These are the topics and homework (HW) and practice problems (PP) relevant to each topic.

Partition functions of simple systems

(a) Computing the mean and variance in energy for systems with discrete energy levels. Specific examples include the two state and three state systems and the quantum harmonic oscillator. Interpreting the results.

- HW 4.4,HW 5.2, HW 5.3, HW6.3, HW6.4, PP1

(b) Partition function and probability of continuous systems. Phase space. Compute the partition function of particles in simple potentials. Interpret probability distributions and change variables. (See also the classical ideal gas problems, which also discusses these points)

- HW 4.5,HW 5.2, PP3

(c) Classical ideal gas in various dimensions:

- HW5.4, HW5. 5, HW 6.5, PP3

The equipartition theorem, thermodynamics, making estimates

(a) Adiabatic and Isothermal expansions simple engine cyles involving ideal gasses

- HW2.2, HW1.5, PP2

(b) The equipartition theorem and making estimates for the properties of diatomic and monoatomic gasses

- HW1.1, HW1.3, HW4.5(c), HW5.5(b), PP1(a)

Math you may need in physical problems

(a) Taylor series

- HW2.3, HW2.4, HW6.2, HW6.3, HW4.1(b)

(b) Gaussian integrals and the Γ function.

- HW1.4, HW2.2, HW2.4, HW4.3, HW6.5,

Basic Combinatorics and the Central Limit Theorem

(a) The combinatorics of choosing, the Stirling approximation, and the Shannon Formula

- HW3.3, HW4.1, HW4.2

(b) The central limit theorem and independent probability distributions

- HW3.4, HW4.4