

1. *In one second, light leaving Los Angeles reaches approximately as far as (a) San Francisco, about 500 km; (b) London, roughly 10,000 km; (c) the Moon, 384,000 km; (d) Venus, 45,000,000 km from Earth at closest approach; or (e) the nearest star, about three light-years from Earth. Which is correct? (Problem 1 in Chapter 1).*

Ans:

Distance = speed * time.

Speed of light = 300,000 km/sec

$$\text{Distance} = 300,000 \frac{\text{km}}{\text{sec}} \cdot 1 \text{sec} = 300,000 \text{ km}$$

Answer C, the moon is the closest to 300,000 km

2. *Refer to Figures 1 and 2 in the Motion lecture-tutorial handout you recently worked on in class. Looking at the figures does Star B ever set? Explain your reasoning..*

Ans: No, it never sets. Looking at figure 2 you can see that the circle star B makes on the celestial sphere never goes below the horizon. If it never goes below the horizon, it never sets.

3. *Estimate the angular speed of the Moon around the earth in degrees per day. Then convert that to degrees per hour.*

Ans:

The angular speed is the moon moves to go once around 360° in one cycle. A cycle of once around the earth for the moon is 27.3 days, a synodic month.

Angular Speed = angular distance / time

$$\text{Angular Speed} = 360 \text{ deg} / 27.3 \text{ days} = 13.2 \text{ deg} / \text{day} \text{ or about } 13 \text{ deg per day.}$$

Convert the time from days to hours to get degrees per hour

$$13 \frac{\text{deg}}{\text{day}} \cdot \frac{1 \text{day}}{24 \text{hours}} = 0.54 \text{ deg} / \text{hour} \text{ or about one half of a degree per hour.}$$

The moon is slightly over half a degree in width, so the moon moves its own width every hour.

A full cycle of phases for the moon is 29.5 days, but the moon goes around more than 360° in that time, so the total angle is harder to figure out. Using 29.5 days about gives about 12 degrees per hour. That is also okay for an estimate, but its better to using 27.3 days as they talk about in the text.

4. The Moon lies roughly 384,000 km from Earth and the Sun lies 150,000,000 km away. If both have the same angular size, as seen from Earth, how many times larger than the Moon is the Sun? (Problem 13 in Chapter 1)

What you want is the ratio of the diameters. From More Precisely 1-4 in the text:

$$\text{diameter} = \text{distance} \cdot \frac{\text{angular diameter}}{57.3^\circ}$$

But the angular diameters are the same so if we take the ratio of the two diameters

$$\frac{\text{diameter}_{\text{sun}}}{\text{diameter}_{\text{moon}}} = \frac{\text{distance}_{\text{sun}} \cdot \frac{\text{angular diameter}}{57.3^\circ}}{\text{distance}_{\text{moon}} \cdot \frac{\text{angular diameter}}{57.3^\circ}}$$

$$\frac{\text{diameter}_{\text{sun}}}{\text{diameter}_{\text{moon}}} = \frac{\text{distance}_{\text{sun}}}{\text{distance}_{\text{moon}}} = \frac{150,000,000 \text{ km}}{384,000 \text{ km}} = 391$$

So the sun is 391 times larger than the moon.

5. Juan Valdez is standing on the equator and he sees the sun just rising in the east. From the perspective of looking down on the earth from above the northern hemisphere, draw a 2-D sketch showing the earth and sun with an arrow pointing to the spot on the earth where Juan is standing.



Do a second sketch showing where Juan is when it is noon.

