PHYS 171: Planetary & Stellar Astronomy
Due: Friday, September 13, 2019

Problem Set #2

1. Space Car: In 2018, a rocket company launched a car into orbit around the sun. The orbital period of the car is 557 Earth days.

a) Calculate the semimajor axis of the orbiting car.

b) The car's orbit has an eccentricity of $\varepsilon=0.26$. Calculate the distances of the car from the sun at aphelion and at perihelion.

c) Suppose instead that the car has a circular orbit with the same orbital period ($\varepsilon=0$). Calculate the velocity of the car in m/s and km/h.

2. Applicability of Kepler's laws: In class, we saw that Kepler's laws apply to planets, comets, and asteroids orbiting the Sun. Please provide 1-2 sentence explanations for your answers to the following questions:

a) Does the type of object (i.e. its material, shape, color, living vs inanimate, etc) orbiting the Sun affect whether Kepler's laws apply? Explain.

b) Can you apply Kepler's laws to moons or satellites orbiting a planet? Explain.

c) Describe an orbital situation in which one or more of Kepler's laws do not apply.

3. Comet speeds: Consider a comet with a very eccentric orbit around the Sun. Suppose that the velocity of the comet at perihelion is 54 km/s at a distance of 89×10^6 km from the Sun. The comet's aphelion distance from the Sun is 5.2×10^9 km.

a) Calculate the velocity in km/s of the comet at aphelion.

b) Calculate the semimajor axis of the comet in AU.

c) Calculate the eccentricity of the orbit

d) Calculate the period of the comet in Earth years.