Grande Prairie Regional College

DEPARTMENT OF SCIENCE

CHEMISTRY 2630 (Winter 2004)

INSTRUCTOR: Dr. Som K. Pillay
(Office: E 308; Tel: 539-2985)

PREREQUISITE: CH 1010, 1020 and CH 2610

TRANSFER CREDITS: U. of Alberta: CHEM 263, 3 Credits

LECTURES: Mondays & Wednesdays
8:30 - 9:50 AM (J 203)

SEMINARS: Fridays (J 203)
8:30 - 9:50 PM

LABORATORY: Tuesdays
2:30 - 5:20 AM (J 116)

TEXT BOOKS AND LABORATORY ITEMS:

L. G. Wade, Jr., *Organic Chemistry*, Fifth Edition, Prentice-Hall, Inc., 2003.

L. M. Browne, *Experiments in Organic Chemistry, Chemistry 263*, 2003-2004 edition, University of Alberta, 2003.

Hardcover Laboratory Note Books, Lab Coats and Safety Glasses

Molecular Model Set and Chemist's Triangle

Web Pages: http://www.pillai.ca/som/
http://webct.gprc.ab.ca/CH2630_A3/

COURSE EVALUATION

THEORY:

Assignments/Quizzes	10.0 %
Mid-term Examination (Week of February 23)	27.0 %
Final Examination (Week of April 20)	38.0 %
	75.0 %

Note: *Students must obtain a minimum mark of 50 % in the theory component to pass the course. There will be no supplemental exam or re-examination.*

LABORATORY:

General Competence in the Laboratory, Experimental Results, Lab Reports, Lab Quizzes, and Lab Exam:	25.0 %

Note: *Students must obtain a minimum mark of 60 % in the laboratory component to pass the course.*

Descriptor	Grade	Points	Descriptor	Grade	Points
Excellent (84% - 100%)	*A+*	*4.0*	***Satisfactory (60% - 71%)***	*C+*	*2.3*
	A	*4.0*		*C*	*2.0*
	A-	*3.7*		*C-*	*1.7*
Good (72% - 83%)	*B+*	*3.3*	***Poor***	*D+*	*1.3*
	B	*3.0*	***Minimal Pass***	*D*	*1.0*
	B-	*2.7*	***Fail***	*F*	*0*

Note: Other institutions may not consider grades of D sufficient to award transfer credit.

COURSE OUTLINE

EMPHASIS IS PLACED ON UNDERSTANDING OF PRINCIPLES AND THE ABILITY TO USE PRINCIPLES TO SOLVE PROBLEMS.

1. ELECTROPHILIC AND NUCLEOPHILIC AROMATIC SUBSTITUTIONS

Structure and Stability of Aromatic Compounds; Aromaticity; Huckel's Rule; Nomenclature of Aromatic Compounds.

Electrophilic Aromatic Substitution: The Arenium Ion Mechanism; Reactivity in Substituted Benzene Rings; Directing Effects of Substituents; Nitration; Halogenation; Sulfonation; Diazonium Coupling; Friedel-Crafts Alkylation & Acylation.

Nucleophilic Aromatic Substitution: The Addition-Elimination Mechanism; The Elimination-Addition Mechanism; Benzyne Intermediates; Oxidation & Reduction Reactions of Aromatic Compounds.

Chapters: 16 & 17; Problem Sets: 1, 2, & 3

2. INTRODUCTION TO SPECTROSCOPY

Principles of UV, IR NMR & MS and their Applications to Structural Elucidation of Organic Molecules.

Chapters: 12, 13 & 15; Problem Set: 4

3. AMINES

Nomenclature; Structure & Basicity; Amines as Nucleophiles; The Hofmann Elimination; The Cope Elimination; Arenediazonium Salts; Semi-Pinacol Rearrangement; The Hofmann Rearrangement.

Chapter: 19; Problem Sets: 5 & 6

4. NUCLEOPHILIC ADDITION TO THE CARBONYL GROUP

Nomenclature of Aldehydes and Ketones; Review of Synthesis of Ketones and Aldehydes; Structure and Reactivity of the Carbonyl Group; Addition of HCN, Water, Alcohols, Thiols, and Amines; Addition of Organometallic Reagents; Oxidation and Reduction of Aldehydes and Ketones;

Chapter: 18; Problem Sets: 7 & 8

5. NUCLEOPHILIC ACYL SUBSTITUTION

Nomenclature of Carboxylic Acids and Their Derivatives; The Tetrahedral Mechanism; Structure and Reactivity; The Chemistry of Carboxylic Acids, Acid Chlorides, Anhydrides, Esters, & Amides; Organometallic Reagents; Reduction Reactions.

Chapters: 20 & 21; Problem Sets: 9, 10, & 11

6. CARBANIONS

Stability & Structure of Carbanions; Enols and Enolate Ions; Halogenation of Ketones; Alkylation of Enolate Anions; Enamine Synthesis; The Cannizzaro Reaction; The Wittig Synthesis; The Aldol Condensations; The Claisen Ester Condensations; Ambident Nucleophiles; Acetoacetic Ester Synthesis; Malonic Ester Synthesis; The Michael Reaction; The Robinson Annulation.

Chapter: 22; Problem Set: 12

SPECIAL TOPICS

7. BIOMOLECULES

A. **Carbohydrates** - Structure and Nomenclature of Carbohydrates; Chemistry of Monosaccharides; Nucleosides and Nucleotides; Glycolysis.

B. **Proteins:** - Structure, Properties and Synthesis of Aminoacids; Proteins & Enzymes; Nucleic Acid & Protein Synthesis.

Chapters: 23 & 24; Problem Set: 13

LECTURE SESSION

Regular attendance of lectures/seminars is essential to achieve a good understanding of the course material. You are encouraged to ask questions and to participate in class discussions. Help is also available outside the classroom. **NO APPOINTMENTS ARE NEEDED.**

TENTATIVE LECTURE SCHEDULE

WEEK OF	CHAPTER*	TOPICS
Jan. 5	16 &17	Electrophilic & Nucleophilic Aromatic Substitution
12	16 &17	Electrophilic & Nucleophilic Aromatic Substitution
19	16 &17	Electrophilic & Nucleophilic Aromatic Substitution
26	12 & 13	Introduction to Spectroscopy
Feb. 2	13	Introduction to Spectroscopy
9	13 & 15	Introduction to Spectroscopy
16	-	*** WINTER BREAK ***
23	19	The Chemistry of Amines
Mar. 1	18	Nucleophilic Addition to Carbonyl Group
8	18	Nucleophilic Addition to Carbonyl Group
15	20 & 21	Nucleophilic Acyl Substitution
22	20 &21	Nucleophilic Acyl Substitution
29	22	Carbanions
Apr. 5	22	Carbanions
12	23 & 24	Special Topics
19	-	*** FINAL EXAM ***

***TEXT:** L. G. Wade, Jr., *Organic Chemistry*, Fifth Edition, Prentice-Hall, Inc., 2003.

READING AND PROBLEM ASSIGNMENTS

Problem solving is an essential part of this course. It will guide your study in the right direction and also will help you to monitor your performance in the course.

Approximately ten questions will be assigned as homework every week. However, you are encouraged to solve as many additional problems as you can. It is important that you work out these problems independently. Seek help with the ones you cannot solve yourself. Unless instructed otherwise, Assignments are due on Fridays at 10:00 AM. **NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!**

LABORATORY SESSION

Laboratory sessions start at 10:00 AM sharp. Surprise Lab Quizzes will be administered at the beginning of the laboratory period. All students are expected to come to the laboratory well prepared in the experiment that is to be performed and on time.

Students are expected to attend all laboratory periods. Absences due to illness must be substantiated by presenting suitable evidence to the Instructor/Lab Technician. An opportunity to make-up a lab will be given only for excused absences.

The laboratory experiments are designed to allow a well-prepared student to finish all the work within the allotted time. If necessary, melting points and weights of dry samples may be measured between 10:00 and 12:20 hours on Fridays. You may complete any other unfinished part of the experiment during the regular laboratory period the following week. **IT IS YOUR RESPONSIBILITY TO COMPLETE THE LAB ON TIME.**

LABORATORY REPORT

You must record everything you do and observe as you carry out your experiment. Use a hardcover laboratory notebook for this purpose. Do not copy the procedure from the laboratory manual. Keep your notebook neat. Your notebook will be checked periodically.

Formal lab reports should be written using the format given in your laboratory manual. The lab report should be handed in with your samples at the beginning of the next laboratory period. **NO LATE LAB REPORTS ARE ACCEPTED.**

TENTATIVE LABORATORY SCHEDULE

DATE	EXPERIMENT*
Jan. 13	1. Recrystallization Review
20	2. The Diels-Alder Reaction
27	3. Sodium Borohydride Reduction
Feb. 3	4. The Grignard Reaction
10	5. Spectroscopic Analysis
17	* **WINTER BREAK** *
24	* **Midterm** *
Mar. 2	6. Qualitative Organic Analysis
9	7. Qualitative Organic Analysis
16	8. Qualitative Organic Analysis
23	9. Practical Laboratory Test
30	10. Lab Exam
April 6	* **Check-out** *

***TEXT**: L. M. Browne, *Experiments in Organic Chemistry, Chemistry 263*, 2003-2004 Edition, University of Alberta, 2003.

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Send mail to pillay@gprc.ab.ca with questions or comments about this web site.

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