

2.

(a) Compute the molar-specific volume (or ‘molar volume’) for a pure Helium ideal gas at room temperature ($T = 298$ K) and atmospheric pressure. Find the length corresponding to this volume. Will the answer differ if I choose nitrogen or any other ideal gas?

(b) Repeat the above but for a pure Helium van der Waals gas. Is a mole of He in the van der Waals gas larger or smaller than a mole of He in an ideal gas when T and P are fixed? Explain.

(c) Now consider T and v to be variables and consider the ratio of pressures, i.e. $Ratio = P(\text{van der Waal})/P(\text{ideal})$. Is the ratio larger or smaller than 1? Explain.

(d) Suppose that we adopt 5% as representing a significant departure in pressure from an ideal gas. Find the molar volume that makes $P(\text{van der Waal})$ differ from $P(\text{ideal})$ by 5%. What are $P(\text{van der Waal})$ and $P(\text{ideal})$ for this situation? What is the corresponding length? Comment on your result.