Intro to Organic Chemistry

- Be able to use the rules of valence to expand condensed molecular formulas into structural formulas.
- Be able to use the rules of valence to expand carbon backbone diagrams into condensed molecular formulas or structural formulas.
- Know what is meant by the following terms: hydrocarbon, alkane, alkene, alkyne, and aromatic hydrocarbons.
- Given a molecular formula or structure, be able to identify the class of hydrocarbon.
- Know the definition of an isomer.
- Be able to identify structural isomers. (E.g., isomers of hydrocarbons, including cycloalkanes).
- Know what is meant by a geometric isomer and be able to identify geometric isomers of alkenes.
- Be able to identify a molecule that COULD have geometric isomers.
- Understand the difference between an alkene and an aromatic hydrocarbon in terms of structure and function (properties)
- Given a molecule be able to identify the following functional groups if they are present. Alcohol, ether, amine, aldehyde, ketone, carboxylic acid, ester, and amide
- Given the name of a functional group, be able to identify molecules that have that functional group.
- Given carbon backbone structures, be able to identify structural features (functional groups, or hydrocarbon classes)
- Be able to identify structural isomers when functional groups are present.
Week 7: 9 Oct thru 15 Oct; Lectures 19-21

Homework Problems
Due before the exam on Monday Oct. 14.
Get help in the Resource Room (211 Whitmore) as needed.
Free Help available: hours given on course web page
http://courses.chem.psu.edu/chem110fall/help/help.htm#TAs_Office_Hours

1. The carbon backbone for a molecule is given below. What is the molecular weight of this compound?
   A. 114 g/mol
   B. 115 g/mol
   C. 119 g/mol
   D. 120 g/mol
   E. 126 g/mol

2. A. What is the molecular formula of this compound?
   B. What is its molar mass?
   C. How many σ and π bonds are in the molecule?

3. Which of the following will have delocalized π bonding?

4. Draw the structure of a hydrocarbon with 6 carbon atoms that is a) an alkane, b) an alkene, c) an alkyne, and d) an aromatic. Which of these are saturated? Which are unsaturated?

5. Which of the following are not acceptable structures for C₄H₁₀?

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A. 1 and 2
B. 2 and 3
C. 3 and 4
D. 3 and 5
E. 1, 3 and 5
6. Which of the following is(are) **not** correct structure(s) of octane $C_8H_{18}$?

I. 

II. 

III. 

A. I only  
B. III only  
C. I and II  
D. II and III  
E. all of these are possible structures for octane.

7. Of the structures shown below, which is a structural isomer of n-pentane?

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8. How many isomers of hexane ($C_6H_{14}$) are there? Draw the Lewis structure of all of them.
9. Which of the compounds shown below can have a geometrical isomer?

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| 1. | ![Chemical Structure](image1)
| 2. | ![Chemical Structure](image2)
| 3. | ![Chemical Structure](image3)

A. 1 only  
B. 2 only  
C. 3 only  
D. 1 and 2  
E. 2 and 3

10. Which of the following is/are geometric isomers of the structure below?

- ![Chemical Structure](image4)
- ![Chemical Structure](image5)
- ![Chemical Structure](image6)
- ![Chemical Structure](image7)
- E. none of these are alcohols

A. 1  
B. 2  
C. 3  
D. 1 and 2  
E. 1 and 3

11. Identify the functional groups present in the following structure.

- 1. ester
- 2. ether
- 3. amine
- 4. ketone
- 5. amide

A. 1 and 5  
B. 2 and 5  
C. 2 and 3  
D. 4 and 5  
E. 3 and 4

12. Which one of these molecules is an alcohol?

- ![Chemical Structure](image8)
- ![Chemical Structure](image9)
- ![Chemical Structure](image10)
- ![Chemical Structure](image11)
- E. none of these are alcohols

A. CH₃-C-CH₂-C₂H₅  
B. CH₂CH₂-C₃H₇  
C. H-C-CH₂-C₂H₅  
D. ![Chemical Structure](image12)

13. Threonine is a naturally occurring amino acid found in many proteins. What functional groups are present in threonine?

- ![Chemical Structure](image13)

a) alcohol, amine, ketone  
b) alcohol, amine, ester  
c) carboxylic acid, alcohol, amide  
d) alcohol, carboxylic acid, amine  
e) amide, amine, alcohol
WEEK 7: 9 OCT THRU 15 OCT; LECTURES 19-21

POST EXAM II REFLECTION

Fill out this first part for your own information. (If you DID NOT take the exam, there is info at the bottom of this page explaining how you can complete this assignment.)

Score on Exam I __________. Score on Exam II __________.

You should self grade your exam immediately after the exam and compare the percentage you get with the score on the report sent to you by testing services.

What grade do you need/want to get in Chem 110? __________

What scores do you need to get on Exam III and the Final in order to get this grade?

Exam III ___________ Final ____________

Reflect on your progress in the course so far. The following questions can be used to guide your reflection.

1. (a) Comment on your preparation for exam II compared to exam I.
   (b) Did this preparation affect your performance on exam II?

2. Analyze your score for exam II.
   (a) Was your score higher or lower than you expected?
   (b) On a separate sheet of paper list the concepts being dealt with in the questions you got wrong.
   (c) On the same page, or on a separate sheet, redo all of the questions you got wrong.
      BE SURE TO SHOW YOUR WORK!
   (d) Indicate why you got each question wrong. Be sure to list any words or phrases (in the question or answers) that you did not know at the time of the test. If you think you made a “careless error,” be sure to specify what that error was, e.g., “I forgot to multiply by 2,” or “I forgot the negative sign.
   (e) Review your answers to the Chem 110 Learning Strategies Questionnaire that you took after Exam 1. Did you implement any new study techniques between exam 1 and 2? Did these changes account for the improvement? If you did not improve or if your improvement was less than you had hoped for, are there any more ideas that look promising in the list of strategies?

If you are not satisfied with your performance in Chem 110 so far, you should schedule an appointment with your Chem 110 instructor as soon as possible!

If you missed the exam because of an excused absence (illness or family emergency) you will be allowed to take the Make-up Exam at the end of the semester. Your score on the Make-up exam at the end of the semester will be used to replace this exam score. You will be asked to sign-up for this exam shortly after Exam 3. Information about the Make-up (time and date) are given on the Course Web page under exam schedule. There is only one Make-up Exam (covering the material from Exams 1, 2 and 3). If you missed more than one midterm contact your instructor immediately.

The feedback that you get from an exam is very useful. If you are underprepared in this block of material, it is good to know now so you can take steps to learn the material better. If you missed the exam, we strongly advise that you print out a copy of the exam (it is posted on the course Web site) and take it under exam conditions (by yourself, with only a calculator and data sheet in 75 minutes). Then use the results of that practice session to answer all questions on this questionnaire using the results from that exam.
Strategy for Solving Gas Law Problems
1. For each question below, first decide which variables are constant.
2. Then determine the equation needed to solve this problem by eliminating the constant
   variables and R from the ideal gas equation. Be sure to show the necessary equation before
   solving the problem.
3. Convert units of any data as needed. If you do not need to convert WHY NOT???

1. A 50L cylinder of oxygen gas is stored at 150 atm. What volume would the oxygen gas
   occupy if the cylinder was opened into a hot air balloon (completely deflated) until the final
   pressure is 735 torr?

2. Standard automobile tires are inflated to approximated 1750 torr. If you fill your tires during
   the day when it is 26.7°C what pressure would they measure at midnight when the
   temperature drops to 13°C? (Assume the volume of the tires remains constant.)

3. A sample of gas is found to have a volume of 52.8 mL at a pressure of 614 torr. The
   pressure is then decreased to 417 torr at constant T. What volume will the gas occupy after
   the change in pressure?

4. A given balloon can hold a maximum of 7.5L of gas. If it is filled at room temperature (25°C)
   with 2.5L how hot will the balloon have to get in order to burst (i.e., have a volume of 7.5L)?

5. A weather balloon is filled with 100L of helium gas. It is launched from State College on a
   clear 30°C day, where the barometric pressure is found to be 0.973 atm. What volume will
   the helium gas occupy when the balloon reaches an altitude of 50,000 feet where the
   atmospheric pressure is 83 torr and the balloon measures a temperature of –73.0°C?

6. The balloon continues to rise and experiences a temperature increase to –50°C with no
   change in pressure. What volume does the balloon now occupy?

7. The average human lung capacity is 6.0L. What volume of air can be inhaled exhaled into a
   balloon on a cold day when the temperature is found to be –7.0°C. The average human
   body temperature is 37°C. (Assume the full volume of air in the lungs is able to be exhaled
   into the balloon.)

8. A basketball is found to have a volume of 7.0L. How many moles of gas must be added to
   the ball at 22°C to provide a pressure of 388 torr?

9. At what temperature would 40g of hydrogen occupy a volume of 448.5L if P = 1 atm?