

# Chemistry 120B – Physical Chemistry (Statistical Mechanics) (3 Units)

## Summary

Statistical mechanics is the second course of the Physical Chemistry series, which explains macroscopic systems like thermodynamics, equilibria, and kinetics using probability distributions. It is independent of Chemistry 120A; the two can be taken in either order.

## Prerequisites

- Math 53, 54 (Required)
- Chem 120A (Recommended, not required)

## Course Outline

1. Foundations of statistical thermodynamics
  1. Equilibrium states of macroscopic systems
  2. The Boltzmann distribution
  3. Partition functions
  4. Heat and work: The 1<sup>st</sup> law of thermodynamics
  5. Entropy: The 2<sup>nd</sup> law of thermodynamics
  6. Temperature, pressure, and chemical potential
  7. Heat capacity and stability
  8. Free energies and conjugate variables
2. Mass equilibrium
  1. Probability, chemical potential, and reversible work
  2. Chemical equilibrium
    1. Law of mass action
    2. Molecular partition functions
  3. Phase equilibrium
  4. Solutions
    1. Ideal solutions
    2. Dielectric solvation
    3. Electrolyte solutions
3. Dynamics
  1. Chemical kinetics
    1. Phenomenological laws

- 2. Transition state theory
- 2. Electron transfer

## Workload

- Weekly problem sets
- Two midterms, one final
- Three hours of lecture a week

## Choosing the Course

When to take:

Third years typically take the physical chemistry series, as this is an upper-division requirement for Chemistry and Chemical Biology majors. The class can be time-intensive with the problem sets, though not overly so. This class is *not nearly* the workload of Chem 120A. About 5-10 hours spent per problem set.

What next?

- Chem 125: Physical Chemistry Laboratory
- Chem 120A: Physical Chemistry (Quantum Mechanics)

## Additional Comments:

To reiterate, all Chemistry and Chemical Biology students have to take the 120 series! As a fair warning, this class can be demanding in terms of the problem sets and also requires you to be quite comfortable with the math involved, like partial derivatives, Taylor expansions, etc, but otherwise, this class is not math intensive like Chem 120A is. Also, this class overall is not nearly as demanding as is Chem 120A.

Most people think this class is pretty cool! You learn to derive many of the equations you saw in general chemistry.

It is perfectly fine to take Chem 120B before 120A! The two don't connect. Many people in 120B have not taken 120A. All that 120A does is give background information on some of the systems covered in 120A, but that background is easy to pick up on, in 120B.

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