

Astronomy 45
Introduction to Astrophysics

Problem Set 1 - Due Friday, February 11

1. Given that $1\text{AU} = 1.496 \times 10^8 \text{ km}$, make a list of the velocities of the planets in km s^{-1} .
2. 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		

3. 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.
 - d) Assume the baseline forming the two observers is known to high precision. The time at which they both observe is uncertain by a time Δt . If the distance to Mars is to be measured to within an error of 10%, how small must Δt be?