RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester I Examination – November/December 2016

CHE 3209 – NATURAL PRODUCT CHEMISTRY

Time: Two (02) hours

Answer any four questions.

1.

a) Write a brief note on "Aldoses" and "ketoses" (10 marks)

b) How many stereoisomers can be present for following monosaccharides? Deduce all possible structures.

i. Aldo-hexose
ii. Keto-pentose
iii. Aldo-pentose
iv. Keto-tetrose (20 marks)

c) Outline the Kiliani-Fischer synthesis of D-galactose and D-talose from D-xylose (30 marks)

d) X and Y are two different monosaccharides which react with 5 moles of HIO_4 in the following manner

i. $X + 5HIO_4 \longrightarrow 5HCOOH + HCHO$

ii. $Y + 5HIO_4 \longrightarrow 3HCOOH + HCHO + CO_2$

Using clear arguments, deduce the structures of X and Y (40 marks)

2.

a) Briefly describe following terms

i. Zwitterion

ii. Essential amino acids

iii. Isoelectric point (15 marks)

b) State the differences between

i. Glutamate and Glutamine

ii. Leucine and Isoleucine

iii. Cysteine and Cystine (15 marks)

c) What amino acid/s can be converted into another amino acid with gentle hydrolysis, resulting in release of ammonia? Describe your answer with appropriate structures. (20 marks)

d) Show how you would use a Strecker synthesis to make following amino acids.

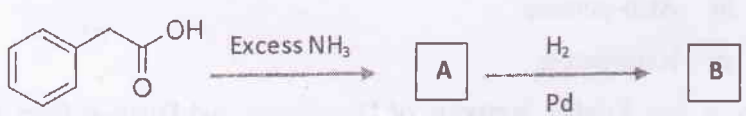
i. Phenylalanine.

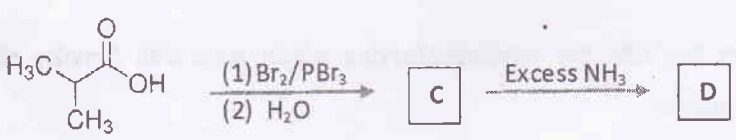
ii. Leucine

iii. Valine

iv. Aspartic acid (20 marks)

e) The schemes below illustrate the synthesis of amino acids in different reactions. Give the structures of **A, B, C** and **D** with the corresponding letter.

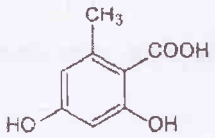
i. 

ii. 

(30 marks)

3.

a) Propose a biosynthetic pathway for orsellinic acid starting from acetyl coenzyme A.

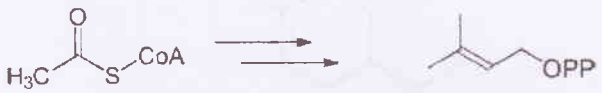


Orsellinic acid

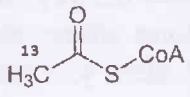
(25 marks)

b) Indicate which carbon/s of orsellinic acid will be labelled as ^{13}C, if $CH_3{}^{13}CO\text{-}SCoA$ is used as the precursor. (10 marks)

c) Give a detailed reaction scheme to show how acetyl coenzyme A can be transformed into 3,3-dimethylallyl pyrophosphate (isopentenyl pyrophosphate) in the mevalonate pathway. (20 marks)



d) Indicate the position of ^{13}C labeled atom/s in 3,3-dimethylallyl pyrophosphate, if methyl carbon [1-^{13}C] of acetate was labeled by ^{13}C.



(20 marks)

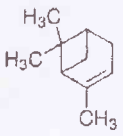
e) Briefly classify Flavonoids drawing the basic C_{15} ring structure or the nucleus.

(25 marks)

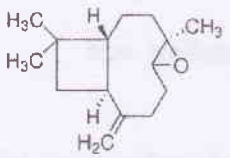
4.

a) Identify the isoprene units embedded in the following terpene molecular structures and draw them on the molecule.
(Note: Use a different color to draw isoprene units on the structure) (25 marks)

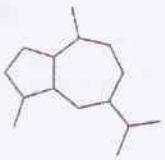
Limonene



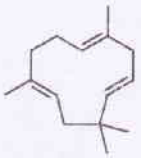
α-pinene



Caryophyllene



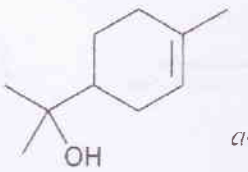
Gaujan



Humulene

b) Propose a mechanistic pathway for the biosynthesis of *α*-terpineol from isopentenyl diphosphate

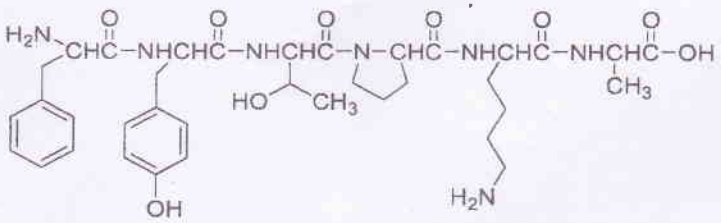
(20 marks)



α-terpineol

c) The terpene known as alloocimene ($C_{10}H_{16}$) shows λ_{max} at 288 nm and gives 1 mol of 2-proponone and 1 mol of ethanal among other products on ozonisation. What is the likely structure of alloocimene? Show your reasoning. (25 marks)

d) Insulin is a hormone that is used by the human body to regulate glucose metabolism. Fragmentation of the B chain of insulin gave the hexapeptide fragment below. Identify the amino acids present in the above structural moiety. Draw and name them separately. (10 marks)



e) What would be the effect of treating the hexapeptide with carboxypeptidase? (5 marks)

5.

a) Name 5 alkaloids you can find in the nature. Why do you think plants produce alkaloids? (10 marks)

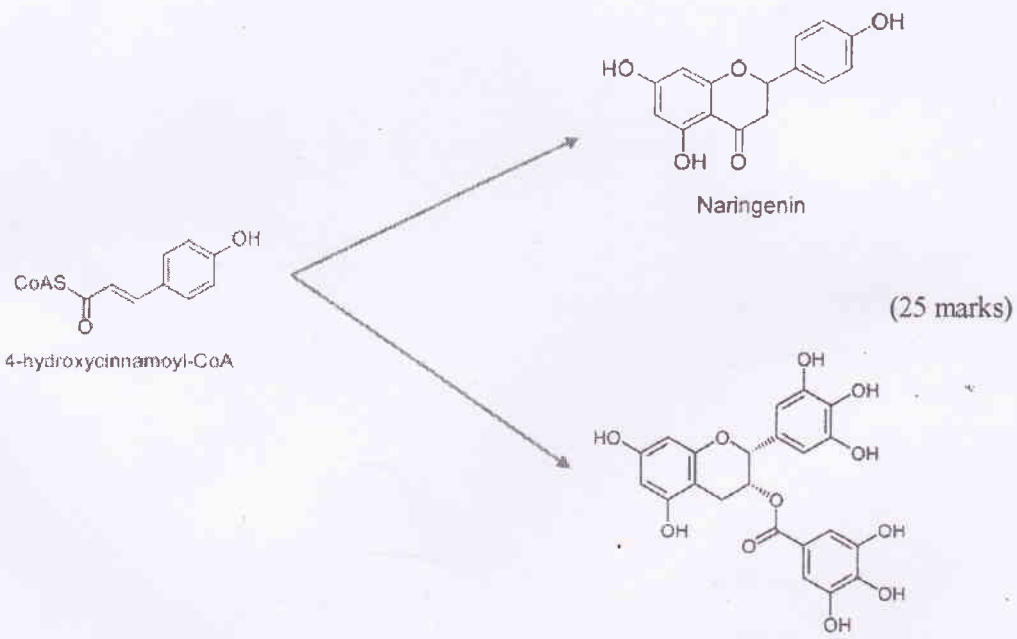
b) Briefly classify alkaloids based on the ring structure or nucleus. (10 marks)

c) Explain the process of extracting alkaloids from plant material. (10 marks)

d) Sugar **X** has molecular formula $C_{11}H_{20}O_{10}$. Oxidation of **X** with bromine water followed by hydrolysis gives D-gluconic acid D-xylose. Methylation of **X** followed by hydrolysis, gives 2,3,4-tri-O-methyl-D-xylose and 2,3,4-tri-O-methyl-D-glucose. Using clear arguments, deduce the structure of sugar **X**.

(20 marks)

e) Both Naringenin and Epigallocatechin gallate are biosynthetically derived from 4-hydroxycinnamoyl-CoA. Propose biosynthetic pathways for both flavonoids.



(25 marks)

(25 marks)

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