

Astronomy 45
Introduction to Astrophysics

Problem Set 1 - Due Friday, September 27, 2002

- Given that $1\text{AU} = 1.496 \times 10^8 \text{ km}$, use the table on p. 1-13 to make a list of the velocities v of the planets in km s^{-1} . Then make a list of the values of $v^2 r$ where r is the radius of the orbit. Can you say anything about the force experienced by the planets?
- Which planet of the Solar system has the shortest synodic period and what is its value in Earth years? The sidereal periods in Earth years are given in the Table.

Planet	Sidereal Period	Planet	Sidereal Period
Mercury	0.2408	Saturn	29.4577
Venus	0.6152	Uranus	84.0139
Earth	1.0000	Neptune	164.793
Mars	1.8809	Pluto	248.54
Jupiter	11.8622		

- What is the synodic period of Earth as seen by an observer on Mars expressed in Martian years?

4. The parallax angle of Mars was measured in 1672 at the time of opposition.
 - a) For observers separated by a baseline of twice the Earth radius of 6.378×10^3 km, the difference in their measurements of the angular position of Mars was 33.6 arcseconds. What was the distance between Earth and Mars?
 - b) Calculate the velocity of a point on the surface of the Earth due to its rotation.
 - c) Calculate the relative orbital velocity of a point on the surface of the Earth and a point on the surface of Mars as they move around the Sun.
 - d) If the times at which the observations are made are identical, the baseline joining the two observers is known to be $2R_{\oplus}$. If the times at which the observations are made are actually uncertain by an amount Δt , how small must Δt be for the distance of Mars to be measured to within an error of 10 percent?