September 16, 2009

Course: CHMC21H3F, Topics in Biophysical Chemistry

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Required Text: I. Tinoco, K. Sauer, J. C. Wang, and J. D. Puglisi, *Physical Chemistry: Principles and Applications in Biological Sciences*, 4th Edition (Prentice-Hall, Upper Saddle River, New Jersey, 2002). (The textbook on sale in the UTSC bookstore is a corrected version of the one printed in 2002. However, both version have the 2002 copyright symbol and the same ISBN number 0-13-095943-X. The textbook I have put on reserve in the UTSC library is the earlier version as I do not have the version with the 2003 corrections.)

Marking Scheme for CHMC21H3F, 2009

Problem Sets	60%
Final Exam	40%
TOTAL	100%

There will be 4 or 5 problem sets which will all have the same value.
Course Description in Calendar: Advanced Topics in Physical Chemistry with emphasis on biochemical systems. Spectroscopic methods for (bio) molecular structure determination, including IR, NMR, UV/VIS; colloid chemistry; polymers and bio-polymers, bonding structure and statistical mechanics; physical chemistry of membranes, active transport and diffusion; oscillatory (bio)chemical reactions.

Course Outline: *The Course Description in the UTSC Calendar does not follow the order in which the corresponding topics appear in the textbook. In lectures I will follow the order in which the topics appear in the textbook. Also, it is clear that we will not have time to cover all of the textbook so I shall select/compress topics accordingly.*

The following represents the order in which I hope to cover topics. I modify it slightly but will inform you of any changes.

I will talk about a few selected topics in Chapters 2–5 (see details below). Much of the material in these chapters was covered in CHMB20H3F and I will not repeat it. However, if there is a

demand I will post my lecture notes from CHMB20H3F on the current course website. (I tend to lose thing so reposting the notes will overcome this problem.)

1. *Chapter 1:* I talk about gene expression—transcription and translation (pages 6–11). There is material on the world wide web which I will give you addresses for. If you cannot access these sites I will hand out copies of the material I have downloaded.

2. *Chapter 2:* This chapter covers the thermodynamic done in CHMB20H3Fi. There will be very little discussion of this material.

3. *Chapter 3:* I will discuss a configurational model of entropy called a lattice gas. This model corresponds to Boltzmann's formula $S = k \ln N$ (see textbook, page 68) and relates to entropies of mixing, gases, lattice models of polymers in dulte solution, etc. (Actually, the formula on the tombstone is $S = k \log W$; google images "boltzmann tombstone vienna"; it was the first image in the set.)

4. *Chapter 4:* Out of general interest read Sections: "Thermodynamics of Metabolism", "Biological Redox Reactions", etc. pages pages 165–176.

5. *Chapter 5:* Read sections on "Equilibrium Dialysis", "Scatchard Equation", pages 197–202. I will discuss in detail "Cooperative Binding and Anticooperative Binding" pages 202–206.

   I will make some comments about membranes (see text pages 213–227.)

6. *Chapter 6, Molecular Motion and Transport Properties:* I will treat many of the topics in this chapter in detail so read it all. Topics include: Kinetic Theory; Molecular Collisions; Mean Free path; Diffusion; Sedimentation, Molecular Weight Determination by Sedimentation, Viscosity and Electrophoresis; the size and shapes of molecules.

7. *Chapters 7, Kinetics: Rates of Chemical Reactions:* I will treat many topics in this chapter, summarizing the material covered in CHMB20H3F.

   Summary of the elementary parts of kinetics, e.g., the definition of the order of a reaction as you will already have some background in kinetics. Discussion of Transition State Theory and Diffusion Controlled Reactions.

8. *Chapter 8, Enzyme Kinetics*
   : I will discuss enzyme kinetics in detail since it is a fascinating topic. My approach may differ from the books in part and in mathematical details.

   If there is time I will discuss some aspects of oscillatory chemical reactions.

9. *Chapters 9–12:* I will not have time to treat the material in these chapters in detail. I do suggest you carefully read Chapter 11 on statistical mechanics.