



# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR

FORTH YEAR SECOND SEMESTER  
MAIN EXAMINATIONS

FOR THE DEGREE OF BSC (CHEMISTRY)

**COURSE CODE:** SCH 424

**COURSE TITLE:** CHEMISTRY OF NATURAL PRODUCTS

**DATE:** <sup>31</sup>~~30~~/08/2022

**TIME:** 2:00PM-4:00PM

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## INSTRUCTIONS TO CANDIDATES

Time: 2 Hours

Answer question ONE and any other TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

**QUESTION ONE [30 MARKS]**

a. Provide definition of following terms as used in natural product **[5 marks]**

- i. Anabolism
- ii. Isoprene unit
- iii. Oxylipins
- iv. Alkaloid
- v. Biocatalyst

b. State whether the following are primary metabolite or secondary metabolite

**[3 marks]**

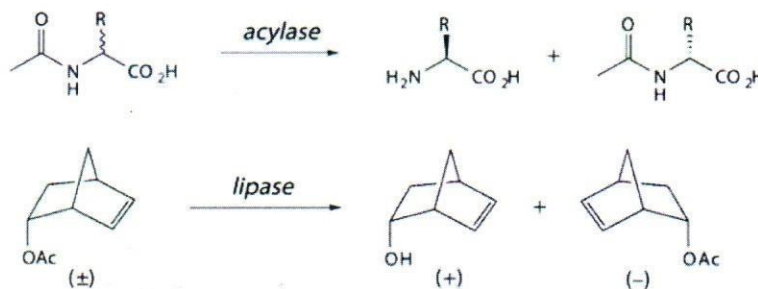
- i. Carbohydrates
- ii. Alkaloids
- iii. Glycosides
- iv. Fats
- v. Flavonoids
- vi. volatile oils

c. List any four mechanism of enzyme catalysis

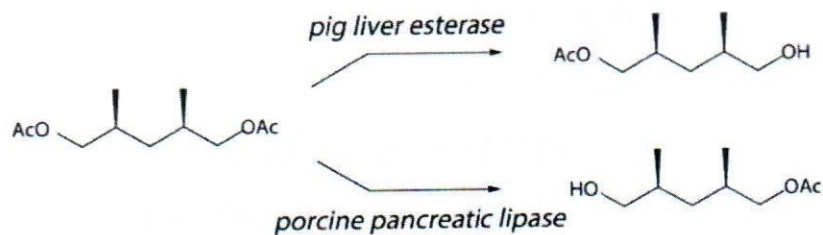
**[4 marks]**

d. Enzymes have superb selectivity for a certain substrate/functional group as well as specificity of their product. State and explain selectivity exhibited by the enzymes in **i** and **ii**

**[4 marks]**

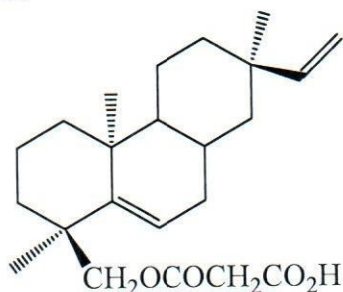


i.

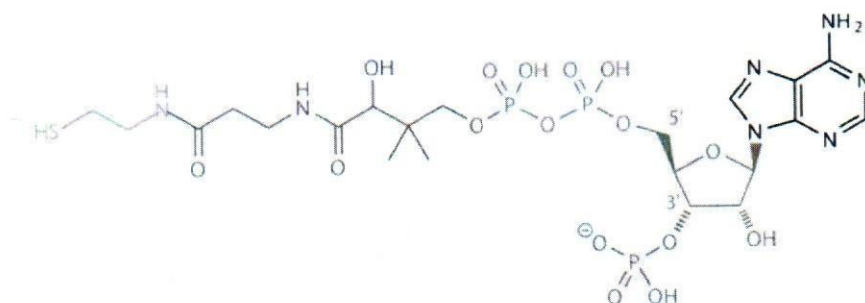


ii.

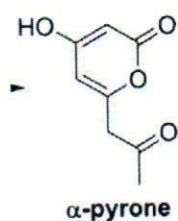
- e. Repeated column chromatography on the stem bark of *Calceolaria pinnifolia* Cav. (Scrophulariaceae) sample from San Juan Province of Argentina produced several terpenoids active against *M. tuberculosis* on such terpenoid shown below exhibited an MIC value of 4.0  $\mu\text{g/mL}$ . Indicate, using bold lines, its constituent isoprene units and state the classification of this terpenoid [4 marks]



- f. The structure below is for coenzyme A made of five parts, name the parts [5 marks]



- g. Consider structure of  $\alpha$ -pyrone below. Show biosynthetic pathway of  $\alpha$ -pyrone starting from tetraketide [5 marks]

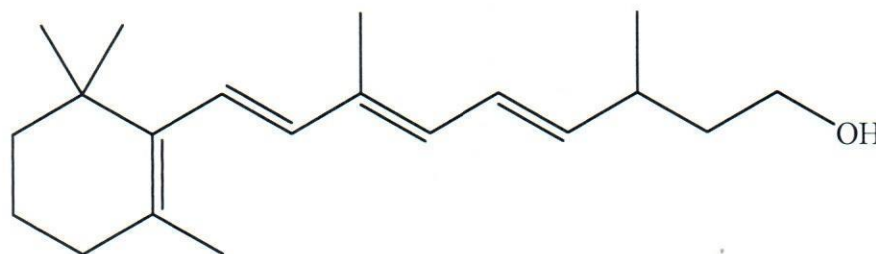


**QUESTION TWO [20 MARKS]**

a. Allelochemicals are chemicals which carry messages between members of different species. Explain the following types of allelochemical **[3 marks]**

- i. Allomones
- ii. Kairomones
- iii. Synomones

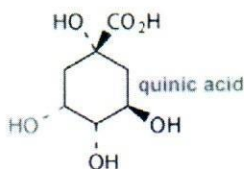
b. The structure below is a terpenoid. Indicate, using bold lines, its constituent isoprene units **[4 marks]**



c. Explain the following classification of alkaloids

- i. True alkaloid **[2 marks]**
- ii. Protoalkaloid **[2 marks]**
- iii. Pseudalkaloid **[2 marks]**

d. Show how biosynthesis pathway of quinic acid starting with phosphoenolpyruvate and D-Erythrose 4-P **[7 marks]**



### QUESTION THREE [20 MARKS]

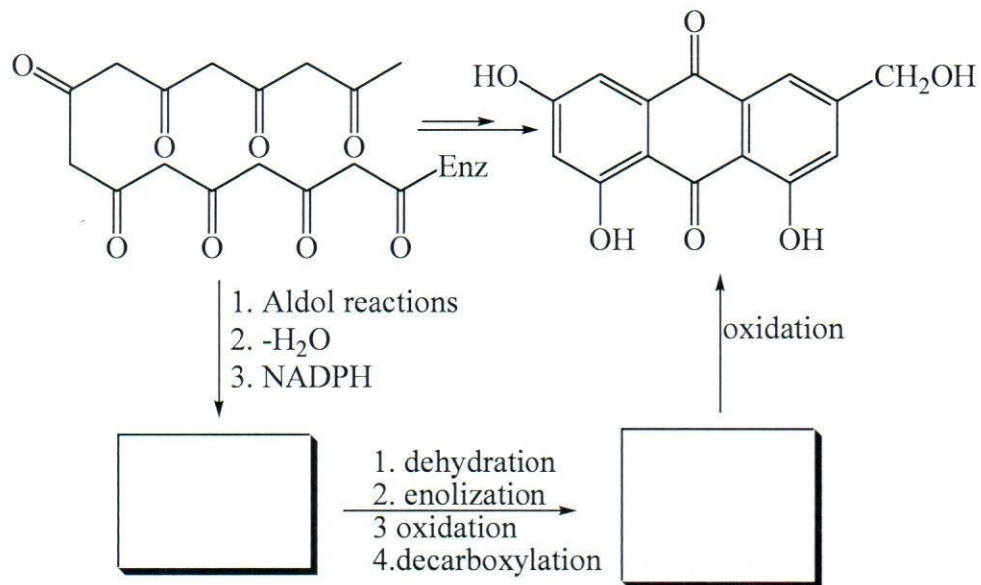
- a. The group of enzymes involved in the overall process of fatty acid synthesis is fatty acid synthase (FAS)
- Name and explain significant structural differences found in various organisms [4 marks]
  - FAS is a large multifunctional protein with seven discrete functional domains. Name these functional domains [7 marks]
- b. Explain what you understand with the following types of tannins [3 marks]
- Hydrolysable tannins
  - Gallotannins
  - Ellagitannins
- c. Show how biosynthesis pathway of tropane alkaloid, (-)-Hyoscyamine shown below [6 marks]



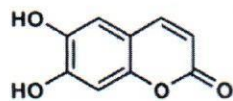
### QUESTION FOUR [20 MARKS]

- a. State the difference between synthesis and biosynthesis based on the following [3 marks]
- Process
  - Resulting polymers
  - Occurrence
- b. List steps involved (stepwise) biosynthesis of saturated fatty acid catalyzed by FAS [6 marks]
- c. Growing poly- $\beta$ -keto chain is stabilized on enzyme surface until the chain reaches the required length. The poly- $\beta$ -keto ester is very reactive – various possibilities for undergoing Claisen or Aldol reactions, dictated by the nature of the enzyme and folding of the substrate. Anthraquinone aloec-emodin is one of such compounds produced from polyketide pathway. Provide its intermediate during its biosynthesis. [5 marks]

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d. Show how biosynthesis pathway of aesculetin starting with cinnamic acid [6 marks]



aesculetin