Homework 3 Spring 2008 . . . . YOUR NAME:__________________________

Some numbers: $L_\odot = 4 \times 10^{33}$ ergs/second $M_\odot = 2 \times 10^{33}$ grams c= 3×10^{10} cm/second.

1. **What is the energy source for the Sun? (select one)**

   ___Nuclear fission reactions

   ___Nuclear fusion of hydrogen into helium

   ___Conversion of gravitational potential energy into heat and light

   ___None of the above

2. **Why are high temperatures required for fusion reactions? (select one)**

   ___The high temperature is required to counteract gravity

   ___Only at high temperature do the nuclei in a gas approach close enough for the nuclear force to overcome electrical repulsion

   ___Uranium only undergoes radiactive decay at high temperature

   ___The strong force only exists in high temperature environments.

3. **Label the following questions about star formation processes True or False.**

   ___Dust is required to shield molecular cloud cores from starlight and thereby allow the cores to cool

   ___Protostars enter the HR Diagram from the upper left corner

   ___Most or all stars form in groups or clusters of stars

   ___Protostars stop their gravitational contraction when their central temperature is high enough for hydrogen fusion to begin

4. **Coal burning releases** 4×10^{12} **ergs per gram of coal**.

   (a) What is the total amount of energy that could be generated if the Sun were coal-powered and made of coal?

   (b) How long would the coal-powered Sun of part (a) last before running out of fuel?

5. **How much energy is produced by nuclear fusion in the core of the Sun each second?**

6. **How long will a 0.3**$M_\odot$ **star with** $L = 0.01L_\odot$ **spend on the main-sequence? (Hint, the main-sequence lifetime of the Sun is 10 billion years).**

7. **In the fusion of four protons into helium,** 4.7×10^{-26} **grams of matter is turned into energy. How much energy does this amount of matter produce?**

8. **Four stars occupy the four corners of an H-R diagram (UL, LL, UR, LR).**

__________In which corner(s) is (are) the largest star(s)?

__________In which corner(s) is (are) the most luminous star(s)?

__________In which corner(s) is (are) the hottest star(s)?

__________In which corner(s) is (are) the lowest mass main-sequence stars?