

CHAPTER OVERVIEW

18: Partition Functions and Ideal Gases

In chemistry, we are typically concerned with a collection of molecules. However, if the molecules are reasonably far apart as in the case of a dilute gas, we can approximately treat the system as an ideal gas system and ignore the intermolecular forces. The present chapter deals with systems in which intermolecular interactions are ignored. In ensemble theory, we are concerned with the ensemble probability density, i.e., the fraction of members of the ensemble possessing certain characteristics such as a total energy E , volume V , number of particles N or a given chemical potential μ and so on. The molecular partition function enables us to calculate the probability of finding a collection of molecules with a given energy in a system. The equivalence of the ensemble approach and a molecular approach may be easily realized if we treat part of the molecular system to be in equilibrium with the rest of it and consider the probability distribution of molecules in this subsystem (which is actually quite large compared to systems containing a small number of molecules of the order of tens or hundreds).

[18.1: Translational Partition Functions of Monatomic Gases](#)

[18.2: Most Atoms are in the Ground Electronic State](#)

[18.3: The Energy of a Diatomic/Polyatomic Molecule Can Be Approximated as a Sum of Separate Terms](#)

[18.4: Most Molecules are in the Ground Vibrational State](#)

[18.5: Most Molecules are Rotationally Excited at Ordinary Temperatures](#)

[18.6: Rotational Partition Functions of Diatomic Gases Contain a Symmetry Number](#)

[18.7: Vibrational Partition Functions of Polyatomic Molecules Include the Partition Function for Each Normal Coordinate](#)

[18.8: Rotational Partition Functions of Polyatomic Molecules Depend on the Shape of the Molecule](#)

[18.9: Molar Heat Capacities](#)

[18.10: Ortho and Para Hydrogen](#)

[18.11: The Equipartition Principle](#)

[18.E: Partition Functions and Ideal Gases \(Exercises\)](#)

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