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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: BSC & BED SCI **TIME: 2 HOURS**

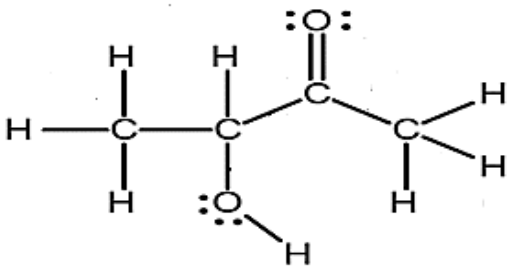
DAY/DATE: MONDAY 22/03/2021 **11.30 A.M. – 1.30 P.M.**

INSTRUCTIONS

- Answer question **One** (Compulsory) and any other **Two** questions

QUESTION ONE (30 MARKS)

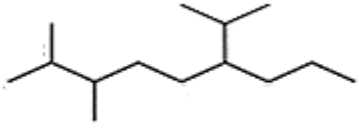
a) Predict the hybridization of each carbon atom in the molecule of organic compound given below. Also indicate the total number of sigma and pi bonds in this molecule. (3 marks)

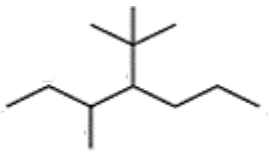


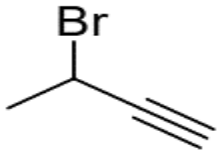
b) When 1-iodo-1-methylcyclohexane is treated with $NaOCH_2CH_3$ as the base, the more highly substituted alkene product predominates. When $KOC(CH_3)_3$ is used as the base, the less highly substituted alkene predominates. Give the structures of the two products. (2 marks)

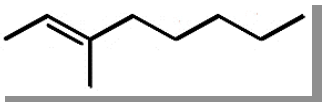
c) Write the IUPAC name of each of the following organic compound (6 marks)

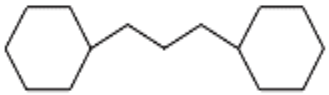
(i)



(ii) 

(iii) 

(iv) 

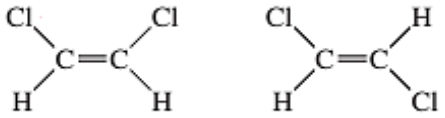
(v) 

(vi) $CH_3CH_2CH_2CH_2CHCH_2CH_2CH_2CH_2CH_3$
$C{\equiv}CCH_3$

d) Write structures for the following compounds (4 marks)
(i) 2.2,4-Trimethylpentane
(ii) 3-isopropyl-2,6-dimethylhept-3-ene
(iii) 2,3-dimethylcyclohexene
(iv) 2,2,5,5-tetramethylhex-3-yne

e) Briefly explain three (3) physical properties of alkanes (3 marks)

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



bp = 60 °C bp = 48 °C

g) Briefly discuss the Lucas test for differentiating between the primary, secondary and tertiary alcohols (3 marks)

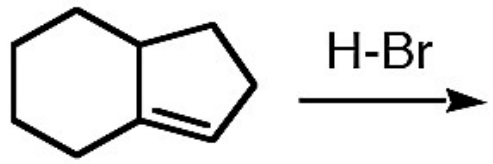
h) When 2-heptyne was treated with aqueous sulfuric acid containing mercury (II) sulfate, two products, each having the molecular formula $C_7H_{14}O$, were obtained in approximately equal amounts. Write the structures of the two compounds. (2 marks)

i) Write the structural formula for all the constitutional isomers with the molecular formula C_6H_{14} (5 marks)

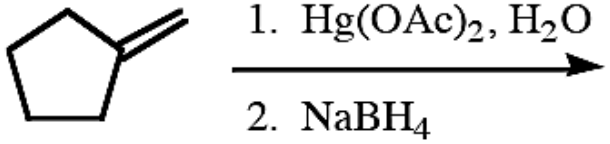
QUESTION TWO (20 MARKS)

a) Draw the major product (s) of each of the following reactions (10 marks)

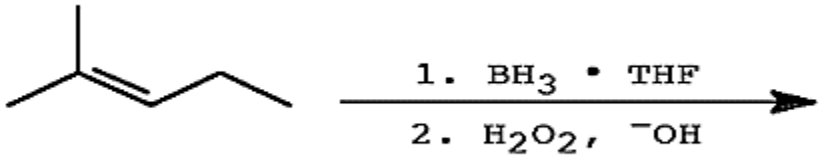
(i)



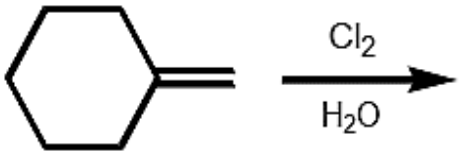
(ii)



(iii)



(iv)



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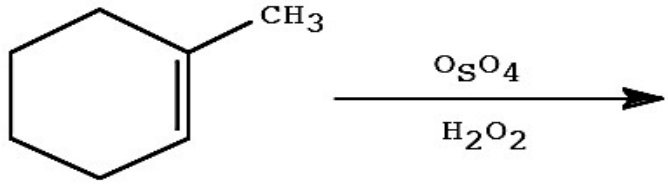
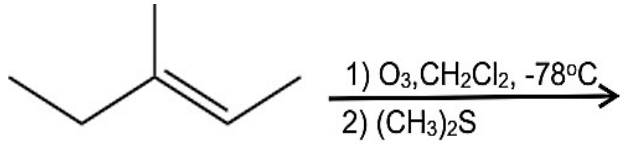
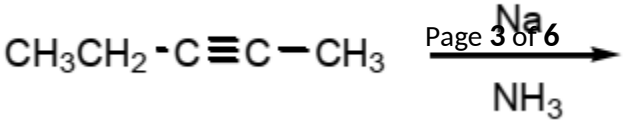


(vi)





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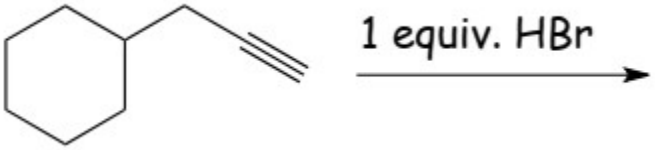
(viii)



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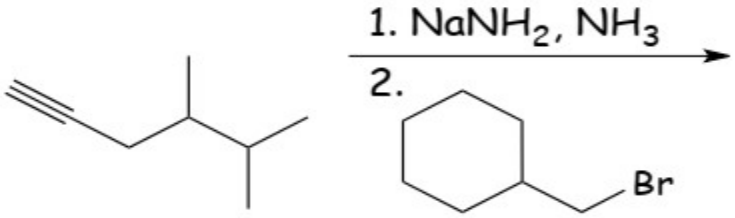
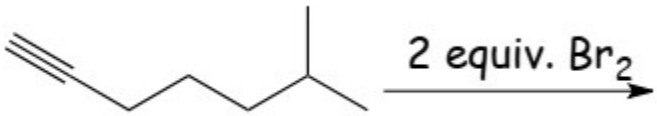


(x)



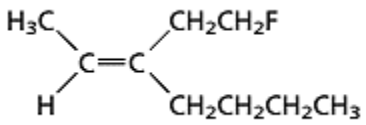
b) Write the stepwise mechanism of reaction when methane (CH_4) reacts with chlorine (Cl_2) in presence of light showing initiation, propagation and termination steps (6 marks)

c) Give **2** chemical tests that can be used to distinguish an alkene from an alkane (4 marks)

QUESTION THREE (20 MARKS)

a) Assign E or Z configuration to the following alkenes (4 marks)

(i)



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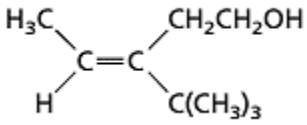
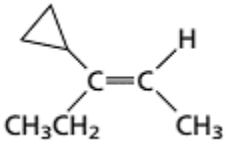
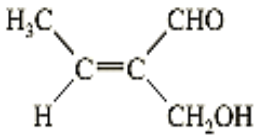


(iii)



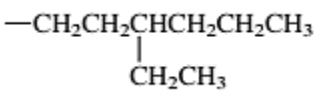
(iv)

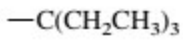


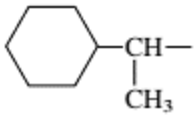
b) Predict the more stable alkene of each pair. Justify your answers (6 marks)

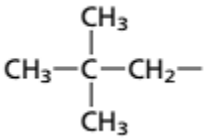
(i) 2-methylpent-2-ene or 2,3-dimethylbut-2-ene
(ii) *cis*-3-hexene or *trans*-3-hexene
(iii) *trans*-2-hexene or 2-methyl-2-pentene

c) Give the IUPAC name for each of the following alkyl groups, and classify them as primary, secondary, or tertiary (6 marks)

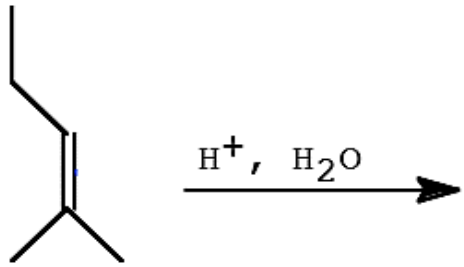
(i) 

(ii) 

(iii) 

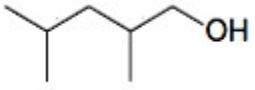
(iv) 

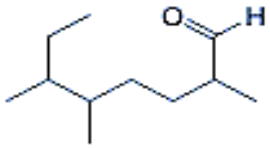
d) Complete the following reaction and provide a detailed, step-by-step mechanism for the process (4 marks)



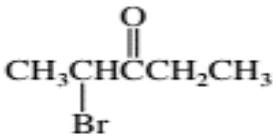
QUESTION FOUR (20 MARKS)

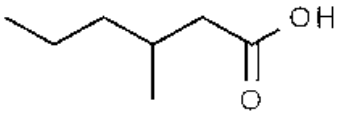
a) Write the IUPAC name of each of the following organic compound (8 marks)

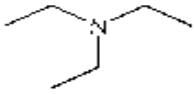
(i) 

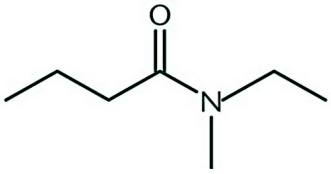


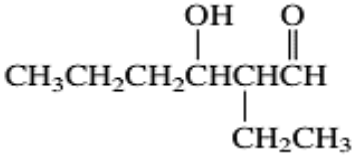
(ii)

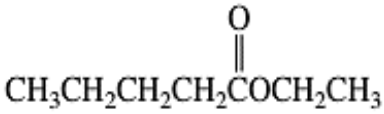
(iii) 

(iv) 

(v) 

(vi) 

(vii) 

(viii) 

b) Write the stepwise mechanism of the free radical polymerization of ethene (6 marks)

c) State two sources of alkanes (2 marks)

d) For each of the following pair of compounds, predict the one with a higher boiling point. Justify your answers. (4 marks)

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

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