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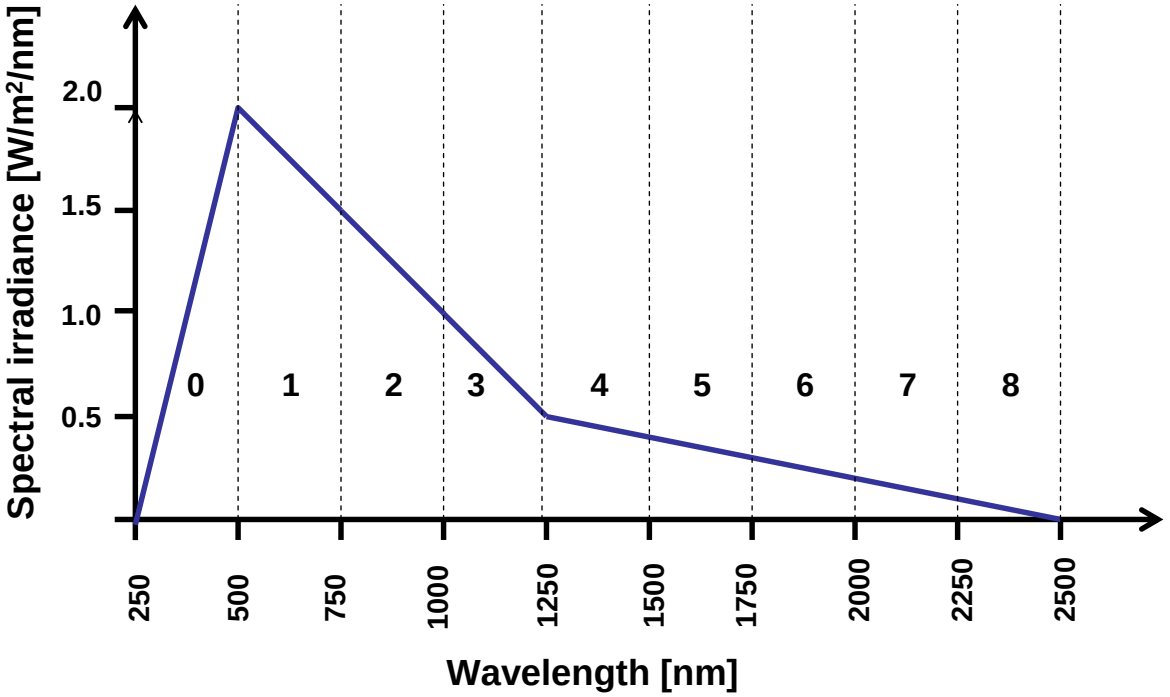
Exercises "Advanced materials B"

#9

Exercise 9: Optical power

The following image is an approximated plot of the spectral irradiance of the Sun.



1. Calculate the optical power density P_{opt} (W/m^2) of the section of the spectrum according to the last digit of your matriculation number.

2. From the Poynting vector it is possible to calculate the P_{opt} of the electromagnetic waves. The average power (calculated in 1) is equal to ½ E_0H_0. Calculate the values of H_0 and E_0. Hint: these parameters are related with each other through $\sqrt{\varepsilon_0 / \mu_0}$.

3. Calculate B_0 and D_0, considering that the light is observed in vacuum.

4. Which is the velocity of the light in a medium with refraction index equal to your matriculation number?

5. The flux of photons Φ ($1/cm^2s$) is calculated as the ratio P_{opt}/E, where E is the average energy of the photons. Calculate the average Φ for your segment of the Sun light spectrum.

6. Consider that the light incides on the photoelectric material X. If every 2 of the incident photons produce one electron, how large is the electric current density? How large is the efficiency of the material?