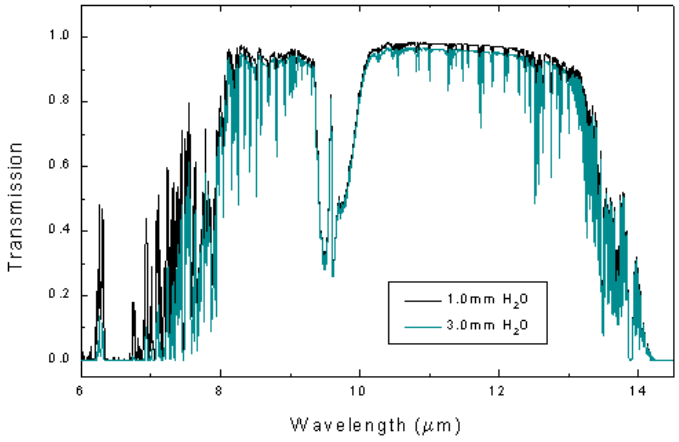
Name_____

1. Briefly explain the following:

   a. Two sealed chambers contain the same amount of water vapor and are at the same temperature. One contains only water vapor while the other holds a mixture of water vapor and air. Which has the smaller transmissivity averaged over a narrow spectral region containing a single water vapor absorption line?

   b. Consider the following atmospheric spectra



   Two sealed cells contain some amount of water vapor and air. The concentration of water vapor in one cell is adjusted so that the transmission of the ~9.8 μm radiation through one cell matches the transmission of 6.3 μm radiation through the other cell. Which cell contains the most water?

   c. The rotational-vibrational spectra of CO_2 exhibits absorption lines that are regularly spaced whereas absorption lines of H_2O are more randomly distributed in the spectrum.

2. Derive a formula that gives the line intensity, S(T), at some temperature T in terms of a reference temperature T_0.

3. A measurement is made along a 100 m atmospheric path at a pressure of 1 atm and temperature of 296 K. Assuming that only the $8_{7\ 2} \leftarrow 7_{4\ 3}$ line of water vapor absorbs radiation in your experiment and that the spectral parameters for this line are $S=5.66 \times 10^{-22}$ cm^{-1}/(molecule cm^{-2}), $\omega_0=695.4530$ cm^{-1}, and the halfwidth is $g=0.0643$ cm^{-1}/atm. Calculate the transmission at 659.44 cm^{-1} and at 657.51 cm^{-1} and compare the results.