The fastest way to get from place to place in our solar system is to travel at the speed of light, which is 300,000 km/sec (670 million miles per hour!). Unfortunately, only radio waves and other forms of electromagnetic radiation can travel exactly this fast.

When NASA sends spacecraft to visit the planets, scientists and engineers have to keep in radio contact with the spacecraft to gather scientific data. But the solar system is so vast that it takes quite a bit of time for the radio signals to travel out from Earth and back.

Problem 1 – Earth has a radius of 6378 kilometers. What is the circumference of Earth to the nearest kilometer?

Problem 2 – At the speed of light, how long would it take for a radio signal to travel once around Earth?

Problem 3 – The Moon is located 380,000 kilometers from Earth. During the Apollo-11 mission in 1969, engineers on Earth would communicate with the astronauts walking on the lunar surface. From the time they asked a question, how long did they have to wait to get a reply from the astronauts?

Problem 4 – In the table below, fill in the one-way travel time from the sun to each of the planets. Use that fact that the travel time from the Sun to Earth is 8 ½ minutes. Give your answer to the nearest tenth, in units of minutes or hours, whichever is the most convenient unit.

Planet	Distance from Sun in Astronomical Units	Light Travel Time
Mercury	0.38	
Venus	0.72	
Earth	1.00	8.5 minutes
Mars	1.52	
Jupiter	5.20	
Saturn	9.58	
Uranus	19.14	
Neptune	30.20	

Problem 1 – Earth has a radius of 6378 kilometers. What is the circumference of Earth to the nearest kilometer?

Answer: $C = 2 \pi R$ so $C = 2 \times 3.141 \times (6378 \text{ km}) =$ **40,067 km.**

Problem 2 – At the speed of light, how long would it take for a radio signal to travel once around Earth?

Answer: Time = distance/speed so
Time = 40,067/300,000 = **0.13 seconds. This is about 1/7 of a second**.

Problem 3 – The Moon is located 380,000 kilometers from Earth. During the Apollo-11 mission in 1969, engineers on Earth would communicate with the astronauts walking on the lunar surface. From the time they asked a question, how long did they have to wait to get a reply from the astronauts?

Answer: From the proportion:

$$\frac{0.13 \text{ seconds}}{40067 \text{ km}} = \frac{X}{380000 \text{ km}}$$ we have $X = (380000/40067) \times 0.13 = 1.23$ seconds.

This is the one-way time for the signal to get to the moon from Earth, so the round-trip time is twice this or **2.46 seconds**.

Problem 4 – In the table below, fill in the one-way travel time from the sun to each of the planets. Use that fact that the travel time from the Sun to Earth is 8 ½ minutes. Give your answer to the nearest tenth, in units of minutes or hours, whichever is the most convenient unit.

Answer: Use simple proportions based on 8.5 minutes of time = 1.00 AU of distance.

Planet	Distance from Sun in Astronomical Units	Light Travel Time
Mercury	0.38	3.2 minutes
Venus	0.72	6.1 minutes
Earth	1.00	8.5 minutes
Mars	1.52	12.9 minutes
Jupiter	5.20	44.2 minutes
Saturn	9.58	1.4 hours
Uranus	19.14	2.7 hours
Neptune	30.20	4.3 hours