E/Z

Universe Ch3 - Moons & Eclipses - due Tues 27 Jan 04

#23, 43, 30, 33, 24 - start 45 when sky clears.

23. (a) The Moon moves noticeably over the space of a single night. To show this, calculate how long it takes the Moon to move through an angle equal to its own angular diameter (½°) against the background of stars. Give your answer in hours. (b) Through what angle (in degrees) does the Moon move during a 12-hour night? Can you notice an angle of this size? (*Hint:* See Figure 1-10.)

Angular speed $\omega = \frac{\text{angle}}{\text{time}}$

Moon orbits earth about once a month. $\omega \approx \frac{360^\circ}{30\ d} =$

How long does it take to move $\frac{1}{2}^\circ$? time =

time $= \frac{\frac{1}{2}^\circ}{12^\circ/\text{day}} = \frac{1}{24}$ day $\approx$ 1 hour!

(b)

a,

24. During an occultation, or "covering up," of Jupiter by the Moon, an astronomer notices that it takes the Moon's edge 90 seconds to cover Jupiter's disk completely. If the Moon's motion is assumed to be uniform and the occultation was "central" (that is, center over center), find the angular diameter of Jupiter. (*Hint:* Assume that Jupiter does not appear to move in the sky during this brief 90-second interval. You will need to convert the Moon's angular speed from degrees per day to arcseconds per second.)

angle = $\omega \cdot$ time

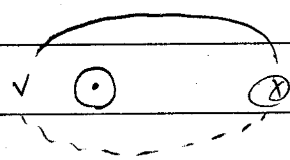
$\omega = \frac{\ \ ^\circ}{\text{day}} = \qquad = \frac{\ \ ''}{\text{sec}}$

OBSERVING PROJECTS

45. Observe the Moon on each clear night over the course of a month. On each night, note the Moon's location among the constellations and record that location on a star chart that also shows the ecliptic. After a few weeks, your observations will begin to trace the Moon's orbit. Identify the orientation of the line of nodes by marking the points where the Moon's orbit and the ecliptic intersect. On what dates is the Sun near the nodes marked on your star chart? Compare these dates with the dates of the next solar and lunar eclipses.

E/2

Universe Ch 4 # 35, 36, 39, 44, 48, (50), 52)



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

36) Suppose that you traveled to a planet with 3 times the mass and 3 times the diameter of the Earth. Would you weigh more or less on that planet than on Earth? By what factor?

$$F_g = \frac{GmM}{R^2} = mg$$

m = your mass, M = planet's mass, R = planet's size, g = planet's gravity

Earth: $g_{\otimes} = \frac{GM_{\otimes}}{R_{\otimes}^2}$, $g_{planet} = \frac{GM}{R^2} =$

44. The average distance from the Moon to the center of the Earth is 384,400 km, and the diameter of the Earth is $2R = D =$ 12,756 km. Calculate the gravitational force that the Moon exerts (**a**) on a 1-kg rock at the point on the Earth's surface closest to the Moon and (**b**) on a 1-kg rock at the point on the Earth's surface farthest from the Moon. (**c**) Find the difference between the two forces you calculated in parts (a) and (b). This difference is the tidal force pulling these two rocks away from each other, like the 1-ball and 3-ball in Figure 4-23. Explain why tidal forces cause only a very small deformation of the Earth.