



Grande Prairie
Regional College

Department of Science and Technology

CHEMISTRY 2610 (Fall 1999)

SEP 06 2000

COURSE INFORMATION

INSTRUCTOR:

Dr. Som K. Pillay
(Office: J 210; Tel: 539-2985)

PREREQUISITE:

CH1010 and CH1020

**TRANSFER
CREDITS:**

U. of Alberta: CHEM 261, 3 Credits

LECTURES:

MONDAYS, & WEDNESDAYS
11:30 - 12:50 AM (J 201)

SEMINARS:

FRIDAYS (J 201)
11:30 - 12:20 AM

LABORATORY:

MONDAYS
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 261,
University of Alberta, 1999.

Hard-Cover Laboratory Note Books, Lab Coats and
Safety Glasses

Molecular Model Set and Chemist's Triangle

E-mail:

Pillay@gprc.ab.ca or kspillai@agt.net

Web Pages:

<http://www.gprc.ab.ca/Academics/Science/Chemistry/>
<http://spillay@gprc.ab.ca/>

COURSE EVALUATION

THEORY:

<i>Assignments/Quizzes</i>	<i>10.0 %</i>
<i>Mid-term Examination (Week of October 13)</i>	<i>30.0 %</i>
<i>Final Examination (Week of December 13)</i>	<i>40.0 %</i>
	<i>80.0 %</i>

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

LABORATORY:

<i>General Competence in the Laboratory, Experimental Results, Lab Reports, Lab Quizzes, and Lab Exam:</i>	<i>20.0 %</i>
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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. STRUCTURE & BONDING (REVIEW):

Approximately two weeks of lectures and two weeks of seminars. The following topics are relevant, and the material should be known from CH 1010 and CH 1020.

Atomic Orbitals; Electron Configuration; Molecular Orbitals & Bonding; Hybrid Orbitals; Delocalized Bonding & Resonance; Molecular Geometry; Electronegativity & Bond Polarity; Intermolecular Forces; Acid-Base Properties; Structural Formulas; Functional Group Classification of Organic Compounds, Nomenclature of Organic Compounds.

Chapters: 1 & 2; Problem Sets: 1 & 2

2. INTRODUCTION TO STEREOCHEMISTRY:

Nomenclature of Alkanes; 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: 3 & 5; Problem Sets: 3 & 4

3. FREE-RADICAL SUBSTITUTION REACTIONS:

The Reaction Mechanism; Reaction Energetics & Kinetics; Structure & Stability of Free Radicals; Halogenation of Alkanes.

Chapter: 4; Problem Set: 5

4. NUCLEOPHILIC SUBSTITUTION AND ELIMINATION REACTIONS:

Nomenclature of Alkyl Halides; The S_N1 & S_N2 Mechanisms; 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 & Nomenclature of Alkenes; Stability of Alkenes; Dehydration of Alcohols; Dehalogenation of Vicinal Dihalides.

Chapters: 6 & 7; Problem Sets: 6, 7 & 8

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 Alkynes; Acidity of Alkynes; Acetylide Ions as Nucleophiles; Addition Reactions of Alkynes.

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

Chapters: 8, 9 & 15; Problem Sets: 9 & 10

6. ALCOHOLS:

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.

Chapters: 10 & 11; Problem Sets: 11 & 12

8. ETHERS AND EPOXIDES:

Structure & Nomenclature; Synthesis & Reactions of Ethers and Epoxides.
Chapter: 14; 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 class room. **NO APPOINTMENTS ARE NEEDED.**

TENTATIVE LECTURE SCHEDULE

WEEK OF	TOPICS
Sept. 6	Introduction
13	Review: Structure and Bonding
20	Review: Structure and Bonding
27	Introduction to Stereochemistry
Oct. 4	Introduction to Stereochemistry
11	Free-radical Substitution Reactions
18	Nucleophilic substitution & Elimination Reactions
25	Nucleophilic substitution & Elimination Reactions
Nov. 1	Nucleophilic substitution & Elimination Reactions
8	Nucleophilic Addition to Carbon-Carbon Multiple Bonds
15	Nucleophilic Addition to Carbon-Carbon Multiple Bonds
22	The Chemistry of Alcohols
29	The Chemistry of Alcohols
Dec. 6	The Chemistry of Ethers & Epoxides
13	* 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 11:30 AM. **NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!**

PROBLEM SET #	CHAPTER*	PROBLEMS
1	1	35, 36, 38 – 42, 44 – 47.
2	2	28, 34, 37- 42.
3	3	37, 39, 40, 42 – 44.
4	5	26, 28, 29, 31, 32, 34 – 36, 38.
5	4	36, 39, 42 – 44, 46, 49.
6	6	51, 55, 61, 64, 65, 67 – 69,
7	6	70 – 72, 74, 79, 81 – 84.
8	7	21, 27, 30, 33, 34, 36, 41, 44.
9	8	44, 46, 53, 55, 56, 58, 60 – 62, 64, 65, 67, 69.
10	9	29, 33 – 37, 39, 40.
	15	25, 27, 30, 33, 34.
11	10	31, 32, 35, 37, 38, 40, 42, 44, 45, 46, 48.
12	11	40, 41, 46, 48 – 53, 55, 58.
13	14	30, 31, 35 – 37, 39, 42, 43.

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

LABORATORY SESSION

Laboratory sessions start at 2:30 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 14:30 and 17:00 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
Sept. 13	1. Check In
20	2. Solids: Purity and Identification
27	3. Solids: Purity and Identification
Oct. 4	4. Liquids: Purity and Identification
11	* NO LAB *
18	5. Separation Based on Solubility
25	6. Isolation of Caffeine from tea
Nov. 1	7. Separation Based on Solubility
8	8. KMnO_4 Oxidation of an Alkene
15	9. Isolation of Cholesterol from Crude Synthetic Gallstones.
22	10. Lab Exam
29	* Check Out *