

**UNIVERSITY OF SWAZILAND**  
**SUPPLEMENTARY EXAMINATION 2013, JULY**

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**TITLE OF PAPER** : Introductory Organic Chemistry

**COURSE NUMBER** : C203

**TIME** : Three Hours

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

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This Examination Paper Contains Five Printed Pages Including This Page

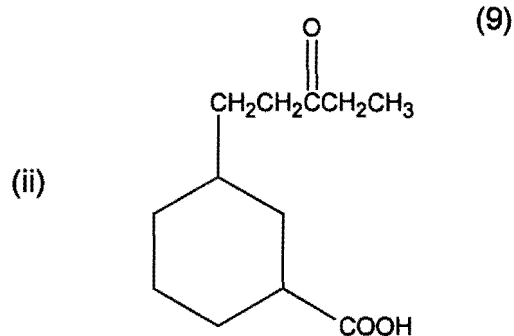
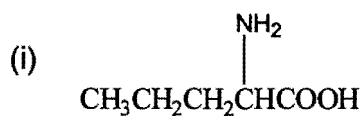
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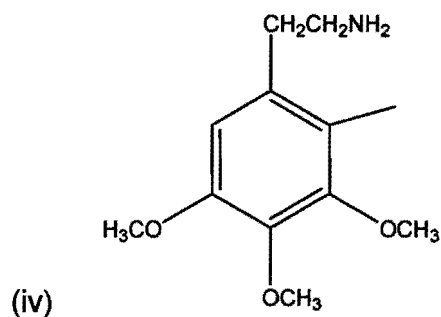
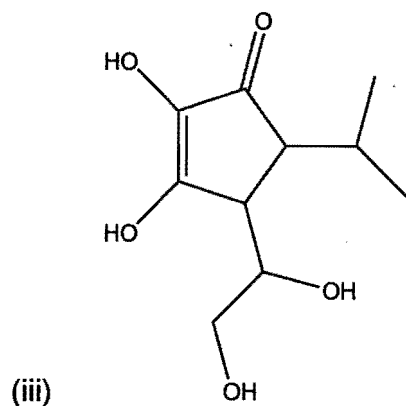
### Question 1

- (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)

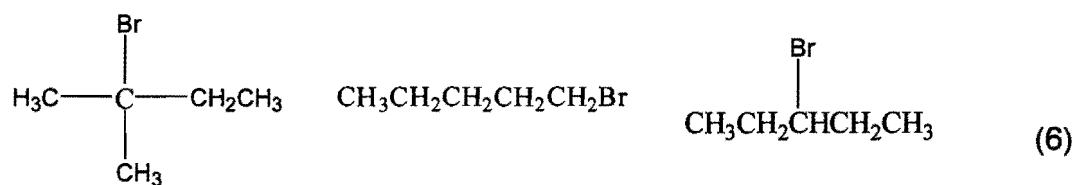




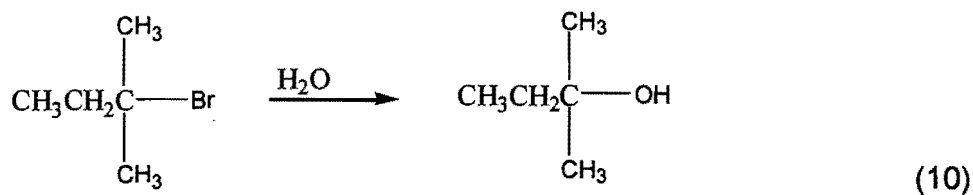
(b) Rank the following alkyl halides in order of decreasing reactivity in;

(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) Oxymecuration-demercuration (5)
- (iii) Hydroboration-oxidation (5)
- (b) Propose a mechanism for the aldol condensation of propanal (CH<sub>3</sub>CH<sub>2</sub>CHO) (10)

#### **Question 4**

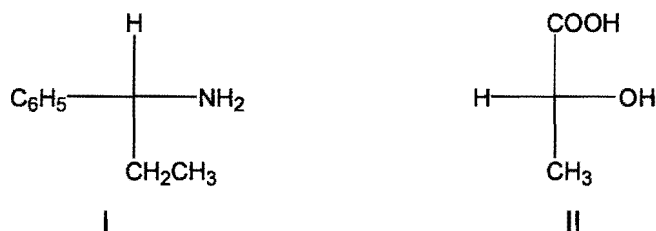
- (a) Write a valid mechanism for the esterification of benzoic acid and ethanol (8)
- (b) Write the equations for the reaction of 1-heptanol with
  - (ii) Pyridiniumchlorochromate (PCC) in dichloromethane
  - (iii) Acidified potassium dichromate (8)
- (c) (i) Explain the reaction of Tollen's reagent 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<sub>3</sub>CH<sub>3</sub>
  - (ii) CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub>
  - (iii) H<sub>2</sub>C=CH<sub>2</sub>
  - (iv) C<sub>2</sub>H<sub>5</sub>OH
- (c) What would be the splitting pattern for the peaks observed in the <sup>1</sup>H NMR spectrum of C<sub>2</sub>H<sub>5</sub>OH? (5)

### Question 6

- (a) The structure of tartaric acid, an important compound in the history of stereochemistry, is  $\text{HOOC-CH(OH)-CH(OH)-COOH}$
- (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)