

A. What do you get for the lifetime of the Sun on the main sequence? \_\_\_\_\_

B. The previous answer is difficult to comprehend in any meaningful manner. Convert it to years by dividing by the number of seconds in a year which is roughly  $3 \times 10^7$  s. (Hint:  $10^{16}/10^7 = 10^9$ .) Main sequence lifetime of Sun = 10 billion years. 10,000,000,000 years

C. Round your result so you have one significant digit. What is the lifetime of the Sun in years? \_\_\_\_\_ In billions of years (one billion =  $10^9$ )? \_\_\_\_\_

5. Giuseppe: "Stars more massive than the Sun should last longer than the Sun because they have more fuel (mass). Thus, the more massive a star is, the longer it will live."

Marina: "That may not be the case; you have to take into account how fast the stuff is used, the luminosity of the star, as well as its mass."

Who do you think is correct and why? \_\_\_\_\_

6. If a star has twice the mass of the Sun and the same luminosity, then it can be expected to last twice as long. On the other hand, if the star's luminosity is greater than the Sun, it will not last as long. Thus, the lifetime of a star is approximately

$$\text{lifetime of a star} = \frac{\text{number of times more massive than Sun}}{\text{number of times more luminous than Sun}} \times (10 \text{ billion years})$$

*lifetime of the Sun*

Table 1 lists some main sequence stars of various spectral types, approximate masses, and approximate luminosities for these stars in terms of the corresponding Sun value.

A. Find the lifetimes of these stars in terms of the lifetime of the Sun, namely 10 billion years. Fear not, the numbers are all approximate and quite simple to use. Simply multiply 10 billion by the number in Column 2 (the energy), and divide by the number in Column 5, the rate at which the energy is being used.

B. Which stars last the longest on the main sequence, hot blue stars or small red stars?

C. The more massive a star the \_\_\_\_\_ time it spends on the main sequence.

*trillion: 1,000,000,000,000*  
*million: 1,000,000 billion: 1,000,000,000*

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Spectral Type	Mass ( $M_{\text{Sun}}$ )	Luminosity ( $L_{\text{Sun}}$ )	Lifetime (years)
O	50	500,000	1 million years
B8	5	100	500 million years
A	2	10	2 billion years
G	1	1	10 billion years
K	0.5	0.1	50 billion years
M	0.1	0.005	200 billion years

TABLE 1. Finding the main sequence lifetimes of stars.

Main Sequence Star Type	blue O stars	blue-white B stars	yellow-white A stars	yellow G stars	orange K stars	red M stars
Zero-age star cluster	✓	✓	✓	✓	✓	✓
10 million year old	XXXX	✓	✓	✓	✓	✓
1 billion year old	XXXX	XXXX	✓	✓	✓	✓
4 billion year old	XXXX	XXXX	XXXX	✓	✓	✓
13 billion year old	XXXX	XXXX	XXXX	XXXX	✓	✓
100 billion year old	XXXX	XXXX	XXXX	XXXX	XXXX	✓