UNIVERSITY OF SWAZILAND
MAIN EXAMINATION 2007/08

TITLE OF PAPER	:	Organic Chemistry
COURSE NUMBER	:	C303
TIME	:	Three Hours
INSTRUCTIONS	:	Answer any FOUR questions. Each question carries **25** marks.

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QUESTION 1

Explain the following observations with appropriate structures and mechanisms:

(a) Catalytic reduction of alkynes usually gives mainly cis-products (3)
(b) Reduction of alkynes with sodium and ammonia gives trans- products (3)
(c) Halogenation of 2-butene is stereoselective. (7)
(d) Bimolecular elimination is both stereoselective and stereospecific (12)

QUESTION 2

(a) Write all steps in the mechanism for any reaction which involves anchimeric assistance clearly indicating the stereochemistry of both the reactant and product with or without anchimeric assistance. (10)

(b) Write the mechanism and names of all the products for the following reactions:

(i) Eletrophilic addition of any hydrogen halide to 3,3-dimethyl-1-butene
(ii) Dehydration of 3,3-dimethyl-2-butanol in the presence of acid
(iii) Conversion of propanoic acid to butanoic acid (15)

QUESTION 3

(a) Outline all steps in the following reactions:

(i) Conversion of 1-butanol to 2-ethyl-1-hexanol
(ii) Conversion of benzaldehyde to 1,3-diphenylpropenone
(iii) Conversion of diethyl hexanedioate (diethyl adipate) to ethyl 2-oxocyclopentane carboxylate. (15)

(b) Outline all steps in the synthesis of 3-methyl-2-hexanone starting with ethyl acetoacetate (10)

QUESTION 4

(a) Define the following terms and illustrate with an example in each case:

(i) Concerted reaction
(ii) Conrotatory motion (6)

(b) Write structures of the following compounds and products of their photochemical reactions:

(i) Cyclobutene
(ii) 1,3-Cyclohexadiene
(iii) tran,trans-2,4-Hexadiene
(iv) trans-5,6-Dimethyl-1,3-cyclohexadiene (9)

(c) Write the Woodward-Hoffmann rules for electrocyclic reactions (4)

(d) Why does ethene dimerise easily in the presence of light but it does not dimerise when it is heated? (6)

QUESTION 5

(a) What is an aromatic compound and how can it be distinguished from an anti-aromatic compound? (5)

(b) Outline the mechanism for the chlorination of benzene in the presence of iron (III) chloride (5)

(c) Give reasons why nucleophilic substitution occurs readily with alkyl halides while it is difficult with aryl halides (15)

QUESTION 6

(a) Define the following terms:

(i) Auxochrome
(ii) Fingerprint region
(iii) Blue shift. (6)

(b) Describe how infra red spectroscopy can be used to distinguish between the following pairs of compounds:

(i) A carboxylic acid and an alcohol
(ii) A concentrated phenol and a diluted phenol
(iii) An amide and an amine. (6)

(c) What is the structure of a compound, C_9H_{12} which has δ values of 7.1, 2.2, 1.5 and 0.9 ppm in the ^1H NMR signals? (8)

(d) The mass spectrum of 1-(4-methylphenyl)-ethanol shows an abundant ion at m/z 121 and a less abundant ion at m/z 119. Write the structures for the two ions. (5)