Chemistry 2500:
An Introduction to Organic Chemistry

Dr. P. G. Hayes

B.Sc. (Honours), Chemistry, Mount Allison University, 1999

Ph.D. Organometallic Chemistry, University of Calgary, 2004

Postdoctoral Research: University of California, Berkeley, 2004-2006

Assistant Professor, University of Lethbridge, 2006-2010

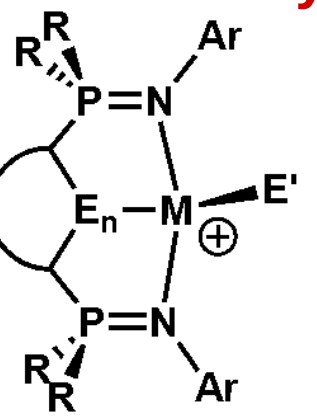
Associate Professor, University of Lethbridge, 2010-present

Professor, University of Lethbridge, 2015-present

Associate Editor, *RSC Advances*, 2015-present

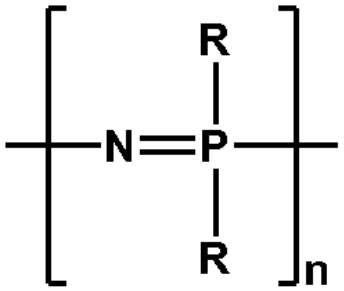
Hayes Group Research: Organometallic Chemistry, Catalysis and Polymers

Biodegradable Polymers



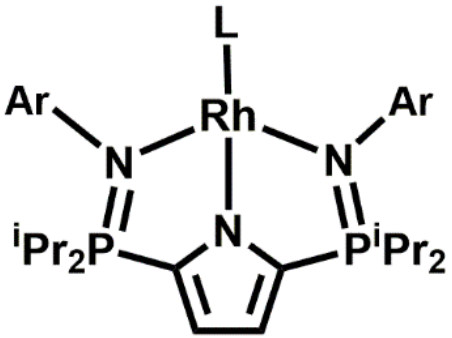
M = Zn, Mg, Al, In, Sc, Y

Polyphosphazenes

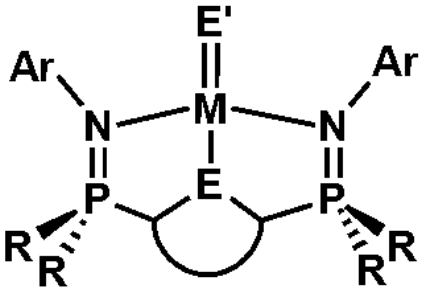


Collaboration with Prof. Hazendonk

Small Molecule Functionalization



New Functionalities



M = Sc, Y, Lu, Er, Sm, U, Th

people.uleth.ca/~p.hayes/

Why Participate in (Chemistry) Research?

- Course Credit
  - (Independent Study, Applied Study, COOP, Honours Project)
- $$$
  - Summer work, COOP, etc. (NSERC USRA, Chinook Award)
- Great workforce experience
- Be a part of cutting edge science
- Hand-on experience with state-of-the-art instrumentation and techniques
- Reinforces previous knowledge and introduces new material relevant to future courses (and professional school exams, e.g. MCATs)
- Chemistry is an approved route for Medical School
- Improve your writing and critical thinking skills
- Reference Letters
- Chemists get jobs!
- Fun

Currently accepting undergraduate and graduate students!

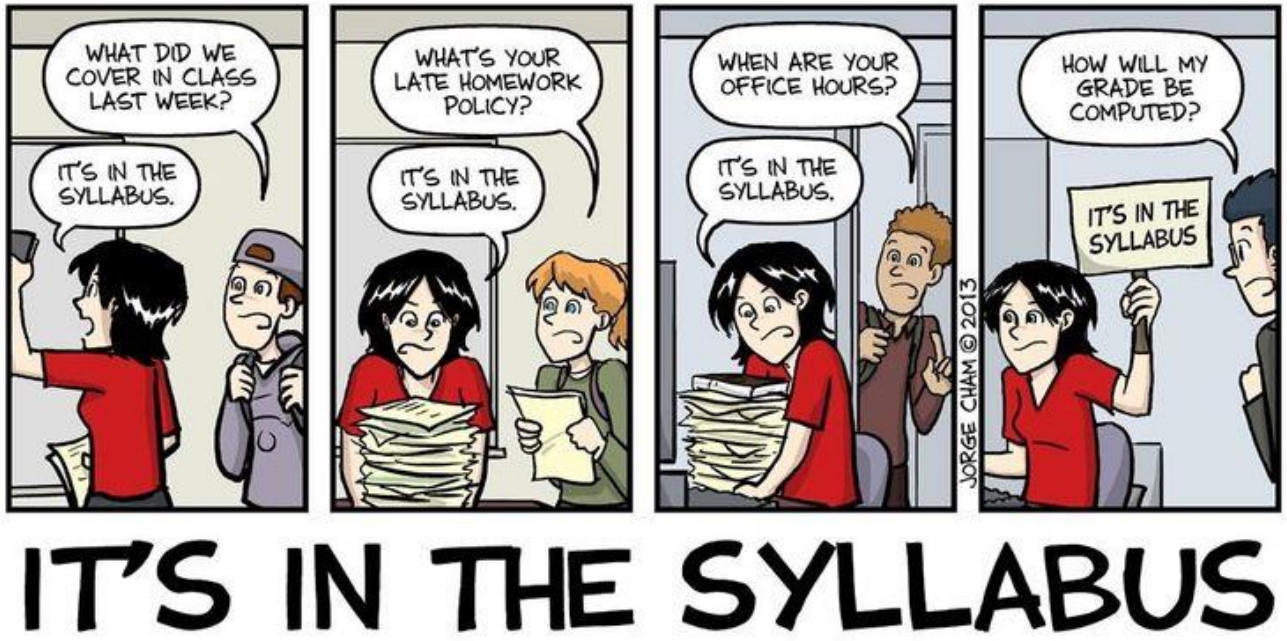
- p.hayes@uleth.ca
- http://people.uleth.ca/~p.hayes/
- E870
- 329-2313

What Careers Involve Chemistry?

- school teacher
- medicinal chemist
- polymer chemist
- patent lawyer
- environmental scientist
- agricultural scientist
- university professor
- geochemist
- metallurgical analyst
- biotechnologist
- business management
- scientific journalism
- nutritionist/dietition
- process chemist
- petroleum research
- occupational health & safety officer
- research laboratory
- forensic laboratory
- art conservation
- scientific instrument sales
- pulp & paper research
- scientific instrument development & service
- pharmaceutical sales
- journal editor
- food scientist

Chemistry 2500: Organic Chemistry I – Fall 2017

Professor: Dr. P. G. Hayes
Contact Information: Office: E870 (University Hall)
E-mail: p.hayes@uleth.ca
URL: http://people.uleth.ca/~p.hayes
Phone: (403) 329-2313
Office Hours: 11:00-13:00 Wednesdays (or by appointment)



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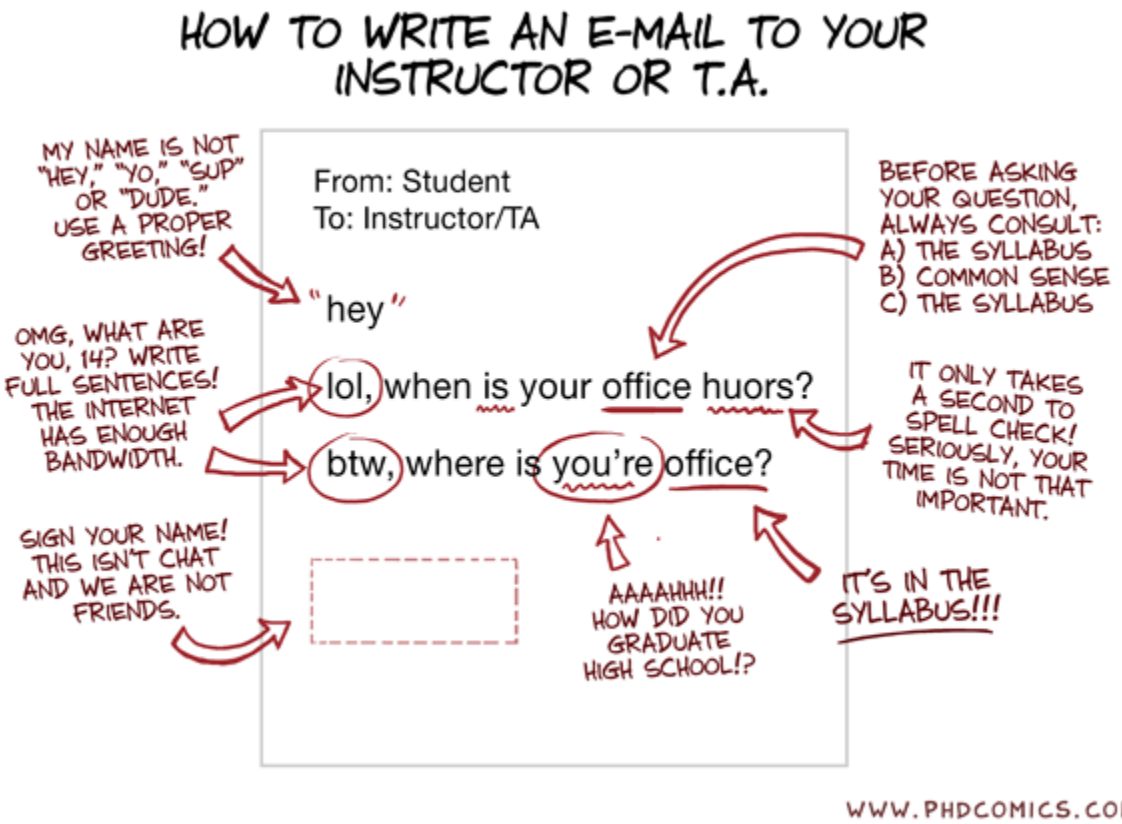
Class URL:
http://people.uleth.ca/~p.hayes/Chem%202500%20Web%20Page%202017/index.htm

Credit Hours: 3.0

Email: Due to the complex nature of the subject, it is not possible to properly answer questions about course material via email. Thus, all such inquiries should be made in person. Only emails of an administrative nature (*e.g.* exam absence, appointment set-up, *etc.*) will receive responses. Grades will not be given out by email.



Chemistry 2500: Organic Chemistry I – Fall 2017

Pre-requisites: Chemistry 2000. Students who lack the proper pre-requisites will be automatically removed from the course on Tuesday, September 12, 2017.

Substantially Similar: Chemistry 2120. Student cannot receive credit for both Chemistry 2120 and Chemistry 2500.

Lectures: Section A: MWF at 10:00 – 10:50 in C674
Section B: TTh at 10:50 – 12:05 in C610

Course Subject: Introduction to the chemistry of carbon: nomenclature; structure, bonding, conformation and stereochemistry; reaction mechanisms; substitution and elimination reactions.

Course Contents (may be subject to change):

1.	Review: Functional Groups and Drawing Organic Molecules	Chapters 1–2
2.	Isomers and Nomenclature	Chapter 2.5, 4
3.	Stereochemistry and Conformations of Organic Molecules	Chapters 3–4
4.	Bonding: MO Theory and Aromaticity	Chapters 1.9, 9
5.	Types of Organic Reactions	N/A
6.	Operational Species: Acids, Bases, Nucleophiles, Electrophiles, Leaving Groups (Exophiles)	Chapters 6–8
7.	Substitution Reactions (S_N1 and S_N2) and Kinetics	Chapter 11
8.	Elimination Reactions (E1 and E2)	Chapter 12

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Evaluation Mechanisms:

- Laboratory (30%). Note: *All experiments must be performed (and submitted before the end of the course) in order to pass, and hence, the course*. A grade of 50% constitutes a pass.
- Online Sapling Assignments (10%)
- Midterm Exam (20%)
- Final Exam (40%)

Note: For students who earn a higher grade on the final exam than the midterm, an alternative grading scheme will be utilized wherein the midterm exam will carry a weight of 0% and the final exam 60%.

Exams: Midterm: Friday, October 27th (17:00 – 19:00) in PE250

Final: Saturday, December 9th (14:00 – 17:00)
(*N.B.* Tentative only – confirm time and location with registrar's office)

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Note: As stated in the 2017/2018 University of Lethbridge calendar (Pg. 75), failure to attend an exam without a valid reason (*e.g.* illness) will earn a grade of 0. Proof of illness requires presentation of an appropriately signed medical certificate. Notify Prof. Hayes **as soon as possible** if you are going to miss an exam. ***If any course component is missed for a valid reason, that portion of the course grade will be shifted to the final examination.***

IMPORTANT NOTE: Exams will cover all course material including demonstrations, practice problems and assigned readings up to the end of the preceding lecture unless otherwise stated. They are **cumulative** covering all material presented in lecture, assignments, etc. up to that point in the semester. Assignments and suggested problems are intended as partial preparation for exams. Failure to put forth effort is perilous.

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Special Needs Students: Please contact the Accommodated Learning Centre (B760) to arrange for accommodations at least one week prior to any evaluation. Also, feel free to inform Prof. Hayes of your special needs in order for you to have a productive learning experience.

Sapling Assignment Schedule:

Assignment	**Due Date**
Training Assignments (not for credit)	N/A
HW1: Drawing and Classifying Organic Molecules	Sun., Sept. 17
HW2: Isomers and Nomenclature	Sun., Sept. 24
HW3: Stereochemistry	Sun., Oct. 1
HW4: Conformations of Organic Molecules	Sun., Oct. 15
HW5: Molecular Orbital Theory and Aromaticity	Sun., Oct. 22
HW6: Reaction Types and Factors Favouring Reactivity	Sun., Oct. 29
HW7: Reaction Mechanisms and Acidity (pKa values)	Sun., Nov. 5
HW8: Substitution Reactions of Alkyl Halides	Sun., Nov. 19
HW9: Substitution Reactions of Alcohols	Sun., Nov. 26
HW8: Elimination Reactions	Sun. Dec. 3

**The deadline for all assignments is 23:55 on the date listed

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How to Register for Sapling Online Assignments:

1) Go to http://saplinglearning.ca **NOTE:** Make sure to enter .ca, NOT .com

2) If you already have a Sapling Learning account, log in, click "View Available Courses", then skip to step 6.*

3) Otherwise, click “Create account” located under the Login box.

4) Choose a username and password, and supply the other requested information. Click "Create my new account".

5) Check your email (and spam filter) for a message from Sapling Learning. Click on the link provided in the email.

6) Find “University of Lethbridge – CHEM 2500 – Fall17 – HAYES) and click the link.

7) Click the button that says "Send payment via Paypal or Credit Card" and follow the remaining instructions.**

8) Once you have registered and enrolled, you can log in at any time to complete or review your assignments.

9) If you have any problems, visit https://community.macmillan.com/community/digital-product-support/college-students-support-community or https://community.macmillan.com/docs/DOC-6915-students-still-need-help

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*If you completed Sapling for CHEM 2500 in a previous semester (*i.e.* if you were not dropped from Sapling for a refund), you can contact Sapling support (see step 9) to be unenrolled from the old course in exchange for free enrollment in this semester's course. Old Sapling grades will NOT be reused; you must do THIS semester's assignments.

** The University Bookstore also sells cards with Sapling access codes. Since online prices are in US$, this may be a cheaper option, depending on the exchange rate. **Note that you have to follow the instructions that the bookstore gives you on how to "cash in" the code you buy for one that you can use in Sapling.**

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How to Use Sapling:

Once you have registered your account, you can get started using the system. A training assignment is available to introduce you to the system if you have not used Sapling before. An additional training assignment shows how to answer question types specific to organic chemistry. The first graded assignment is due on Sunday, September 17th at 23:55. Subsequent assignments will also be due on Sunday nights at 23:55 (usually one assignment per week). This does not mean that you should wait to do the assignments on Sunday! If you want to leave your weekend free, finish the assignment during the week. Each assignment has been calibrated to take approximately an hour for the average student who understood the lectures and has already done the Exercises posted on the class website. If you tend to work slowly, expect that the assignments may take you longer than that. They can typically be completed more quickly if you've prepared/studied before starting the assignment.

Go to http://saplinglearning.ca

Enter your Username and Password then click "GO".

Click on the assignment you want to work on. This will bring up the first question in the assignment. They can be done in any order; use the "map" icon to navigate the assignment if you want to work on questions out-of-order. There is no need to submit the Assignment as a whole once you've finished all questions.

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New assignments will appear approximately once a week. Unless you are otherwise informed, there is one assignment due every Sunday night. All assignments are weighted equally, and if an assignment is broken into parts "a" and "b" (e.g. HW1A and HW1B), each part is considered to be half an assignment and is weighted accordingly. No credit is given for late assignments. No extensions will be granted for any reasons other than those which would merit an exemption from a midterm exam (documented illness, etc.).

Calculator Policy:
While calculations are not the primary focus of Organic Chemistry, you may still need a calculator capable of simple algebra. You will be informed prior to each test whether or not you should bring your calculator. You are not allowed to store/download text to your calculator. Any calculators found to be in violation of this policy during a test will be confiscated along with the test paper; this is cheating and will be dealt with as such. **CALCULATORS WITH WIRELESS COMMUNICATION CAPABILITIES ARE STRICTLY FORBIDDEN.**

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Labs:

- Commence Monday, September 11th.
- Both the lab and lecture portions of the course must be passed independently (*i.e.* A good lab mark cannot raise a failing lecture grade).
- All students must wear a lab coat, safety glasses (contact lenses beneath safety glasses are not acceptable), adequate footwear (sandals are not permitted) and have fully covered legs (shorts and skirts and not permitted).
- A deposit of $15.00 is required in order to obtain a locker key. Please pay at the cashier's office and bring the token to the laboratory.
- Lab books and coats can be purchased at the university book store.
- Refer to the lab manual (available on Moodle) for complete details on these and other topics relating to the laboratory component of Chemistry 2500 – any questions should be addressed to the laboratory component, Mr. Kris Fischer (fiscke@uleth.ca, E830 University Hall)
- Attending the laboratory component of this course is mandatory, and you will be assigned a grade of 0 for any lab missed without a valid reason. Since all experiments must be completed to pass CHEM 2500, an unexcused laboratory absence could result in course failure. Please see your lab manual for the correct protocol to make up a lab that was missed due to illness, etc.

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Text Books:

- William Ogilvie, Nathan Ackroyd, C. Scott Browning, Ghislain Deslongchampss, Felix Lee and Effie Sauer, *Organic Chemistry: Mechanistic Patterns*, Nelson Education Ltd., Toronto, 2018. ISBN: 978-0-17-650026-9, [QD251.3.Q45 2017].

- James W. Zubrick, *The Organic Chem Lab Survival Manual, A Student's Guide to Techniques, 9th Ed.*, John Wiley & Sons, New York, 2012. ISBN: 978-1-118-08339-0, [QD261.Z83 2012].
  - Available in e-book format from the book store for approximately half price.

Additional Useful Materials:

- It is highly recommended that students obtain a molecular model kit.
- These kits are permitted for all assignments and exams.
- Model kits can be purchased from the Chemistry and Biochemistry Undergraduate Society (CBC). Contact Dr. Patenaude in E782 ($30.00).
- The university book store sells a more expensive, alternate model kit (~$80.00).

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What is plagiarism?

- Plagiarism is defined as the taking of someone's thoughts, writings or inventions and using them as one's own.
- When writing a paper or lab report on a given topic, you must read up on the topic, get the necessary information and then present it IN YOUR OWN WORDS. If you use a sequence of text verbatim (*i.e.* exactly) from someone else's work, THAT IS A QUOTE and must be cited (to give proper credit to the author). If you use an idea or data from someone else's work, then that work must be cited specifically as a reference, and/or in your paper's bibliography.
- Beware of information that is found on the web -- it is rarely primary source information and is generally not acceptable (*i.e.* Wikipedia!)
- **IF, IN THE COURSE OF WRITING A REPORT, YOU EXECUTE A CUT AND PASTE FROM A WEBSITE OR OTHER SOURCE (without a citation) YOU HAVE COMMITTED PLAGIARISM.**
- It is important to point out that there is a difference between working out answers to an assignment or a lab report with a friend and plagiarism. If, after conferring with others, what you write down is based on your own understanding of the material and is in your own words, then that is acceptable. If, however, you look at a friend's answer to a question, and then simply write (essentially) the same thing on your assignment (a mental cut and paste), then you have committed plagiarism. PLAGIARISM IS CHEATING and is subject to discipline as described in the university calendar. If you are unclear about any aspect of the student discipline policy, refer to Pages 69-71 of the 2017-2018 calendar.

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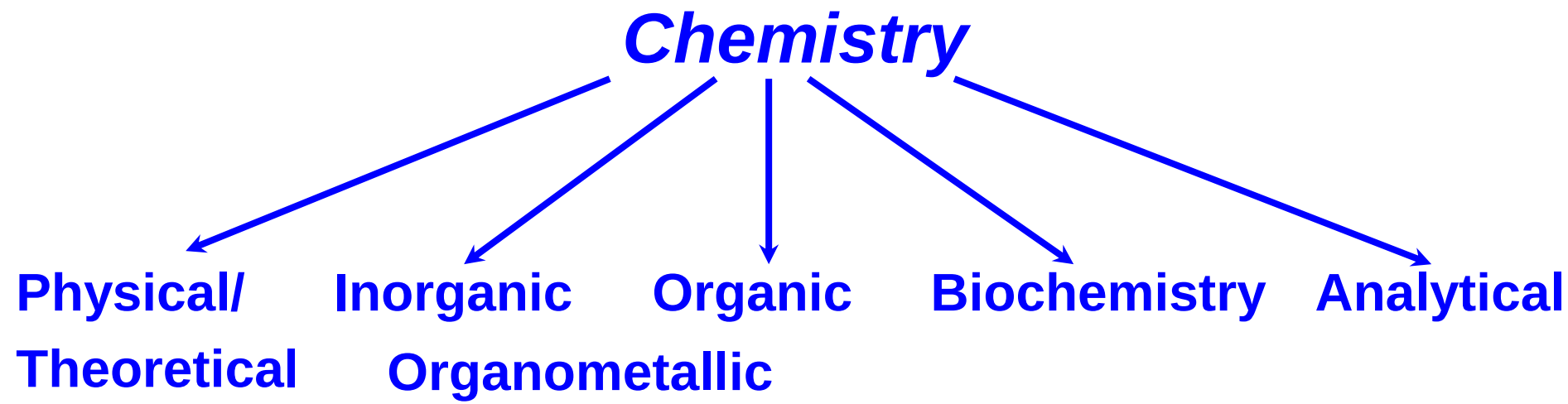
Plagiarism & Cheating:

- If caught cheating on any component of Chemistry 2500 (including Sapling online assignments) **you will be assigned a grade of F for the course**. In addition, a letter describing the offense will be placed in your student file. Two such letters is grounds for expulsion from the university.
- **STUDENTS WHO CHEAT, CHEAT THEIR FELLOW STUDENTS BY DEVALUING THEIR HARD WORK, EARNED GRADES AND DEGREE**.

- Online assignments are used for assessment in this course. Once again, the answers you provide for such assessments must be your own. Under no circumstances should you obtain or provide any information pertaining to questions or answers on the Sapling assignments to other students.

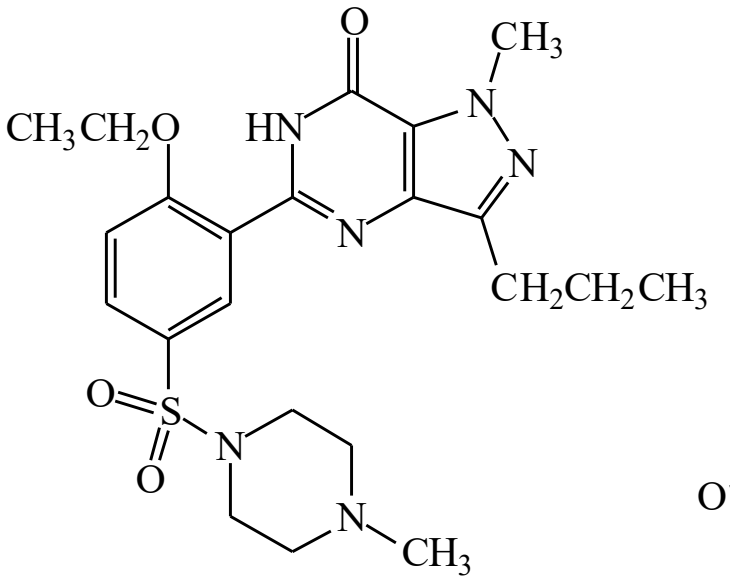


Organic: chemistry of substances containing carbon

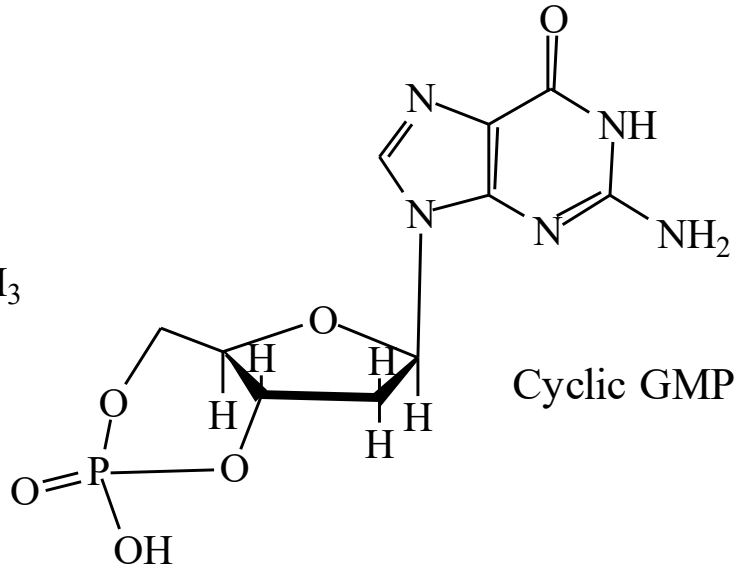
- **Synthesis**
- **Structure Elucidation**
- **Polymer Chemistry**
- **Medicinal/Pharmaceutical**
- **Nutrition/Food**
- **Forensic Science**

Why is Organic Chemistry Important?

Biochemistry and Pharmaceuticals

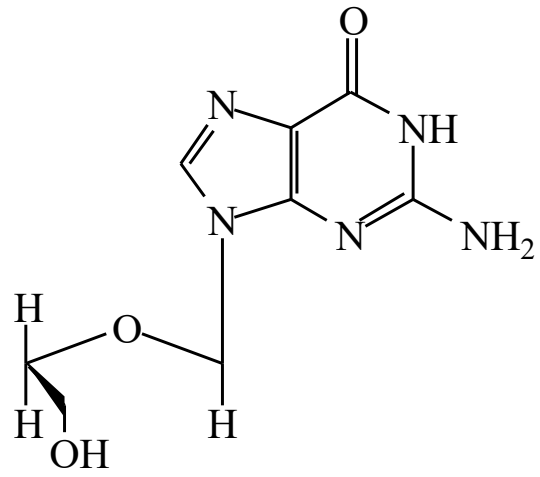


Viagra

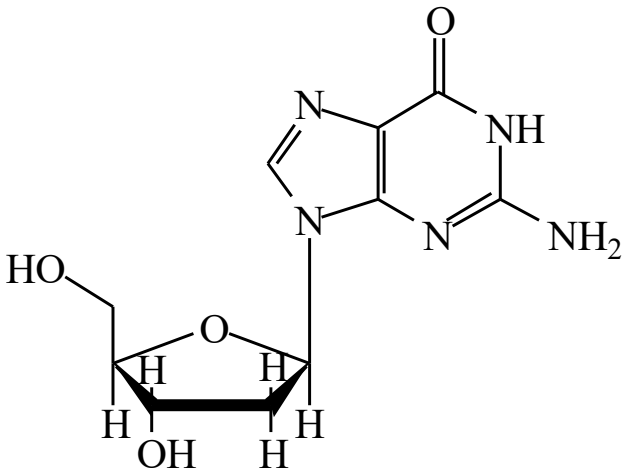


Cyclic GMP

Why is Organic Chemistry Important?



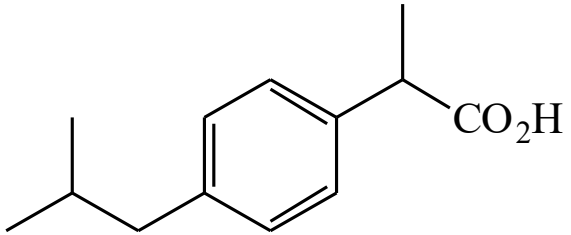
Acyclovir



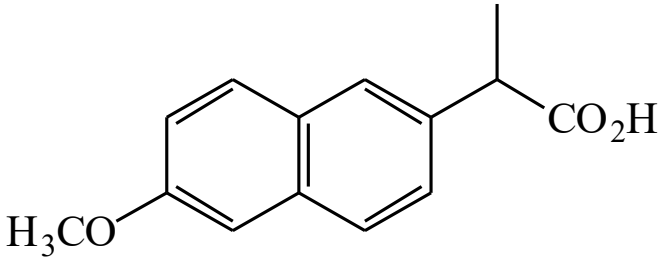
Guanine

- Small structural changes can have a major physiological effect

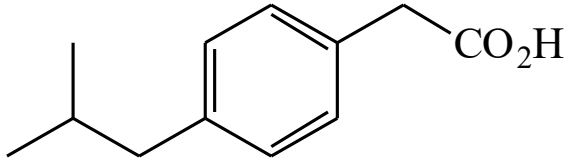
Why is Organic Chemistry Important?



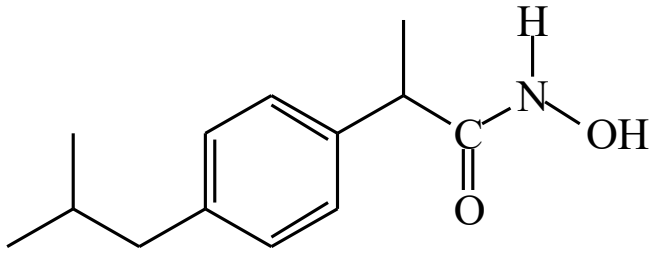
Ibuprofen



Naproxen



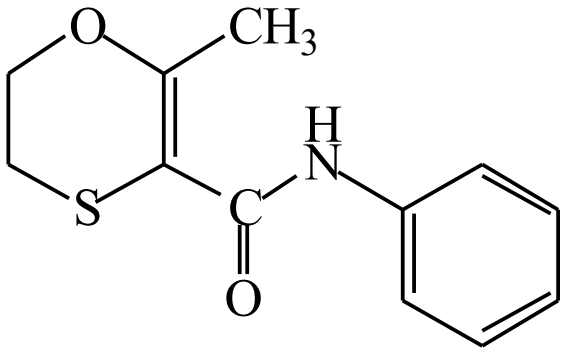
Ibufenia



Ibuproxam

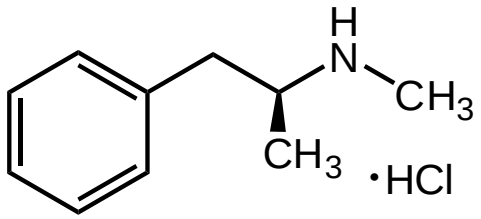
- Similar structures can have similar properties

Why is Organic Chemistry Important?

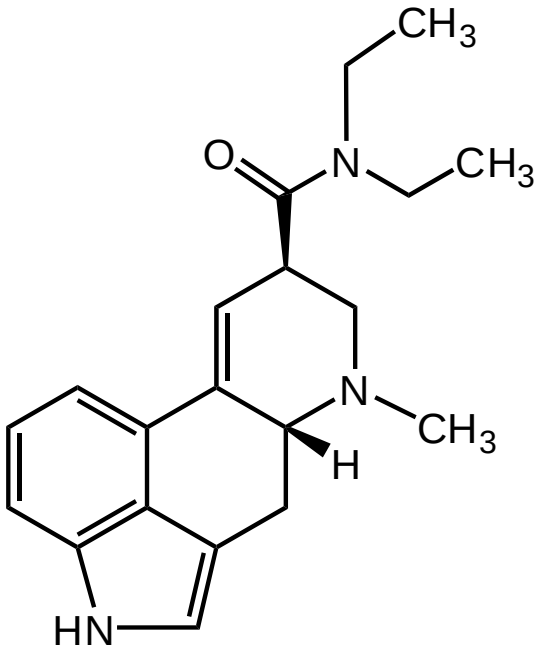


Vitavax

Also, Illicit Drugs:



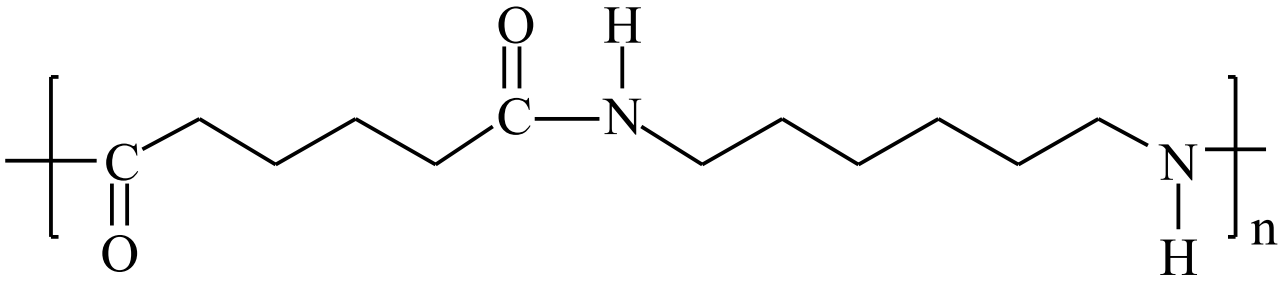
Methamphetamine



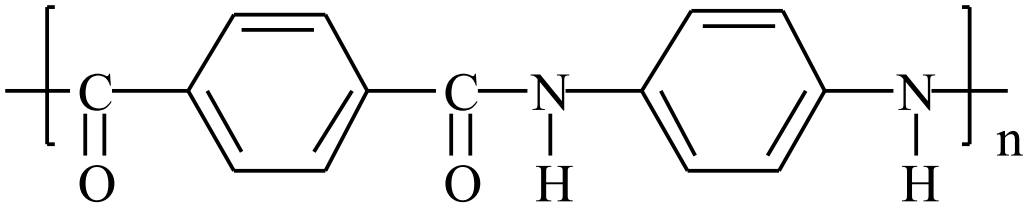
LSD

Why is Organic Chemistry Important?

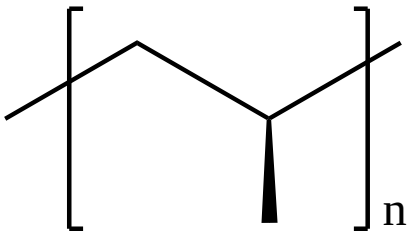
Materials



Nylon



Kevlar



Polypropylene – plastics

Exciting Career Opportunities

Canadian Security Intelligence Service | Service canadien du renseignement de sécurité

Canada

Canadian Security Intelligence Service

Scientific and Technical Services, Scientific Assessments and Analysis, Scientist

The Service is always looking for talented and skilled individuals to join our team. Diversity is not only part of the Service's culture it is a core business strategy. Our objective is to have a workforce which is representative of the Canadian mosaic and our programs and policies are designed to foster diversity and inclusion.

Reference Number	Closing Date
10-CSIS-08-039	2010-08-31

Job Summary

The Canadian Security Intelligence Service (CSIS) is seeking qualified individuals to fill a Scientist position. The incumbent will be responsible for directing the design, development, planning, testing and implementation of all aspects related to scientific collection and analysis to meet operational requirements.

- Provide leadership and advice on major assigned projects/plans/activities, budgetary and policy/procedural issues, including the acquisition, planning, development, implementation, documentation and evaluation needed for their completion.
- Research, evaluate and test new technologies, tools and procedures in order to support the development, evaluation, and planning of capabilities and recommend future developments to maintain and improve capabilities.
- Administer and resolve complex problems/issues/contracts by researching, analysing and providing advice, or liaising with other resources, as required.
- Prepare detailed documents on issues pertaining to projects by gathering information and data, conducting analysis and preparing reports and assessments of technology gaps and opportunities.
- Provide training and support to clients and colleagues to maintain and improve scientific capabilities.
- Assess information and provide operational support to meet managerial and operational requirements for plans, policies and budgetary needs in accordance with requirements.

Exciting Career Opportunities

Education

Undergraduate degree in Chemistry or Biochemistry (with a strong background in Analytical Chemistry and / or Organic Chemistry). Preferences may be given to candidates with a Masters or a PhD.

Related Experience

- Candidates must have a minimum of four (4) years experience in planning and conducting scientific projects and in the application of scientific methodologies in the analysis and examination of various materials.
- Experience in project management and preparation and submission of proposals to funding agencies.
- Experience in the identification of priority areas on which to focus scientific research and the development required to fulfill gaps.

Desirable Experience

Experience in synthetic organic chemistry.

Condition of Employment:

The incumbent must be prepared to work flexible hours with short notice of travel requirements and under a variety of unfavourable conditions and environments.

Who Can Apply

Canadian citizens eligible for a Top Secret security clearance.

Security Requirements

Candidates must have no criminal record, must not have used illegal drugs in the last twelve (12) months and be able to obtain a Top Secret security clearance. This process involves a security interview, a polygraph, a background investigation that includes credit and financial verifications.

Language Requirements

English essential

Salary Range

$70,700 to $86,120 per year. Salary is commensurate with qualifications and experience.

Exciting Career Opportunities

We also offer

Organized and recreational sports activities, on-site fitness facility, full service cafeteria, dedicated bus route.

Location

CSIS National Headquarters, Ottawa, Ontario

Conditions of Employment

Term or indeterminate.

How To Apply

If you meet these requirements, you may submit your candidacy by clicking How to apply and quoting: Reference **10-CSIS-08-039**.

Notes

CSIS is committed to Employment Equity and encourages the equitable participation of all Canadians. In the event that your application is retained and should you require any special accommodation during the selection process, please inform us. Personal Information is protected under the *Privacy Act*. It will be held in Personal Information Bank SIS/P-PU-025.

We thank all applicants for their interest in CSIS. However, only those who are selected for further consideration will be contacted.

Date Modified: 2010-05-27

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Important Notices