



Grande Prairie Regional College

DEPARTMENT OF SCIENCE & TECHNOLOGY

CHEMISTRY 2630 (Winter 2003)

INSTRUCTOR:	Dr. Som K. Pillay (Office: J 210; 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 (E 306A)
SEMINARS:	Fridays (E 306A) 8:30 - 9:50 AM
LABORATORY:	Tuesdays 10:00 - 12:50 AM (J 116)
TEXT BOOKS AND LABORATORY ITEMS:	L. G. Wade, Jr., <i>Organic Chemistry</i> , Fifth Edition, Prentice-Hall, Inc., 2003. L. M. Browne, <i>Experiments in Organic Chemistry, Chemistry 263</i> , 2002-2003 edition, University of Alberta, 2002. Hardcover Laboratory Note Books, Lab Coats and Safety Glasses. Molecular Model Set and Chemist's Triangle

Web Pages: <http://www.pillai.ca/som/>
<http://spillay/>



COURSE EVALUATION

THEORY:

Assignments/Quizzes	10.0 %
Mid-term Examination (Week of February 17)	27.0 %
Final Examination (Week of April 21)	<u>38.0 %</u>
	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 %
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Note: Students must obtain a minimum mark of 60 % in the laboratory component to pass the course.

Grade	Marks (%)	Grade	Marks (%)
9	90-100	5	56-65
8	80-89	4	50-55
7	74-79	3	45-49
6	66-73	2	36-44



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. 6	16 & 17	Electrophilic & Nucleophilic Aromatic Substitution
13	16 & 17	Electrophilic & Nucleophilic Aromatic Substitution
20	16 & 17	Electrophilic & Nucleophilic Aromatic Substitution
27	12 & 13	Introduction to Spectroscopy
Feb. 3	13	Introduction to Spectroscopy
10	13 & 15	Introduction to Spectroscopy
17	19	The Chemistry of Amines
24	-	* WINTER BREAK *
Mar. 3	18	Nucleophilic Addition to Carbonyl Group
10	18	Nucleophilic Addition to Carbonyl Group
17	20 & 21	Nucleophilic Acyl Substitution
24	20 & 21	Nucleophilic Acyl Substitution
31	22	Carbanions
Apr. 7	22	Carbanions
14	23 & 24	Special Topics
21	-	* 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!**

WEEK OF	CHAPTER*	PROBLEMS
Jan. 6	16	Problem Set I
13	17	Problem Set II
20	17	Problem Set III
27	12 & 13	Problem Set IV
Feb. 3	13	Problem Set IV
10	13 & 15	Problem Set IV
17	19	Problem Set V
24	17, & 19	Problem Set VI
Mar. 3	18	Problem Set VII
10	18	Problem Set VIII
17	20	Problem Set IX
24	21	Problem Set X
24	20 & 21	Problem Set XI
31	22	Problem Set XII
Apr. 7	22	Problem Set XII
14	23 & 24	Problem Set XIII

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



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. 14	1. Recrystallization Review
21	2. Sodium Borohydride Reduction
28	3. The Grignard Reaction
Feb. 4	4. The Conversion of Oil of Wintergreen to Aspirin
11	5. Spectroscopic Analysis
18	* Midterm *
25	* WINTER BREAK *
Mar. 4	6. Qualitative Organic Analysis
11	7. Qualitative Organic Analysis
18	8. Qualitative Organic Analysis
25	9. Practical Laboratory Test
31	10. Lab Exam
April 4	* Check-out *

*TEXT: L. M. Browne, *Experiments in Organic Chemistry, Chemistry 263*, 2002-2003 Edition, University of Alberta, 2002.

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