Course Syllabus

Ch21c. Physical Chemistry

Thermodynamics, Statistical Mechanics, and Chemical Kinetics

SPRING 2024

Instructors:

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LOCATION: B204 Noyes

Hours: TBD

Course Objective:

This course will introduce take the fundamental concepts you learned in quantum mechanics and spectroscopy (Ch 21a and 21b), and apply them to develop the machinery of statistical thermodynamics that we will then apply to classical thermodynamics and chemical reaction kinetics.

Required Texts:

1. Atkins (Peter Atkins; Julio de Paula; James Keeler), **Physical Chemistry**, 11th ed. Oxford University Press, Vol. 3 of edition 11e available electronically
2. Andrew Maczek; Anthony Meijer, **Statistical Thermodynamics**, Oxford University Press, 2nd ed.
3. Focus Area 13 (Statistical Thermodynamics) of Vol. 2 of the Atkins, 11th ed. will be made available through the library on the class Canvas site.

Recommended Texts:

Paul Houston, **Chemical Kinetics and Reaction Dynamics**, Dover Press, 2001.

Prerequisites:
Ch21ab, Ph1 and Ph2a, Ma1 and Ma2 or equivalents (linear algebra, matrices, vector calculus, differential equations), or taken concurrently. Ch41abc are highly recommended.
***see Instructor for permission if you do not meet these**

Students who have had more advanced preparation in statistical mechanics (e.g. Ph2c, Ph12c or BE25) SHOULD NOT TAKE THIS COURSE. They will receive credit for meeting option requirements. Contact Ch Option Rep and Registrar.

COURSE OUTLINE

I. Properties of Gases
Kinetic Theory of Gases: The Maxwell Distribution
Real Gases: Intermolecular Forces

II. Thermodynamics
First Law: Enthalpy, Thermochemistry
Second and Third Laws: Entropy,
Free Energies
Chemical Potential; Mixtures, Chemical Equilibrium

III. Statistical Mechanics
Probability Distributions, State Counting
Entropy
Partition Functions
Thermodynamic Functions
Chemical Equilibrium

IV. Applications
Phase Transitions
Real Mixtures

V. Kinetics of Chemical Reactions
Kinetics
Catalysis
Transition State Theory

VI. EXTRA TOPICS
Diffusion
Relaxation
Astrochemistry
Surfaces
Biological systems