CHEM 2360/ MBIO 2360/ CHEM 2860
BIOCHEMISTRY I: BIOMOLECULES AND AN INTRODUCTION TO METABOLIC ENERGY
FALL 2019

Instructors

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Lecture Notes

All students are required to purchase a mandatory course pack containing all of the lecture notes from the University of Manitoba Bookstore. Both lectures sections will be using these notes, but note that revisions may be made during the course***. A unique perforated tear-away page must be used as the cover page for the midterm examination. Exams will not be marked without this page.*** The course pack should be available in the bookstore by the end of August.

All other course material will be available to registered students through the UMLearn website (https://universityofmanitoba.desire2learn.com/d2l/login). ***Material presented in class takes precedence over all other material.***

Laboratory

Lab book (2019 Fall edition) is available at the bookstore. Labs begin the week of September 16-20th, and are held in Parker Building Rooms 406, 416, 422, and 428. Your lab room, lab partner and locker will be assigned to you and this information will be posted to the bulletin board located between 415 and 413 Parker prior to your first lab session. Students require a lab coat, googles and closed toe shoes to participate in labs. A USB key is required for Experiment 1.

In order to be eligible for a Lab Exemption, a student must have completed the Laboratory (practical + lab exam) with an overall grade in the Laboratory portion of the course no less than 70.0 %. Please note that you must also have completed the course (i.e. a VW is not allowed at any point if you wish to remain eligible for a future lab exemption).

Evaluation

Laboratory- practical		17.5%
Laboratory- exam	Monday Dec. 2nd, 6:00-7:30 PM	12.5%
Midterm Exam	Monday Oct. 28th, 6:00-8:00 PM	20%
Final Exam	TBA	50%

Students must receive a mark of at least 15/30 on the laboratory portion of the course (practical + exam) to get credit for the course.

There is no deferred midterm exam. For students who do not complete the midterm exam, the final exam will be pro-rated to 70%. ***NO EXCEPTIONS.***

There is no deferred lab exam.

Should major disruptions to University activities occur, the course content, marks breakdown, and other provisions of this document may be adjusted as the circumstances warrant.

Mark Breakdown

A+	90-100%
A	80-89%
B+	75-79%
B	70-74%
C+	65-69%
C	57-64%
D	50-56%
F	0-49%

Academic Misconduct

In the case of academic misconduct (cheating, plagiarism, etc.) the exam or paper in question will be given a grade of 0% and the student reported to the appropriate authorities for further punishment. It is up to the student to understand the rules of cheating and plagiarism. Please refer to the University of Manitoba General Academic Regulations and Requirements: (https://umanitoba.ca/student/resource/student_advocacy/academicintegrity/Academic-Integrity-policies-and-procedures.html).

Previous Examinations

Previous midterm and final examinations are available in the course pack. ***No answers will be provided.***

Course Outline

Biochem I is an introductory course dealing with kinds of molecules encountered in biochemistry, and the concept of metabolic energy as a product of catabolism and a requirement for biosynthesis.

1. **Water:** structure of liquid water; hydrogen bonding; electrostatic and van der Waals interactions; the hydrophobic effect; detergents. Ionization of water; strong and weak acids and bases; ionization constants; calculation of pH, and understanding titration curves; Henderson-Hasselbalch equation; buffers.

2. **Amino Acids:** structures of the 20 common amino acids found in proteins; properties and classification of the R-groups; stereochemistry; ionization properties, titration curves, and calculation of pH.

3. **Protein Structure:** the peptide bond; amino acid sequence (primary structure); secondary structure and H-bonding: alpha-helix, beta-sheets; disulfide bonds; tertiary structure and the hydrophobic effect; quaternary structure; folding and denaturation of proteins; prosthetic groups; methods of protein purification.

4. **Enzymes:** catalysis; the enzyme-substrate complex; transition state theory; how enzymes lower the transition state; chiral specificity of enzymes; fundamentals of enzyme kinetics, and the Michaelis-Menten equation; inhibitors and their effects on kinetics; allosteric enzymes.

5. **Carbohydrates:** structures of simple sugars: aldoses and ketoses; naming, and stereochemistry; hemiacetal and acetal chemistry; cyclic forms of monosaccharides, Haworth structures, mutarotation and reducing sugars; sugar derivatives; glycosidic bonds; oligosaccharides; polysaccharides, including their physical properties.

6. **Nucleic Acids:** purines and pyrimidines; structures and naming of nucleosides and nucleotides; the nucleic acids; DNA structure, including the double helix, Watson-Crick base pairs, denaturation; RNA and secondary structure; messenger, transfer and ribosomal RNA; mutations and oxidative damage to DNA.

7. **Lipids and Membranes:** properties of lipids; fatty acids and fats derived from them; storage and membrane lipids; phospholipids; glycolipids, including sphingolipids and gangliosides; steroids and terpenoids; beta-carotene and vision; cholesterol and other steroids; composition of biomembranes; facilitated diffusion and active transport mechanisms.

8. **Bioenergetics:** brief review of thermodynamic concepts; free energy as a means of understanding metabolism; standard free energy change and its measurement from equilibrium constants or cell potentials; redox reactions; biochemical electron carriers; ATP and its central role as storage form and source of free energy.

9. **Glucose metabolism:** glucose oxidation by cells as a source of ATP; detailed description of glycolysis and the tricarboxylic acid cycle; fate of pyruvate under anaerobic conditions; the electron transport chain; mechanism of oxidative phosphorylation; calculations of ATP yield.