

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
EDUCATION SCIENCE**

COURSE CODE: CHEM 212

COURSE TITLE: ORGANIC CHEMISTRY II

STREAM: Y2S1

DAY: WEDNESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 05/08/2009

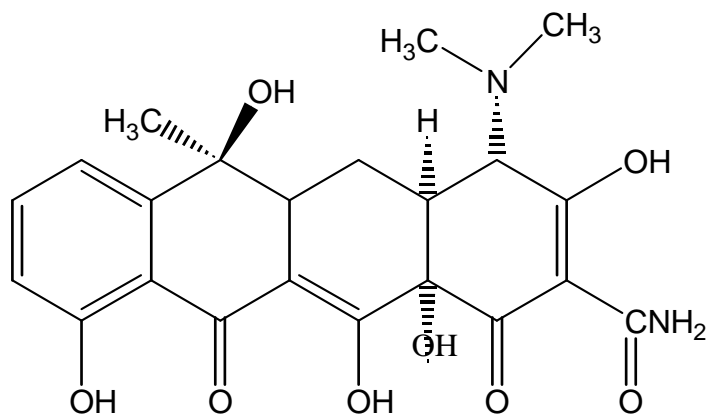
INSTRUCTIONS TO CANDIDATES:

Attempt all questions

Each question = 17.5 marks

PLEASE TURN OVER

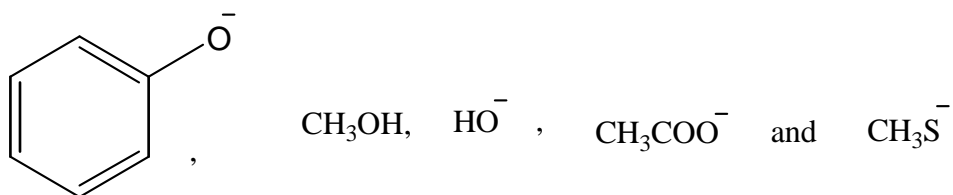
1. (a) (i) Define the following terms: Dextrorotatory, levorotatory, optical activity, diastereomers, and racemic mixtures. (2.5 mks)
- (ii) Explain the difference between constitutional isomers and stereoisomers. Give examples. (2 mks)
- (iii) Explain the difference between Geometrical isomers and optical isomers. Give examples. (2 mks)
- (b) (i) Explain how R and S configuration is related to the signs (+) and (-) in the nomenclature of stereoisomers. (1 mk)
- (ii) Tetracycline is called a broad-spectrum antibiotic, using its structure below; identify all sp^3 hybridized asymmetrical carbons. (1.5 mks)



- (iii) Give structural formulae of (E)-2-chloro-2-butene and (Z)-1-chloro-2-butene. (2 mks)
- (c) (i) Draw three dimensional structures for each of the following molecules: (2 mks)
- I. (S)-1-bromo-1-chlorobutane
- II. (2R, 3R)-2, 3-dichloropentane.
- (ii) Draw and name using R / S notation the stereoisomers of 2, 3-dibromobutane. (1.5 mks)
- (iii) Identify the pair of structures in (c) (ii) above that forms a pair of enantiomers, diastereomers or meso compounds. (1 mk)

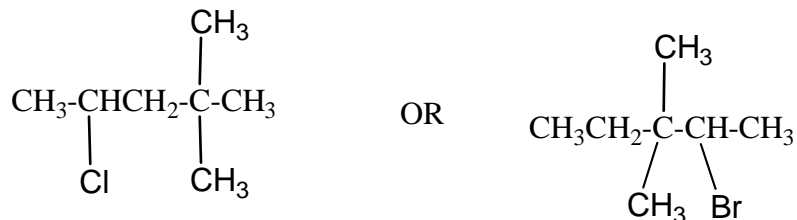
(d) Draw Newman projections of all possible conformational isomers of 1, 2-dibromo-1, 2-dichloroethane. Name the type of conformation for each stereoisomer. (2 mks)

2. (a) (i) Which of the following ions is a stronger base, RO^- or RS^- ? Explain. (2 mks)
 (ii) Which of the ions in (2) (a) (i) above is a better nucleophile in aqueous solution? (1 mk)
 (iii) List the following species in order of decreasing nucleophilicity in aqueous solution? Explain the order. (2 mks)



(b) (i) Arrange the following alkyl bromides in order of decreasing reactivity in $\text{S}_{\text{N}}1$ reactions: Isopropyl bromide, *n*-propylbromide, tert-butylbromide and methylbromide. Explain the order. (2 mks)

(ii) Which of the following alkyl halide form a substitution product in an $\text{S}_{\text{N}}1$ reaction that is different from a substitution product formed in an $\text{S}_{\text{N}}2$ reaction? (1 mk)



(iii) Give the mechanism for the $\text{S}_{\text{N}}1$ reaction of one of the compounds in (b) (ii) above that reacts with aqueous solution of sodium hydroxide to give two products. (3 mks)

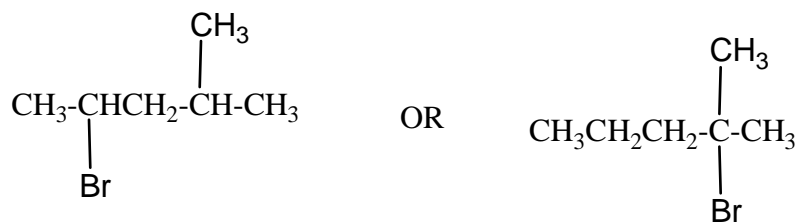
(iv) Name the major and the minor products formed in the above reaction

(2) (c) (iii). (1 mk)

(c) (i) Which of the following alkyl halides is the most reactive towards an E₂ reaction?

Explain.

(2 mks)

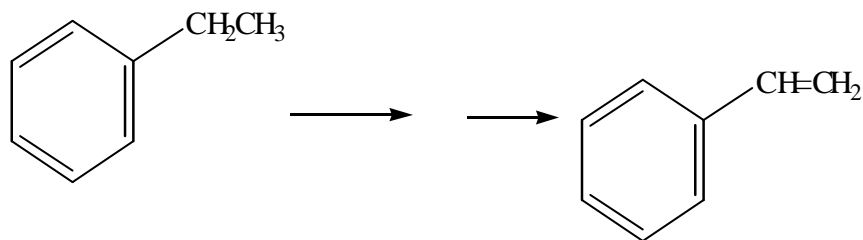


(ii) Give the mechanism for the E1 reaction of 2-bromo-2-methylpentane with sodium tert-butoxide.

(2 mks)

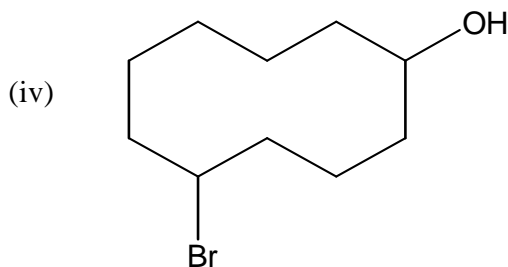
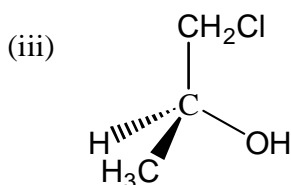
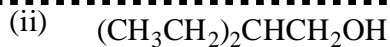
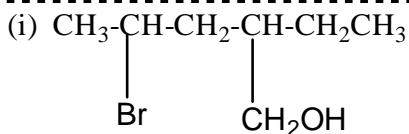
(iii) Using the given starting material and any necessary reagents, indicate how the desired compound could be synthesized.

(1.5 mk)



3. (a) Name the following alcohols according to the IUPAC nomenclature system and classify them into primary, secondary and tertiary alcohols (including their Configuration where possible):

(4 mks)



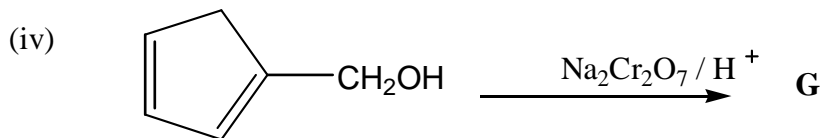
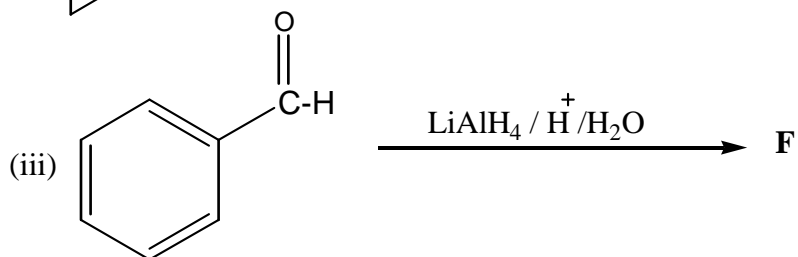
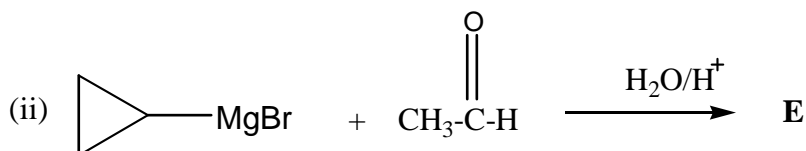
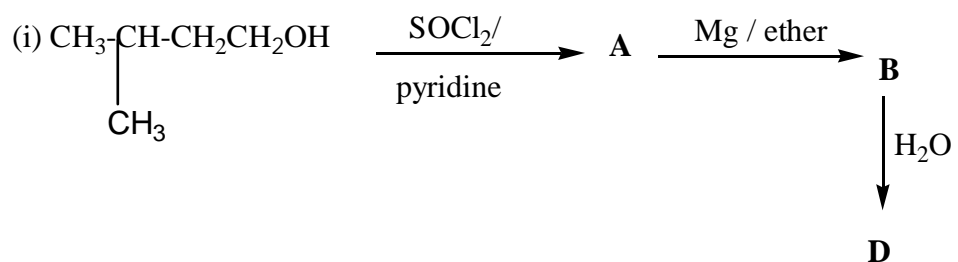
(b) (i) The treatment of 3-methyl-2-butanol with HBr acid yields

2-bromo-2-methylbutane as the sole product. Outline a mechanism for the reaction. (2.5 mks)

(ii) Show how you would utilize the hydroboration-oxidation procedure to prepare each of the following alcohols: (3 mks)

- I. 3,3-dimethyl-1-butanol
 II. 2-phenyl ethanol

(c) Give the products of the following reactions: (6 mks)



(d) Devise a synthesis of 3-octanol starting from an aldehyde and any other reagents. (2 mks)

4. (a) Draw the structures of the following compounds: (4 mks)

(i) 3-bromo-4-tert-butylaniline

(ii) *p*-methoxy-*m*-nitrotoluene

(iii) 3-phenyl-cyclohexanol

(iv) 2, 4, 6-trihydrobenzene sulphonic acid

(b) (i) Outline all steps in a reasonable mechanism for the formation of isopropylbenzene from propene and benzene in presence of an acid HF. (3 mks)

(ii) Starting with benzene and any other reagent, outline a synthesis for each of the

Following: (5 mks)

I. *o*-chloronitrobenzene

II. *m*-methylbenzene sulphonic acid

(c) (i) Outline the chemical reactions involved in the industrial manufacture of phenol. (3 mks)

(ii) Complete the following reaction equations of phenol: (2.5 mks)

