



(University of Choice)

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

**MAIN CAMPUS**

**UNIVERSITY REGULAR EXAMINATIONS**

**2022/2023 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: 14/04/2023**

**TIME: 2.00-5.00 PM**

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INSTRUCTIONS TO CANDIDATES

Attempt all questions

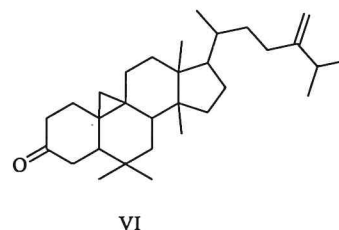
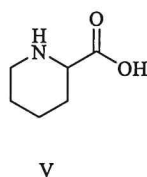
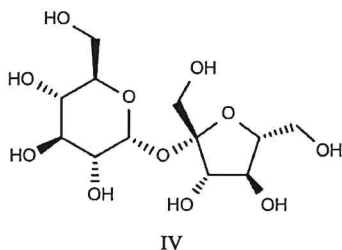
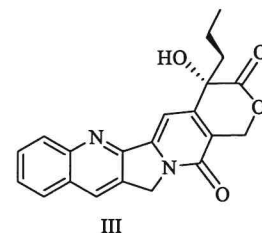
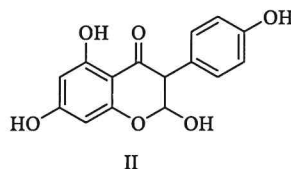
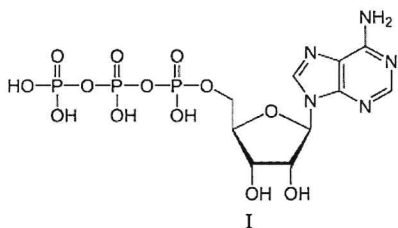
TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

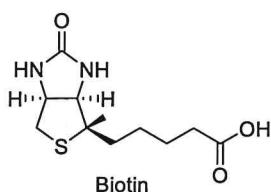
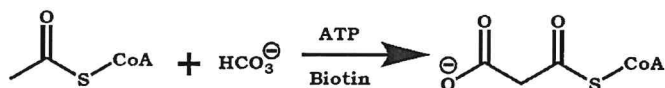
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**Question One 18 marks**

- a) Classify the compounds (I-VI) below as either primary or secondary metabolites 6 marks



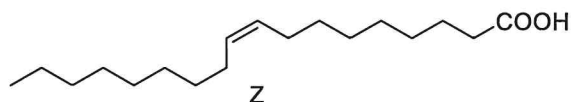
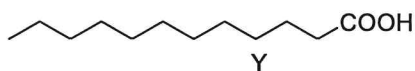
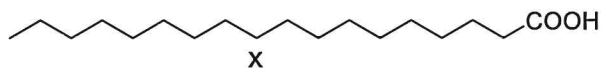
- b) Explain four reasons why plants biosynthesize secondary metabolites 4 marks
- c) Explain two hall marks of enzyme catalysis 2 marks
- d) Acetyl-CoA is the precursor in fatty acid and polyketides biosynthesis. However, for most of the reactions, acetyl-CoA needs to be further activated by a biotin-dependent enzyme before it can be used by the fatty acid synthase complex.



Describe the mechanism of the above reaction and give the name of the enzyme for the above transformation. 6 marks

**Question Two 18 marks**

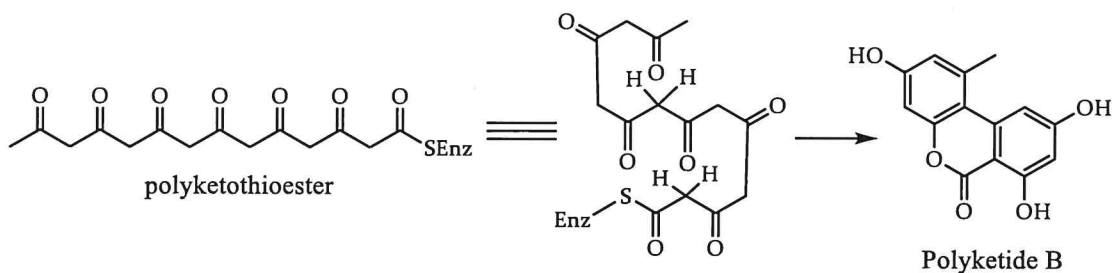
- a) By use of chemical equations, show how acetyl SCoA is a common precursor to the saturated fatty acids and polyketides 6 marks
- b) Arrange the molecules X-Z in the order of increasing boiling points. Explain 4 marks



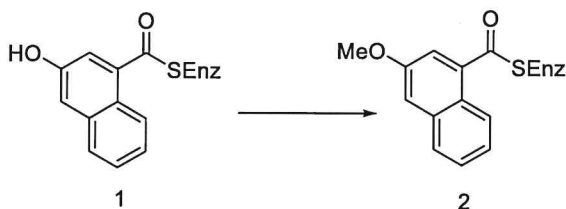
- c) Explain how molecule Z is biosynthesized from X 2 marks
- d) Alkaloids are natural products biosynthesized by a variety of organisms including bacteria, fungi and plants.
- i. State three amino acids that lead to the biosynthesis of alkaloids 3 marks
- ii. Explain three medicinal applications of alkaloids 3 marks

**Question Three 17 marks**

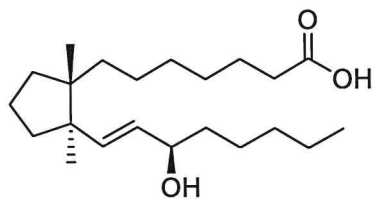
- a) Describe how polyketothioester shown below is biosynthetically modified to aromatic polyketide B. Show the reagents involved and reaction mechanisms in all the processes involved. 6 marks



- b) Draw a mechanism for the conversion of naphthol (1) to its methyl ether (2) by a *S*-adenosyl methionine (SAM) dependent enzyme. How might you accomplish this conversion in the lab? 6 marks



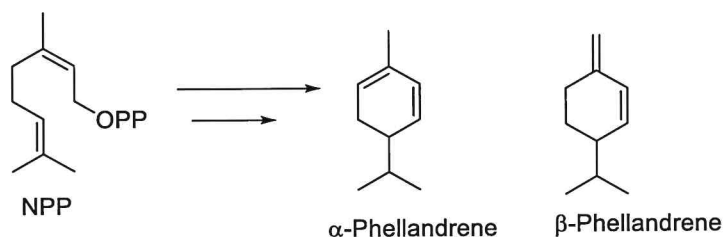
- c) Study the structure of natural product X below and then answer the questions that follow



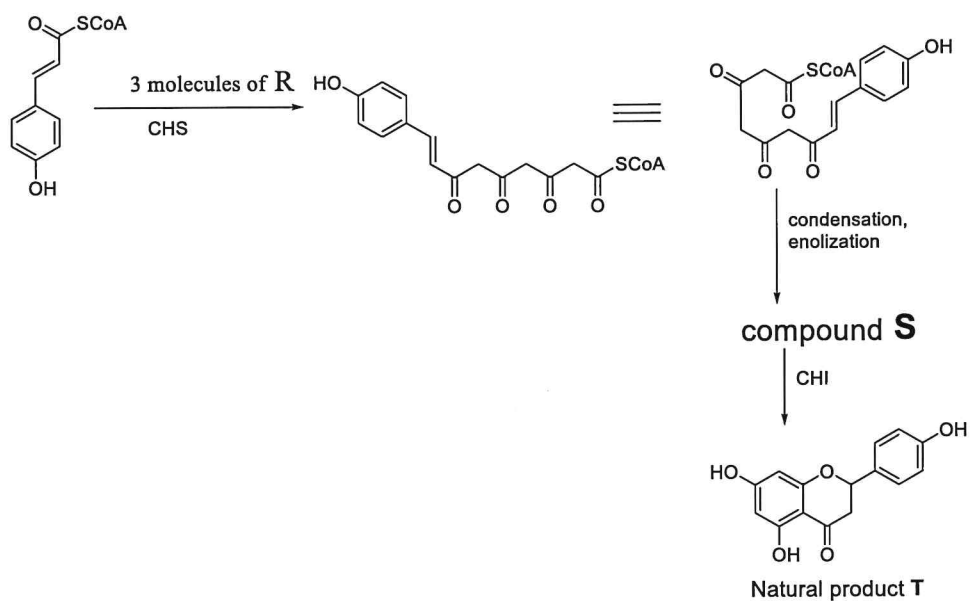
- i. What group of compounds does the structure belong to 1 mark
- ii. State its biosynthetic origin 1 mark
- iii. State three of its uses 3 marks

**Question Four 17 marks**

- a)  $\alpha$ - Phellandrene and  $\beta$ - phellandrene are isomeric organic compounds isolated from plants and are used in perfumery industry.



- i. Starting from NPP, show how the compounds are biosynthesized 6 marks
  - ii. Which class of natural products do these compounds belong to 1 mark
  - iii. Describe the procedure for the isolation and identification of these volatile compounds from pine tree leaves 4 marks
- b) Study the scheme below and then answer the questions that follow



- i. Draw structures of missing compounds R and S 2 marks
- ii. Show the reaction mechanism towards formation of compound S 3 marks
- iii. Which class of compounds does natural product T belong to 1 mark