Handin Homework 1

1. The density of water at 20°C is 0.99821 g mL^{-1}. The vapor pressure of water at 20°C is 2.339 kPa (17.535 torr). The atmospheric pressure is 1.000 bar. Calculate the maximum height of a column of water in a closed end manometer.

2. Calculate the molar volume, the molar density, and the mass density of an ideal gas at 25.0°C and 1.00 bar pressure. Assume the gas is air. (The molar density is n/V).

3. Calculate the altitude in the atmosphere that corresponds to a pressure of 0.500 bar if the surface pressure is 1.000 bar. Assume the temperature is constant at 18.0°C.

4. For liquids with moderate changes in pressure, the density is given by:

$$d = d_o [1 + \kappa (P - P_o)]$$

where κ is the isothermal compressibility, d_o is the density of the liquid at the surface pressure P_o and d is the density at final pressure P. (a). Show that the formula for the pressure as a function of depth is given by:

$$\frac{1}{\kappa} \ln(1 + \kappa (P - P_o)) = d_o g h$$

(b). Calculate the pressure in the Mariana Trench at a depth of 10911 m (35798 ft) given $\kappa = 4.587 \times 10^{-10}$ Pa^{-1} at 20°C. Use the density of pure water, 0.9982 g mL^{-1} at 1 bar, for this problem, instead of the density of sea water. Assume the surface pressure is 1.000 bar.