CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION SCIENCE

CHEM 130: ORGANIC CHEMISTRY 1

STREAMS: BED (SCIENCE), BSC (CHEMISTRY, MATHEMATICS, BIOLOGY, BIOCHEMISTRY AND BIOMEDICAL SCIENCES AND TECHNOLOGY

TIME: 2 HOURS

DAY/DATE: TUESDAY 16/04/2019 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS:

- **Answer question ONE and any other TWO questions**

QUESTION ONE (30 MARKS)

(a) Define the following terms: (2 marks)

(i) Catenation

(ii) Hybridization

(b) Predict the hybridization, bond angles, and geometry for the carbon atoms in ethyne, C_2H_2 (3 marks)

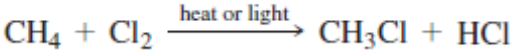
(c) Describe what will happen when non-1-ene is added to the following compounds:

(2 marks)

(i) Water

(ii) 8-methylnon-1-yne

(d) Halogenation reactions of alkanes take place by a radical mechanism. Write the step-wise mechanism for the following reaction: (5 marks)



(e) Rank the following sets of substituents in order of priority according to Cahn-Ingold-Prelog sequence rules (4 marks)

(i) $-CH_3$, -Br, -H, -I

(ii) -OH, $-OCH_3$, -H, $-CO_2H$

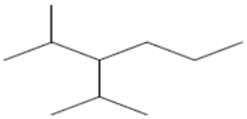
(iii) $-CO_2H$, $-CO_2CH_3$, $-CH_2OH$, $-CH_3$

(iv) $-CH{=}CH_2$, -CN, $-CH_2NH_2$, $-CH_2Br$

(f) Give systematic IUPAC names of the following organic compounds (10 marks)

i)

ii)



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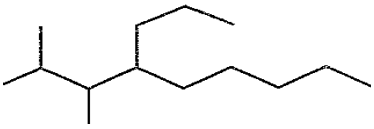

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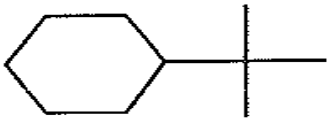

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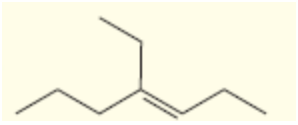

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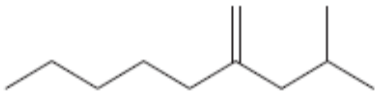

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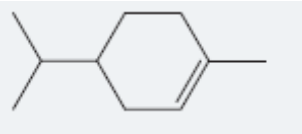

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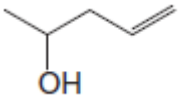

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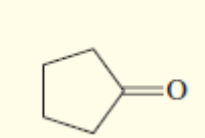

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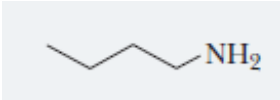
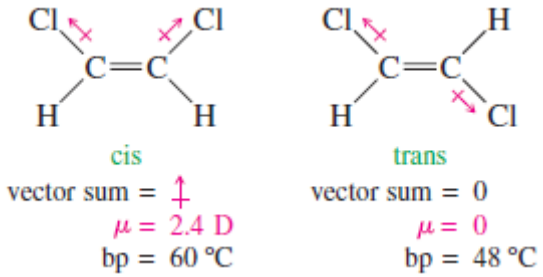


(g) Explain the difference in boiling points of the following alkenes. (2 marks)



(h) Give two uses of alkanes (2 marks)

QUESTION TWO (20 MARKS)

(a) Predict the more stable alkene of each pair. Justify your answers. (6 marks)

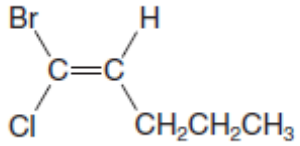
(i) 2-methylpent-2-ene or 2,3-Dimethylbut-2-ene

(ii) Cis-3-hexene or trans-3-hexene

(iii) 1-Hexene or cis-3-hexene.

(b) Give the IUPAC names for each of the following using E/Z designation (4 marks)

i)



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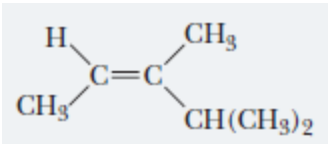

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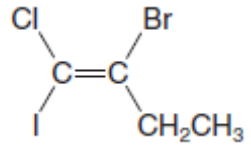

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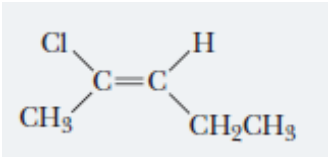


(c) Briefly explain four (4) physical properties of alkanes (4 marks)

(d) For each of the following pair of compounds, predict the one with a higher boiling point. Justify your answers. (6 marks)

(i) Cis-1,2-dichloroethene or cis-1,2-dibromoethene

(ii) Cis or trans-2,3-dichlorobut-2-ene

(iii) Cyclohexene or 1,2-dichlorocyclohexene

QUESTION THREE (20 MARKS)

(a) Write the structural formula for all the constitutional isomers with the molecular formula C_5H_{12} and name them by IUPAC system (3 marks)

(b) Write brief notes on the following;

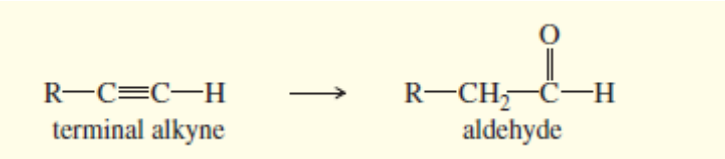
(i) Addition of water to an alkyne (4 marks)

(ii) Oxymercuration-demercuration of alkenes (4 marks)

(c) Ethanol is more reactive and has higher boiling point than ethane yet both of them have two carbon atoms. (2 mark)

(d) Using examples, explain two methods that can be used to synthesize alcohols. (4 marks)

(e) The following functional group interchange is a useful synthesis of aldehydes (3 marks)



What reagents are used for this transformation?

Give an example to illustrate this method.

QUESTION FOUR (20 MARKS)

a) Draw the structures of the following compounds (7 marks)

i) Cis-1-ethyl-3-methylcyclopentane

ii) Trans-1-ethyl-3-methylcycloheptane

iii) 2,4-Dimethylpentan-1-ol

iv) 4-Bromo-2-methylheptanal

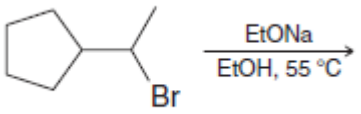
v) Pent-4-en-2-ol

vi) 2,4-Dimethylpentan-2-one

vii) Cyclohexylamine

b) Draw the structure of the major products for each of the following reactions. (10 marks)

i)



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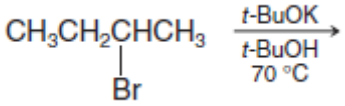

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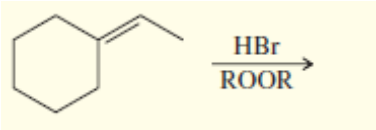

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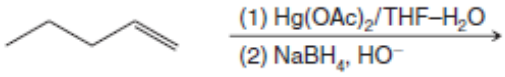

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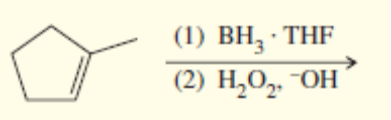

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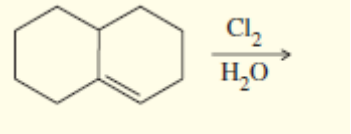

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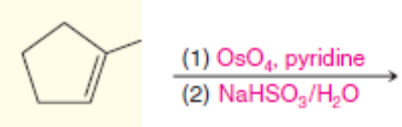

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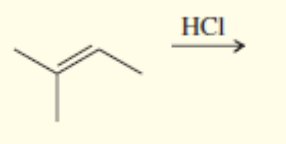

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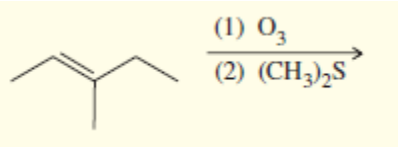

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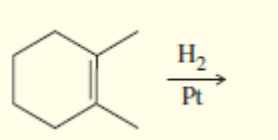

c) Describe with the aid of suitable examples, the synthesis of alkanes from alkenes, stating the required conditions. (3 marks)
