

ASTR 2310 General Astronomy I – Spring 2020, Brotherton

Homework #3, due in class Tuesday February 25, 2020

Instructions: Homework write-ups should be clean and clear. Illegible or hard to understand solutions may not earn credit. In addition to the solution, the steps leading to the solution are also important to earn full credit. You may need to use information from the internet to solve some of the problems, and you should clearly state your sources if you do so. Use appropriate units and significant figures for your solutions (or uncertainties if requested). It is permissible to work in groups, but everyone must hand in their own solutions that they have written themselves.

1. Hohmann Transfer Ellipse

Suppose that you wanted to get a spacecraft from an asteroid at 2.3 AU from the Sun to a second asteroid 3.5 AU from the Sun on a least-energy orbit. Assume the asteroids have circular orbits and their own gravity can be neglected. a) How long would it take the spacecraft to get from one asteroid to the second? b) Sketch the orbits of the two asteroids and the spacecraft. c) What is the necessary change in velocity for the spacecraft to initiate the ellipse? d) What is the necessary change in velocity to circularize the orbit at 3.5 AUs? Put your answers in years and km/s to 2 significant figures.

2. The Mercurian Day

Mercury revolves around the Sun in 87.97 days and has a rotation period of 58.65 days (both in Earth days). How long is the solar day on Mercury? Give your answer in Earth days to three significant figures.

3. The Tides of Saturn.

What is the Roche Limit of Saturn for material with the density of ice in term of Saturn radii? Use the version of the equation derived in class with the coefficient of 2.5, and cite your source for the density of ice. What is the radius of the outermost ring (given an altitude of 80,000 km above the surface) measured in Saturn radii? Give your answers to two significant figures. Is the latter number smaller than the Roche limit under these assumptions?

4. Reading carefully?

- What is the aberration of starlight?
- Is a comet orbit with an inclination of 135° retrograde or prograde?
- If Betelgeuse is crossing the celestial meridian, what is the sidereal time?
- If the sidereal time is 10:00, what is the hour angle of Feige 34?
- From Hawaii (lat. $+20^\circ$) can you see the star α Centauri? Can you see it from Laramie?