Stellar/Planetary Atmospheres

Problem 2: The opacity in a H and He atmosphere

Compute the b-f absorption and scattering coefficients in cm^2/g for a H-He mixture with 91% H and 9% He. Equations and tables for the cross sections are given in the script. Plot the results as functions of wavelength (from 10 Å to 100μ) for $T = 1000$, 3000, 5000, 8000, 10000, 50000, and 100000 K at a gas pressure of $P_\mathrm{g} = 100$. Calculate the Rosseland and Planck means of the opacities and plot them as functions of temperature and gas pressure.

What happens to the opacities when you change the partition function of neutral hydrogen by a factor of two? What are the dominant sources of absorption at the different temperatures? At which temperature (if ever) is the b-f absorption from the $n = 10$ level of hydrogen larger than that of the $n = 1$ level (at their respective thresholds)? At which conditions is scattering most important?