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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

**FIRST YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF B.ED (SCIENCE) AND BCH

COURSE CODE: SCH 112/ SCH 113

COURSE TITLE: INTRODUCTION TO ORGANIC CHEMISTRY

DATE: 9/2/2021 **TIME:** 8-10 AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

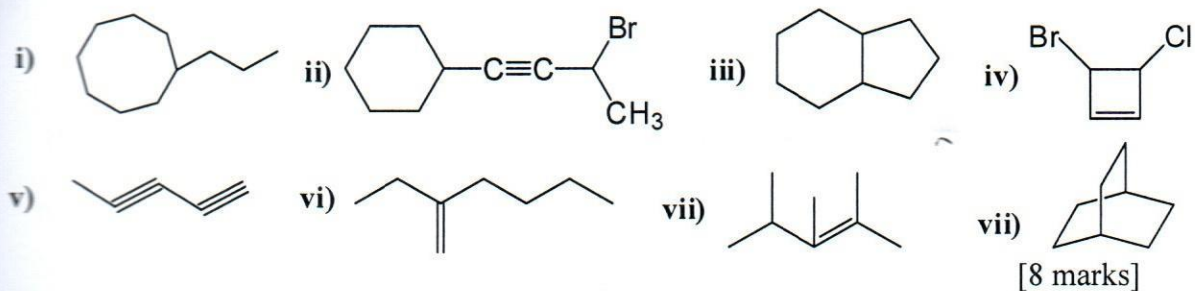
Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

Question 1 (30 marks)

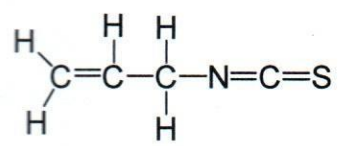
- a) Define the following terms
- i). Moiety
 - ii). Hybrid orbitals
 - iii). Zaitsev's rule
 - iv). Carbanion
 - v). Isomers [5 marks]
- b) Draw the shapes of the orbitals formed when the following orbitals overlap. Indicate the type of bonds formed.
- i). S and S orbitals
 - ii). End to end overlap of p orbitals
 - iii). Side to side overlap of p orbitals [3 marks]
- c) i). Write the electron configuration of oxygen atom (indicate all orbitals that contain the electrons) [1 mark]
- ii). Indicate all the orbitals that contain the valence electrons and give the number of valence electrons in oxygen atom. [2 marks]
- iii). The orbitals containing the valence electrons in oxygen atom overlap to give hybrid orbitals. Identify the hybrid orbitals formed. [1 mark]
- iv). Draw the shape of the structure that has the orbitals formed in c (iii) above. Indicate the number of electrons in each hybrid orbitals. [2 marks]
- d) Give structures of the following compounds
- i). 1-bromo-3-ethyl-5-methylcyclohexane
 - ii). 3-ethyl-2-pentene
 - iii). 1-methylcyclobutene
 - iv). 1-ethenylcyclohexene
 - v). 1-triiodo-4-dimethyl-2-nonyne
 - vi). 4,4-dimethyl-2-pentyne
 - vii). cyclopropylcyclopentane [8 marks]

e) Give IUPAC names for the following compounds.



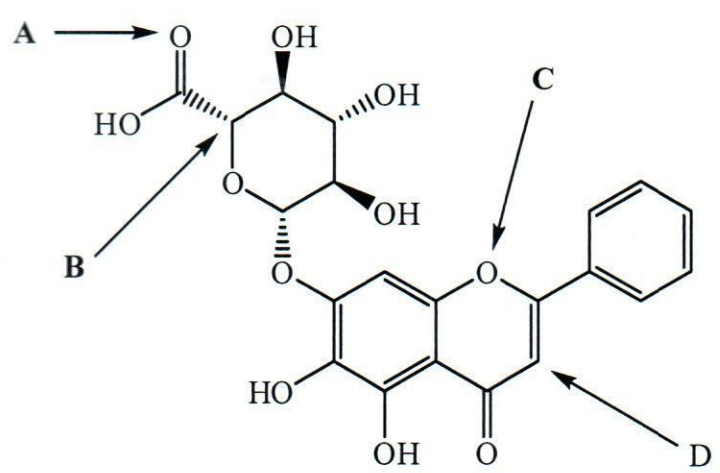
Question 2 (20 marks)

a) Draw a diagram showing all of the atomic orbitals in the molecule shown below. Indicate the orbitals that overlap to form sigma (σ) bonds, those that overlap to form pi (π) bonds and those which hold lone pair of electrons. Do not draw the back lobes of the hybrid orbitals.



[12 marks]

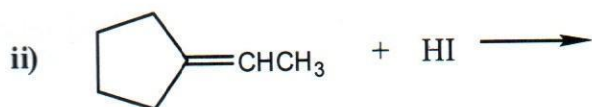
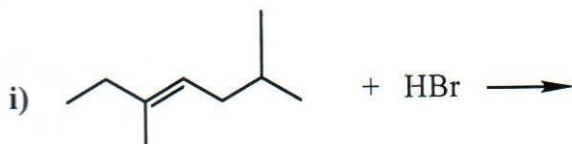
b) Below is the structure of Baicalin, an anti-HIV agent.



- i). Identify and name all the functional groups present in the compound. [6 marks]
- ii). What is the hybridization of the atoms labelled A, B, C and D [2 marks]

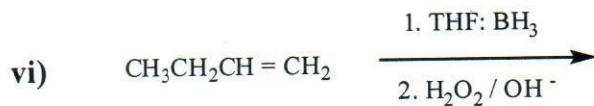
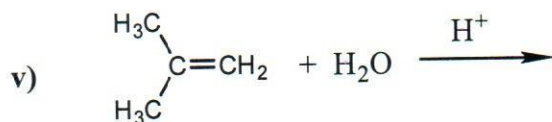
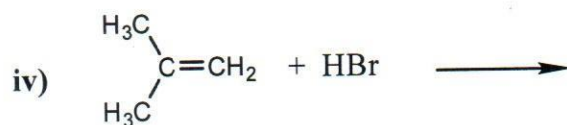
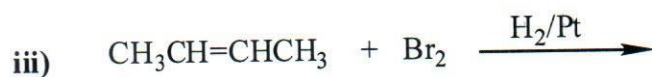
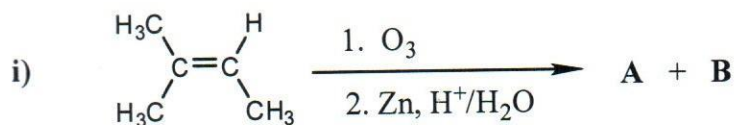
Question 3 (20 marks)

- a) Name four kinds of organic reactions [4 marks]
- b) Give the structures of the most stable carbocation intermediates you would expect in these reactions.



[2 marks]

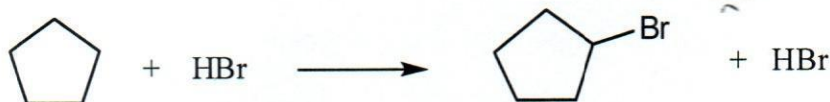
- c) Complete the following reactions



[14 marks]

Question 4 (20 marks)

- a) An alkane reacts with a halogen in the presence of light to form an alkyl halide as shown in the equation below.



The reaction has a free radical mechanism; therefore it has initiation, propagation and termination steps. Show the initiation, propagation and termination steps in the above reaction. [6 marks]

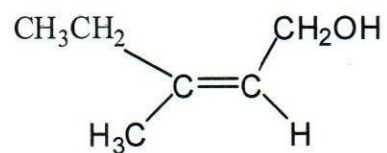
- b) When 9.83mg of an unknown chemical compound extracted from human sweat glands was submitted for elemental analysis, it was found to contain carbon, hydrogen and oxygen only. After combustion, 23.26mg of CO₂ and 9.52mg of water were produced.
- Calculate the empirical formula of this compound
 - The molecular mass for this compound is 130g/mol. Calculate the molecular formula of this compound
 - Determine the index of hydrogen deficiency for this molecule
 - Give a possible bond line structure for this compound. [14 marks]

Question 5 (20 marks)

- a) State four methods of preparing alkanes in the laboratory. Write generic equations to illustrate each method. [8 marks]
- b) Compound **J**, known as leaf alcohol, has the structural formula $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}_2\text{OH}$ and is produced in small quantities by many green plants. The *E* isomer of **J** is responsible for the smell of freshly cut grass.
- Give the structure of the *E* isomer of **J**. [1 mark]

- ii). Give the skeletal formula of the organic product formed when **J** is dehydrated using concentrated sulfuric acid. [1 mark]
- iii). Write an equation for complete combustion of leaf alcohol [2 marks]

a) Another structural isomer of **J** is shown below



Explain how the Cahn-Ingold-Prelog (**CIP**) priority rules can be used to deduce the full **IUPAC** name of this compound [6 marks]

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