Second Exam
ASTR 3730
November 10, 2015 Name:_____
Each problem worth 25 points.

1. A layer of hydrogen accumulates on the surface of a one solar mass white dwarf. When the layer reaches a mass of 10^{25}g, it ignites in a runaway burning.
a) (10) estimate how much energy is released.
b) (15) show whether or not the burning gas will escape from the star.

2. Hot plasma can be contained by a magnetic field. The field on a neutron star is 10^{12} Gauss.

a) (15) Assume the thermal density of matter equals the magnetic field energy density. What is the particle density of hydrogen that can be contained by this field at 10^{7}K?

b) (10) How long will the hydrogen take to cool through thermal bremsstrahlung radiation? (Assume Line-free emission)

3. The Sun will become a white dwarf in a few billion years. When its radius drops to $7x10^8$cm (1% of what it is now) and its temperature is a 11,000K (twice what it is now), what will the temperature of the Earth? How close to the Sun would have move the Earth to maintain its current temperature? (That's an expensive project, but maybe we can do it given billions of years.)

4. A four solar mass red supergiant has a surface temperature of 3000K. At what radius will the escape velocity equal the thermal velocity of the hydrogen of its photosphere? What happens when that radius is achieved?