Astronomy 1102/1104 **Name:** _____

Spring 2016 - Problem Set 6 **Section #** _____

Due in section the week of April 4th
Problems are based off lecture and readings - Show all work - Don't forget units - 10pts total

1) Albedo of the Terrestrial planets (2pt each)

The effective temperature of a planet is largely influenced by its albedo. Albedo is a measure of a planet's efficiency to reflect light. An albedo of A=1 means all light is reflected (think projector screen) and an albedo of A=0 means all light is absorbed (think black hole).

Below is a simplified but generalized form of the equation we found in lecture 17 relating albedo, distance, and effective temperature, where d is the distance between the planet and the Sun.

$$1.1\times10^{8}\left(\frac{1-A}{d^{2}}\right)^{1/4}=T_{eff}$$

The actual temperature of a planet also depends on the effectiveness of its atmosphere at trapping heat. If we relate the actual temperature to the effective temperature using a greenhouse efficiency we would get the following relationship, where n represents the efficiency of letting heat escape (1 being all heat can escape easily and 0 being all heat is trapped).

$$T_{actual}=\left(\frac{1}{n}\right)^{1/4}T_{eff}$$

a) Using d and T_{eff} from the table below find the albedos of these planets to complete the table.
b) Find what n is for the planets in the table.

	Venus	Earth	Mars
d (meters)	$1.08\text{x}10^{11}$	$1.50\text{x}10^{11}$	$2.28\text{x}10^{11}$
T_{eff} (kelvin)	229	255	218
T_{actual} (kelvin)	737	288	223
A			
n			

2) Exoplanetary Habitability (1pt each)
Exoplanet Kepler 442 b is one of the most likely planets to be habitable but it has a T_{eff} of 233 kelvin, quite cold. This planet will definitely need some form of greenhouse to get its actual temperature into the liquid water range.
a) Using the equation from before find the min and max values of *n* for liquid water to be on the surface.
b) Based on your values for *n* in our solar system do you think there could be an atmosphere that fits in this range?

3) Exoplanet Detection (1/4pt each) Fill in the table.

	Direct Imaging	Doppler Method	Transit Method
How does it work?			
What planets are hardest to find using this method? (no repeats!)			
What can't we learn about a planet using this method?			

4) True/False (1/4pt each) Circle your answer.
a) Lots of meteorites are found in Antarctica due to the converging magnetic field lines: T F
b) Planets can exchange material through asteroid impacts: T F
c) The lunar maria are older than the lunar highlands: T F
d) The Moon's synchronous rotation is due to Earth's tidal effect on the Moon: T F
e) Large bodies are generally less geologically active than smaller ones: T F
f) Most asteroids are extremely dense hunks of iron: T F
g) It's not a matter of IF but WHEN the Earth will be hit by another large asteroid: T F