JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL, PHYSICAL MATHEMATICS AND ACTUARIAL SCIENCES
BACHELOR OF SCIENCE EDUCATION WITH IT
THIRD YEAR SECOND SEMESTER EXAMINATIONS
UNIVERSITY EXAMINATIONS: 2021/2022 ACADEMIC YEAR

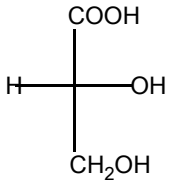
SCH 303/SPB 9421: NATURAL PRODUCTS CHEMISTRY SPECIAL/RESIT EXAMINATIONS

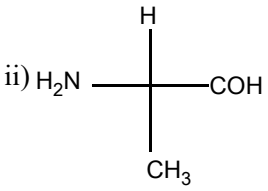
ANSWER ALL QUESTIONS IN SECTION A AND ANY TWO QUESTIONS IN SECTION B

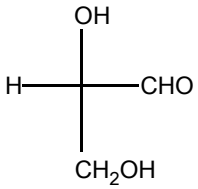
SECTION A: ANSWER ALL QUESTIONS

QUESTION 1 (30 MARKS)

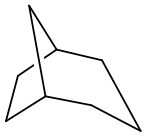
a) Natural products are often used as starting points for drug discovery. Discuss. (5 marks)
b) Briefly explain the criteria that often used in classifying natural products. (3 marks)
c) Convert the following Fischer projections into tetrahedral representations, and assign *R* or *S* stereochemistry to each one of them. (9 marks)

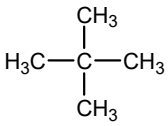
i) 

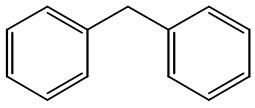
ii) 

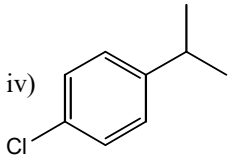
iii) 

d) For each of the compounds below tell how many signals you would expect the molecule to have in its normal broadband decoupled ^{13}C NMR spectra. Explain your answers. (8 marks)

i) 

ii) 

iii) 

iv) 

e) In which class of natural products do the following compounds belong? (5 marks)

i. Quinine
ii. Cholesterol
iii. Phelandrene
iv. Triacylglycerol
v. Caffeine

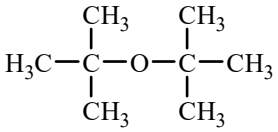
SECTION B (40 MARKS):

ANSWER ANY TWO QUESTIONS FROM THIS SECTION-
EACH QUESTION CARRIES 20 MARKS

QUESTION 2

a) Carbohydrates are very important biomolecules. Discuss this on **FOUR** counts. (4 marks)
b) Illustrate how a series of chemical interconversions starting with CO_2 and H_2O leads to the formation of prophenic acid, amino acid, shikimic acid and terpenoids and draw the structures of prophenic and shikimic acids. (8 marks)

c) Predict how signals would appear in the ^1H NMR spectrum of the following compound. Explain your answer. (4 marks)

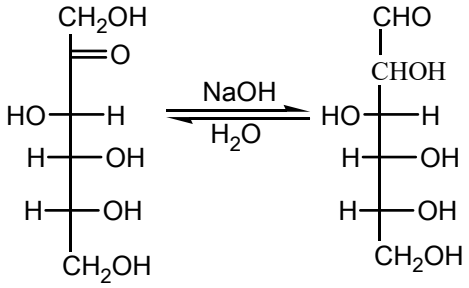


d) Give an example for each of the following: (4 marks)

a. Sex steroids
b. Corticosteroids
c. Ecdysteroids
d. Plant steroids

QUESTION 3

a) Fructose reduces Tollens' reagent even though it contains no aldehyde group. This occurs because fructose is readily isomerized to an aldose in basic solution. Write the complete stepwise mechanism for the base catalyzed isomerization of fructose to an aldohexose. Show all intermediate structures and all electron flow with arrows. (8 marks)



b) Name any **three** subclasses of flavonoids and one representative compound for each class. (6 marks)

c) State **Four** parameters that a good chromatographic movement depends on (2 marks)

d) Briefly discuss the biosynthesis of flavonoids. (4 marks)

QUESTION 4

a) Illustrate the biosynthesis of glucose using a chemical equation and give any **TWO** products of its derivatisation. (6 marks)

b) Explain why all protons in a molecule do not absorb energy at the same frequency. (4 marks)

c) What are lipids? Give **Four** examples. (4 marks)

d) Name four sesquiterpenes and their biological importance. (6 marks)

QUESTION 5

a) Draw and name any TWO naturally occurring D sugars. (4 marks)

b) Illustrate the process of saponification. (4 marks)

c) Outline the steps involved in the biogenetic synthesis of cholesterol. (7 marks)

d) Outline **five** functions of flavonoids in plants. (5 marks)