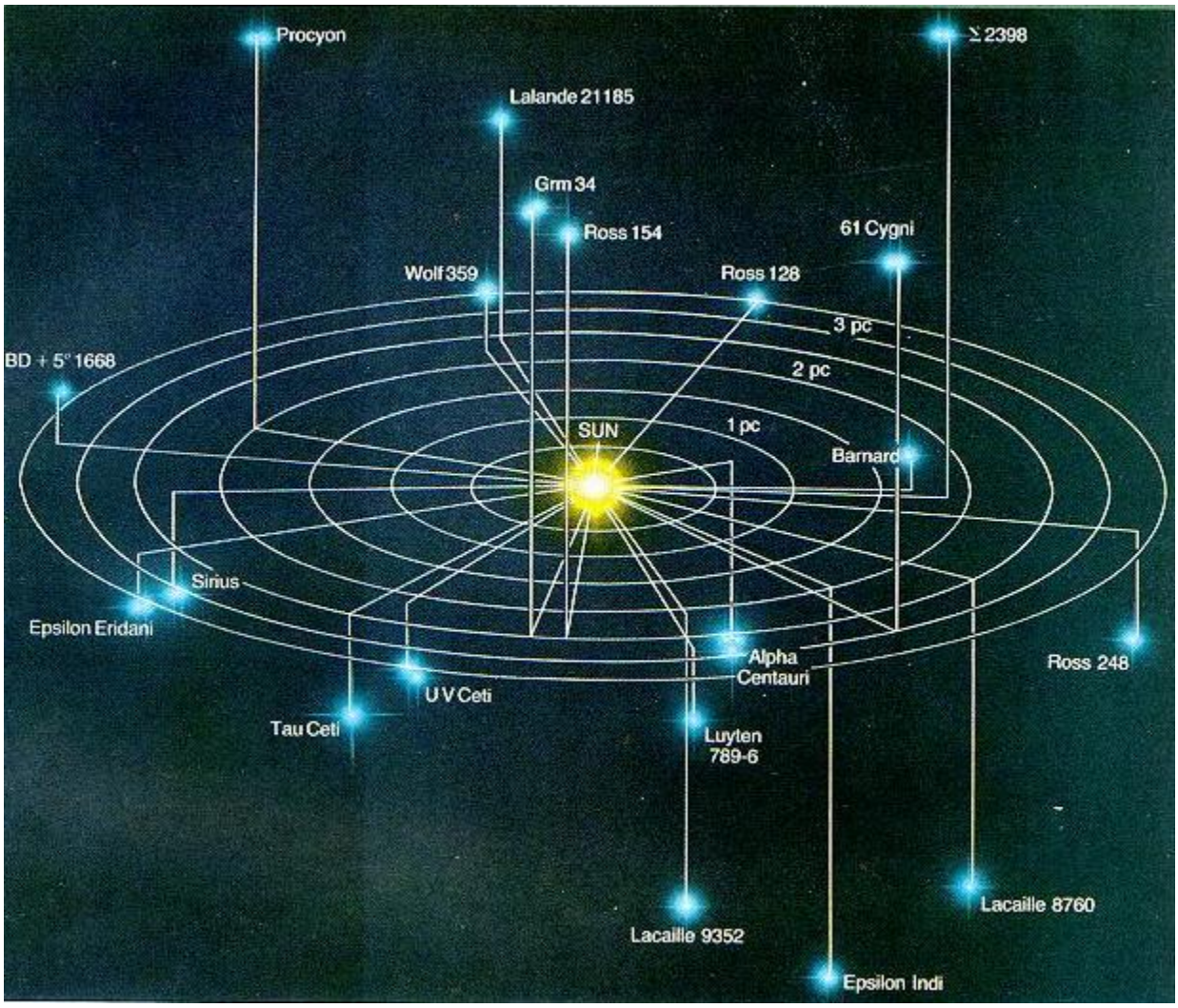
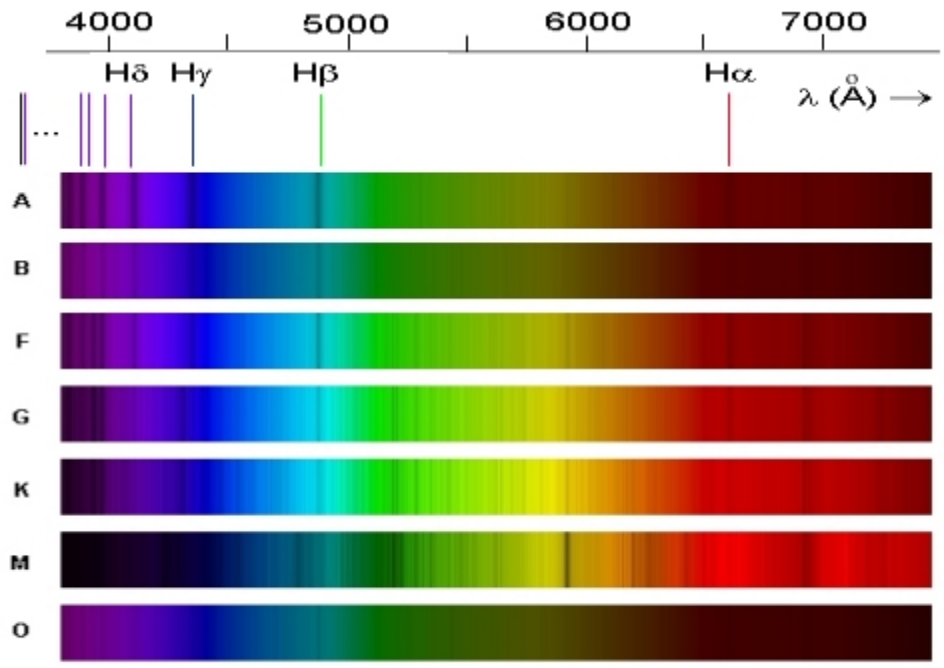
ASTROPHYSICS HOMEWORK QUESTIONS

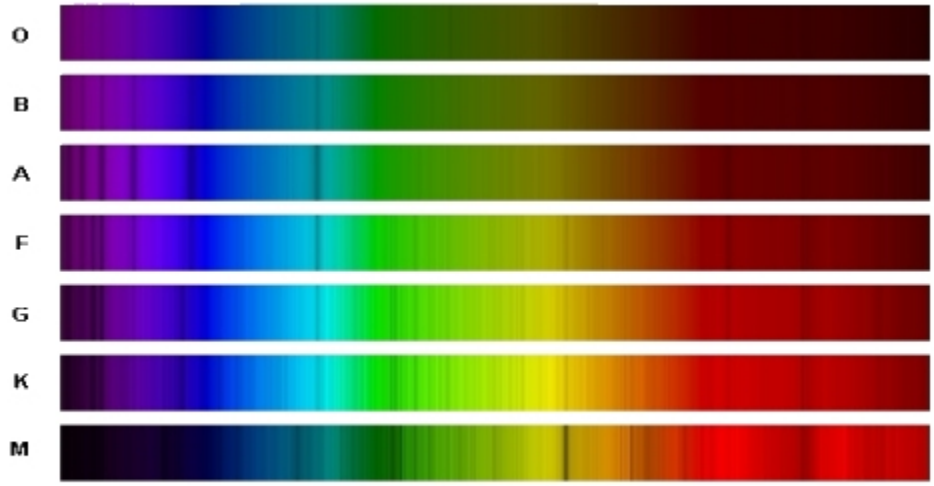
1. What is the brightness ratio between a 1^{st} magnitude star and a 2^{nd} magnitude star?
2. What is the flux ratio of the faintest star we can see with a naked eye (with or without a beautiful eye ball) to the faintest object with the largest telescope (30^{th} magnitude)?
3. Calculate 1 pc in m and in ly (light years – the distance that light travels in 365.25 days).
4. Find the relationship between the distance in pc and the parallax angle.
5. A star has a parallax of 0.5", how far away is it?
6. A star is 20 pc away, what is its parallax?
7. Find the temperature of an object whose blackbody spectrum peaks in the middle of the visible part of the spectrum, λ = 5500 Å.
8. The earth has an average temperature of about 300K. What is the peak wavelength of the earth's radiation?
9. Generally, what is the color of a hot star? What is the color of a cool star?
10. The surface of the sun is about 5800 K and its radius is 6.96 X 10^5 km. What is the luminosity of the sun? (Answer: 3.906 X 10^{33} erg/sec $\equiv 1L_{\odot}$, one solar luminosity)
11. A star is at distance of 1000 pc, and its apparent magnitude is +5. What is its absolute magnitude?
12. The sun's apparent magnitude is -26.5. What is its absolute magnitude?
13. Stars α Romeo and β Can't Eat Just one have magnitude of 3 and 5. What is the ratio of their brightness?
14. Sirius's apparent magnitude is – 1.5 and absolute magnitude of 1.4. What is the distance in pc?

20 Nearby Stars

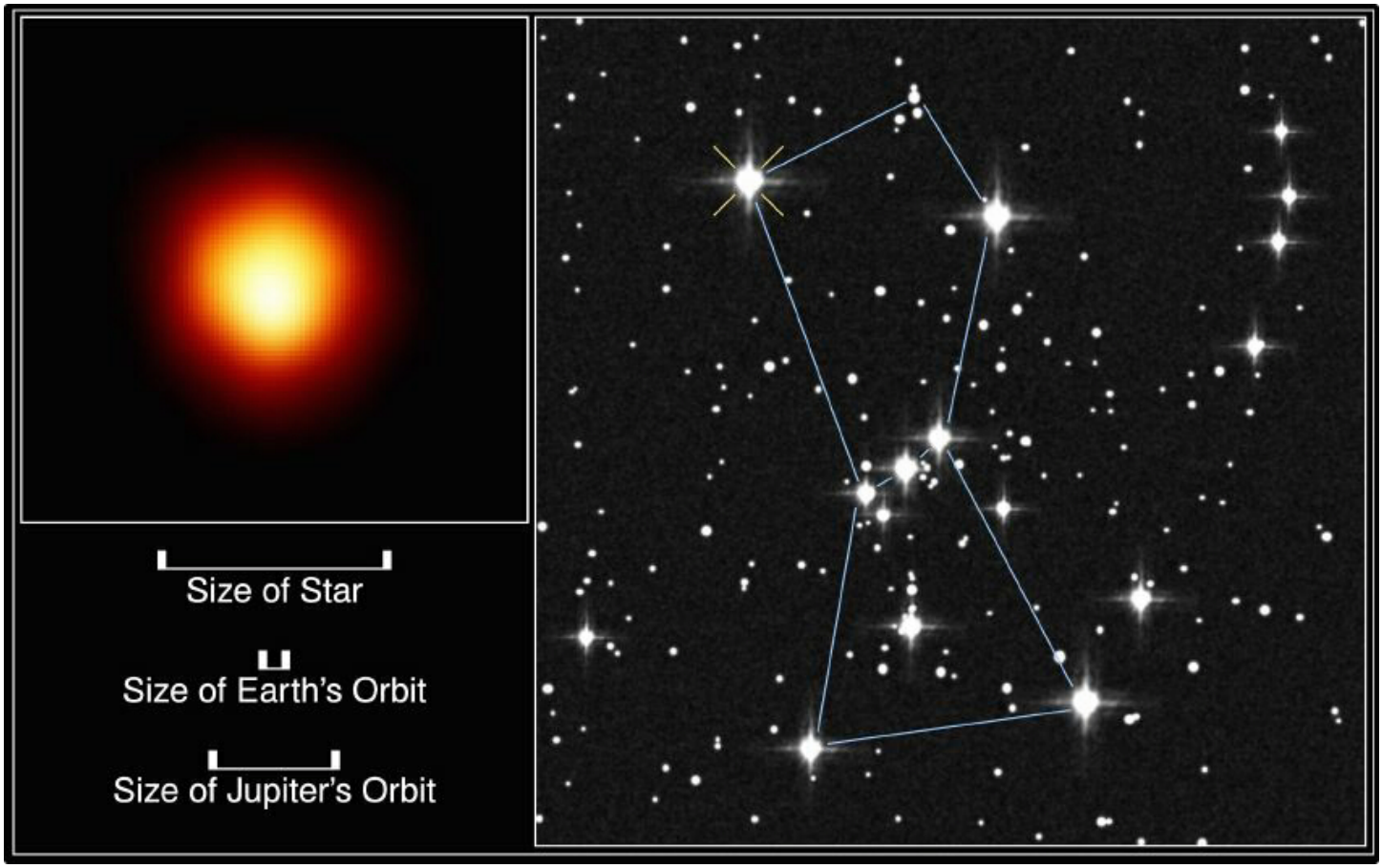


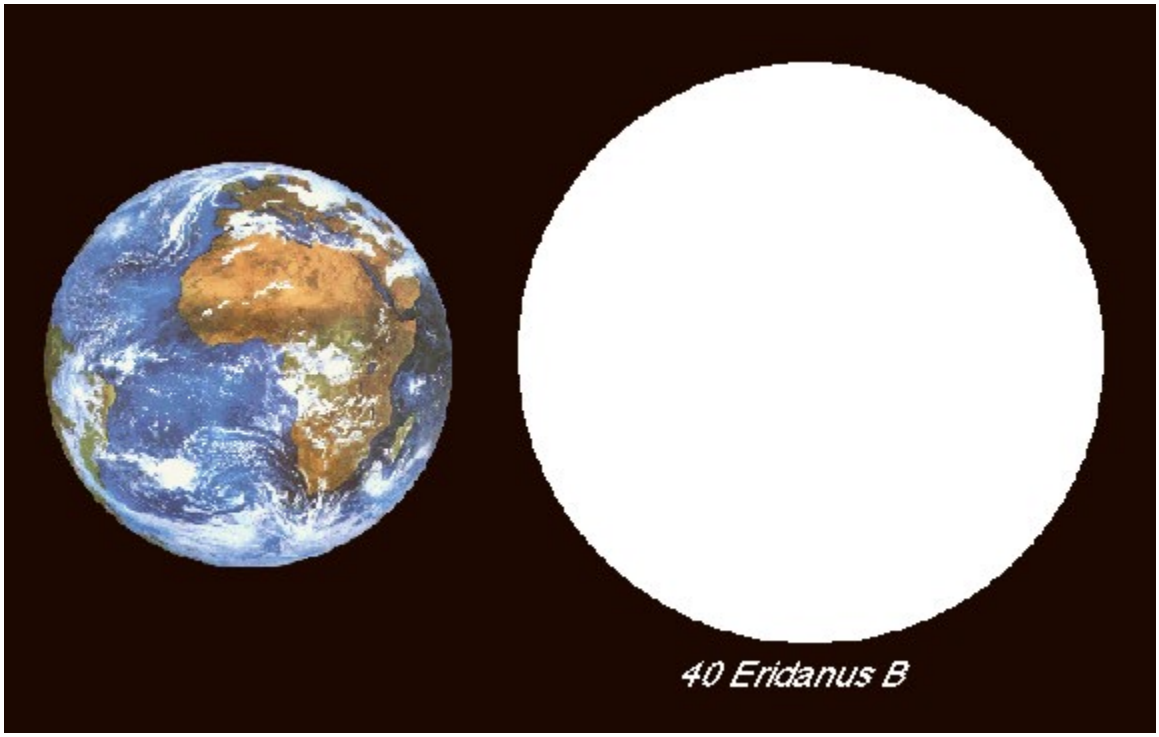


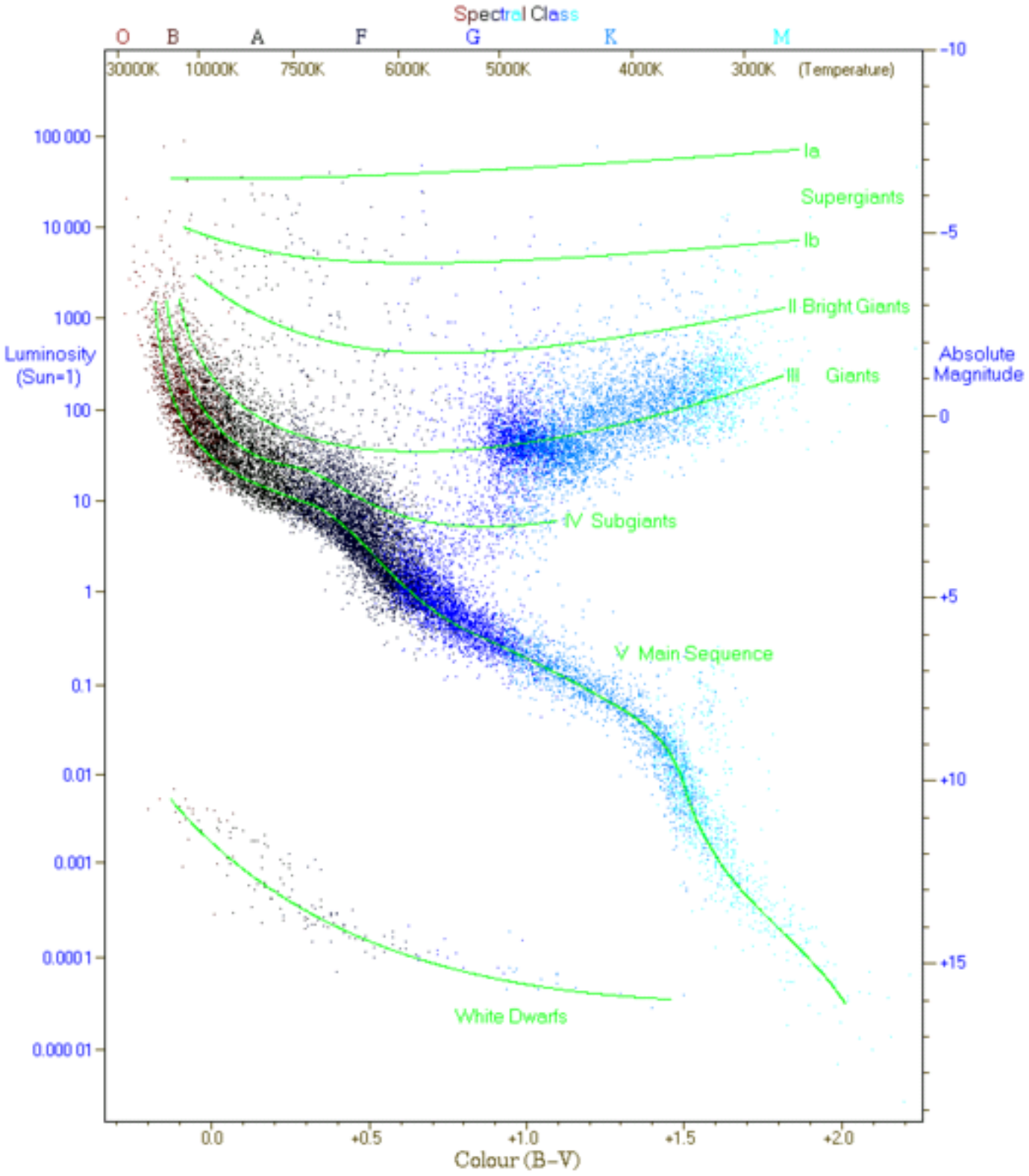
The hydrogen Balmer spectrum is visible for most stars. And astronomers catagorized stars according to the strength of the hydrogen absorption lines in the spectrum in the late 19th century.



The spectral sequence is:
O, B, A, F, G, K, M
Hotter to cooler
(A temperature sequence)


Size of Star
Size of Earth's Orbit
Size of Jupiter's Orbit


40 Eridanus B


Spectral Class
O
B
A
F
G
K
M
30000K
10000K
7500K
6000K
5000K
4000K
3000K
(Temperature)
100 000
10 000
1000
100
10
1
0.1
0.01
0.001
0.0001
0.000 01
Luminosity
(Sun=1)
-10
-5
0
+5
+10
+15
Absolute
Magnitude
Ia
Supergiants
Ib
II Bright Giants
III Giants
IV Subgiants
V Main Sequence
White Dwarfs
0.0
+0.5
+1.0
+1.5
+2.0
Colour (B–V)

For T < 9100 K

$B-V = -3.684 \log(T) + 14.551$

For T > 9100 K

$B-V = 0.344 [\log(T)]^2 - 3.402 \log(T) + 8.037$

Using the above information, H-R diagram, and Stefan-Boltzmann law, calculate (a) distance, and (b) the radius of each star listed below. (with appropriate comparable units such as $R_\odot$, $R_\oplus$, AU's.) For accurate calculations, use $\sigma = 5.6703 \times 10^{-5}$ erg/(cm^{2}K^{4}sec), 3.906×10^{33} erg/sec $\equiv 1L_\odot$, and $1M_\odot = 1.99\ X\ 10^{33}$g. For 40 Eridani, calculate the average density of the star.

Name	Note	m	M	B – V	Mass
Betelgeuse	Right shoulder of Orion	+0.4	-5.6	+1.85	
Aldebaran	Eye of the bull	+0.9	-0.7	+1.54	
40 Eridani B		+9.52	10.999	+0.0731	0.501 $M_\odot$
Sirius A	Brightest star seen from Northern Hemisphere	- 1.46	1.5	0.00	
Sirius B		+8.7	11.6	+1.08	

Here is the data of a star known as Eye of the Devil, called Tascotch 666a.

Distance: 2800 pc
M: +13
Luminosity Class: Main Sequence
B magnitude: + 26.4

Calculate/estimate the following

(a) Stellar parallax angle

(b) V magnitude

(c) m

(d) Surface temperature

(e) Radius