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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER REGULAR MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHE 203**

COURSE TITLE: **ORGANIC CHEMISTRY II**

DATE: 28TH JULY 2021 **TIME:** 2 - 5 PM

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 6 PRINTED PAGES **PLEASE TURN OVER**

REGULAR – MAIN EXAM

CHE 203: ORGANIC CHEMISTRY II

STREAM: BED (Science) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

*Answer **ALL** questions*

Question One

a) Distinguish between the following terms as used in stereochemistry (6 Marks)

i) Chirality and stereoisomers

ii) Conformation and configuration

iii) Enantiomers and diastereomers

b)

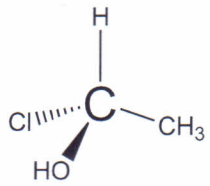
i) Draw both chair conformations of *cis*-1,2- dimethylcyclohexane, and determine which conformer is more stable (3 Marks)

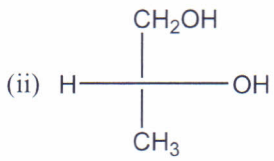
ii) Repeat for the trans isomer. (3 Marks)

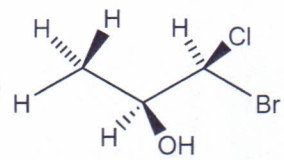
iii) Predict which isomer (cis or trans) is more stable. (3 Marks)

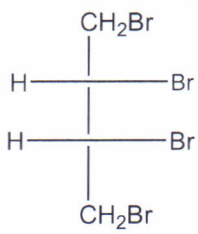
Question Two

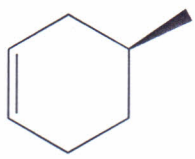
a) For each of the following structures, star (*) any asymmetric carbon atom (s), label it as (*R*) or (*S*), hence identify the structure as either chiral, achiral or meso compound (11 Marks)

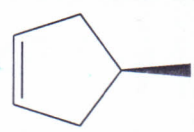
(i) 

(ii) 

(iii) 

(iv) 

(v) 

(vi) 

b)

i) When one of the enantiomers of 2-butanol is placed in a polarimeter, the observed rotation is 4.05° counter clockwise. The solution was made by diluting 6 g of 2-butanol to a total of 40 mL, and the solution was placed into a 200-mm polarimeter tube for

the measurement. Determine the specific rotation for this enantiomer of 2-butanol. (2 ½ Marks)

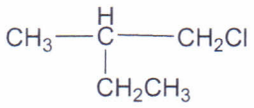
ii) The specific rotation of (*S*)-2-iodobutane is +15.90°. Determine the % composition of a mixture of (*R*)- and (*S*)-2-iodobutane if the specific rotation of the mixture is -3.18° (2 ½ Marks)

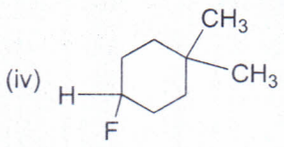
Question Three

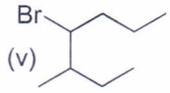
a) Give the IUPAC name for each of the following compounds, classifying each as methyl, primary, secondary, or tertiary halide. (5 Marks)

(i) $(CH_3)_2CHCH_2Cl$

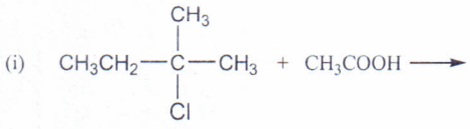
(ii) $(CH_3)_3CBr$

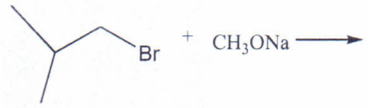
(iii) 

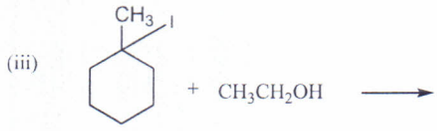
(iv) 

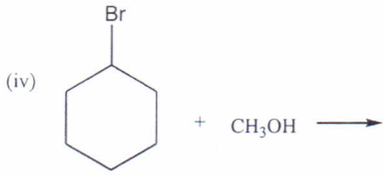
(v) 

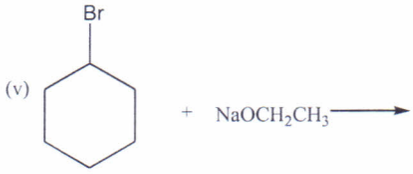
b) For each reaction, give the expected substitution product, and predict whether the mechanism will be predominantly first order (S_N1) or second order (S_N2) (7 ½ Marks)

(i) 

(ii) 

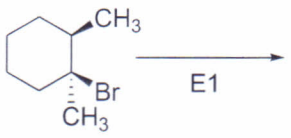
(iii) 

(iv) 

(v) 

c) State the Zaitsev's rule (1 Mark)

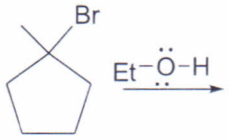
d) Predict the products of E1 elimination of the following compounds. Label the major and minor products (4 Marks)

(i) 

(ii) 

e) S_N1 substitution and E1 elimination frequently compete in the same reaction.

i) Propose a mechanism and predict the products for the solvolysis of 1-bromo-1-methylcyclopentane in ethanol (3 Marks)

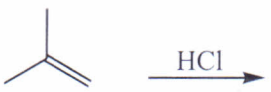


ii) Compare the function of the solvent (ethanol) in the E1 and S_N1 reactions (2 Marks)

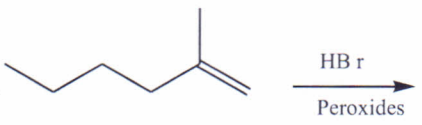
Question Four

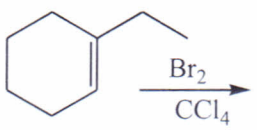
a) State Markovnikov's Rule (1 Mark)

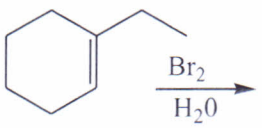
b) Draw the major products in the following reactions indicating stereochemistry where applicable (10 ½ Marks)

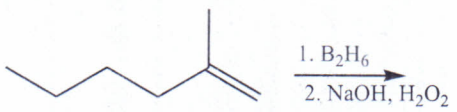
(i) 

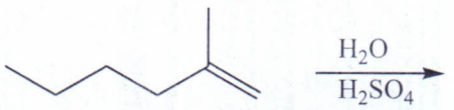
(ii) 

(iii) 

(iv) 

(v) 

(vi) 

(vii) 

(viii) 

(c) Outline the mechanism for the reaction between but-1-ene and HBr and explain why there are two different products, one major and the

other minor. (3 Marks)

$CH_2{=}CH{-}CH_2{-}CH_3 \; + \; HBr \longrightarrow$

(d) Show how you would accomplish conversions of 1-methylcyclohexene to 1-bromo-1-methylcyclohexane shown below (3 Marks)

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