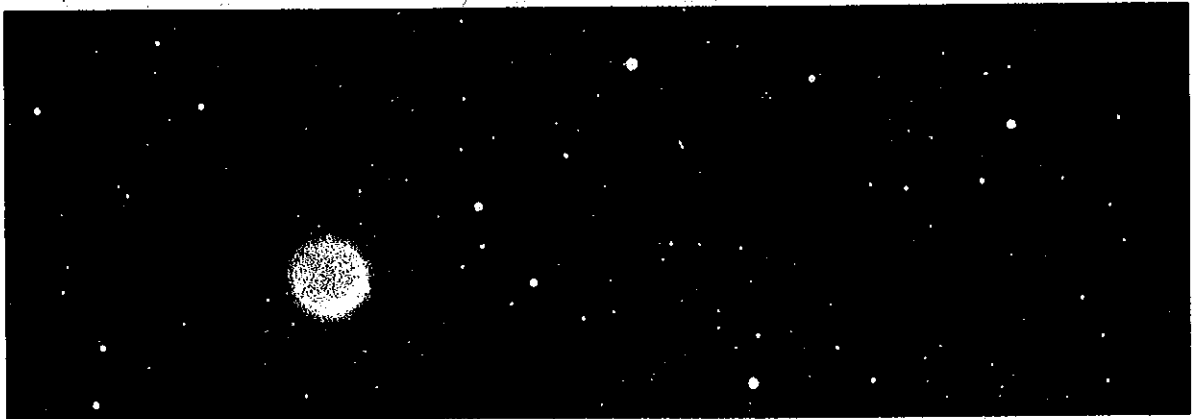
The table below shows how far away the planets are from the sun.

Planet	Astronomical Units	Kilometers
Mercury	0.4	58,000,000
Venus	0.7	108,000,000
Earth	1.0	150,000,000
Mars	1.5	230,000,000
Jupiter	5.2	778,000,000
Saturn	9.5	1,427,000,000
Uranus	19.2	2,870,000,000
Neptune	30.1	4,500,000,000
Pluto	39.4	5,900,000,000

To travel the distance between the sun and Pluto, you would have to circle the Earth more than 460,000 times!

## HOW FAR AWAY ARE THE STARS

---



**Figure A**

The closest star to Earth (other than the sun) is 4.3 light-years away.

That's 42,300,000,000,000 kilometers or 26,700,000,000,000 miles.

Now here is something to think about. Most other stars are millions and hundreds of millions of light-years away! In fact, some stars in distant galaxies are believed to be about 16 million light-years away.

That's about 16,000,000,000,000,000 kilometers or 96,000,000,000,000,000 miles.

## FILL IN THE BLANK

---

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided.

150,000,000  
star  
one year  
kilometers  
Earth

ten trillion  
300,000  
light-year  
sun

light  
second  
stars  
astronomical units

1. The sun is a \_\_\_\_\_.
2. The sun is \_\_\_\_\_ kilometers from Earth.
3. Distances between planets are measured in \_\_\_\_\_.
4. One astronomical unit (AU) is the distance between \_\_\_\_\_ and the \_\_\_\_\_.
5. All the other \_\_\_\_\_ are much farther away from Earth than the sun is.
6. We do not measure the distances between stars in \_\_\_\_\_.
7. The distances between stars are measured in a unit called the \_\_\_\_\_.
8. A light-year is the distance that \_\_\_\_\_ travels in \_\_\_\_\_.
9. Light travels \_\_\_\_\_ kilometers per \_\_\_\_\_.
10. One light-year is equal to about \_\_\_\_\_ kilometers.

## REACHING OUT

---

People sometimes say that when we look at stars that are very far away that we are "looking back in time." Why do people say this? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_