

DEPARTMENT OF SCIENCE & TECHNOLOGY

SEP 06 2000

CHEMISTRY 2630 (Winter 2000)

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
11:30 - 12:50 PM (J 201)

SEMINARS: Fridays (J 201)
11:30 - 12:20 AM

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

**TEXT BOOKS
AND LABORATORY
ITEMS:**

L. G. Wade, Jr., *Organic Chemistry*, 4th Ed., Prentice-Hall, Inc., 1999.

Experiments in Organic Chemistry, Chemistry 263, University of Alberta,
2000.

Hardcover Laboratory Note Books, Lab Coats and Safety Glasses

Molecular Model Set and Chemist's Triangle

Web Pages: <http://www.spillay.gprc.ab.ca/>
<http://www.abn.gpab.net/Som/>

COURSE EVALUATION

THEORY:

Assignments/Quizzes	10.0 %
Mid-term Examination (Week of February 14)	30.0 %
Final Examination (Week of April 17)	<u>40.0 %</u>
	80.0 %

Note: A Pass Grade is Essential for the Theory Component.

LABORATORY:

General Competence in the Laboratory, Experimental Results, Lab Reports, Lab Quizzes, and Lab Exam:	20.0 %
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Note: A Pass Grade is Essential for the Laboratory Component.

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

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: 3

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 Set: 4

5. **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 Set: 5

6. **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: 6 & 7

7. **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: 8

SPECIAL TOPICS

8. **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: 9

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	TOPICS
Jan. 3	Electrophilic & Nucleophilic Aromatic Substitution
10	Electrophilic & Nucleophilic Aromatic Substitution
17	Electrophilic & Nucleophilic Aromatic Substitution
24	Introduction to Spectroscopy
31	Introduction to Spectroscopy
Feb. 7	The Chemistry of Amines
14	Nucleophilic Addition to Carbonyl Group
21	* WINTER BREAK *
28	Nucleophilic Addition to Carbonyl Group
Mar. 6	Nucleophilic Acyl Substitution
13	Nucleophilic Acyl Substitution
20	Carbanions
27	Carbanions
Apr. 3	Special Topics
10	Special Topics
17	* FINAL EXAM *

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 11:30 AM. **NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!**

PROBLEM SET #	CHAPTER*	PROBLEMS
1	16	26, 28, 29, 31-34
2	17	42-47, 53-57, 63, 64
3	12	16, 20, 23, 25
	13	33, 36-38, 42-45, 47, 48
4	19	39, 40, 42-45, 47, 48, 52, 54, 56, 57, 59, 60
5	18	37, 41, 42, 49, 50, 54, 59, 63-65, 68, 70-72
6	20	24, 27-30, 32-43
7	21	44, 45, 48-50, 53-57, 60, 63-69
8	22	59, 60, 62-76, 79
9	23	TBA
	24	

*TEXT: L. G. Wade, Jr., *Organic Chemistry*, 4th Ed., Prentice-Hall, Inc., 1999.

LABORATORY SESSION

Laboratory sessions start at 5:00 PM 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 15:00 and 17:30 hours on Tuesdays. 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. 11	1. The Diels Alder Reaction
18	2. Friedel Crafts Alkylation
25	3. The Grignard Reaction
Feb. 1	4. Aspirin
8	5. Qualitative Organic Analysis
15	* Midterm *
22	* WINTER BREAK *
29	6. Qualitative Organic Analysis
Mar. 7	7. Qualitative Organic Analysis
14	8. Qualitative Organic Analysis
21	9. Lab Exam
28	* Check-out *

*TEXT: *Experiments in Organic Chemistry, Chemistry 263*, University of Alberta, 2000.

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Last modified: Monday, January 03, 2000