



SOUTH EASTERN KENYA UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

SECOND SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY, BIOLOGY, BIOCHEMISTRY, GEOLOGY AND BACHELOR OF EDUCATION (SCIENCE)

SCH 102: INTRODUCTION TO ORGANIC CHEMISTRY (CHEMISTRY OF ALKANES AND CYCLO ALKANES)

DATE: 18TH APRIL, 2017 TIME: 10.300-12.30 P.M

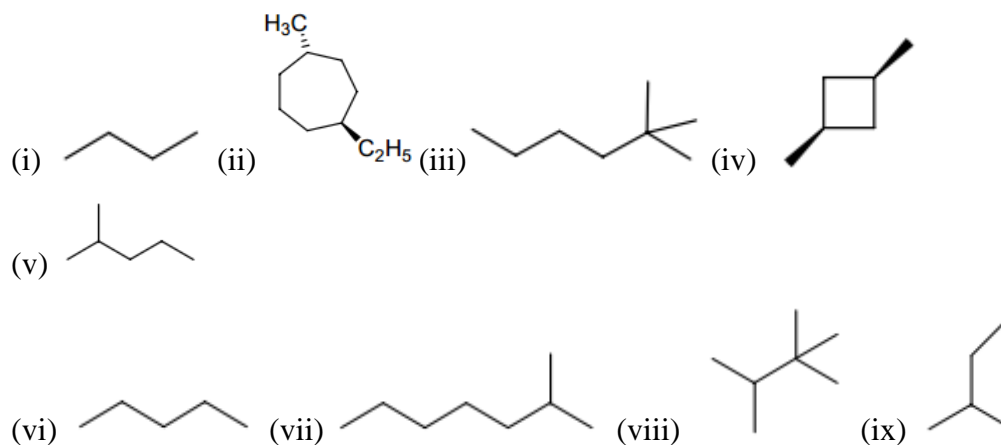
INSTRUCTIONS TO CANDIDATES

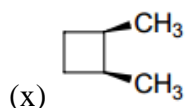
- (a) Answer question One and any other Two questions
(b) Question 1 carries 30 marks while the other questions carry 20 marks each
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Illustrate your answers with well labeled diagrams where appropriate

QUESTION ONE (30 MARKS)

(a) Name the following compounds using the IUPAC form (10 marks)





(b) Even in its most stable geometry, Bromo-cyclohexane can exist as two conformers.

(i) Draw these two conformers (4 marks)

(ii) Label the more stable conformer (2 marks)

(iii) In a sentence explain why one is more stable. (2 marks)

(c) Draw the Lewis structure for N_2H_2 (2 marks)

(i) Name the set of hybrid atomic orbitals used by each N atom in N_2H_2

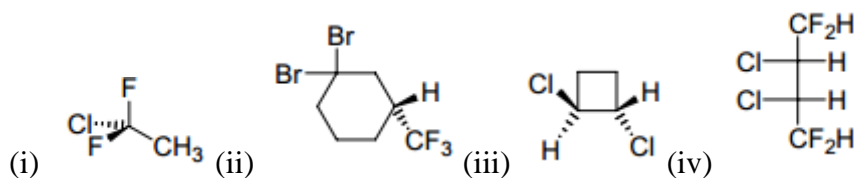
(2 marks)

(ii) Draw a picture showing the π bonding in N_2H_2 (including orientation of orbitals) (2 marks)

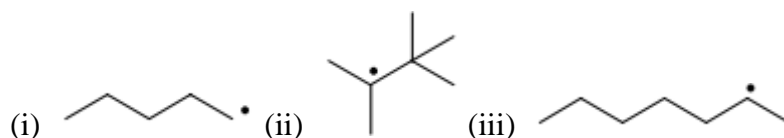
(d) Write the electronic configuration of the following; C, Na, B, Mg, Ca and O (6 marks)

QUESTION TWO (20 MARKS)

(a) Use asterix (star,*) to show the chiral atoms in the molecules below, and assign R or S to each chiral center. (8 marks)



(b) Name the radicals as either primary, secondary or tertiary AND then rank them in order of increasing stability (6 marks)



(c) Give the molecular formula of the alkane which contains 14 carbon atoms. (3 marks)

(d) Write an equation for the incomplete combustion of decane, $C_{10}H_{22}$, to

produce carbon and water only.

(3 marks)

QUESTION THREE (20 MARKS)

(a) The most stable conformation for a cyclohexane ring bearing an ethyl group is a “chair conformation with the ethyl group equatorial”.

(i) Draw the chair conformation (2 marks)

(ii) With a help of a diagram explain the term ‘equatorial’ (4 marks)

(iii) Explain why it is energetically preferred to put the substituent equatorial (4 marks)

(b) By use of diagram(s), explain how *sp* orbitals are formed. (4 marks)

(i) Clearly indicate the number, type and geometry of all orbitals involved. (3 marks)

(ii) Explain the main difference between a hybrid atomic orbital and a molecular orbital (3 marks)

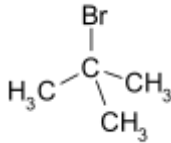

QUESTION FOUR (20 MARKS)

(a) Briefly explain what is meant by the following terms: (8 marks)

- (i) Orbital
- (ii) Chiral molecule
- (iii) Optically active mixture
- (iv) pi Bond

(b) Using a diagram, differentiate between an s-orbital and and P-orbital
(2 marks)

(c) Complete the table below by giving the names and structures of isomers having the molecular formula C_4H_9Br (8 marks)

Structure	Name
	-
	-
-	1-bromo-2-methylpropane
-	2,2-dibromo-3-methylbutane

(d) Explain how solvents affect SN_1 and SN_2 reactions(2 marks)

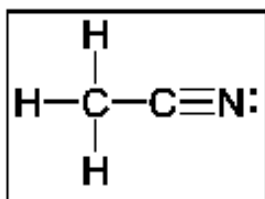
QUESTION FIVE (20 MARKS)

(a) Using Newman projections, draw any two different conformations of cyclohexane, and indicate which of the two you have drawn would have high energy.

(10 marks)

(b) The structure of Acetonitrile (CH_3CN) has the connectivity shown below

(10 marks)



- (i) Indicate the molecular geometry at each central atom.
- (ii) What is the hybridization of the C (of CH₃) and C (of CN) atoms when VB theory is applied to acetonitrile:
- (iii) Indicate the number of sigma bonds in one molecule of acetonitrile
- (iv) Indicate the number of pi bonds in one molecule of acetonitrile