Astronomy 1102/1104 **Name: _____**

Spring 2016 - Problem Set 3 **Section # _____**

Due in section the week of February 29th
Problems are based off lecture and readings - Show all work - Don't forget units - 10pts total

Q1) Angular Momentum in the Solar System

a) Calculate the circular velocity of Jupiter and the Earth in units of km/s. (use $G=6.67\times10^{-11}$ $m^3/kg/s^2$, $M_{Sun}=2\times10^{30}$ kg, $a_{Jupiter}=5.2$ AU, and $a_{Earth}=1.0$ AU) (1pt)

b) Using the information from part a, calculate the orbital angular momentum of Jupiter and the Earth in units of kg m^2/s ($M_{Jupiter}= 1.90\times10^{27}$ kg, $M_{Earth}= 5.97\times10^{24}$ kg). How many times more angular momentum is in Jupiter than the Earth? (1 pt)

c) The Sun has rotational angular momentum given by $L_{rotational}\sim0.3MR^2/P$. Where M is the mass of the sun, P is the period of rotation of the sun (P=24.6 days), and R is the radius of the sun ($R=6.95\times10^5$ km). Compare the angular momentum of the sun with the angular momentum of Jupiter from part b. How many times more angular momentum is in Jupiter than the Sun? (1 pt)

Q2) Escape Velocity

a) Calculate the escape velocity from Mars in km/s ($M_{Mars}= 6.4\times10^{23}$ kg, $R_{Mars}=$ 3,390 km). What is the ratio of the escape velocity from Earth to the escape velocity from Mars? Recall the escape velocity from Earth is ~11 km/s. (1 pt)

b) Planet A has 1/2 the mass and 2 times radius of Planet B. How much more is the escape velocity on planet B compared to planet A? (1 pt)

Q3) Blackbody Radiation

a) Imagine you see very hot coals in a fire that are glowing red. What is the difference in the mechanism producing radiation you see from the coals vs. the radiation you see when you see someone wearing a red sweater? (1 pt)

b) True/False: For an ideal blackbody the spectrum only depends on the object's temperature. (1 pt)

c) Imaging that we have four objects that are radiating like blackbodies and emit strongest in the following colors: blue, green, red, and yellow. Which of the objects is the hottest? Which is the coolest? (1 pt)

Q4) Blackbody Radiation

a) Calculate the peak wavelength of two stars, one with an effective temperature of 15,000 K and the other 5,800 K. Now, calculate the peak wavelength of a planet with an effective temperature of 290 K. Express answers in nm (units hint: 1 nm = 10^{-9} m). Are any of these within the visible range of human sight? (1 pt**)**

b) If the temperature of a blackbody is tripled, by what factor is the flux of the blackbody increased? (1 pt)