Chem 231 Course Syllabus

Class topics

In progress. I will add and possibly rearrange some material. Please make suggestions.

Introduction

Electronic Structure and Reactivity

The Born-Oppenheimer Approximation

Potential Energy Surfaces and Vibronic Coupling

Principle of Microscopic Reversibility

Transition-State Theory

Hammond Postulate

Chemical Kinetics, Molecular Mechanisms, and Reaction Rate Laws

What is a Catalyst?

What is an Enzyme?

A Structural Molecular Biologist's Bias

Enzyme Kinetics

The Steady-State Approximation

Michaelis-Menton Kinetics

Statistical Treatment of Data

Enzyme Inhibition

Competitive Inhibition

Uncompetitive Inhibition

Mixed Inhibition

More Difficult Cases

Deriving complex equations via the King-Altman Method

Allosteric Interactions

Pre-Steady-State Kinetics

General Principles of Enzyme Catalysis

Some of these are quite controversial and are actively disputed by their critics.

Lock and Key vs. Induced Fit

Acid-Base Catalysis

Transition-State Stabilization

Intrinsic Binding Energy

Proximity Effect

Solvation and Entropic Effects

Electrostatic Effects

Surface Complementarity vs. Charge Complementarity

Orbital Steering

Low-Barrier Hydrogen Bonds

Other suggested contributions

Protein Enzymes and Ribozymes: Case Studies

Serine Proteases

Lysozyme

RNase A

Ribozyme Phosphodiester Isomerases

Enzyme Evolution

Ribozymes and the Origin of Life

The emergence of protein enzymes

The Ribosome is a Ribozyme

Enzyme in vitro Evolution

Catalytic Antibodies

in vitro selected ribozymes

Recent Developments