# ATMS 458: Practice Problems on Measures of Composition

1. The OH radical has an average number density that is nearly constant with altitude at ~ $1x10^{6}$ molec $cm^{-3}$. Does the mixing ratio change with altitude? To check determine what the OH mixing ratio is at the surface: P ~ 1 atm, T ~ 288K? Now calculate the mixing ratio at 10 km altitude: P ~ 0.260 atm, T ~ 220 K.

2. Over the oceans, sea salt aerosols can affect visibility and marine clouds. If the typical number concentration of 10 μm diameter particles is 10 per $cm^3$, what is the mass concentration (density = 2 g $cm^{-3}$) of sea salt? What is the volume mixing ratio of sea salt ($cm^3$ of sea salt per $cm^3$ of air) in units of parts per billion?

3. $CO_2$ is ~380 ppm throughout the atmosphere. What is the partial pressure of $CO_2$ at the surface? Does the partial pressure of $CO_2$ vary with altitude?

4. Methane has a constant mixing ratio throughout the troposphere of 1.76 ppm. If the total pressure as a function of altitude can be calculated by P(z) = P(z=0)*exp(-z/H) where H = 7.4 km, calculate the atmospheric column of methane in units of molecules per $cm^2$.