

Due in section the week of April 11th

Problems are based off lecture and readings - Show all work - Don't forget units - 10pts total

Q1) The Sun as the power source of the solar system

a) Calculate the energy flux (energy per time per square meter) received at Mars, Jupiter, and Pluto from the Sun. Use units of W/m^2 in your answer. (Hint: Use the fact that the Earth receives $1300 \text{ W}/\text{m}^2$ at a distance of 1 AU). (1 pt)

b) For this problem we want to power a house on the Earth with solar energy. Assume that approximately $350 \text{ W}/\text{m}^2$ actually reaches the Earth's surface due to the atmosphere. If solar panels are 15% efficient at collecting this flux and a household needs 6000 W during the day, how large of a solar panel area is needed for this house (in m^2)? (1 pt)

c) Imagine now we want to power the Juno spacecraft at Jupiter with solar energy. Juno needs $\sim 500 \text{ W}$ to operate and has solar panels that are $\sim 15\%$ efficient. How large do the solar arrays on Juno need to be (in m^2)? (1 pt)

Q2) Mercury

a) What is the orbital velocity of Mercury (in km/s)? Assume the orbit of Mercury is circular with $a=0.39$ AU. Recall that $v \propto 1/a$ and use the fact that the orbital velocity of Earth is 30 km/s. (1 pt)

b) How long does it take Mercury to complete one orbital period? If Mercury undergoes a full rotation every 58.6 days, what is the ratio of the rotation period to the orbital period? Why would this be unusual to someone who is accustomed to an Earth day? (1 pt)

Q3) The Moon

a) Briefly explain our current theory of the origin and formation of the moon. Discuss the significant evidences we have for this theory. (1 pt)

b) True/False: (1 pt)

The moon's orbit is moving further from the Earth	T	F
The moon is younger than the Earth	T	F
The <u>surface</u> of the Moon is younger than the Earth	T	F
The Earth's spin is increasing due to the Moon	T	F

Q4) Asteroids and Resonances

a) What are the names of the three classes of asteroids based on their orbits? (1 pt)

b) Explain how Jupiter's orbit effects the orbits of asteroids in the asteroid belt. (1 pt)

c) Calculate the location of the Jupiter 3:2 resonance. Are asteroids commonly found at this location? (1 pt)