Astronomy 2110   Homework #2

Spring 2024

Due Thursday, February 1 in class.

For full credit you must write your solutions neatly and show all work.
Do not forget the units. Drawing figures may be helpful.

1) Can you ever observe an annular eclipse of the Moon? Why or why not?

2) Which type of total eclipse – lunar or solar – do you think most people on Earth have seen? Why?

3) The Moon is highest in the sky when it crosses the meridian, halfway between the time of moonrise and moonset. At approximately what time does the Moon cross the meridian if it is a (a) new moon? (b) a first quarter moon; (c) full moon; (d) third quarter moon? Explain your answers.

4) The orbit of a spacecraft around the Sun has a perihelion distance of 0.1 AU and an aphelion distance of 0.4 AU. What is the semimajor axis of the spacecraft's orbit? What is its orbital period?

5) Suppose that the Earth were moved to a distance of 3.0 AU from the Sun. How much stronger or weaker would the Sun's gravitational pull be on Earth? Justify your answer.

6) What is the difference between spring tides and neap tides? What is a king tide?

7) A comet orbits the Sun with a sidereal period of 64 years. (a) Find the semimajor axis of the orbit. (b) At aphelion the comet is 31.5 AU from the Sun. How far is it from the Sun at perihelion?

8) One trajectory that can be used to send spacecraft from Earth to Mars is an elliptical orbit that has the Sun at one focus, perihelion at Earth, and its aphelion at Mars. The spacecraft is launched from Earth and coasts along this ellipse until it reaches Mars, when a rocket is fired to either put the spacecraft into orbit around Mars, or cause it to land. (a) Find the semimajor axis of the ellipse. (b) Calculate how long (in days) such a one-way trip to Mars would take.

9) The mass of Saturn is approximately 100 times that of Earth, and the semimajor axis of Saturn's orbit is roughly 10 AU. Using these approximations, how does the gravitational force that the Sun exerts on Saturn compare to the force that the Sun exerts on Earth? How do the accelerations on the two planets compare?

10) Suppose that you traveled to a planet with 4 times the mass and 4 times the diameter of Earth. Would you weight more or less on that planet than on Earth? By what factor?