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University Examinations 2020/2021

FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE BIOLOGICAL, BIOCHEMISTRY,
CHEMISTRY, PHYSICAL SCIENCES AND BACHELOR OF EDUCATION

SCH 3152: ORGANIC CHEMISTRY I

DATE: JULY 2021

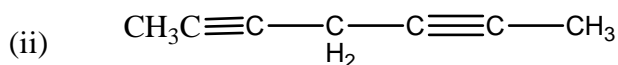
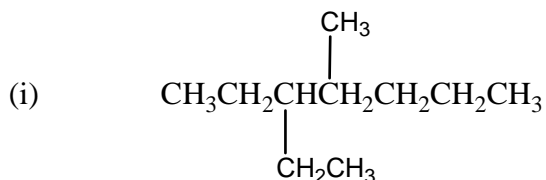
TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions.

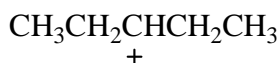
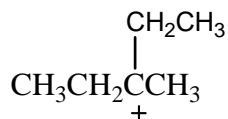
USEFUL DATA : ATOMIC NUMBERS : H=1, C= 6; O=8; N=7; F=9; Br=35; I=53; Cl=17

QUESTION ONE (30 MARKS)

- a) Explain the following terms concisely: (4 Marks)
- (i) Homologous series
 - (ii) Functional group
 - (iii) Catenation
 - (iv) Substitution reaction
- b) Draw all the constitutional isomers of $C_4H_{10}O$ and give their systematic (IUPAC) name. (4 Marks)
- c) Write down the systematic name of the following molecule.



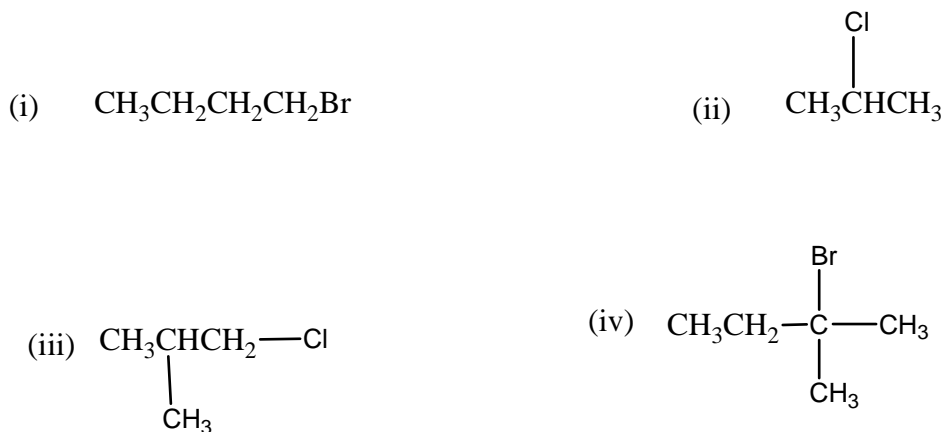
- d) Which of the following carbocations is more stable than the other? Explain. (2 Marks)



- e) (i) What is a hybrid orbital? (1 Mark)
- (ii) What shapes are associated with the sp , sp^2 and sp^3 hybrid orbital? (1 Mark)
- (iii) On the basis of the concept of hybridization of atomic orbital, predict the shapes and bond angle of BeF_2 , CO_2 and BF_3 (3 Marks)
- f) Distinguish between inductive and electrometric effect, giving one example in each case (3 Marks)
- g) Describe simple chemical tests that would distinguish between an butane and an butane (2 Marks)
- h) Explain the following observations.
- (i) The melting point of hexane is higher than of heptanes (2 Marks)
- (ii) Chlorination of methane is an exothermic process yet UV light is required (2 Marks)
- i) Give the necessary condition(s) to effect the transformation;
- (i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \xrightarrow{\quad ? \quad} \text{C}_6\text{H}_6 + 4\text{H}_2$ (1 Mark)
- (ii) $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3 \longrightarrow \text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$ (1 Mark)
- j) A sample of CH_4 weighing 9.67mg produced 26.53mg of CO_2 and 21.56mg of H_2O . Determine the percentage of C and H in the sample. (2 Marks)

QUESTION TWO (20 MARKS)

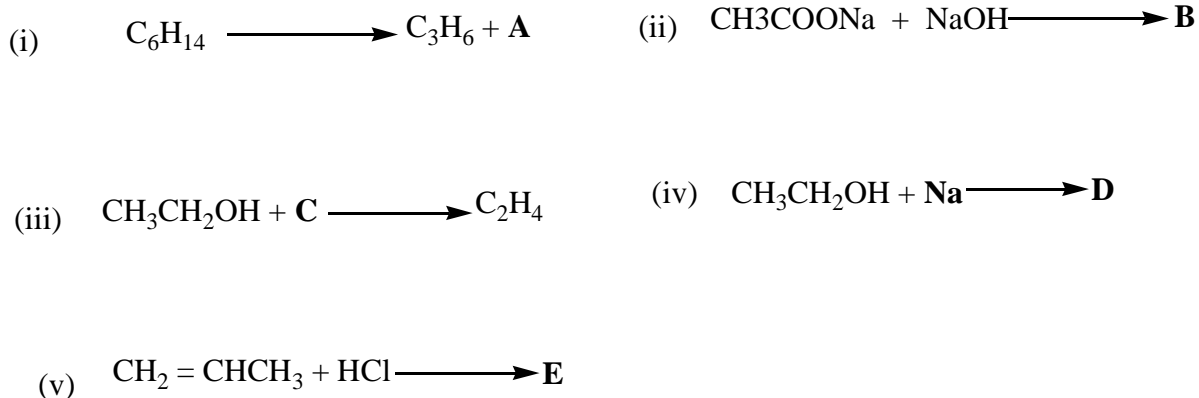
- a) Arrange the following in the order of increasing acidity CH_4 , CH_3 , H_2O and HF . Explain your answer. (4 Marks)
- b) Explain the observation “phenol is more acidic than alcohol” (1 Mark)
- c) Show the initiation, propagation and termination steps for the monochlorination of ethane. (5 Marks)
- d) (i) What are alkyl halides? (1 Mark)
- (ii) Give the common and IUPAC names of the following alkylhalides



e) Write the conjugate base of (i) $\text{C}_2\text{H}_5\text{OH}$ (ii) HCO_3^- (iii) $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ (3 Marks)

QUESTION THREE (20 MARKS)

- a) Distinguish between heterolytic and hemolytic fission of a covalent bond (2 Marks)
- b) The table below shows how the boiling points of alkanes vary as the number of carbon atoms in the chain increases.
- | Alkane | B.P (°C) |
|---------|----------|
| Methane | -161 |
| Ethane | -89 |
| Propane | -42 |
| Butane | 0 |
| Pentane | 36 |
| Hexane | 69 |
- (i) Sketch the graph to show the trend in b.p of these alkanes (4 Marks)
- (ii) Explain the trend in the graph (2 Marks)
- c) Describe Lassaigne's test to detect nitrogen in an organic compound containing halogen (3 Marks)
- d) Describe briefly how you would separate a mixture of amino-acids chromatographically. (4 Marks)
- e) Identify the reagent or product A,B,C, D and E in the reaction below (5 Marks)



QUESTION FOUR (20 MARKS)

- a) Briefly explain the following intermolecular forces. (6 Marks)
- (i) Dipole – dipole forces
 - (ii) Hydrogen bonds
 - (iii) London forces
- b) Give two criteria of purity of organic compounds (2 Marks)
- c) 0.20g of an anhydrous acid gave on combustion 0.04g H_2O and 0.195g CO_2 . The acid is found to be dibasic and 0.5g of its silver salt leaves on ignition 0.355g silver. Determine the ;
- (i) Empirical formula (3 Marks)
 - (ii) Molecular formula (2 Marks)
 - (iii) Structural formula (2 Marks)
- d) Using Newman's projection draw the conformations of 1,2 dichloromethane (5 Marks)