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(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE (CHEMISTRY, INDUSTRIAL CHEMISTRY)

COURSE CODE: SCH 431

COURSE TITLE: CHEMISTRY OF NATURAL PRODUCTS

DATE: 02/08/2022 **TIME:** 8.00-10.00 AM

INSTRUCTIONS TO CANDIDATES

Attempt all questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

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

Question one (15 marks)

a) Chemistry of Natural products is dated far back in early Century.

i. By citing examples, explain the two divisions of natural products 4 marks

ii. Explain three ways how humans exploit natural products 3 marks

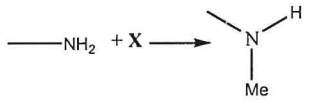
b) Biosynthetic reactions are catalyzed by enzymes.

i. What is a difference between an enzyme and a cofactor? 2 marks

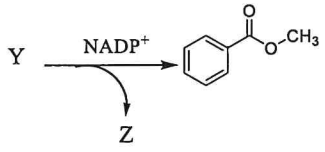
ii. Explain how enzymes catalyze biological reactions, highlighting the hallmarks of the catalysis 3 marks

c) Complete the equations below by providing missing reagents or products in biological systems 3 marks

i.



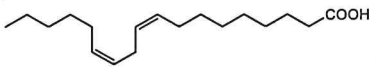
ii.



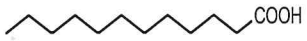
QUESTION TWO (19 marks)

a) Most naturally occurring fatty acids contain an even number of carbon atoms and are un-branched. Explain 1 mark

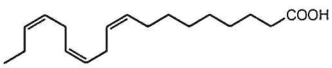
b) By use of an explanation, arrange the fatty acids below in order of increasing boiling points. 4 marks



A



B



C

c) List any three biological functions of fatty acids 3 marks

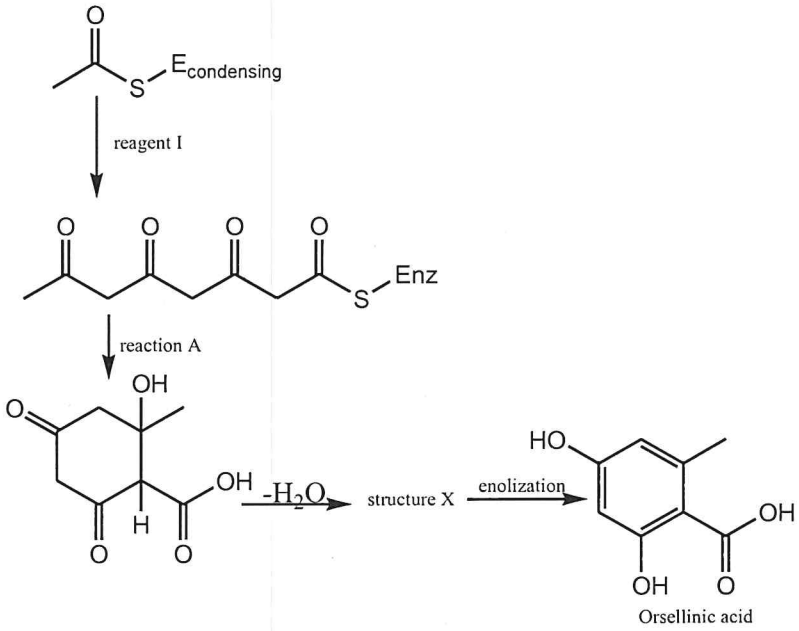
d) Flavonoids comprise a large group of secondary metabolites which are derived from subunits supplied by the acetate and shikimate pathways.

i. Show the contribution of both acetate and shikimate pathways in the formation of flavonoid structure 2 marks

ii. By use of illustrations, differenciate between a flavone and a flavanone 2 marks

iii. Name any three functions of flavonoids in plants 3 marks

e) Polyketides can cyclize to obtain various classes of natural products. Consider the scheme below involving formation of orsellinic acid and answer the questions that follow



Orsellinic acid

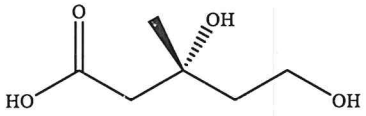
i. Define the term polyketide 1 mark

ii. Identify reagent I, reaction A and structure X 3 marks

Question Three (18 marks)

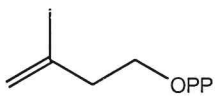
Triterpenoids constitute the largest and most diverse class of natural products, biosynthesized via mevalonate pathway in plants.

a) By use of appropriate arrows, show how mevalonic acid whose structure is given below is transformed to isopentenyl pyrophosphate (IPP). 3 marks

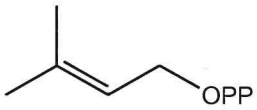


(3R)-Mevalonic acid

b) Show how farnesyl diphosphate (FPP), a sesquiterpene precursor is obtained from IPP and DMAPP. 6 marks

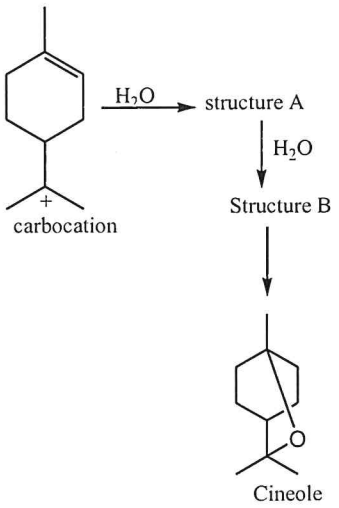


IPP



DMAPP

i. The scheme below shows formation of triterpenoid (cineol) Study it the answer the questions that follow



i. Explain the subdivision of cineol as a triterpenoid 2 marks

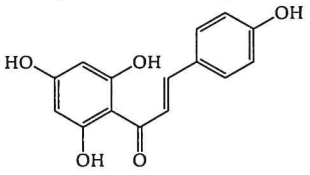
ii. State any three characteristics of the cineol 3 marks

iii. By use of curly arrows show how the carbocation is obtained from either NPP or LPP 2 marks

iv. Identify the structures A and B 2 marks

Question Four (18 marks)

a) Study the natural product Q below then answer the questions that follow



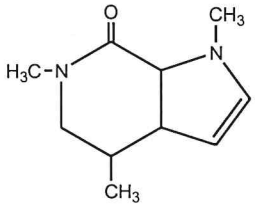
Q

i. Explain the class of compound Q belongs 2 marks

ii. Identify the biosynthetic origin of the compound Q 1 mark

iii. List three biological functions of the compound Q 3 marks

b) The compound below is an alkaloid



i. What is an alkaloid? 1 mark

ii. State any use of the compound above 1 mark

iii. One characteristic of the compound above is that it is basic. Explain 1 mark

iv. Describe how the alkaloid can be isolated from plants 5 marks

v. Alkaloids can be classified basing on the amino acid it is derived from. List any four of the amino acids 4 marks