

HOMEWORK SET 23: WIEN DISPLACEMENT LAW

Due Friday, April 11, 2025

PROBLEMS FROM OR AFTER TREX¹

WHEN YOU GET A RESULT, COMMENT ON IT!! DOES IT MAKE SENSE, IS IT INTERESTING, IS IT RIDICULOUS AND INDICATE THAT THE MODEL DOESN'T WORK VERY WELL?

TRex 3.18) Calculate the temperature if the spectra distribution peaks at **a)** gamma rays, $\lambda_\gamma = 1.50 \times 10^{-14}$ m; **b)** X-rays, $\lambda_X = 1.50$ nm; **c)** red light, $\lambda_{\text{red}} = 6.40$ nm; **d)** broadcast television waves, $\lambda_{\text{TV}} = 1.00$ m; and **e)** AM radio waves, $\lambda_{\text{AM}} = 204$ m; YOU MIGHT FIND EXCEL HELPFUL FOR THESE CALCULATIONS.

TRex 3.20) **a)** At what wavelength will the human body radiate the maximum radiation? **b)** Estimate the total power radiated by a person of medium build (assume an area given by a cylinder of 174-cm height and 12-cm radius) **c)** Using your answer to b), compare the energy radiated by a person in one day with the energy intake of a 2000-kcal diet. TAKE $T_{\text{HUMAN}} = 37^\circ\text{C}$, $1 \text{ kcal} = 4.184 \text{ kJ}$. THEN PONDER WHY IT IS THAT WE DON'T RADIATE OURSELVES TO DEATH.

TRex 3.21) White dwarf stars have been observed with surface temperatures as hot as $200,000^\circ\text{C}$. What is the wavelength of the maximum intensity produced by the star?



<https://mimiandeunice.com/2011/09/26/let-your-thermal-radiation-emit/>

¹ Thornton and Rex, *Modern Physics for Scientists and Engineers*, 3rd Edition, Cengage Learning, 2013