Title: Biological Thermodynamics and Kinetics [2-1-0-3]

Content *:*

Thermodynamic functions – U, A, H, S and G.
The First law: work, heat, energy, heat transactions, enthalpy, standard enthalpy changes.
The Second law: entropy, entropy changes accompanying specific processes.
The Third law and Biology.
Chemical equilibrium: Gibb's energy minimum, description of equilibrium, How equilibria respond to pressure, temperature & pH.
Applications of thermodynamic principles to biological systems.
Statistical thermodynamics: distribution of molecular states (introduce molecular partition function), the internal & the statistical entropy, Boltzmann distribution.
Basic kinetic concepts: Reaction stoichiometry, rates of consumption & formation, extent of reaction, rate of reaction, Analysis of kinetic results, influence of temperature on reaction rates.
Theories of reaction rates: Kinetic theory of collision, transition state theory of reaction rates, potential energy surfaces and reaction dynamics; diffusion; kinetics of unimolecular and bimolecular reactions; application of kinetics to biological systems.
Catalysis: General catalytic mechanism (Arrhenius intermediate, Van't Hoff intermediate), Acid-base catalysis, acidity function, Enzyme catalysis, Michealis-Menten equation, Inhibition, effects of pH, Bisubstrate reactions (sequential reaction, ping-pong reactions).

Texts / References:
1. Biothermodynamics : the study of biochemical processes at equilibrium, Edsall, J.T., Gutfreund, H., Chichester : John Wiley, 1983
2. Biological thermodynamics, Haynie, D.T. Cambridge: Cambridge University Press, 2001
3. Thermodynamics and kinetics for the biological sciences Hammes, G.G. J Wiley 2000
4. Atkin's Physical chemistry. 8th ed. P W Atkins & J. dePaula, Oxford Univ Press, 2008