Study Guide for the Final Exam – Chem 391 - Fall 2018
Exam available by 9 AM on 12/11/18. Due on 12/12 by 5 PM.

This is a comprehensive exam, but is focused on the last half of the semester. All terms and concepts from the first half are in play, but they will mostly find application in the context of the material we have covered more recently. To prepare, see the web page for old reading assignments and problem set solutions. The final will assume familiarity with all material covered in lecture and problem sets, including papers read in class as groups.

Some info: R = 0.001987 kcal/mol•K = 0.0083145 kJ/mol•K; $E = E^\circ - (RT/nF)\ln Q$; $\Delta G = -nFE$

Basics

Amino acid and nucleotide structure
Basic thermodynamics and kinetics: ΔH and ΔS, ΔG° and K, $\Delta G^{\neq}$ and k
Intermolecular forces, especially H-bonding and hydrophobic effect
Secondary and tertiary structure in proteins and polynucleotides

Ligand Binding

Algebra of binding, determining K_d from experimental data
Protein-metal ion interactions
Carbohydrate chemistry, nomenclature, lectin binding
Antibody structure and function
Antigen and hapten binding

Enzyme Kinetics

Steady-state assumption and Michaelis-Menten equation
The kinetic constants (k_{cat}, V_{max}, K_m, k_{cat}/K_m, K_i) and their meaning
Competitive inhibition, Lineweaver-Burk plot
$\Delta\Delta G_{cat}^{\neq}$ and $\Delta\Delta G_{overall}^{\neq}$ and reaction profiles

Enzyme Catalysis

Transition state stabilization (catalytic antibodies)
General acid/base catalysis (triose phosphate isomerase, ketosteroid isomerase)
Nucleophilic/covalent catalysis (serine proteases, lysozyme, etc.)
Lewis acid catalysis by metals: electrophile activation, nucleophile stabilization
(nitrile hydratase, carbonic anhydrase)
Redox catalysis and tuning redox potential (superoxide dismutase, P450)

Specificity in Catalysis

aaRS and selectivity for amino acids, tRNA
Hopfield mechanism for kinetic proofreading (hydrolytic editing & GTP hydrolysis)
Ribosome structure and function: specificity and catalysis (entropy trap)
G-Proteins (EF-Tu and EF-G)

Name ***Sample Page***

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Chemistry 391
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Do not open the exam until ready to begin!

Rules of the Game:

This is a take-home Exam. The exam is due on Wednesday, December 12th at 5 PM. Otherwise, you may hand it in to me or to Kayla Johnston personally. DO NOT LEAVE IT IN MY MAILBOX OR SLIDE IT UNDER MY DOOR.

- You have **three** consecutive hours in which to take the exam.

- This is a **open** book/notes exam. You may use any printed or on-line resources available to you within the 3-hour period, so long as that resource does not include communication with a sentient being somewhere out there in the universe.

- You must do the work independently. You may not consult with others (see that thing about sentient beings above).

- You may contact me during the 3-hour exam period, my office number is 503-517-7679, and my cell number is 503-841-8173. Do NOT call after 9 PM. I can't promise to be available except during work hours, but if you contact me before starting the exam, I can tell you whether or not I'll be around.

- Unless stated otherwise, the temperature is 298 K. R = 0.001987 $^{kcal}/_{mol \cdot K}$ and F = 96485 C/mol e^-. $E = E^\circ - (RT/nF)\ln Q$; $\Delta G = -nFE$

Note that there are X pages to this exam, including this front page.