

CHEM 163 - GENERAL CHEMISTRY III

SUMMER TERM, 2006

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Office Hours: One hour before class each week or at other times by appointment

A. PREREQUISITES CHEM 162 or equivalent

B. COURSE OBJECTIVE

This is the third of three introductory courses illustrating the fundamental principles of chemistry with applications to everyday situations. In this course the primary areas of emphasis will be the organic chemistry of hydrocarbons, functional groups, petroleum chemistry, and polymers, followed by a discussion of chemical kinetics, nuclear chemistry, and thermodynamics.

C. REQUIRED MATERIALS

TEXTBOOK: Chemistry, Fourth Edition by John McMurry and Robert C. Fay - Prentice Hall (2004)

D. CLASS MEETING TIMES

Classes will meet on Wednesday Evenings from 6:00 to 8:40 in Room 27-135

E. EXAM SCHEDULE

Exam I - Wednesday July 26, 2006

Exam II - Wednesday August 16, 2006

Final Exam - Wednesday September 6, 2006

F. GRADE BREAKDOWN

25% of your grade will come from Exam I on Wednesday July 26, 2006

25% of your grade will come from Exam II on Wednesday August 16, 2006

15% of your grade will come from a Problem Set on Chemical Kinetics

35% will come from the Final on Wednesday September 6, 2006

NOTE: NO EXAMS WILL BE GRADED OR RETURNED TO ANY STUDENT NOT OFFICIALLY ENROLLED IN THE CLASS

G. ACADEMIC HONESTY POLICY

Drexel University is committed to a learning environment that embraces academic honesty. In order to protect members of our community from results of dishonest conduct, the University has adopted policies to deal with cases of academic dishonesty. Please read, understand, and follow the "Academic Honesty Policy" as written in the official student handbook. Instances of academic dishonesty, such as cheating and plagiarism, will be dealt with appropriately.

H. COURSE LEARNER OBJECTIVES

Upon completion of this course the student should be able to:

- name and draw structures for hydrocarbons and select functional groups of organic compounds
- predict reactants or products for a wide variety of organic reactions involving hydrocarbons and/or functional groups. Some of these reaction types are combustion, oxidation, reduction, esterification, and polymerization
- understand the correlation between octane number and molecular structure for gasolines
- qualitatively rank hydrocarbons on a relative scale for octane number (burning efficiency of gasoline components)
- determine octane numbers for various gasoline blends
- predict the composition/structure of various addition polymers (such as Teflon and Polyvinyl Chloride) and condensation polymers (such as polyesters and Nylons)
- quantitatively state the rate at which a chemical reaction takes place with respect to reaction order
- understand the influence of temperature on the rate of a chemical reaction
- understand the consequence of a reaction mechanism on rates
- understand the differences between chemical and nuclear transformations
- understand the concept of a half life as it relates to nuclear decay and chemical kinetics
- balance equations for nuclear transformations
- understand the different types of nuclear decay processes
- understand the physical significance of the thermodynamic state functions entropy, enthalpy, and free energy
- qualitatively predict entropy changes for various chemical and/or physical processes
- use free energy as a criterion for the thermodynamic feasibility of a chemical reaction

I. MAKING UP MISSED EXAMS

A single make-up exam will be given to replace either Exam I or Exam II. This exam will be given after the second exam and will cover material from both exams. This means that if you miss either Exam I or Exam II the make-up exam you take will cover material from both exams. The make-up exam will replace one exam only, so that if you miss both exams you will forfeit 25% of your grade. To do this, you first have to make an appointment with either Melissa Knight (215-895-0903) or Marge Fritsche (215-895-2164) at the College of Evening and Professional Studies, located at One Drexel Plaza at 30th and Market Streets. All make-up exams will be administered through the College of Evening and Professional Studies and you must schedule it at a mutually agreeable time between Thursday August 17 and Tuesday August 22. **If you do not complete the make-up exam by Tuesday August 22, your grade for the missed exam will be zero because no make-up exams will be permitted after August 22. THE MAKE-UP EXAM IS TO REPLACE A MISSED EXAM, NOT TO REPLACE A POOR GRADE. THERE IS A TWO HOUR TIME LIMIT ON THE MAKE-UP EXAM SO YOU WILL HAVE TO ARRIVE EARLY ENOUGH TO RECEIVE THE FULL TIME ALLOWED. THE OFFICE WILL NOT REMAIN OPEN PAST THEIR REGULAR HOURS FOR YOU TO COMPLETE THE EXAM IF YOU ARRIVE LATE. IT IS YOUR RESPONSIBILITY TO MAKE A SUITABLE APPOINTMENT TO TAKE THE EXAM.**

J. ATTENDANCE POLICY

Considering the needs of part time students occasionally having to miss class because of employment or familial commitments, attendance will not affect your grade. If you miss a class for any reason, it is your responsibility to call me to find out what work you missed.

CHEM 163 LECTURES AND RECITATION ASSIGNMENTS

| <u>WEEK</u> | <u>DATE</u> | <u>LECTURE TOPICS</u> | <u>CHAPTER</u> | <u>RECITATION PROBLEMS</u> |
|-------------|-------------|--|----------------|--|
| 1 | 6-28 | Hydrocarbons | 23 | COURSE INTRODUCTION |
| 2 | 7-5 | Hydrocarbons Functional Groups | 23 23 | 23.46, 23.50, 23.52, 23.56, 23.58 23.60a, 23.66a, 23.68a,b,d, 23.70 23.72, 23.74, 23.78 |
| 3 | 7-12 | Functional Groups | 23 | 23.66b,c, 23.68c,e, 23.20, 23.22, 23.82a,b, 23.18, SP1, 23.42, 23.43a, SP5, SP6, SP7 |
| 4 | 7-19 | Polymer Chemistry Petroleum Chemistry | 23 * | 23.83a,b, 23.84, 23.90, 23.94, 23.96a,c, 23.98a,c, 23.40a,b, 23.44, 23.45 |
| 5 | 7-26 | EXAM I ON MATERIAL FROM LECTURES 1-3 | | |
| 6 | 8-2 | Chemical Kinetics | 12 | SP2, SP3, SP4, 23.102 23.103, 23.104, 23.105, 23.106, 23.107, 23.108, 23.109 |
| 7 | 8-9 | Chemical Kinetics Nuclear Chemistry | 12 22 | 12.36, 12.40, 12.42, 12.46, 12.48, 12.50, 12.52, 12.56, 12.58, 12.60 |
| 8 | 8-16 | EXAM II ON MATERIAL FROM LECTURES 4 AND 6 | | |
| 9 | 8-23 | Thermodynamics | 17 | 12.78, 12.79, 12.80, 12.82, 22.30, 22.32, 22.34, 22.19, 22.44, 22.50, 22.48, 22.87 |
| 10 | 8-30 | REVIEW FOR FINAL EXAM | 17 | 17.32, 17.38, 17.40, 17.48, 17.50a,b, 17.66, 17.68, 17.70a,b, 17.72a,b, 17.84, 17.97 |

SP = Supplementary Problems included in this handout

*** = Study Material on Petroleum Chemistry which will be distributed in class**

CHEM 163 SUPPLEMENTARY PROBLEMS

- Each of the following compounds may be synthesized from an alkene, or an alkyne, and another reactant. In each case give the name and the structure of the alkene or alkyne and the other reactant:
 - 2-propanol
 - 2,2,3,3-tetrabromobutane
 - 1-butene
 - 2-bromopropene
- Assuming that octane numbers are additive (which they really are) calculate the percentage of 2,2,3-trimethylbutane which must be added to an 85 octane rating gasoline to bring its octane number up to 93.
- Calculate the octane number for each of the following "gasoline" blends.
 - 60% 2,2,4-trimethylpentane, 20% n-octane, 20% toluene
 - 40% 2,2,3-trimethylbutane, 20% 2-methylbutane, 40% toluene
 - 35% p-xylene, 35% benzene, 30% n-hexane
- Based only on molecular structure (do not use a table of octane numbers), arrange the following compounds in their expected order of increasing (lowest to highest) octane number: p-xylene, n-octane, 2-methylheptane, 2,2,4-trimethylpentane, 2,2,3,3-tetramethylbutane, ethylbenzene, and benzene.
- Draw a structure and give the IUPAC name for each of the following:
 - the dialcohol derived from an alkene with the molecular formula C_5H_{10} in which the two -OH groups are on adjacent carbon atoms
 - The two alcohols that could be made from the reaction of 2-pentene with water
 - The alcohol needed to make a five carbon ketone in which the $C=O$ is on the third carbon atom
 - The structure only (not the name--we haven't covered them yet) for the two products resulting from the reaction of 1-butanol with an oxidizing agent.
 - In what way, if any, would the answer to (d) be different if it had been 2-butanol instead of 1-butanol?
- You are given a bottle containing a liquid which is believed to contain either 1-butanol or 1-octanol. The only thing you are able to do is a simple solubility test. When you add some of the liquid to water, you find that it forms two separate phases and does not dissolve very much at all.
 - Which alcohol do you think it was?
 - If it had been the "other one", would you expect the solubility to have been higher or lower? Explain!
- Which alcohol(s) would you use to make the following ether
$$\begin{array}{c} CH_3-O-CH-CH_3 \\ | \\ CH_3 \end{array}$$