KMM2621 Physical Chemistry for Engineers

Homework 1 : Properties of gases

P1. Calculate the pressure exerted by 1.0 mol H_2S behaving as (a) a perfect gas, (b) a van der Waals gas when it is confined under the following conditions: (i) at 273.15 K in 22.414 dm^3 , (ii) at 500 K in 150 cm^3.

P2. Clyinder of compressed gas typically filled to a pressure 200 bar. For oxygen, what would be the molar volume at this pressure and 25°C based on (a) the perfect gas equation, (b) the van der Waals equation. For oxygen, a =1.364 dm^6 atm mol^{-2}, b=3.19 x10^{-2} dm^3 mol^{-1}.

P3. A vessel of volume 22.4 dm^3 contains 2.0 mol H_2 and 1.0 mol N_2 at 273.15 K initially. All the H_2 reacted with sufficient N_2 to form NH_3. Calculate the partial pressures and the total pressure of the final mixture.

P4. Derive an expression for the compression factor of a gas that obeys the equation of state $p(V - nb) = nRT$, where b and R are constants. If $V_m = 10b$, what is the numerical value of the compression factor?