



Grande Prairie
Regional College

DEPARTMENT OF SCIENCE & TECHNOLOGY

CHEMISTRY 2630 (Winter 1999)

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

PREREQUISITE: *CH 1010, 1020 and CH 2610*

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

LECTURES: *MONDAYS, WEDNESDAYS & FRIDAYS*
9:00 - 9:50 AM (J 201)

SEMINARS: *THURSDAYS (J 201)*
8:00 - 8:50 AM

LABORATORY: *MONDAYS*
3:00 - 5:50 PM (J 116)

TEXT BOOKS AND LABORATORY

ITEMS: *L. G. Wade, Jr., Organic Chemistry, 3rd Ed., Prentice-Hall, Inc., 1995*
Experiments in Organic Chemistry, Chemistry 263, University of Alberta, 1999.
Hard-Cover Laboratory Note Books, Lab Coats and Safety Glasses
Molecular Model Set and Chemist's Triangle

Web Pages: <http://www.gprc.ab.ca/academics/science/chemistry/chemistry263/>
<http://www.kairali.dynip.com/chemistry263/>

COURSE EVALUATION

THEORY:

| | |
|---|----------------------|
| <i>Assignments/Quizzes</i> | <i>10.0 %</i> |
| <i>Mid-term Examination (Week of February 15)</i> | <i>30.0 %</i> |
| <i>Final Examination (Week of April 19)</i> | <u><i>40.0 %</i></u> |
| | <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> |
|--|---------------|

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

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

COURSE OUTLINE

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

1. ELECTROPHILIC AND NUCLEOPHILIC AROMATIC SUBSTITUTION:

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: 11, 12 & 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 class room. **NO APPOINTMENTS ARE NEEDED.**

TENTATIVE LECTURE SCHEDULE

| WEEK OF | TOPICS |
|------------|--|
| Jan.4 | Electrophilic & Nucleophilic Aromatic Substitution |
| 11 | Electrophilic & Nucleophilic Aromatic Substitution |
| 18 | Electrophilic & Nucleophilic Aromatic Substitution |
| 25 | Introduction to Spectroscopy |
| Feb. 1 | Introduction to Spectroscopy |
| 8 | The Chemistry of Amines |
| 15 | Nucleophilic Addition to Carbonyl Group |
| 22 | * WINTER BREAK * |
| Mar. 1 | Nucleophilic Addition to Carbonyl Group |
| 8 | Nucleophilic Acyl Substitution |
| 15 | Nucleophilic Acyl Substitution |
| 22 | Carbanions |
| 29 | Carbanions |
| Apr. 5 | Special Topics |
| 12 | Special Topics |
| 19 | * 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 9:00 AM. **NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!**

| PROBLEM SET # | CHAPTER* | PROBLEMS |
|---------------|----------|--|
| 1 | 16 | 25, 26, 28, 31, 33-35 |
| 2 | 17 | 43-48, 54-56, 57 |
| 3 | 11 | 16 |
| | 12 | 33, 35-37, 41, 42, 44-46 |
| 4 | 19 | 3, 40, 42, 44, 46, 47, 49, 53, 54, 57 |
| 5 | 18 | 32, 37, 40, 42, 44, 45, 49, 50, 54, 55, 61, 62 |
| 6 | 20 | 25, 27-29, 31, 32, 34, 35, 37-42 |
| 7 | 21 | 42, 48, 49, 52, 54-57, 59, 62, 63, 65, 67 |
| 8 | 22 | 63, 64, 66-68, 72-75, 78, 80 |
| 9 | 23 | TBA |
| | 24 | |

*TEXT: L. G. Wade, Jr., *Organic Chemistry*, 3rd Ed., Prentice-Hall, Inc., 1995.

LABORATORY SESSION

Laboratory sessions start at 3:00 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 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. 11 | 1. Friedel Crafts Alkylation |
| 18 | 2. Sodium Borohydride Reduction |
| 25 | 3. The Grignard Reaction |
| Feb. 1 | 4. Aspirin |
| 8 | 5. Qualitative Organic Analysis |
| 15 | * NO LAB * |
| 22 | * WINTER BREAK * |
| Mar. 1 | 6. Qualitative Organic Analysis |
| 8 | 7. Qualitative Organic Analysis |
| 15 | 8. Qualitative Organic Analysis |
| | 9. Lab Exam |
| 22 | * Check-out * |

*TEXT: *Experiments in Organic Chemistry, Chemistry 263, University of Alberta, 1999.*