

1. Determine the molar volume of $N_2(g)$ at 500K and 600 bar according to the virial equation. The virial coefficient B of $N_2(g)$ at 500 K is $0.0169 \text{ L mol}^{-1}$. 10%
2. One mole of an ideal gas expands from 5 to 1 bar at 298K. Calculate the work (a) for a reversible expansion and (b) for an expansion against a constant external pressure of 1 bar. 15%
3. When one mole of an ideal monatomic gas is allowed to expand adiabatically and reversible from 22.7 L mol^{-1} at 1 bar and 0°C to a volume of 45.4 L mol^{-1} , the pressure drops to 0.315 bar. How much work is done in the adiabatic expansion? 20%
4. Half a mole of an ideal gas expands isothermally and reversibly at 298.5K from a volume of 10 L to a volume of 20 L. (a) What is the change in the entropy of the gas? (b) How much work is done on the gas? 15%
5. The quantity $\left(\frac{\partial U}{\partial V}\right)_T$ is called the internal pressure, how does the internal pressure of a van der Waals gas depend on the molar volume? 20%
6. (a) What is the ideal solution?
(b) Describe the Gibbs phase rule. 20%