

Lecture 17 — The Canonical Ensemble

Chapter 6, Monday February 18th

- Single-particle in a box (quantum mechanics)
- 3D particle in a box
- Factorizing the partition function
- Equipartition theorem
- Rotational energy levels in diatomic molecules

Reading: All of chapter 5 (pages 91 - 123)
Homework 5 due next Friday (22nd)
Homework assignments available on web page
Assigned problems, Ch. 5: 8, 14, 16, 18, 22

Quantum mechanics

The one-dimensional, time-independent Schrödinger equation:

$$\underbrace{-\frac{\hbar^2}{2m} \frac{\partial^2 \phi(x)}{\partial x^2}}_{\text{Kinetic energy}} + \underbrace{V(x) \phi(x)}_{\text{Potential energy}} = \underbrace{\varepsilon \phi(x)}_{\text{Total energy}}$$

$$K.E. = \frac{\hat{p}_x^2}{2m}; \quad \hat{p}_x = -i\hbar \frac{\partial}{\partial x}$$

For a region of constant potential:

$$-\frac{\hbar^2}{2m} \frac{\partial^2 \phi}{\partial x^2} = (\varepsilon - V) \phi$$

A single particle in a one-dimensional box

