COURSE INFORMATION

DEPARTMENT [illegible] June 1980

CHEMISTRY CHE 321 ORGANIC CHEMISTRY I H 5

NAME OF UNIVERSITY COURSE DESCRIPTIVE TITLE

CREDIT

CATALOGUE DESCRIPTION:

This course deals with the fundamental principles of modern organic chemistry and includes the structure properties and reactions of all common functional groups. Emphasis would be placed on reaction mechanisms and the physical aspects of the science. The course is designed for prospective Honors and Majors students in Science. Credit will not be given for both Chemistry 220 and Chemistry 321.

COURSE PREREQUISITES: CHE - 210

COURSE COREQUISITES:

D EXPERIENCE

LECTURE 4 HRS. FIEL

18. do problems on synthesis using hydrogenation, reduction by metals and coupling reactions
19. write equations for halogenation, combustion and pyrolysis reactions of hydrocarbons
20. explain the order $3^\circ > 2^\circ > 1^\circ$ for hydrogen abstraction in light of the stability of free radicals
21. discuss the transition state for halogenation [illegible] do not occur [illegible] of free radicals
22. define stereochemistry and stereoisomers, plane polarized light and optical activity
23. do problems involving specific rotation
24. define enantiomers and diastereomers with appropriate examples
25. discuss the chiral center and its relationship to chirality
26. define and discuss the racemic modification and do concentration calculations based on optical rotation
27. specify configurations by the Cahn-Ingold-Prelog [illegible]
28. recognize and draw enantiomers and meso structures for compounds with two chiral centers
29. [illegible] deduce the shape [illegible] feature of the carbon double bond in alkene structures
30. with appropriate examples explain what geometric isomers are
31. name the alkenes using common names and the I.U.P.A.C. system
32. write equations for the preparation of alkenes by dehydrohalogenation, dehydration, dehalogenation and reduction
33. give reasonable mechanisms for the above (32) reactions
34. discuss the carbonium ion, its structure and stability [illegible] considerations
35. write equations for the reactions of alkenes with halogens, [illegible] water, [illegible]
36. write equations [illegible] or anti hydroboration as they apply to alkenes
37. use the mechanism of hydrogen halide addition to demonstrate Markovnikov's rule
38. demonstrate an understanding of the peroxide effect
39. show with the aid of [illegible] understanding of orientation and reactivity in electrophilic addition to alkenes
40. demonstrate an understanding of carbonium ion rearrangements
41. distinguish between Markovnikov and anti-Markovnikov orientation and give reasons for the difference
42. show an understanding of resonance [illegible] as an example
43. demonstrate an understanding of hyperconjugation
44. do problems on synthesis based on the reactions studied under alkenes

45. convert an achiral compound into a chiral

ults when reactions with a chiral molecule do not

46. explain the process and res

ve the bonds at the chiral center and was

tive compounds

47. give a simple reaction pathway to the synthesis of optically ac

48. demonstrate the use of optically active compounds as chemical

and relate these

49. define with appropriate examples and demonstrate reactio

to the mechanism of bromination of alkenes

e of the carbon

50. discuss and illustrate the structure, bonding orbitals and shap

bond

carbon or p e

ynes up to C

using the common and IUPAC systems

51. name the alky

e preparation of alkynes by dehydrohalogenation,

52. write equations for th

dehalogenation

, hydrogen, halogens.

53. demonstrate a knowledge of the reaction of alkynes with

hydrogen halides and water

lkali metal

54. show an understanding of the formation of heavy metal acetylides and a

acetylides

mples

55. demonstrate a knowledge of keto-enol tautomerism using appropriate exa

56.

57. discuss and illustrate the structures, bonding orbitals and shape of conjugated

systems

58. name the dienes up to C

10

59. discuss the industrial processes used in the

manufacture of 1,4-butadiene and

its importance in the rubber industry

0. explain the stability of dienes and other conjugated systems using the orbital

60

resonance and hyperconjugation

pre

for the products of 1,2-and 1,4-addition in light of the mechanism of the

61. account

addition reactions of dienes

d in product distribution attributable to the rate

ble to equilibration at high temperature

62. explain the difference observe

of addition and that attributa

approach and the stability of free radicals

63. explain using a mechanistic ap

ratios for free radical addition of free radicals to dienes

the alycyclic hydrocarbons including bicyclo[2.2.1] heptane, bicyclo[2.2.2]

64. name t

70. discuss in some detail [illegible] orbital picture and aromatic characteristics of benzene and other aromatic compounds

71. name all the common benzene derivatives

72. [illegible] sulfonation, halogenation, alkylation, acylation [illegible] and protonation [illegible]

73. [illegible] the mechanisms of the above reactions and with the aid of these mechanisms theorize on the directional influences on the various [illegible]

74. write equations [illegible] halogenation of alkyl benzenes

75. discuss the resonance stabilization of the benzyl and triphenylmethyl free radical

76. discuss the electromagnetic spectrum and the use of the infrared and ultraviolet spectrophotometer in the identification of organic compounds

77. know the common [illegible] of all the alkyl halides up to C_{10} and how they are prepared

[illegible] second order reactions and relate these to

97. write equations for the reaction of acids to give [illegible]

esters, amides, alcohols and a pha halogens

idity and the role of resonance

98. discuss the effects of various substituents on ac and inductive effects on acidity

leic, fumaric and the pathalic

99. draw structures for oxalic, malonic, succinic, nuc

he infrared spectra of acids

100. recognize the distinct absorption patterns in t

e.g. acid chlorides, anhydrides,

101. name the common derivatives of carboxylic acids amides and esters

[illegible]

102. write equations for the reaction of [illegible] and alcohols

riedel-crafts acylation of acid chlorides and anhydrides

103. outline the F

ns for the reactions of esters with Grignard reagents, Lithium ide and hydrogen

104. write equatio aluminum hydr

ils of the mechanism of the acid and base hydrolysis of esters dings of kinetics, stereochemistry, tracer studies and isotopic

105. give the deta under the hea exchange

s and ketones by their common and IUPAC names

106. name aldehyde

ons for the preparation of aldehydes from alcohols, methylbenzenes and acid chlorides

107. write equatio

08. write equations for the preparation of ketones by the oxidation of alcohols

i-crafts acylation and reactions of acid chlorides

Friede

e the results of the reactions of aldehydes and ketones with the common

109. outline

oxidiz

NH_2NH_2)

110. write the equations for the reactions of aldehydes and ketones with Grignar reagents, cyanide, bisulfite, hydroxylamine, hydrazine, phenylhydrazine, se carbazide and alcohols

d

mi-

111. outline the Cannizzaro reaction and the halogenation of ketones

112. recognize the distinct absorption patterns in the infrared and ultraviolet spectra of aldehydes and ketones

COURSE OUTLINES

1. STRUCTURE AND PROPERTIES [illegible]

energy, polarity, acids [illegible] Covalent bond, Hybrid orbitals, bond dissociation and base, spatial arrangements, isomerism.

1. METHANE

Classification, structure, reactions, mechanism of halogenation, activation energy, rate of reaction, energy, bond dissociation, transition states, elemental analysis

IV. STEREOCHEMISTRY - 1

reo,somers, Isomer numbers, Optical activity, Enantiomers, Chirality, Ste
ules, Diastereomers, Meso-structures, Conformations. Configurations, Sequence r

V. ALKENES

[redacted]

XIII. ALKYL HALIDES

Structure and Nomenclature. Properties. Preparation. Reactions. First and
t cs, SN1 and SN2 reactions, Inversion and Retention of
action mechanisms. Stereochemistry.

XIV. ALCOHOLS

Preparation and Physical Properties. Nomenclature. Chemical Reactions.
Hydroboration. Reactions and mechanisms. Synthesis and Analysis.

XV. ETHERS AND EPOXIDES

Structure, Nomenclature, Preparation, Electrophilic substitution, Cyclic
ethers. Cleavage reactions. Ethylene oxide.

XVI. CARBOXYLIC ACIDS

ylic acids. Structure, nomenclature, preparation, reactions, derivatives of carbox
lysis. substituent effects, spectroscopic ana

XVII. ALDEHYDES AND KETONES

eactions, spectroscopic analysis. Structure, nomenclature, preparation re

METHOD

em sessions, The course will be presented using lectures, assigned readings, probl
class discussions and student directed learning. Films and other aud
ourse material. course will be used to illustrate the practical aspects of the co
assroom work when- Close co-ordination will be maintained between laboratory and cla

EVALUATION

45%	1. Class Tests (a minimum of three) and Assignments
30%	2. Final Examination
25%	3. Laboratory