**PHYS 375; PS3**

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Code can be found at <https://github.com/Morhc/PHYS-375---Problem-Set-3>

**Declaration of Collaboration**

While working on this problem set, I discussed approaches to question 3 with Suhail Chander.

**Question 2**

**Question 3**

3a)

Text, letter

Description automatically generated

3b)

Text, letter

Description automatically generated

3c)

Text, letter

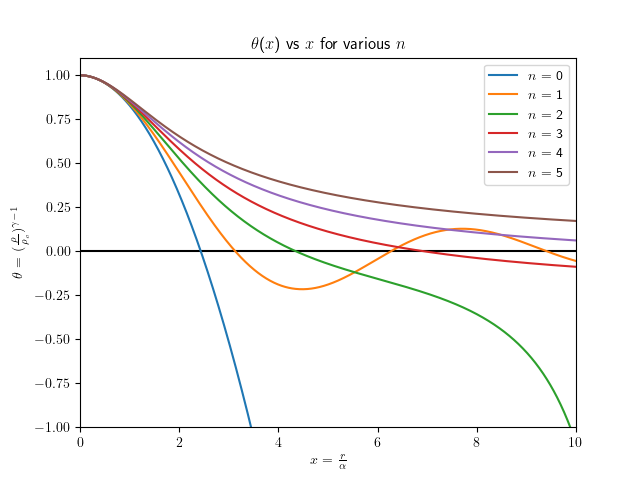
Description automatically generated

3d)

Text, letter

Description automatically generated

3e, f)



Text, letter

Description automatically generated

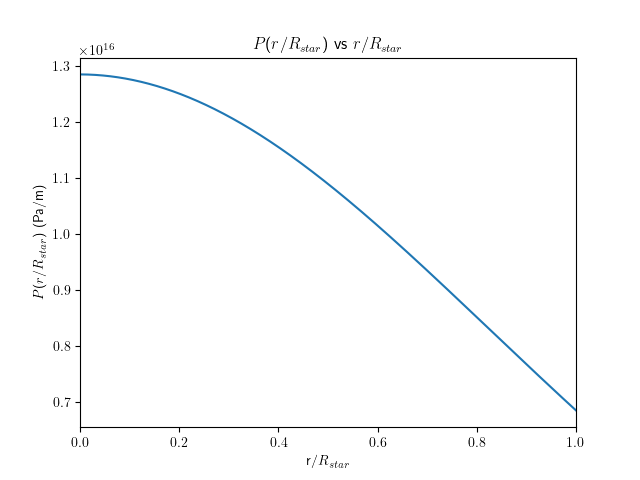
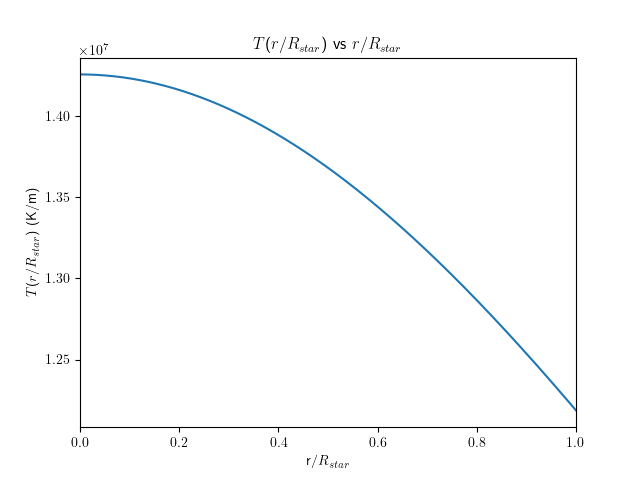
3g) The results for the variables are:

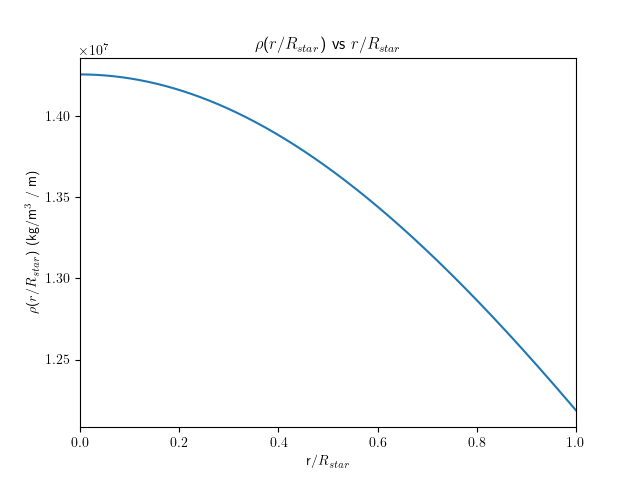
α = 1.00 \* 108 m [assuming that x is dimension-less]

ρc = 7.80 \* 104 kg/m3

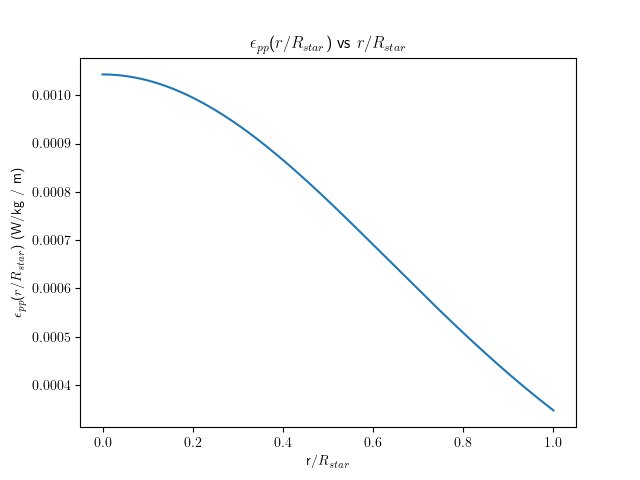
K = 3.86 \* 109 [dimension-less]

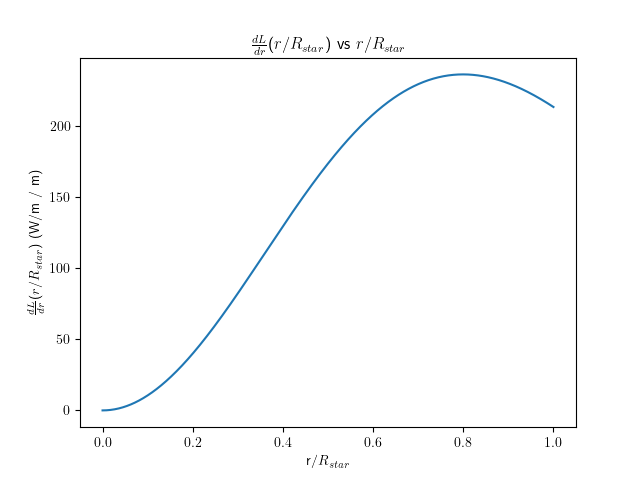
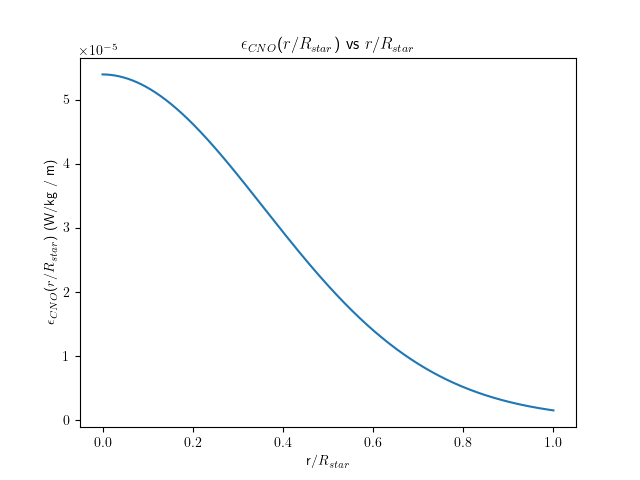
3h)





3i)





The total luminosity of the star is 4.88 \* 1028 W.[[1]](#footnote-1)

3j)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mass/Msun | Radius/Rsun | ρc (kg/m3) | Tc (K) | Total L (W) |
| 1 | 1 | 7.80 \* 104 | 2.85 \* 107 | 4.88 \* 1028 |
| 0.5 | 0.6 | 1.80 \* 105 | 1.19 \* 107 | 2.68 \* 1028 |
| 20 | 10 | 1.56 \* 103 | 1.43 \* 107 | 3.44 \* 1032 |

We can see that the lower mass star has a greater density, and the greater mass star has a lower density than the solar mass star; each differs by a factor of 10 from the next. The luminosities for the lower mass star and the solar mass are on the same order, but the higher mass star has a luminosity that is 10,000 times greater than the other two. Interestingly, all the core temperatures are the same order.

1. Yes, I know this is not in line with the expected 1026 W. [↑](#footnote-ref-1)