Investigate Further

In-Depth Questions to Increase Your Understanding

Short-Answer/Essay Questions

40. New Planet. A planet in another solar system has a circular orbit and an axis tilt of 35°. Would you expect this planet to have seasons? If so, would you expect them to be more extreme than the seasons on Earth? If not, why not?

41. Your View of the Sky.
   a. What are your latitude and longitude?
   b. Where does the north (or south) celestial pole appear in your sky?
   c. Is Polaris a circumpolar star in your sky?

42. View from the Moon. Assume you live on the Moon, near the center of the face that looks toward Earth.
   a. Suppose you see a full earth in your sky. What phase of the Moon would people on Earth see? Explain.
   b. Suppose people on Earth see a full moon. What phase would you see for Earth? Explain.
   c. Suppose people on Earth see a waxing gibbous moon. What phase would you see for Earth? Explain.
   d. Suppose people on Earth are viewing a total lunar eclipse. What would you see from your home on the Moon? Explain.

43. View from the Sun. Suppose you lived on the Sun (and could ignore the heat). Would you still see the Moon go through phases as it orbits Earth? Why or why not?

44. A Farther Moon. Suppose the distance to the Moon were twice its actual value. Would it still be possible to have a total solar eclipse? Why or why not?

45. A Smaller Earth. Suppose Earth were smaller. Would solar eclipses be any different? If so, how? What about lunar eclipses?

46. Observing Planetary Motion. Find out which planets are currently visible in your evening sky. At least once a week, observe the planets and draw a diagram showing the position of each visible planet relative to stars in a zodiac constellation. From week to week, note how the planets are moving relative to the stars. Can you see any of the apparently wandering features of planetary motion? Explain.

47. A Connecticut Yankee. Find the book A Connecticut Yankee in King Arthur’s Court by Mark Twain. Read the portion that deals with the Connecticut Yankee’s prediction of an eclipse. In a one- to two-page essay, summarize the episode and explain how it helped the Connecticut Yankee gain power.

Quantitative Problems

Be sure to show all calculations clearly and state your final answers in complete sentences.

48. Arcminutes and Arcseconds. There are 360° in a full circle.
   a. How many arcminutes are in a full circle?
   b. How many arcseconds are in a full circle?
   c. The Moon’s angular size is about 3°. What is this in arcminutes? In arcseconds?

49. Latitude Distance. Earth’s radius is approximately 6370 km.
   a. What is Earth’s circumference?
   b. What distance is represented by each degree of latitude?
   c. What distance is represented by each arcminute of latitude?
   d. Can you give similar answers for the distances represented by a degree or arcminute of longitude? Why or why not?

50. Angular Conversions I. The following angles are given in degrees and fractions of degrees. Rewrite them in degrees, arcminutes, and arcseconds.
   a. 24.3°
   b. 1.59°
   c. 0.3°
   d. 0.01°
   e. 0.001°

51. Angular Conversions II. The following angles are given in degrees, arcminutes, and arcseconds. Rewrite them in degrees and fractions of degrees.
   a. 7°38′42″
   b. 12°54′
   c. 1°59′59″
   d. 1°
   e. 1″

52. Angular Size of Your Finger. Measure the width of your index finger and the length of your arm. Based on your measurements, calculate the angular width of your index finger at arm’s length. Does your result agree with the approximations shown in Figure 2.7c? Explain.

53. Find the Sun’s Diameter. The Sun has an angular diameter of about 0.5° and an average distance of about 150 million km. What is the Sun’s approximate physical diameter? Compare your answer to the actual value of 1,390,000 km.

54. Find a Star’s Diameter. Estimate the diameter of the supergiant star Betelgeuse, using its angular diameter of about 0.05 arcsecond and distance of about 600 light-years. Compare your answer to the size of our Sun and the Earth-Sun distance.

55. Eclipse Conditions. The Moon’s precise equatorial diameter is 3476 km, and its orbital distance from Earth varies between 356,400 and 406,700 km. The Sun’s diameter is 1,390,000 km, and its distance from Earth ranges between 147.5 and 152.6 million km.
   a. Find the Moon’s angular size at its minimum and maximum distances from Earth.
   b. Find the Sun’s angular size at its minimum and maximum distances from Earth.
   c. Based on your answers to parts a and b, is it possible to have a total solar eclipse when the Moon and Sun are both at their maximum distance? Explain.

Discussion Questions

56. Earth-Centered Language. Many common phrases reflect the ancient Earth-centered view of our universe. For example, the phrase “the Sun rises each day” implies that the Sun is really moving over Earth. We know that the Sun only appears to rise as the rotation of Earth carries us to a place where we can see the Sun in our sky. Identify other common phrases that imply an Earth-centered viewpoint.

57. Flat Earth Society. Believe it or not, there is an organization called the Flat Earth Society. Its members hold that Earth is flat and that all indications to the contrary (such as pictures of Earth from space) are fabrications made as part of a conspiracy to hide the truth from the public. Discuss the evidence for a round Earth and how you can check it for yourself. In light of the evidence, is it possible that the Flat Earth Society is correct? Defend your opinion.

Web Projects

58. Sky Information. Search the Web for sources of daily information about sky phenomena (such as lunar phases, times of sunrise and sunset, or dates of equinoxes and solstices). Identify and briefly describe your favorite source.

59. Constellations. Search the Web for information about the constellations and their mythology. Write a short report about one or more constellations.

60. Upcoming Eclipse. Find information about an upcoming solar or lunar eclipse. Write a short report about how you could best observe the eclipse, including any necessary travel to a viewing site, and what you could expect to see. Bonus: Describe how you could photograph the eclipse.