Astrophysics

Compulsory Home Exercises. Problem Set 5.

Return by Monday, April 15, 2026.
Please, write down **every step in your line of thinking** and state assumptions etc.
A sole answer is not enough.

1. In terms of the specific intensity I, which of the listed below is the correct expression for the amount of radiation flowing per unit time, per unit solid angle through a unit area at an angle to the normal?

   (a) $I \sin\theta$
   (b) $I\ \theta$
   (c) $I \cos\theta$
   (d) $I \cos\theta\ \sin\theta$
   (e) I

2. Which 2 opacity sources do dominate in a stellar atmosphere ($T_{\rm eff}$=8064 K, $P_{\rm e}$=30 dyn/cm^2) at 5000Å and 18000 Å?
   Is the contribution of the second one negligible enough to be not taken into account?

3. Calculate the ratio of the absorption coefficients due to bound-free absorption above and below the Balmer edge (Balmer jump) for a hydrogen atmosphere with $T_{\rm eff}$=9520K.

4. Balmer hydrogen lines are not seen in the spectra of either O stars or K stars. Why not?

5. An F star has a temperature $T_{\rm eff}$=7000 K. Microturbulence in the atmosphere has RMS velocity $\xi_{\rm t}$=3 km/s. Determine the FWHM of an optically thin line of iron with wavelength 4000 Å. Assume that no pressure effects are present.

6. Determine the FWHM of an optically thin line which is broadened due to both the quadratic Stark effect with the FWHM of $\Delta\lambda_{1/2}$=3 Å, and other pressure effects with the FWHM of $\Delta\lambda_{1/2}$=0.5 Å.