Lesson Plan Three

Travel Time to Pluto

Standard IV: Students will understand the scale size, distance between objects, movements, and apparent motion (due to Earth's rotation) of objects in the universe and how cultures have understood, related to and used these objects in the night sky.

Objective 1: Compare size and distance of objects within the systems in the universe.

Indicator a: Use the speed of light as a measuring standard to describe the relative distances to objects in the universe.

Directions:

1. Review what was learned in the last activity about light years and how important it is in measuring distances in the universe.
2. Do Activity Two in Investigation One.

Investigation One

Background Information

The distances between objects in space are so incredibly vast that they are almost incomprehensible. Measuring these distances with the same measuring units we typically use for distances on Earth requires such huge numbers that they become meaningless. To help solve this dilemma, distances in space are measured using light units, or the time it takes light to travel a particular distance. The most common light unit is a light year: the distance light travels in one year. When distances are put into light units, smaller numbers can be used.

For example, the distance from Earth to the sun is about 93,000,000 miles. That's a pretty big number for the average person to comprehend. If the distance is expressed in light time, then the sun is about 8.33 light minutes away from Earth. In other words, light from the sun takes 8.33 light minutes to reach Earth. That is a little easier to understand than millions of miles. To get a feel for just how fast light travels, figure that light would be able to travel around Earth about 7.5 times in one second. The speed of light is about 186,000 miles (300,000 km) per second.

Light travel time not only includes the speed at which visible light travels, but also the speed of all energy in the electromagnetic spectrum, including radio waves. This explains why radio transmissions to objects in the solar system have a delay. For example, Mars is about 4.35 light minutes away from Earth. That means it also takes radio signals 4.35 minutes to reach Mars. It would take another 4.35 minutes to return a message. This delay makes it challenging to control robots and space vehicles on Mars with signals from Earth.

Light-year is a measurement used to measure distances between stars and galaxies in space. Alpha Centauri is the nearest star to Earth; it is 4.3 light years away. Light-years can

also be used to describe the size of something. For example, the Milky Way Galaxy is 100,000 light-years across.

Activity Two—Travel Time to Pluto

Materials
- ☐ **Transparency of "Hypothetical Travel Time for Modes of Transportation."**
- ☐ **Blank Charts for students**
- ☐ **Scrambled charts for students**
- ☐ **Calculator**

Instructional Procedures

In this activity students will learn how far objects in the solar system and in space are in various modes of transportation they are familiar with. They will gain an understanding of how big these distances really are.

1. Use an overhead transparency to show how long different travel modes would take to reach various destinations. Six different travel modes and five different locations are given. You may calculate more using the Clark Planetarium Fact Sheet for the distance to different planets.
2. Students may calculate the distances and times themselves, figuring out how far they could travel at a certain speed in one year. You may have them work in small groups and figure the distance to different planets or stars.

Hypothetical Travel Time for Modes of Transportation From Earth

	Walking	Biking	Car	Jet Plane	Space Shuttle	Voyager Probe
Average Speed	7 km/hr	25 km/hr	80 km/hr	800 km/hr	40,000 km/hr	56,000 km/hr
Distance in 1 year	61,320 km	219,000 km	700,800 km	7 million km	350 million km	490 million km
Time to Moon 384,400 km	6.27 years	1.75 years	6 months	20 days	9.6 hours	6.9 hours
Time to Mars 78,340,000 km	1278 years	357.7 years	111.8 years	11.2 years	81.6 days	58.2 days
Time to Pluto 5,766,200,000 km	94,000 years	26,330 years	8228 years	823 years	16.5 years	11.8 years
Time to Alpha Centauri 4.22 light years	652 million years	183 million years	57 million years	5.7 million years	109,000 years	82,000 years
Time to Sirius 8.6 light years	1.33 billion years	37.3 million years	117 million years	11.7 million years	233,000 years	167,000 years

3. Determine which modes of travel and which destinations you want to use for this activity. Make a blank chart with only the locations and modes of transportation. Make a second chart with the distances scrambled. (See Pluto chart at the end of this activity.)
4. Divide the class into teams of 2 or 3. Give each team a blank chart and a scrambled chart. Have students cut apart the scrambled chart and organize it in the correct order on the blank chart.

Travel Time to Pluto

Mode of Travel from Slow to Fast	Average Speed	Distance Covered in One year	Time to Get to Pluto

Travel Time to Pluto – Scrambled Data

8228 years	Jet Plane	7 million km	40,000 km/hour
219,000 km	7 km/hour	94,000 years	Car
11.8 years	Bike	56,000 km/hour	700,800 km
Space Shuttle	490 million km	25 km/hour	16.5 years
Walk	80 km/hour	26,330 years	350 million km
823 years	800 km/hour	61320 km	Voyager

Travel Time to Pluto (Answer Key)

Walk	7 km/hour	61,320 km	94,000 years
Bike	25 km/hour	219,000 km	26,330 years
Car	80 km/hour	700,800 km	8228 years
Jet Plane	800 km/hour	7 million km	823 years
Space Shuttle	40,000 km/hour	350 million km	16.5 years
Voyager	56,000 km/hour	490 million km	11.8 years