

UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION 2009, JULY

TITLE OF PAPER : Introductory Organic Chemistry

COURSE NUMBER : C203

TIME : Three Hours

INSTRUCTIONS : Answer any **FOUR** questions. Each question carries **25** marks

This Examination Paper Contains Five Printed Pages Including This Page

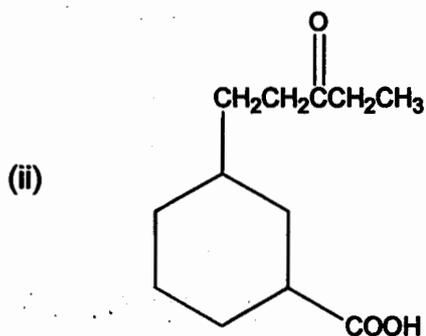
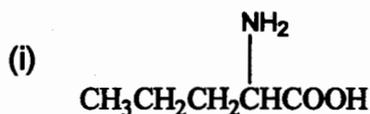
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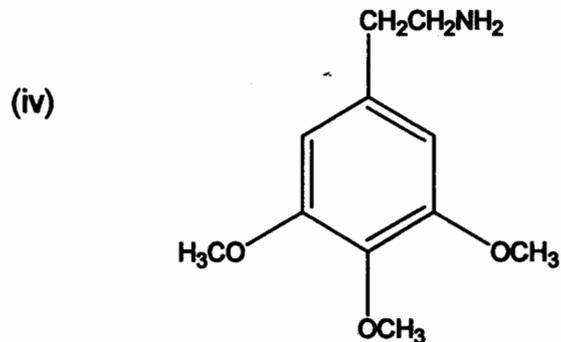
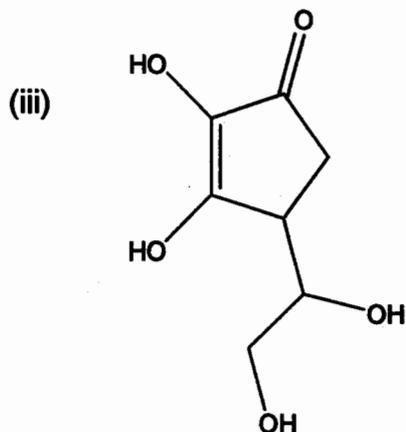
Question 1

- (a) (i) Write the structures of three isomeric substances with the molecular formula C_3H_8O .
- (ii) Name the three isomers.
- (iii) Which of the three isomers is an ether? (5)
- (b) Briefly explain the following terms and give appropriate examples
- (i) Diastereoisomers
- (ii) Meso compound
- (iii) Dextrorotatory compound
- (iv) Levorotatory compound
- (v) Plane-polarised light (10)
- (c) Write the Fischer Projection structures for:
- (i) (R)-2-Bromopropanoic acid
- (ii) (R)-2,3-Dihydroxypropanal
- (iii) (S)-2-Aminobutanoic acid
- (iv) (2S,3S)-Dichlorobutanoic acid
- (v) (2R,3R)-Dibromobutanal (10)

Question 2

- (a) Identify and then name every functional group in each of the following compounds: (9)

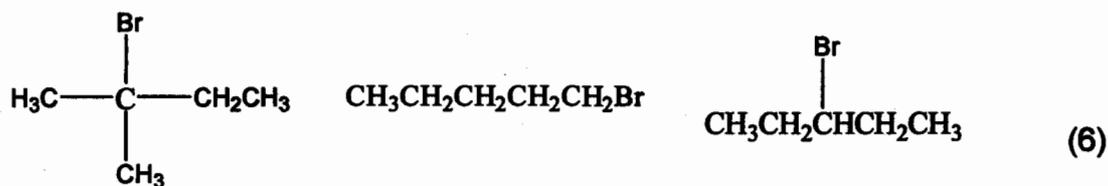




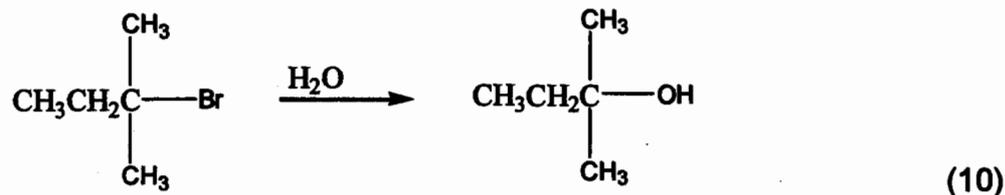
(b) Rank the following alkyl halides in order of decreasing reactivity in;

(i) S_N1 mechanism

(ii) S_N2 mechanism



(c) Show all the steps of the following reaction by S_N1 mechanism.



Question 3

(a) What would be the products of the hydration of 3,3-dimethyl-1-pentene $\{\text{CH}_3\text{CH}_2\text{CH}_2(\text{CH}_3)_2\text{CH}=\text{CH}_2\}$ using:

(i) Acid-catalysed hydration (5)

(ii) Oxymercuration-demercuration (5)

(iii) Hydroboration-oxidation (5)

(b) Propose a mechanism for the aldol condensation of propanal $(\text{CH}_3\text{CH}_2\text{CHO})$ (10)

Question 4

- (a) Write a valid mechanism for the esterification of benzoic acid and ethanol (8)
- (b) Write the equations for the reaction of 1-heptanol with
- (ii) Pyridiniumchlorochromate (PCC) in dichloromethane
 - (iii) Acidified potassium dichromate (8)
- (c) (i) Explain the reaction of Tollen's reagent with butanal and how this reaction could be used to differentiate butanal from butanone (5)
- (ii) Write the steps involved in the reaction of butanone with iodine in aqueous sodium hydroxide and name the product (4)

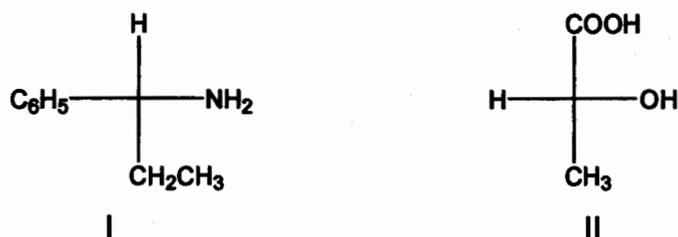
Question 5

- (a) Account for each of the following observations:
- (i) The boiling points of phenol and toluene are 182°C and 110.6°C, respectively, even though they have almost the same molecular weight (5)
 - (ii) Carboxylic acids usually have higher boiling points than alkanes with the same number of carbons (5)
- (b) How many kinds of hydrogens (H) are there in: (10)
- (i) CH_3CH_3
 - (ii) $\text{CH}_3\text{CH}_2\text{CH}_3$
 - (iii) $\text{H}_2\text{C}=\text{CH}_2$
 - (iv) $\text{C}_2\text{H}_5\text{OH}$
- (c) What would be the splitting pattern for the peaks observed in the ^1H NMR spectrum of $\text{C}_2\text{H}_5\text{OH}$? (5)

Question 6

- (a) The structure of tartaric acid, an important compound in the history of stereochemistry, is $\text{HOOC}-\text{CH}(\text{OH})-\text{CH}(\text{OH})-\text{COOH}$
- (i) How many stereogenic centers does tartaric acid have? (3)

- (ii) State the number of all possible stereoisomers of tartaric acid, and draw the Fisher projection structures of each isomer (10)
- (b) Enantiomerically pure amines such as pure (S)-1-phenylpropylamine (I) are often used to resolve racemic forms of acidic compounds such as lactic acid (II)



- (i) Briefly describe how (S)-1-phenylpropylamine (I) may be used to resolve the racemic form of lactic acid (II) into enantiomerically pure acids (6)
- (ii) In the resolution of lactic acid using (S)-1-phenylpropylamine as the resolving agent, the compound obtained by recrystallisation of the mixture of the diastereomeric salts is (S)-1-phenylpropylammonium-(R)-lactate. Name the other component of the mixture that (being more soluble) remains in solution in the re-crystallization solvent. (6)