Grande Prairie Regional College

DEPARTMENT OF SCIENCE & TECHNOLOGY

CHEMISTRY 1610 (Winter 1996)

INSTRUCTOR: Dr. Som K. Pillay
(Office: E 309; Tel: 539-2985)

PREREQUISITE: CHEMISTRY 30

TRANSFER CREDITS: U. of Alberta: CHEM 161, 3 Credits

LECTURES: MONDAYS, WEDNESDAYS & FRIDAYS
11:00 - 11:50 AM (J 201)

SEMINARS: Thursdays (J 227)
9:30 - 10:50 AM

LABORATORY: Tuesdays
8:00 - 10:50 PM (J 116)

TEXT BOOKS AND LABORATORY ITEMS:

T. W. G. Solomons, Organic Chemistry, sixth Ed., John Wiley & Sons, 1995.

Experiments in Organic Chemistry, Chemistry 161, University of Alberta, 1995.

Hard-Cover Laboratory Note Book

Lab Coats and Safety Glasses

Molecular Model Set and Chemist's Triangle

10726-106 Ave., Grande Prairie, AB T8V 4C4 (403) 539-2911 FAX (403) 539-2832

COURSE EVALUATION

THEORY:

Assignments/Quizzes	*10.0 %*
Mid-term Examination (Week of February 13)	*30.0 %*
Final Examination (Week of April 15)	*40.0 %*
	80.0 %

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

LABORATORY:

General Competence in the Laboratory, Experimental Results, Lab Reports and Lab Quizzes:	*20.0 %*

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. STRUCTURE & BONDING:

Atomic Orbitals; Electron Configuration; Bonding; Lewis Structures; Molecular Orbitals & Bonding; Hybrid Orbitals; Delocalized Bonding & Resonance; Molecular Geometry; Electronegativity & Bond Polarity; Intermolecular Forces; Structural Formulas; Functional Group Classification of Organic Compounds; Properties and Molecular Structure.

Chapters: 1 & 2

2. INTRODUCTION TO ORGANIC REACTIONS:

Organic Reactions and Their Mechanisms; Acid-Base Reactions; Structure and Acidity; Effect of Solvent on Acidity; Relationship between K and ΔG°

Chapter: 3

3. INTRODUCTION TO STEREOCHEMISTRY:

Nomenclature of Alkanes and Cycloalkanes; Conformations of Cyclic and Acyclic Compounds; Steric Strain; Bicyclic & Polycyclic Compounds; Strained Carbocycles; Geometrical Isomerism; Stereoisomerism; Chirality & Optical Activity; Fisher Projections; Absolute Configuration; The Cahn-Ingold-Prelog System of Nomenclature; Enantiomerism; Racemates; Meso-compounds; Torsional Asymmetry.

Chapters: 4 & 5

4. NUCLEOPHILIC SUBSTITUTION AND ELIMINATION REACTIONS:

Nomenclature of Alkyl Halides; The S_N1 & S_N2 Mechanisms; Reaction Energetics & Kinetics Carbocations; The Effect of Substrate Structure; Stereochemistry of Nucleophilic Substitution; The Effect of the Leaving Group; The Effect of the Attacking Nucleophile; The Effect of the Reaction Medium; Rearrangements.

The E1 & E2 Mechanisms; The Effect of Substrate Structure; The Effect of the Leaving Group; Basicity Versus Nucleophilicity; The Effect of the Medium; The Direction of Elimination; Stereochemistry of Elimination; Isotope Effects; Elimination versus Substitution; The Chemistry of Alkyl Halides.

Structure and Nomenclature of Alkenes & Cycloalkenes; Stability of Alkenes. Dehydration of Alcohols; Dehalogenation of Vicinal Dihalides.

Structure & Nomenclature of Alkynes; Acidity of Alkynes; Acetylide Ions as Nucleophiles.

Chapters: 6 & 7

5. ELECTROPHILIC ADDITION TO CARBON-CARBON MULTIPLE BONDS:

The Mechanism of Electrophilic Addition; Structure & Reactivity; Orientation and Stereochemistry of Addition; Addition of X_2, HX, H_2O, HOX, and H_2; Hydroboration; Oxymercuration; Alkoxymercuration; Addition of Carbenes; Polymerization; Oxidation Reactions.

Structure & Nomenclature of Dienes; Addition to Conjugated Dienes; The Diels-Alder Reaction.

Chapters: 7, 8, 10 & 12

6. FREE-RADICAL ADDITION AND SUBSTITUTION REACTIONS:

The Reaction Mechanisms; Reaction Energetics & Kinetics; Structure & Stability of Free-Radicals; Halogenation of Alkanes; Free-Radical Addition to Carbon-Carbon Multiple Bonds.

Chapters: 9 & 12

7. *ALCOHOLS AND ETHERS:*

Structure & Nomenclature; Acidity of Alcohols & Phenols; Organometallic Reagents in Alcohol Synthesis; Metal Hydride Reduction of Carbonyl Compounds; Oxidation of Alcohols; Alcohols as Nucleophiles & Electrophiles; The Lucas Test; Dehydration of Alcohols; Pinacol Rearrangement; Periodic Acid Cleavage of Glycols.

Structure & Nomenclature; Synthesis & Reactions of Ethers and Epoxides.

Chapters: 10 & 11

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 class room. ***NO APPOINTMENTS ARE NEEDED.***

TENTATIVE LECTURE SCHEDULE

WEEK OF	*TOPICS*
Jan. 1	*Introduction*
8	*Structure & Bonding*
15	*Structure & Bonding*
22	*Introduction to Organic Reactions*
29	*Introduction to Stereochemistry*
Feb. 5	*Introduction to Stereochemistry*
12	*Nucleophilic Substitution & Elimination Reactions*
19	*Nucleophilic Substitution & Elimination Reactions*
26	**** WINTER BREAK ****
Mar. 4	*Nucleophilic Substitution & Elimination Reactions*
11	*Electrophilic Addition to Carbon-Carbon Multiple Bonds*
18	*Electrophilic Addition to Carbon-Carbon Multiple Bonds*
25	*Free-Radical Addition & Substitution Reactions*
30	*The Chemistry of Alcohols & Ethers*
Apr 1	*The Chemistry of Alcohols & Ethers*
8	*The Chemistry of Alcohols & Ethers*
15	** 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 home work 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 11:00 AM. ***NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!***

PROBLEM SET #	CHAPTER*	PROBLEMS
1	1	22,26,28,33-36,38,40,42
2	2	14,16,18,19,20,22,24
3	3	15-20,22,24,25,29,30,35,36
4	4	17,18,25,27,29,31-33,35,40
5	5	30, 32, 33, 35, 38-41
6	6	13-16, 19-23, 25-28, 29, 30, 32-34, 37-39
7	7	21-24, 26, 29, 34, 35, 37-41, 49
8	8	19, 20, 22, 24, 25, 28, 29, 31, 32, 36-39, 41, 43, 45
9	9	20, 24, 27
10	10	31-33, 35, 36, 38, 39, 41, 44, 47, 48
11	11	11-16, 19, 24
12	12	14, 15, 17-21, 23, 25, 30, 31, 37

TEXT:** **T. W. G. Solomons, Organic Chemistry, sixth Ed., John Wiley & Sons, 1995.

LABORATORY SESSION

Laboratory sessions start at 8:00 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 Technologist. 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 1500 and 1730 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 hard-cover laboratory note book for this purpose. Do not copy the procedure from the laboratory manual. Keep your note book 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. 9	* ***CHECK-IN*** *
16	*1. RECRYSTALLIZATION & MELTIING POINT*
23	*2. SOLUBILITY & FUNCTIONAL GROUP*
30	*3. THE SEPARATION OF ACIDS, BASES AND NEUTRAL COMPOUNDS*
Feb. 6	*4 THE SEPARATION OF ACIDS, BASES AND NEUTRAL COMPOUNDS*
13	* ***NO LAB (MID-TERM EXAM)*** *
20	* ***NO LAB*** *
27	* ***WINTER BREAK*** *
Mar. 5	*5. TRIMYRISTIN FROM NUTMEG*
12	*6. A DIBASIC ACID FROM A CYCLIC ALKENE*
19	*7. STEREOCHEMISTRY*
26	* ***Check-out*** *

TEXT: Experiments in Organic Chemistry, Chemistry 161, University of Alberta, 1995.