Composition Assignment

A weather station reports T = 293 K, RH = 50% at sunset. Assuming that P_{H2O} remains constant, by how much must the temperature drop over the course of the night in order for fog to form?

What is the mass concentration of water vapor (g H_2O per m^3 of air) in a liquid-water cloud at a temperature of 273 K? Considering that the liquid water mass concentration in a cloud ranges typically from 0.1 to 1 g liquid water per m^3 of air, is most of the water in a cloud present as vapor or as liquid?

Calculate the mixing ratio of O_3 at the peak of the O3 layer (z = 25 km; P = 35 hPa; T = 220 K). Would this mixing ratio be in violation of the EPA air quality standard if it were found in surface air? Assume the number of molecules is 5*10^12 per cm^3.

Calculate the mixing ratio of O_3 in surface air (z = 0 km; P = 1000 hPa; T = 300 K). Is it in compliance with the EPA air quality standard? Notice that the relative decrease in mixing ratio between 25 km and the surface is considerably larger than the relative decrease in number density. Why is this? Assume the number of molecules is 1*10^12 per cm^3 at the surface.

Give a rough order of magnitude for the number of molecules present in a typical 1 micrometer aerosol particle.