Nearest vs Brightest Stars Activity & HW Name:_____

ASTR/PHYS 1060, Dan Wik, Started as in-class activity on Sept. 26th.
Due Oct. 3rd, start of class; turn in hard copy with answers to 6)-15) attached on a separate page.

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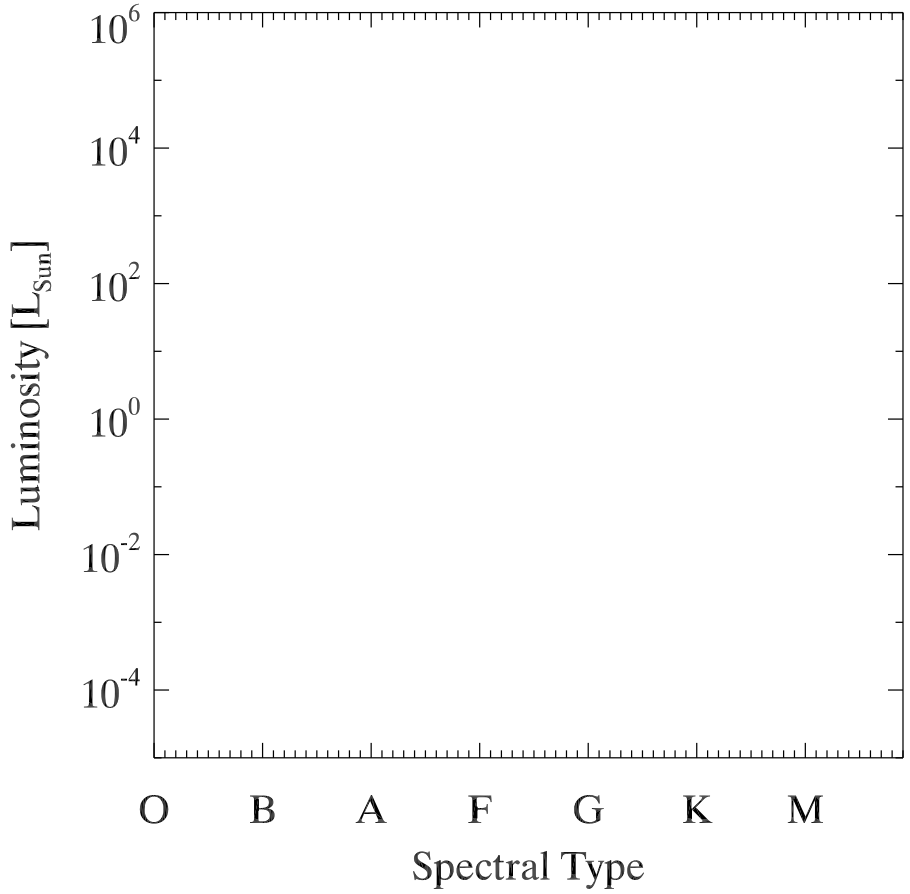
20 Brightest Stars Visible From Earth				
Star	Luminosity [$L_\odot$]	Spectral Type	Temp. [°K]	Dist. [ly]
Sun	1	G2	5800	0.000016
Sirius A	22	A1	9600	8.6
Canopus	15000	F0	7350	310
α Centauri A	1.5	G2	5800	4.3
Arcturus	110	K2	4960	36
Vega	49	A0	9600	25
Rigel	42000	B8	12300	910
Procyon	7	F5	6700	11.4
Betelgeuse	9000	M2	3600	640
Achernar	1100	B5	15200	85
β Cen	12000	B1	23000	525
Capella A	90	G8	5400	42
Altair	11	A7	7900	17
Aldebaran	150	K5	4400	65
Capella B	70	G0	6100	42
Spica A	2200	B1	23000	262
Antares A	7500	M1	3700	600
Pollux	31	K0	5200	34
Fomalhaut	17	A3	8800	25
Deneb	258000(!)	A2	9040	3200

20 Nearest Stars to Earth				
Star	Luminosity [$L_\odot$]	Spectral Type	Temp. [°K]	Dist. [ly]
Sun	1	G2	5800	0.000016
Proxima Centauri	0.00005	M5	3200	4.2
α Centauri A	1.5	G2	5800	4.3
α Centauri B	0.4	K1	5100	4.3
Barnard's Star	0.0004	M3	3500	6.0
Wolf 359	0.00002	M6	3100	7.7
BD +36 2147	0.005	M2	3600	8.2
UV Cet A	0.00005	M5	3200	8.4
UV Cet B	0.00003	M6	3100	8.4
Sirius A	22	A1	9600	8.6
Sirius B	0.002	B1	25000	8.6
Ross 154	0.0004	M3	3500	9.4
Ross 247	0.0001	M5	3200	10.4
ϵ Eri	0.3	K2	5000	10.8
Ross 128	0.0003	M4	3400	10.9
61 Cyg A	0.08	K4	4600	11.1
61 Cyg B	0.04	K5	4400	11.1
ϵ Ind	0.1	K3	4800	11.2
BD +43 44 A	0.006	M1	3700	11.2
BD +43 44 B	0.0004	M4	3400	11.2



1) The spectral type of a star measures its (*fill-in-the-blank*)

_____.

2) Plot the sun with a $\odot$ symbol on the H-R diagram. Then plot the rest of the 20 nearest stars with an "X" and the brightest stars with a $\star$.

3) Use the stellar temperatures from the table to create a temperature scale for the x-axis and write it at the top.

4) Label the ends of the appropriate axes with the words "Red", "Blue","Bright" & "Dim".

5) Identify the main sequence of stars, and draw a circle around it.

Please type up or neatly write your answers to the questions below on a separate sheet of paper!

Typical Stars:

6) Compare the nearest stars to the brightest stars. Describe how they differ in terms of their positions in the H-R diagrams.

7) Which set of stars (nearest or brightest) do you think is most representative of stars in the Milky Way? Why?

8) There are 100 billion stars in the Milky Way. Estimate how many of these stars are fainter and cooler than the sun.

9) The stars that end with an "A" or "B" are members of binary or larger multiple systems. Put a star by each binary star in the tables. What fraction of stars are in a binary system?

Stellar Properties (Size, Mass, Spectra):

10) For stars with the same radius as the sun, we can rewrite the Stefan-Boltzmann law to determine how their luminosity varies with temperature:

$$\frac{L}{L_{sun}} = \left(\frac{T}{5800\ \text{K}}\right)^4$$

where L is the luminosity of the star and T is its temperature in Kelvin.

Use this equation to figure out the luminosity of a sun-sized B1 star (T =23000 K) and M6 star ($T = 3100$ K).

Sun-Sized B1 star luminosity:

Sun-Sized M6 star luminosity:

11) Plot the sun-sized B1 star and M6 star on your H-R diagram with small dots and draw a line between these two points and the Sun. Then figure out which side of this line larger and smaller stars will fall and label this on the plot.

12) Are the brightest main sequence stars larger or smaller than the Sun? How about the faintest main sequence stars?

13) The position of stars along the main sequence is determined by their mass. Where do the highest and lowest mass main sequence stars fall on the H-R diagram?

14) The star Betelgeuse is red but bright. How can you explain its high luminosity despite its low temperature?

15) The sun's spectrum peaks at 500 nm. Use Wien's law ($\lambda_{max} = \frac{2900[\mu\text{m K}]}{T[K]}$) to calculate the peak wavelengths of both Rigel and Proxima Centauri. Also figure out whether these wavelengths are at visible, ultraviolet or infrared wavelengths.