

**Chemistry 2302**  
**Elementary Organic Chemistry II**

6:00-9:00 p.m. Wednesday  
100 Smith Hall  
Spring Semester, 2019

*Instructor:* Professor Steven Kass, 223 Smith Hall, 625-7513 (kass@umn.edu)

*Website:* kass.chem.umn.edu and follow the links (Classes, 2302); **there is no Moodle site.** Alternatively, go directly to <http://www1.chem.umn.edu/class/2302/kass19s>

*Office Hours:* Monday, 11:00-12:00; Wednesday, 4:00-5:00; other times by appointment.

*Texts/Materials:* "Organic Chemistry" by Francis A. Carey and Robert M. Giuliano (10th ed., McGraw-Hill), "Student Study Guide/Solutions Manual", Molecular Model Set (optional), McGraw-Hill ConnectPlus subscription.

*McGraw-Hill Connect:* To log into the website ([www.mhhe.com](http://www.mhhe.com)) go to <http://connect.mheducation.com/class/s-kass-spring-2019-wednesday-600-900-pm> and register. Upon registration, you will have access to the e-book and additional features. There is a LearnSmart Module for reading chapters in an interactive manner before coming to class. There are also 10 online graded assignments. More details are given below.

*Tutor Hours:* Organic tutor hours will be held in Smith 124 throughout the semester beginning January 28 and running through the last week of classes at the following times: Monday-Friday 12:00-6:00 p.m. with several exceptions. For specific details and a listing of individual tutor schedules see the door of Smith 124 and our class website. It is important to me that your time is well spent in this room. Please inform me or the Head Organic TA (Juntian Zhang, [zhan3275@umn.edu](mailto:zhan3275@umn.edu)) if tutors are not present at their scheduled time or helpful. A reminder that the purpose of a tutor is to help you learn, not simply give you answers to questions or problems. The tutors are instructed to ask YOU questions that will help you understand what concept you are missing that is preventing you from solving a particular problem. Self-discovery will enhance the depth and retention of your knowledge.

*ChemFoundations Program:* An optional study group program is ChemFoundations. This program involves the volunteer efforts of advanced undergraduate/graduate students (the ChemFoundations Leader) who enjoy teaching and helping students to succeed in organic chemistry. Each ChemFoundations leader will meet at a designated time and place once a week with students to work problems and review difficult concepts. It is designed to be a one-hour to one and a half hour active-learning session; not a lecture, office hour, or private tutoring session. So please attend only if you are willing to participate and engage in group learning. You are free to "try-out" the different leaders and select one or more that best fits your learning style. Session information will be given the first week of classes and will start January 28 and end on May 6. For questions or problems, please contact Curtis Payne ([payne255@umn.edu](mailto:payne255@umn.edu)) or Professor Jane Wissinger ([jwiss@umn.edu](mailto:jwiss@umn.edu)).

*Exams:* Four 50 minute exams [one 3 x 5 note card is permitted during tests; model sets and calculators are not].

Exam 1, February 13

Exam 2, March 6

Exam 3, April 3

Exam 4, April 24

*Final Exam:*

**Wednesday, May 15, 6:00 p.m. -9:00 p.m. (3 hours)**

*GRADING:*

Hour Exams: 3 x 100 points (55%) [Three best exam scores used]

Final Exam: 200 points (36%)

Homework problems: 50 points (9%, 5 problems/chapter, 10 chapters or chapter reading ahead of class). For each chapter either one can do the LearnSmart reading module or the assigned problems for credit. Due dates differ for the assignments (LearnSmart assignments are typically due each week ahead of class while the problems are due before class on exam days) and can be found on the Connect web page. Full marks will be given for completing each assignment on time. Late homework will not be accepted.

Approximate Grading Scale: A 80–100%; B 60–79%; C 40–59%; D 30–39%; F 0–29% (minus and pluses will be used so the lower end of the specified ranges will receive the letter grade (A, B, and C) with a minus and the higher part of the ranges will get the letter grade with a plus (B and C only).

Final grades will be assigned based on one's best three 50 minute exams (55%), the final exam (36%) and the online homework assignments (9%). Alternatively, for those that are able to take four 50 minute exams and consistently do well, the final can be counted as a single exam (i.e., 100 points) if this leads to a higher total numerical score. This will be determined by the instructor for each student.

*MAKE-UP EXAMS WILL NOT BE GIVEN.* If one misses a 50 minute exam for any reason, then one's grade will be based on the three remaining 50 minute tests and the final. If additional exams are missed, they will be recorded as zeros and counted as such. If the final exam is not taken or an incomplete has not been arranged ahead of time, an 'F' grade will be given.

All exams should be taken in INK. If you believe a grading error has been made, write the nature of the problem on a separate sheet of paper, attach it to your exam and turn it in to me within 1 week of when the exam was returned to the class. The whole test will be examined and points will be added/subtracted as appropriate. Regrades will not be considered for exams taken in pencil.

*Policy for "I" Grades:* Any student who does not officially withdraw or who does not satisfactorily complete the course will receive an "F" grade. As for incompletes, the policy of the Chemistry Department is that a student may request an incomplete only when (a) he or she has a University sanctioned excuse for missing the final exam and (b) he or she is passing the course based on all other graded components. Assignment of an "I" requires that the instructor and student sign a contract, available in the Departmental undergraduate office, stipulating the

procedure by which the "I" grade will be made up (e.g., taking a final exam from another instructor the following semester). Failure to successfully complete the procedure outlined in the contract will result in the "I" being administratively changed by the University Registrar to an "F" or "N" (depending on the grade base) one calendar year from the end of the semester for which the "I" grade was granted.

*Prerequisites for this class:* A "C-" or better in Chem 2301 or equivalent.

### *How To Do Well In This Class*

1. Come to class. Organic chemistry moves at a brisk pace and we will cover 10 chapters during the semester. To do well you will want to keep up.
2. PRACTICE PRACTICE PRACTICE. Like learning a foreign language or training for a 10 K race, one must actively work at learning organic chemistry. This means that one needs to read the text, attend lectures, and do as many practice problems as one can. The more effort one puts into writing molecules and mechanisms, and doing problems, the more one will learn. In this way, the concepts will become clearer, one will begin to be able to predict chemical outcomes, and less rote learning will be needed. This makes organic chemistry interesting and even fun!

### *Student Conduct Code*

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see: [http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student\\_Conduct\\_Code.pdf](http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf).

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

### *Use of Personal Electronic Devices in the Classroom*

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: <http://policy.umn.edu/education/studentresp>.

### *Scholastic Dishonesty*

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or

examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code:

[http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student\\_Conduct\\_Code.pdf](http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf)) If it is determined that a student has cheated, the student may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/education/instructorresp>.

The Office for Community Standards has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <https://communitystandards.umn.edu/avoid-violations/avoiding-scholastic-...>. If you have additional questions, please clarify with Prof. Kass as I can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

#### *Makeup Work for Legitimate Absences*

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: <http://policy.umn.edu/education/makeupwork>.

#### *Appropriate Student Use of Class Notes and Course Materials*

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: <http://policy.umn.edu/education/studentresp>.

#### *Grading and Transcripts*

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

- A 4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
- A- 3.667
- B+ 3.333
- B 3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
- B- 2.667
- C+ 2.333
- C 2.000 - Represents achievement that meets the course requirements in every respect

C- 1.667

D+ 1.333

D 1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements

S Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to: <http://policy.umn.edu/education/gradingtranscripts>.

### *Sexual Harassment*

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: [https://regents.umn.edu/sites/regents.umn.edu/files/policies/Sexual\\_Harassment\\_Sexual\\_Assault\\_Stalking\\_Relationship\\_Violence.pdf](https://regents.umn.edu/sites/regents.umn.edu/files/policies/Sexual_Harassment_Sexual_Assault_Stalking_Relationship_Violence.pdf). In this course, we strive to provide a safe and positive environment for everyone. Please review policy regarding sexual harassment and related topics: <http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>. For support and help please contact the Aurora Center: <http://aurora.umn.edu>

### *Equity, Diversity, Equal Opportunity, and Affirmative Action*

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: [http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity\\_Diversity\\_EO\\_AA.pdf](http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf).

We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences to this course. Instructors, teaching assistants, and peer students are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. This is in agreement with university policy.

### *Disability Accommodations*

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office (UM Twin Cities - [612.626.1333](tel:612.626.1333) or [drc@umn.edu](mailto:drc@umn.edu)) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, can often work with Prof. Kass to minimize classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.

- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact Prof. Kass early in the semester to review how the accommodations will be applied in the course. In no case should this be done with one week or less before a given exam.
- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

In this course, we support anyone requiring accommodations for access to class activities and materials. Please contact the instructor or the Disability Resource Center <https://diversity.umn.edu/disability/>, which will provide a letter to share with the instructor on how to facilitate an inclusive learning environment.

### *Mental Health and Stress Management*

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

### *Academic Freedom and Responsibility*

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.\*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

\* *Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*

### *Multilingual Student Resources*

Student English Language Support: Student English Language Support (SELS) is a free service for international undergraduate students, providing assistance in a wide array of English language skills. Students can sign up online for [one-on-one consultation appointments](#) or visit SELS in Nicholson 20.

New Resource Website for Multilingual Students: A new website to support multilingual students with their language development and communication skills: [esl.umn.edu](http://esl.umn.edu). The website includes self-study materials, practice quizzes, tips, videos, and useful links to provide English language practice with:

Speaking (participating in class, group work, discussions, and conversations and making friends), Vocabulary (academic words and informal language and slang), Reading (managing reading loads and strategies for different types of reading assignments), U.S. Culture (jokes and humor, cultural differences, social media resources, and advice to learn more about U.S. culture), and Confidence (ways to build confidence, be less nervous about mistakes, and increase fluency).

Approximate Course Schedule

- Lectures 1-2: Chapter 13 - Electrophilic and Nucleophilic Aromatic Substitution
- Lectures 2-3: Chapter 15 - Organometallic Compounds
- Lecture 4: **Exam 1 (February 13)** & Chapter 16 - Alcohols, Diols, and Thiols
- Lecture 5: Review Exam 1 & Chapter 16.
- Lecture 6: Chapter 17 - Ethers, Epoxides, and Sulfides
- Lecture 7: **Exam 2 (March 6)** & Chapter 18 - Aldehydes and Ketones: Nucleophilic Addition to the Carbonyl Group
- Lecture 8: Review Exam 2 & Chapter 18.
- Lecture 9: Chapter 19 - Carboxylic Acids;
- Lecture 10: **Exam 3 (April 3)** & Chapter 20 - Carboxylic Acid Derivatives: Nucleophilic Acyl Substitution
- Lecture 11: Review Exam 3 & Chapter 21 - Enols and Enolates
- Lecture 12: Chapter 21
- Lecture 13: **Exam 4 (April 24)** & Chapter 22 - Amines
- Lecture 14: Review Exam 4 & Chapter 22
- Lecture 15: Chapter 23 - Phenols & Review
- Final Exam 6:00 p.m. – 9:00 p.m. (May 15)**

## Problems

(The more you can do, the better!)

### **ChemFoundation Leaders**

Laura Wiessenberger: Monday 4:00-5:00 p.m. in 134 Kolthoff Hall

Mena Youssef: Tuesday 6:00-7:00 p.m. in 134 Kolthoff Hall

Other leaders for the other section of 2302:

Magan Aziz: Monday 3:00-4:00 p.m. in 136 Kolthoff Hall

Yugene Guo: Tuesday 5:00-6:00 pm in 121 Bruinicks Hall

Matt DeJong: Tuesday 7:00-8:00 pm in 135 Kolthoff Hall

Emmie Carpenter: Wednesday 5:00-6:00 pm in 139 Kolthoff Hall

Najash Abdishikur: Thursday 3:00-4:00 pm in 219 Appleby Hall

Leah Wu: Thursday 4:00-5:00 pm in 144 Bruinicks Hall

Andrew Feyo: Monday 5:00-6:00 pm in 139 Kolthoff Hall

Lindsay Robinson: Monday 6:00-7:00 pm in 140 Kolthoff Hall

Matt Porter: Tuesday 3:00-4:00 pm in 136 Kolthoff Hall

Ted Riegel: Tuesday 4:00-5:00 pm in 530B Bruinicks Hall

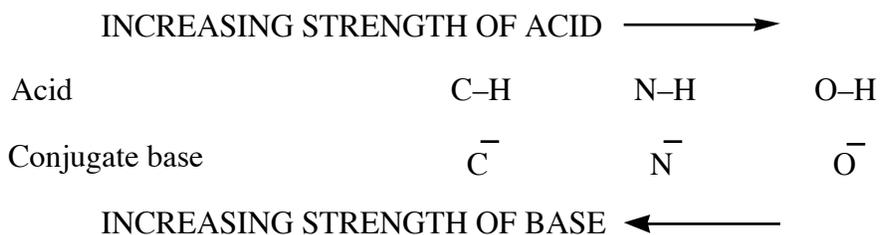
Christopher Rademacher: Tuesday 5:00-6:00 pm in 133 Kolthoff Hall

Zachariah Hoell: Wednesday 3:00-4:00 pm in 133 Kolthoff Hall

## Acid Strength

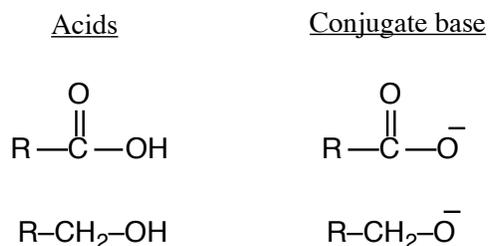
### Steps To Follow For Determining Relative Acidities

1. Look for the most electronegative element which can lose a  $H^+$ . We will primarily be concerned with C, N, and O.
2. Write the structure of the conjugate base (it will usually carry a negative charge). At this point the following broad classification can be made

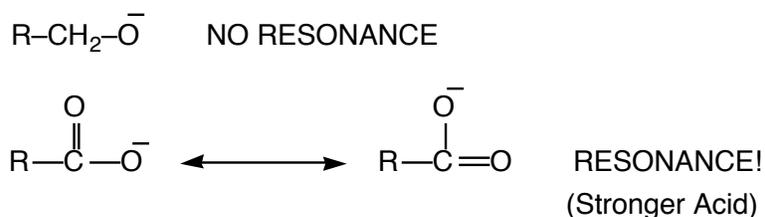


3. Look for resonance stabilization of the conjugate base. Factors stabilizing the conjugate base increase the acidity (i.e., lower the  $pK_a$ ).

example:

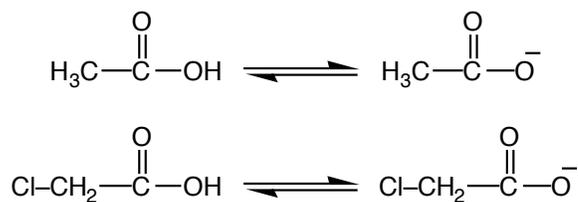


From 1 and 2 above - these two acids should be stronger than their C and N analogs.

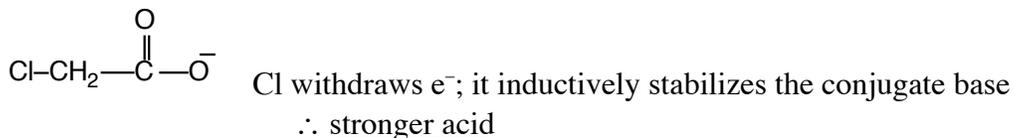


4. Look for inductive stabilization. Again charge dispersal stabilizes the conjugate base, and increases the acidity.

example:

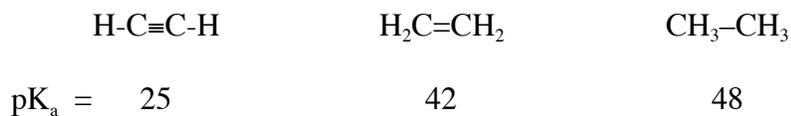


Both conjugate bases are stabilized by resonance.

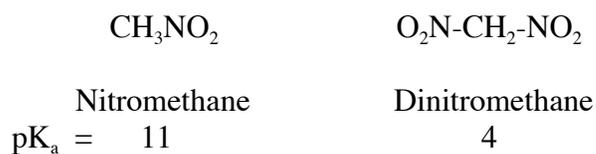
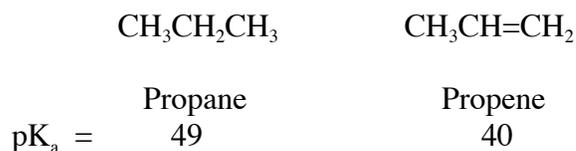
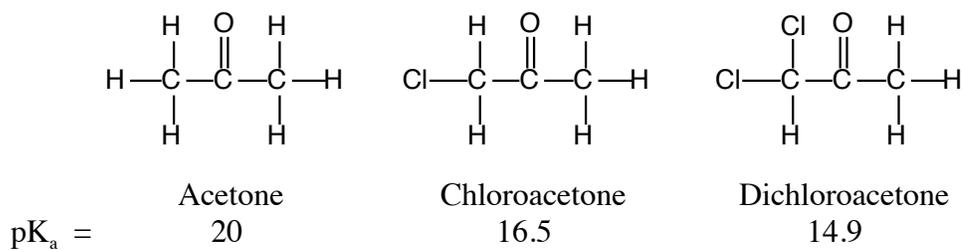


5. Look at the hybridization of the atom losing  $\text{H}^+$  (primarily with carbanions). The more s-character in the orbital containing the extra electron, the more stable the conjugate base.

Acid strength  $sp > sp^2 > sp^3$



Look at the following examples, write structures for the conjugate bases, and rationalize their  $\text{pK}_a$  using steps 1-5 (Draw resonance structures where possible).



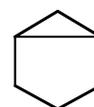
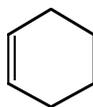
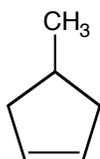
## INDEX OF HYDROGEN DEFICIENCY (IHD)

IHD - The number of H atom pairs that must be removed from an alkane of molecular formula  $C_nH_{2n+2}$  to give the molecular formula of the compound of interest. If a triple bond is considered as two double bonds, the IHD gives the number of rings and double bonds in a molecule.

Example:  $C_6H_{10}$

$C_nH_{2n+2}$  for  $n = 6$  is  $C_6H_{14}$  so  $IHD = (14-10)/2 = 2$

Some possible structures for a compound of this molecular formula are:



etc.

### NOTE

1. The presence of an O or S makes no difference in the index.
2. Halogens are regarded as the equivalent of a hydrogen.
3. Each N raises the number of hydrogens in the corresponding saturated parent compound by one.
4. No hydrocarbon can have an odd number of hydrogens

### EXAMPLES

Structure	Formula	Parent Formula	IHD	H-Deficient Structure
	$C_6H_6O$	$C_6H_{14}$	4	3 C=C, 1 ring
	$C_3H_5NO_2$	$C_3H_9NO_2$	2	1 N=O, 1 ring
$Cl_2CHCH_2C\equiv CH$	$C_4H_4Cl_2$	$C_4H_8Cl_2$	2	2 from $C\equiv C$
	$C_7H_{10}$	$C_7H_{16}$	3	1 C=C, 2 rings
	$C_9H_7N$	$C_9H_{21}N$	7	4 C=C, 1 C=N 2 rings