

Exercise 5.2.5 Rayleigh Scattering

Illustration

1. Generate some numbers for *scattering cross sections* using the [equations given](#).
 - Look, e.g., at "air" molecules including some water vapor or ozone as scatterers, and wave lengths from the IR to the UV.
2. Derive or justify the equation $I_{sc} = 1/n\sigma$. Show that for air we get $I_{sc} (=) 160 \cdot \lambda^4$ if we give I in km and λ in μm .
 - *Hint 1:* Consider the particle to be a cube with σ being the area of a face. All light will be scattered if the total area of those cubes projected on a surface perpendicular to the light beam covers that area completely. λ_{sc} then is the length of a cube that contains enough particle to meet that condition.
 - *Hint 2:* The volume of an air "molecule" can be estimated from the fact the *liquid* air has about the same density as water.
3. Generate some numbers for penetration depths in air. How thick does an ozone (O_3) layer with a density $n_{\text{O}_3} = 8 \text{ ml/m}^3$ have to be to absorb most of the incoming ultraviolet radiation (especially "UV-B"; $\lambda \approx 300 \text{ nm}$)

Link to the [solution](#)