



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER MAIN
EXAMINATIONS**

**FOR THE DEGREE
OF
BACHELOR OF MEDICAL LABORATORY SCIENCES &
BACHELOR OF MEDICAL TECHNOLOGY**

COURSE CODE: BML 125

**COURSE TITLE: ORGANIC CHEMISTRY FOR
BIOMEDICAL SCIENCES**

DATE: 21ST APRIL 2023

TIME: 8.00 – 10.00AM

INSTRUCTIONS TO CANDIDATES

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**). Answer all questions. **DO NOT WRITE ON THE QUESTION PAPER.**

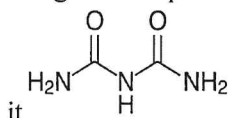
TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

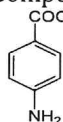
SECTION A: Multiple Choice Questions (20Marks)

- The concept *orbital* is fundamental in organic chemistry and truth about it is that
 - Molecular and atomic orbitals vary in number of electrons accommodated
 - Overlapping between S atomic orbitals can be side-wise
 - Molecular and orbitals have different numbers of electrons
 - Electrons in P orbitals always have same magnetic quantum numbers
- Based on the types of electron orbitals involved in formation of a molecular bond, the bond could be a pi, (i.e π) or sigma (i.e δ) bond and, furthermore
 - Pi (π), bonds are formed by overlap between identical orbitals
 - Pi(π) bonds are actually double bonds
 - Sigma bonds result from side-wise overlap of p orbitals
 - P orbitals engage only in head-wise overlap when bonding
- Addition chemical reactions are with compounds such as the following
 - N-alkanes
 - Cyclic alkanes
 - Alkyl amines
 - An aromatic hydrocarbons
- Partial ionic bonds in hydrogen bonding enable formation of secondary and tertiary structures of biomolecules and they
 - Are perfectly nonpolar
 - Yield dipolar compounds
 - Produce strong electrolytes
 - Make compounds hydrophilic
- Dative bonding is one of the covalent forms of bonding and
 - It involves electron transfer
 - It is based equal contribution of shared electrons
 - Ammonium (NH_4^+) formation is an example
 - It's the reason for non-polarity of compounds
- Under the wave mechanics atomic theory the electronic configuration of an element with AN=8 is
 - $1s^2 2s^2 2p^{x3} 2p^{y1} 2p^{z0}$
 - Impossible to generate
 - $1s^2 2s^2 2p^{x2} 2p^{y2} 2p^{z0}$
 - $1s^2 2s^2 2p^{x2} 2p^{y1} 2p^{z1}$
- The organic compound below is known as a biuret and of crucial biomedical importance as

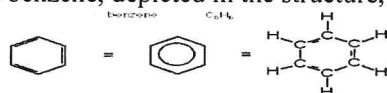


- Is synonymous with urea
 - It contains 2 urate residues in its molecule
 - Is same as the peptide bond uniting amino acids in protein synthesis
 - Is a typical example of an amino acid with two amino groups
- The compound butan-2-one belongs to the chemical class of compounds
 - alkanes
 - β -aldehydes
 - Alkenes
 - Ketones
 - The characterisation of glucose as a furanose based on its possession of
 - Aldo* functional group
 - Keto* functional group
 - A five-membered ring structure
 - An asymmetric carbon atom
 - Condensation, is a key organic reactions and typically it involves
 - Bond formation/undoing with substrate halogenation

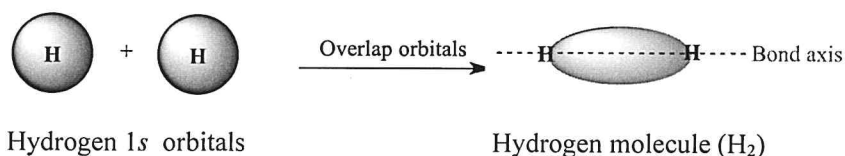
- b) Hydration of substrates
 - c) Bond breaking-making with a small molecule loss
 - d) Hydrogenation of substrates
11. The truth about carbonyl group is that is a functional group
- a) When situated inside the c-c chain it is an carboxy compound
 - b) It can oxidize Fe^{++} to Fe^{+++} in aqueous media when it is $\text{R}_1\text{-CO-R}_2$
 - c) That forms an alcohol when reduced by hydrogenation
 - d) Featuring a double bond between a carbon atom and an oxygen atom
12. The oxidase-based glucose assays use the presence on the sugar of molecule of
- a) The carboxy group
 - b) A chromogenic moiety
 - c) An aldehydic functional group
 - d) The hydroxy (-OH) group
13. Fats are lipids known as glycerides because of their chemical structure, that is
- a) They result from an organic acid-glycerol union
 - b) They are polymers of glycerol
 - c) Their biosynthesis involves oxidation of glycerol
 - d) They are glycerol amines
14. What is known about a polymerisation reaction is that as chemical reaction it
- a) Occurs between molecules of different compounds
 - b) Includes polyester formation
 - c) Involves reactive free oxygen species
 - d) It is basically an elimination reaction
15. The compound below is a position isomer of aminobenzoic acid, specifically



- a) *Meta (m)*-amino-benzoic acid
 - b) *Ortho (o)*-amino-benzoic acid
 - c) *Normal (n)*-amino-benzoic acid
 - d) *Para (p)*-amino-benzoic acid
16. Truth about benzene, depicted in the structure, below is that it



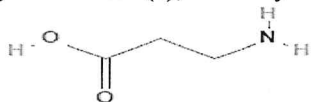
- a) Is the generic nucleus for purines
 - b) The parent structure for steroid hormones
 - c) Is a homocyclic organic compound
 - d) The precursor for adrenaline and thyroid hormones biosynthesis
17. The truth concerning a covalent bond formed by overlap of atomic orbitals along the bond axis (i.e., along a line connected the two bonded atoms), as illustrated below is that



- a) Resulting bonds are sigma bonds
- b) It is a pie bond
- c) The bond is a single c-c bond
- d) It is multiple bond

SECTION B: Short Answer Questions (40Marks)

1. With relevant structural illustrations, define *Cis* and *Trans* isomerism (5marks)
2. With one example each, explain conditions for possibilities of substitution and addition organic reactions. (5marks)
3. Describe the principle underlying the nitroprusside test for ketones in solution. (5marks)
4. Giving a suitable example each, distinguish the principal and azimuthal quantum numbers of an electron. (5marks)
5. Stating the reason(s), identify the class of the compound of which the chemical



formula: _____ by using Greek letter, alpha(α), beta(β), gamma(γ) etc as well as an *Arabic* numeral (1, 3, 2, etc) (5marks)

6. With the aid of relevant structural formulae distinguish a heterocyclic and homocyclic organic compound (5marks)
7.
 - (a) State the use for electrophoresis in organic chemistry (2marks)
 - (b) Describe the general principle underlying the use of chromatography in organic chemistry (3marks)

8. With appropriate illustrations distinguish a peptides and amines (5marks)

SECTION C: Long Answer Questions (60Marks)

1. Describe the general classification scheme for organic compounds, providing the appropriate diagram to illustrate the hierarchy and examples representing each class and level (20marks)
2. Describe **Molecular Absorption Spectrophotometry** as an approach to laboratory analysis of organic compounds in terms of the underlying principle, general procedure, examples of techniques (methods) under this approach and some specific applications or uses of the techniques under the approach in organic analysis.(20marks)
3. Organic chemical reactions can be said to happen in three broad steps, namely (1) Substrate activation (2) Cleavage or fission of existing bonds in the substrate and (3) Formation of the products by formation of new bonds with reagent or other reactants in the reaction environment.
 - a) Explain the nature of substrate *activation* and how it is accomplished through the *inductive* mechanism (5marks)
 - b) With respect to the substrate bond fission or cleavage, distinguish the *homolytic* type and *heterolytic* type (5marks)
 - c) Concerning formation of new bonds to generate the reaction product use ONE example EACH to briefly describe the reaction types:
 - (i) *Condensation* (5marks)
 - (ii) *Reduction-Oxidation (Red-Ox)* (5marks)