Environmental Science, Problems Chapter 2

2.1.1

Calculate the speed of light in a medium with refractive index $n = 1.52$.
Answer: $1.97 \cdot 10^8$ m/s

2.1.2

A light wave with wavelength 555 nm enters a medium with $n = 1.35$. Calculate the wavelength in the medium.
Answer: 411 nm

2.1.3

A photon has the wavelength 633 nm. Calculate the energy of the photon in eV.
Answer: 1.96 eV

2.2.1

A glowing body has its maximum of intensity at 730 nm. Calculate temperature of the body in K.
Answer: 3970 K

2.2.2

The emitted energy per time and area from a body is e_0 at 300 K. How large is the emitted energy at 400 K?
Answer: 3.2 e_0

2.4.1

Calculate the velocity of the carbon monoxide molecule if it is found in the atmosphere and if the temperature is 20 °C = 293 K. The mass of the CO molecule is 12 + 16 u = 28 u, where 1 u = $1.67 \cdot 10^{-27}$ kg. Apply statistical physics.
Answer: 509 m/s

2.4.2

Calculate the velocity of the ozone molecule if it is found near the ground and if the temperature is 25 °C = 298 K. The mass of the O_3 molecule is 3·16 u = 48 u, where 1 u = $1.67 \cdot 10^{-27}$ kg. Apply statistical physics.
Answer: 392 m/s

2.4.3

Looking at the development of the concentrations of ozone from 1978 until 2006, one finds a slight decrease in the atmospheric ozone concentration. Find the decrease in concentration in DU year 2006 if we start at 329 DU 1978 and the slope is -0.07% annually.
Answer: -0.020 DU

2.7.1

Calculate the wavelength maximum if the mean temperature of the Earth has increased to 20 °C.
Answer: 9.9 μm

2.7.2

Calculate the total emitted radiation if the mean temperature of the Earth has increased to 20 °C.
Answer: 420 W/m^2