UNIVERSITY OF RUHUNA

FACULTY OF FISHERIES AND MARINE SCIENCES & TECHNOLOGY

Academic Year 2022/2023

Bachelor of Science Honours in Fisheries and Marine Sciences Degree/
Bachelor of Science Honours in Marine and Freshwater Sciences Degree

Level IV Semester I Examination – April/May 2024

CHM 4132: Natural Product Chemistry **Time:01 hour and 30 minutes**

Answer ~~Two (03)~~ three questions **only.**

01. Answer all parts.

a. Define the following terms.

i. Ethnopharmacology

ii. Secondary metabolites

iii. Nutraceutical

iv. Anti-oxidants (20 marks)

b. Write short answers for the following questions.

i. Name two goals that are pursued with the extraction of natural products.

ii. Briefly explain "Isocratic extraction" and "gradient extraction".

iii. List 05 main extraction methods used in natural product chemistry.

(30 marks)

c.

i. Explain preparative steps that need to be done before the extraction of components in a medicinal plant.

ii. What are the steps that need to be followed to isolate specific bioactive compounds from a plant? (50 marks)

02. Answer all parts.

a. Give short answers to the following questions regarding secondary metabolites.

i. What are the roles of alkaloids in alkaloid-producing plants?

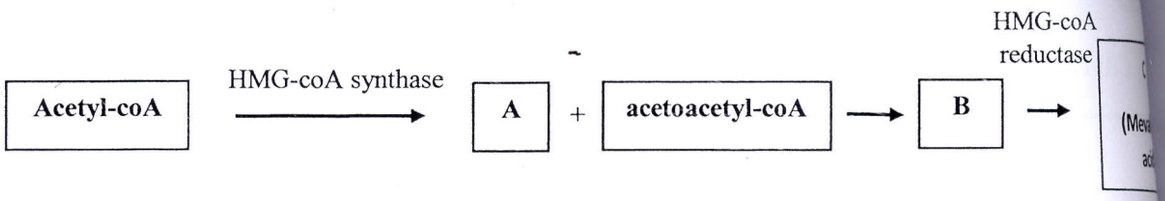
ii. Define the term "meroterpenoids".

iii. Steroids can be classified according to their physiological activity. Mention the classes of steroids that are formed in organisms with an example for each.

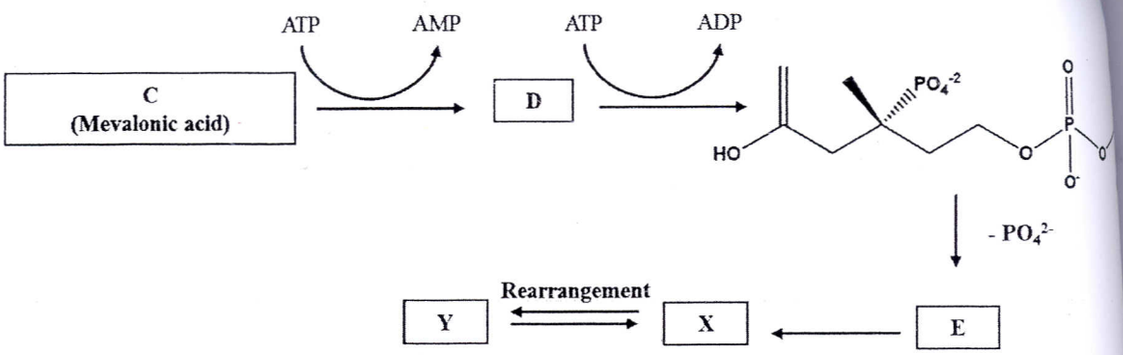
(30 marks)

b. Mevalonic acid reaction pathway is one of the most common biosynthetic pathways involved in the biosynthesis of Terpenoids and Steroids in biological systems. The schematic diagram of an incomplete reaction process is given below. Provide the answers to the following questions based on the given scheme.

Step I:



Step II:



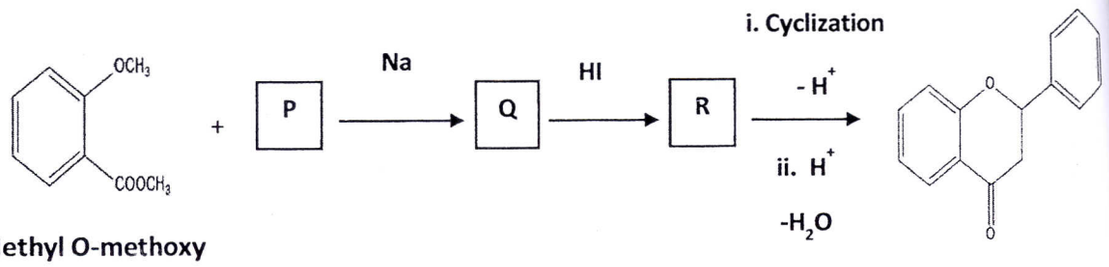
i. Draw structures for **A, B,** and **C** in step I.

ii. Predict the structures for **D, E, X,** and **Y** in step II.

iii. Isoprene units are bound together to form a terpenoid in a specific manner. Giving plausible mechanism, explain bond formation between **X** and **Y**.

(50 marks)

c. Chemical synthesis is an important step for the confirmation of the structure of natural products. A synthetic pathway given below is used to synthesize a flavonoid.



Methyl O-methoxy benzoate

flavone

i. Write down the structures for **P, Q**, and **R**.

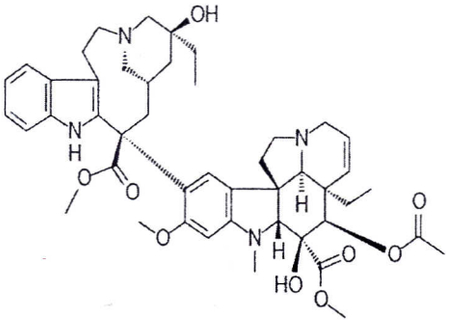
ii. Write down a plausible mechanism for the formation of **Q** from Methyl O-methoxy benzoate and **P**.

(20 marks)

03. Answer all parts.

a. Giving reasons, classify the following secondary metabolites into their relevant classes.

i.



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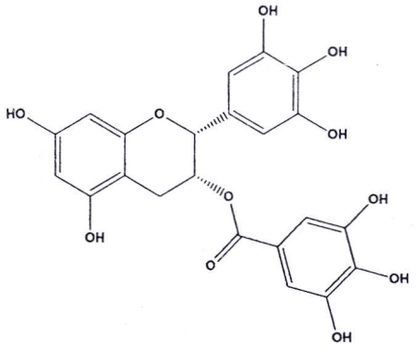

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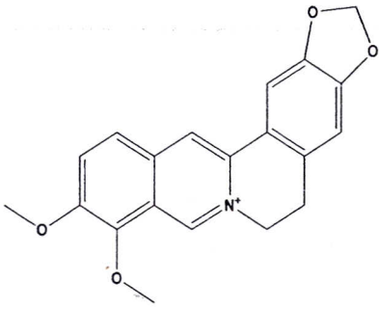

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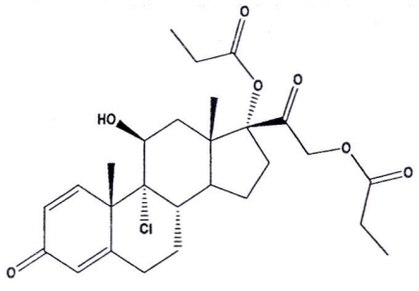
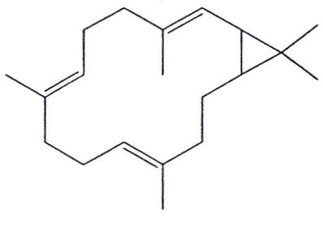


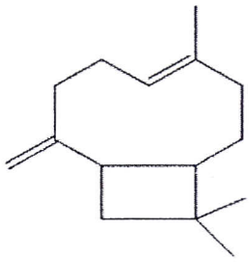
(20 marks)

b. Consider the structures of secondary metabolites given below which belong to the same class of secondary metabolites. Using a suitable method, classify them into their sub-classes by stating the method you applied.

i.



ii.



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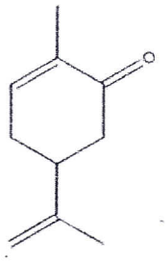

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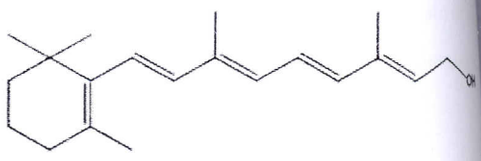

(40 marks)

c. Give short answers to the following questions.

i. The steam distillation method is used to extract essential oils from essential oil-bearing plants but not the solvent extraction method. Explain the reason for this.

ii. Explain a suitable extraction technique that can be used to extract a flavonoid from a plant.

(40 marks)

04. Answer all parts.

a. Define the following terms related to chromatography.

i. Retention time

ii. Reverse phase chromatography

iii. Retardation factor

(15 marks)

b. Give short answers to the following questions.

i. List five applications of chromatography

ii. What are the different types of chromatography classified based on the force of separation?

iii. Give advantages and disadvantages of gas chromatography.

iv. Give an example of the use of gas chromatography in each qualitative and quantitative analysis.

(50 marks)

c. Berberine is an alkaloid that can be extracted from *Coscinium fenestratum* (tree turmeric) which has distinctive medicinal and therapeutic applications. If you have provided a raw sample of tree turmeric, briefly explain what are the basic experimental steps that you would follow to extract and identify the presence of Berberine in that plant under normal laboratory conditions. (Hint: you have a small amount of authentic berberine sample with you)

(35 marks)

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