

ASTR/ATOC 3720
Homework Assignment #1
Due: Tues. Jan. 28 in class

Show your work, as partial credit will be given for your thought processes, even if you don't get to the correct answer at the end! Work the problems on a separate sheet of paper please. Be neat and organized! We can't give credit for answers we can't read!

1. The "Solar Constant" measured in space at the orbit of Earth is 1368 Watts/m^2 . If the Sun were a lightbulb, calculate what "Wattage" light bulb it would be? (Hints: the Sun is emitting energy in all directions; and $1 \text{ AU} = 1.5 \times 10^{11} \text{ m}$).
2. Given that Saturn's distance from the Sun is 9.52 AU and it absorbs 37% of the sunlight that falls on it, what is the effective (or equilibrium) temperature of the planet?
3. The mean distance of Mars from the Sun is 1.524 AU , but the planet is actually in an elliptical orbit with an eccentricity of 0.093 . Given that the albedo of Mars is 0.16 , what is the effective (equilibrium) temperature at both the perihelion (closest) and aphelion (farthest) points on Mars' orbit?
4. Calculate the scale heights of the atmosphere near the surfaces of Mars and Venus. Assume that the atmospheres of Mars and Venus are essentially all CO_2 and the temperature at Mars is 223 K and Venus is 750 K . Note, a periodic table, and the tables at the back of NSS (the New Solar System) will help.
5. What is the percentage change of the acceleration due to gravity (g) between the surface of the Earth and 100 km altitude above the surface? Estimate the error in the pressure determination at 100 km altitude using the barometric equation with g held constant.
6. Calculate the adiabatic lapse rates for Mars, Venus, and Jupiter.