

Name _____

Date _____

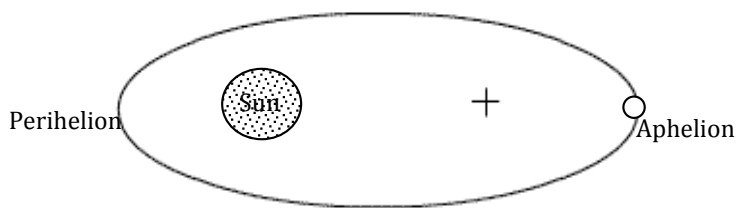
Mr Rawson

Dimensional Analysis

Please write out your work below, and show all work mathematically.

As all scientists know, Earth does not travel in a perfect circle around the Sun, but it travels in an ellipse. The only difference between a circle and an ellipse is that a circle has one central focal point, whereas an ellipse has two focii with the Sun at one focal point. It turns out that at the point when the Earth is furthest from the Sun, at aphelion, is the summer for the northern hemisphere. The Earth at aphelion is 152.6 million km from the Sun. During perihelion, the Earth is 147.5 million km from the Sun. Knowing this, answer the questions below:

1. What is the time that it takes for light to travel from the Sun to the Earth at aphelion? (in minutes; your answer should be between 7 - 10 minutes)
2. How many more seconds does it take for light to reach Earth at aphelion than at perihelion? (your answer should be between 0 - 2 minutes)



Distance from Sun to Aphelion = 152.6 million km = 1.526×10^{11} m
Distance from Sun to Perihelion = 147.5 million km = 1.475×10^{11} m
Speed of Light = 3.0×10^8 m·s

Time it takes light to travel from Sun to aphelion

$$\frac{1.526 \times 10^{11} \text{ m}}{1} \times \frac{1 \text{ s}}{3.0 \times 10^8 \text{ m}} \times \frac{1 \text{ min}}{60 \text{ s}} = 8.47 \text{ minutes}$$
$$= \boxed{8 \text{ minutes } 29 \text{ seconds}}$$

Time it takes light to travel from Sun to perihelion

$$\frac{1.475 \times 10^{11} \text{ m}}{1} \times \frac{1 \text{ s}}{3.0 \times 10^8 \text{ m}} \times \frac{1 \text{ min}}{60 \text{ s}} = 8.19 \text{ minutes}$$
$$= \boxed{8 \text{ minutes } 12 \text{ seconds}}$$

It takes 17 more seconds for light to reach Earth at aphelion than at perihelion.