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University Examinations 2022/2023

FIRST YEAR, FIRST SEMESTER, SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

FIRST YEAR, FIRST SEMESTER, SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

FIRST YEAR, FIRST SEMESTER, SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE

FIRST YEAR, FIRST SEMESTER, SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN EDUCATION

SCH 3152: ORGANIC CHEMISTRY I

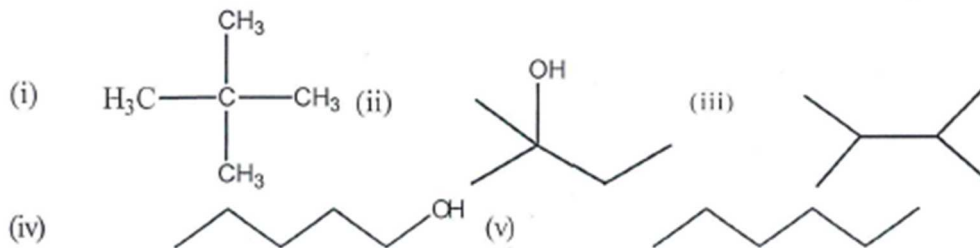
DATE: AUGUST 2023

TIME: 2 HOURS

INSTRUCTIONS: *answer question one and any other two questions*

QUESTION ONE (30 MARKS)

- a) Give four reasons that justifies the treatment of organic compounds as a distinct branch of chemistry (4 marks)
- b) Arrange the following in order of increasing boiling points. Give your reasons (6 marks)



- c) One method of the preparation of tetrachloromethane is through chlorination of methane
- i) Show the stepwise preparation of tetrachloromethane indicating all the products (2 marks)
 - ii) Give the structure and the IUPAC names of the monosubstituted products formed when propane reacts with chlorine (2 marks)
 - iii) Give the structure and IUPAC name of the product formed when n-propyl bromide reacts with alcoholic potassium hydroxide (2 marks)
- d) Describe a chemical test you would use to distinguish between butane and butene (4 marks)
- e) An organic monobasic acid analyzed as follows
- (i) 0.1935g gave 0.132 g CO₂ and 0.027g of H₂O
 - (ii) It contains 55.04% of chlorine
 - (iii) 0.2709g of the 25.2cm³ of $N/_{12}$ NaOH
 - I. Calculate the percentage composition of the acid (4 marks)
 - II. Calculate the empirical formula of the acid (3 marks)
 - III. Determine the molecular formula of the acid (3 marks)

QUESTION TWO (20 MARKS)

- a) With illustration distinguish between a sigma (σ) and a pi (π) bond (2 marks)
- b) Draw the following structure; (2 marks)
 - i) Cis-2-butene
 - ii) Trans-2-butene
- c) Explain why water (H₂O) is liquid while hydrogen sulfide (H₂S) is gas at room temperature (2 marks)
- d) Describe the factors that determines the strength of an acid (2 marks)
- e) Describe a method used to estimate nitrogen in an organic compound (2 marks)
- f) 0.152g of an organic compound X containing C, H and O produces 0.223g of CO₂ and 0.091g of H₂O upon combustion
 - (i) Calculate the empirical formula of the compound (4 marks)
 - (ii) Given the molecular mass of X is 90. Determine its molecular formula and draw its structural formula (3 marks)

- g) Explain the difference between inductive and electromeric effect, giving one suitable example in each case

QUESTION THREE (20 MARKS)

- a) (i) What is a hybrid orbital? (1 mark)
(ii) What shapes are associated with the sp , sp^2 and sp^3 hybrid orbitals? (3 marks)
(iii) On the basis of the concept of hybridization of atomic orbital, predict the shapes and bond angles of the following molecules BeF_2 , NH_3 and BF_3 (6 marks)
- b) Write the Newman projection of formulae of the conformation possible for 1,2-dichloroethane which one of them is the preferred conformation (8 marks)
- c) Explain why 3-pentanol has a higher boiling point than 3-chloropentane (2 marks)

QUESTION FOUR (20 MARKS)

- a) Distinguish between qualitative and quantitative elemental analysis (2 marks)
- b) What is isomerism? Which different compounds are represented by the formula C_4H_{10} (4 marks)
- c) Explain the observations; chlorination of alkanes is an exothermic reaction and yet it requires high temperature or exposure to UV radiation for its success (2 marks)
- d) Indicate the homologous series for each of the following compounds (4 marks)
- (i) $CH_3CH_2CH_2OH$
(ii) $CH_3CH_2COCH_3$
(iii) H_2NCH_2COOH
(iv) $CH_3CH_2OCH_2CH_2CH_3$
- e) Explain the following types of intermolecular forces important for organic compounds (8 marks)
- (i) Dipole-Dipole Interaction
(ii) van der Waals force
(iii) Hydrogen bonds
(iv) London forces