

**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND HEALTH SCIENCES**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF SCIENCE IN PUBLIC &
COMMUNITY HEALTH
1ST YEAR 2ND SEMESTER 2018/2019 ACADEMIC YEAR
KISII CAMPUS**

COURSE CODE: SCH 3121

COURSE TITLE: ORGANIC CHEMISTRY

EXAM VENUE:

STREAM: BSc. CH &D/PH

DATE:26/4/19

EXAM SESSION: 12.00 – 2.00PM

TIME: 2 HOURS

Instructions:

- 1. Answer question ONE (COMPULSARY) and any other TWO questions in section B.**
- 2. Candidates are advised not to write on the question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A

QUESTION ONE-COMPULSARY (30 MARKS)

1. (a) Explain the following observations. (8mks)
- Cholesterol is a steroid that forms a vital component of a cell membrane and is the starting material for the synthesis of all other steroids yet humans do not have to ingest it in their diet.
 - Amino acids are organic compound, generally soluble in water but insoluble in organic solvents
 - The melting point of saturated fatty acids are greater than that for unsaturated fatty acids of the same chain length.
 - Waxes are highly hydrophobic and hence completely insoluble in water.
- (b)
- Outline three main features of Alpha-Helix (α -helix) of secondary protein structures. (3mks)
 - State and explain the two possible orientations in which polypeptide chains may organize themselves in beta-pleated sheets of secondary protein structures. (4mks)
- (c)
- State any three reasons for studying a bacterial cell wall. (3mks)
 - Outline any three differences between a bacterial cell wall and a plant cell wall (3mks)
 - State the chemical substances that constitute the bacterial cell wall and plant cell wall. (2mks)
- (d)
- What are terpene? (1mk)
 - Explain why *trans*-configurations of steroids are more stable than its *cis*-configuration. (2mks)
 - Cholesterol is a steroid that forms a vital component of a cell membrane and is the starting material for the synthesis of all other steroids yet humans do not have to ingest it in their diet. Explain. (2mks)
- (e) Distinguish between hydrolyzable and non-hydrolyzable lipids. (2mks)

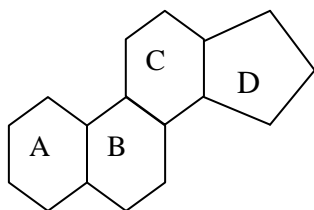
SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION (40 MARKS)

QUESTION TWO (20 MARKS)

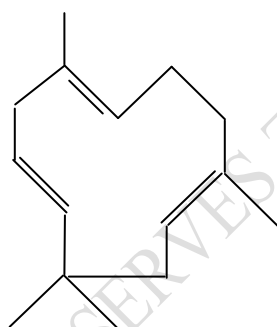
2. (a) i. Distinguish between a protein denaturation and protein coagulation? (2mk)
- Explain the difference between complete and incomplete proteins (3mks)
 - State and explain the four factors which can disrupt the three dimensional conformation of a protein. (8mks)
- (b) Suggest a reason why anti-parallel beta-pleated sheets of secondary protein structures are generally more stable than the parallel beta-pleated sheets? (2mks)
- (c) i. Name the two possible dipeptides formed when glycine and alanine amino acids react. (2mks)
- Len-enkephalia, a pentapeptide that acts as an analgesic and opiate has the following amino acids sequence: Tyr-Gly-Gly-Phe-Leu. Draw the structure of Len-enkephaline and show its N – and C – terminal. (3mks)

QUESTION THREE (20 MARKS)

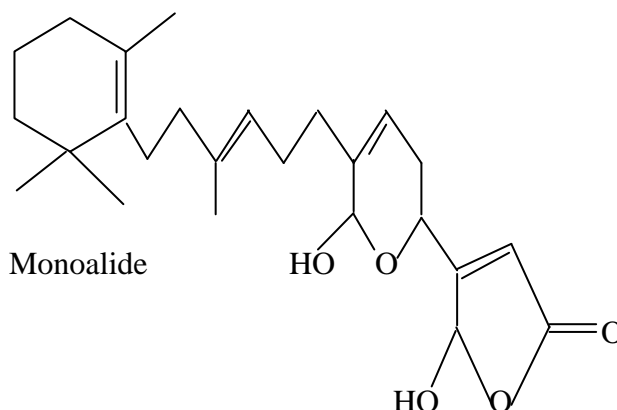
3. (a) (i) Steroids carbon skeleton consists of four fused rings. What is meant by the term 'fused ring'? (1mk)
- (b) The diagram below shows the structure of steroid nucleus. Use it to answer the questions that follow.



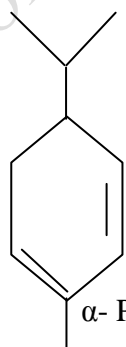
- i. Identify and show carbon-6 and carbon-12 in the above steroid nucleus. (1mk)
- ii. Many steroids also contain two methyl groups called **angular methyls**. Locate the position of angular methyls in the steroid nucleus. (2mks)
- iii. Ethynylestradiol and norethindrone are synthetic oral contraceptives steroids with one angular methyl group only. The steroids also have alcohol group and ethylene groups in carbon-17. The two contraceptives only differ at carbon-3 having alcohol group and oxygen respectively. Draw the structure of the two synthetic contraceptives. (4mks)
- (c) Identify and state the role of any three steroids in the body: (3mks)
- (d) i. Explain why the number of carbon atoms in terpenes is always a multiple of 5. (2mks)
- ii. Locate the isoprene units in the following compounds. Use dotted lines to show the C-C bonds linking two different isoprene units. (4mks)



Humulene



Monoalide



α - Phellandrene



Farnesol

- iii. Classify the above compounds depending on the number of isoprene units linked (3mks).

Class	compound
Monoterpene	
Sesquiterpene	
Sesterpene	

QUESTION FOUR (20 MARKS)

4. (a) i. State and explain the role of lipids in the absorption and availability of lipid soluble vitamins in the body. (2mks)
- ii. Why are lipids (triglycerides) such an efficient molecule for storage of energy in the body? (2mks)
- (b) i. Distinguishes between esterification and saponification process. (2mks)
- ii. Using condensed formulas, write an equation for the esterification of glycerol with three molecules of lauric acid. (2mks)
- (c) i Draw the structures of the following fatty acids. (4mks)
- I. *Trans*-5-Decanoic acid
- II. All *Cis* – 9, 12 – Octadecanoic acid
- ii. Give four characteristics of fatty acids. (4mks)
- iii. State and explain the relationship between fatty acids chain length and their melting point. (2mks)
- (d) Margarine is produced by carefully controlled partial hydrogenation of vegetable oils such as corn oil and soya bean oil.
- i. What is meant by the term ‘**partial hydrogenation**’? (1mk)
- ii. State the significance of controlled partial hydrogenation in the production of margarine from vegetable oils. (1mk)

QUESTION FIVE (20 MARKS)

5. (a) i. Draw the general structure of α -amino acids. Give an example of α -amino acids and draw its corresponding structural formula. (3mks)
- ii. Distinguish between essential and non-essential amino acids. (2mks)
- (b) i State and explain the distinguishing factor between amino acids and other two basic nutrients: sugar and fatty acids. (2mks)
- ii. Differentiate between primary (1^0) and secondary (2^0) amino acids. Give one example of primary (1^0) and secondary (2^0) amino acids. (4mks)
- (c) i. What is electrophoresis? (1mks)
- ii. With the help of chemical equation, explain how electrophoresis can be used to demonstrate the amphoteric nature of amino acids. (6mks)
- (d) i. What is a Zwitterion? (1mk)
- ii. Explain how the existence of amino acids in a Zwitterion form affects their melting point? (2mks)