Stellar Lifetimes & Evolution   Name:____________________

ASTR/PHYS 1060, Dan Wik, In-class activity on October 17th.

Spectral Type	Surface Temperature [K]	Mass [$M_\odot$]	Luminosity [$L_\odot$]	Main Sequence Lifetime [years]
B0	30000	18	20000	
A5	8600	2	20	
G2	5800	1	1	1×10^{10}
K5	4600	0.7	0.16	
M5	3100	0.2	0.008	

The main sequence lifetime of stars can be determined by comparing their mass and luminosity:

$$\text{Main Sequence Lifetime} = 1 \times 10^{10} \frac{\text{Mass}\,[M_\odot]}{\text{Luminosity}\,[L_\odot]} \text{ years}$$

1) Describe which term on the right hand side of the equation is the fuel available to a star, and which is the rate at which that fuel is burnt.

2) What are the units of the Mass and Luminosity, and what is the source of the constant (1×10^{10}) on the right hand side of the equation?

3) Now use this equation to calculate the lifetimes of the B0, A5, K5 and M5 stars and write your answers in the table above.

4) Which live longer, high-mass or low-mass stars? Describe why this is.

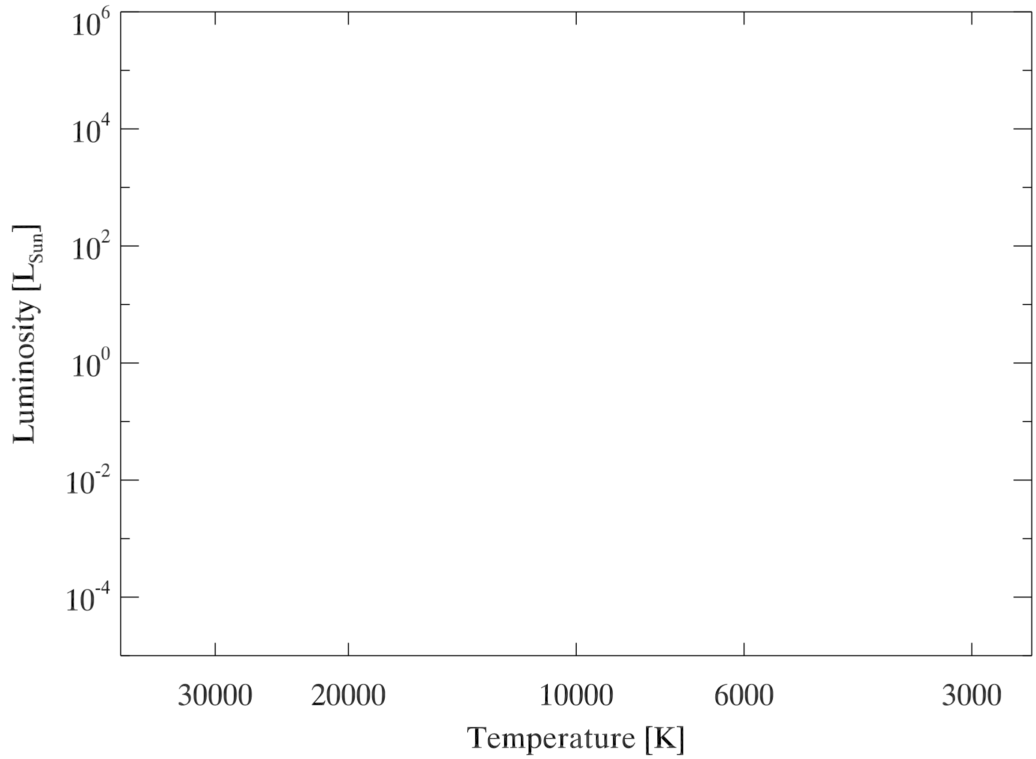
5) Based on your answer to question 4, do you think the rate of nuclear fusion in a high-mass star is greater than, less than or equal to the rate of fusion in a low mass star?

6) If Star A has the same mass as the sun, and Star B has a mass 6 times larger, which statement best describes how their lifetimes compare:

A) Star A will live less than 1/6th as long as Star B
B) Star A will live 1/6th as long as Star B
C) Star A will have the same lifetime as Star B
D) Star A will live 6 times longer than Star B
E) Star A will live more than six times longer than Star B

Explain your reasoning for the choice you made.

Part II (with lecture): The post-main sequence evolution of the Sun



Map out the path of a sun-like star's evolution in the H-R diagram above.

A) Main Sequence

B) The Red Giant Branch

C) Helium Burning

D) Asymptotic Giant Branch

E) White Dwarf