

Homework Assignment #5

1. A 200-W infrared laser emits photons with a wavelength of 2.0×10^{-6} m while a 200-W ultraviolet light emits photons with a wavelength of 7.0×10^{-8} m. (a) Which has greater energy, a single infrared photon or a single ultraviolet photon? (b) What is the energy of a single infrared photon and the energy of a single ultraviolet photon? (c) How many photons of each kind are emitted per second?
2. What is the energy of a photon of light of wavelength $0.70 \mu\text{m}$?
3. Find the (a) wavelength and (b) frequency of a 3.1-eV photon.
4. The photoelectric threshold frequency of silver is 1.04×10^{15} Hz. What is the minimum energy required to remove an electron from silver?
5. A rubidium surface has a work function of 2.16 eV. (a) What is the maximum kinetic energy of ejected electrons if the incident radiation is of wavelength 413 nm? (b) What is the threshold wavelength for this surface?
6. A clean iron surface is illuminated by ultraviolet light. No photoelectrons are ejected until the wavelength of the incident UV light falls below 288 nm. (a) What is the work function (in eV) of the metal? (b) What is the maximum kinetic energy for electrons ejected by incident light of wavelength 140 nm?
7. What is the temperature of an ideal gas whose molecules have a mean kinetic energy of 3.2×10^{-20} J? The gas also contains smoke particles of mass 1.38×10^{-17} kg which are in thermal equilibrium with the gas molecules. What is their rms speed?
8. A system takes in 550 J of heat while performing 840 J of work. What is the change in the internal energy of the system? If these processes occur at a constant temperature of 20°C what is the entropy change of the system? Are the changes reversible or irreversible?