

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2010/2011

LEVEL 5-FINAL EXAMINATION

CHU 3130/CHE 5130-INTRODUCTION TO NATURAL PRODUCTS
CHEMISTRY

Time: 2½ HOURS

Tuesday 28th December 2010

9.30a.m.- 12.00p.m.

Answer any FOUR questions only.

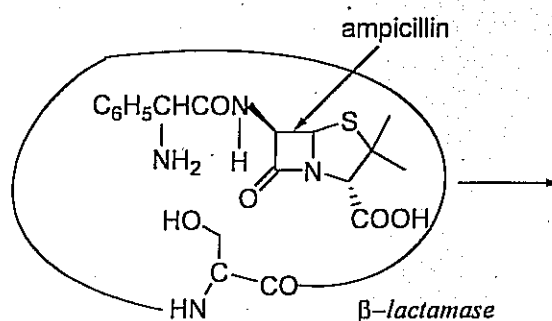
If you have answered more than four questions, only the first four answers will be marked.

1. (a) Fill the table given below with the spray reagents that can be used to detect the following secondary metabolites by TLC and state the colour observed in each case.

Class of compounds	Spray reagent	Colour observed
Anthraquinone		
Alkaloids		

(20 marks)

- (b)(i) β -lactamase causes resistance to ampicillin by bacteria. Name the product formed when β -lactamase acts on ampicillin.
- (ii) Indicate the mechanism of the reaction involved when β -lactamase acts on ampicillin. Give the structure of the product formed.

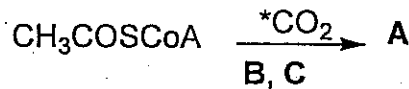


- (iii) 'Patients that have developed resistivity to ampicillin will recover from bacterial infection if treated with a mixture of clavulanic acid and ampicillin'. Explain briefly what happens in the above treatment that indicates how ampicillin becomes resistance to bacteria.

(40 marks)

- (c)(i) Name **three** primary compounds involved in the pathways leading to secondary metabolites.

- (ii) Carboxylation reactions are commonly encountered in biosynthesis. Complete the carboxylation reaction given below obtained by using carbon dioxide labeled with ^{14}C ($^*\text{C}$) by identifying the missing compounds A, B and C.



N.B. B and C are co-enzymes.

- (iii) Indicate the position of the labelled atom(s) in the product A formed in the reaction given in (ii).

(40 marks)

- 2.(a) (i) How do insects, plants and micro-organisms adapt to fluctuation of temperature?

- (ii) What are pheromones? Illustrate your answer using three different types of pheromones by briefly explaining their action.

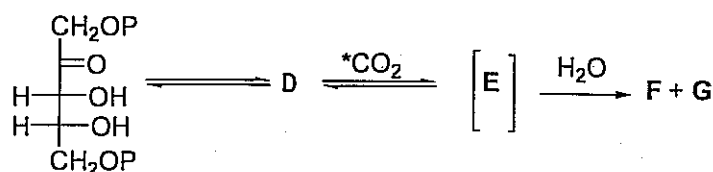
(40 marks)

- (b) (i) Name three vital processes for which acetyl CoA is the starting material.

- (ii) Name the product of the glycolytic pathway that is made use of in biosynthesizing acetyl CoA.

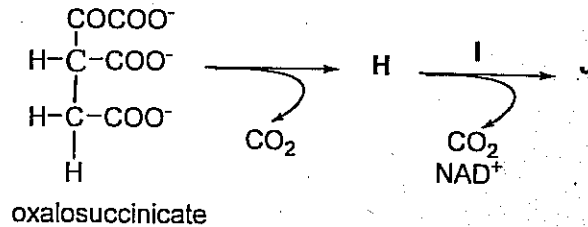
(20 marks)

- (c) Indicate the missing compounds (D-G) and the position of the labeled atoms if any of the following pathway leading to the biosynthesis of carbohydrates during photosynthesis.

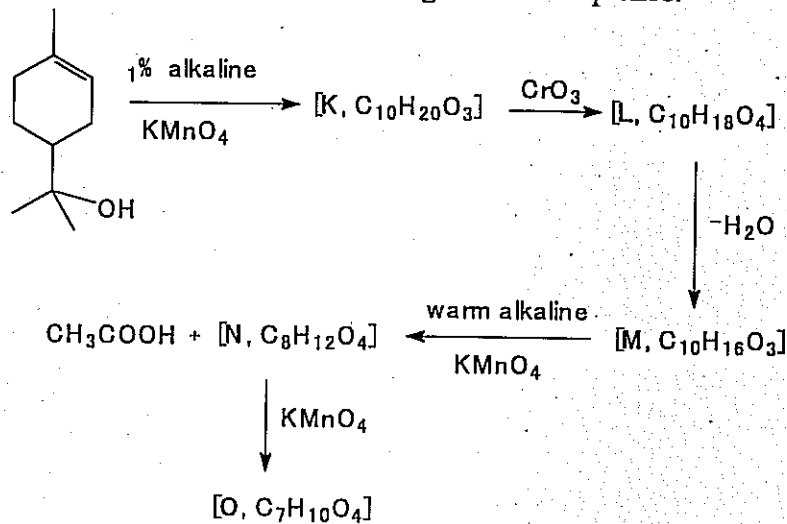


ribulose-1,5-diphosphate

- (d) Indicate the missing compounds (H - J) in the following pathway which is part of the citric acid cycle. (25 marks)



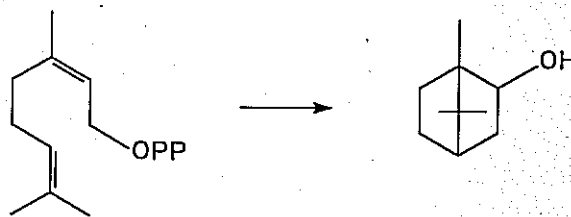
3. (a) α -Terpineol underwent the following reaction sequence. (15 marks)



Propose structures for K, L, M, N and O of this reaction.

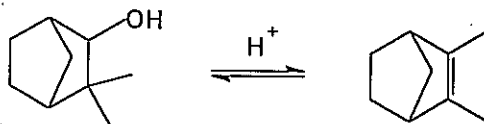
(40 marks)

- (b) Indicate the mechanism involved in the biosynthetic scheme given below.



(20 marks)

- (c) Outline the mechanism of following conversion.

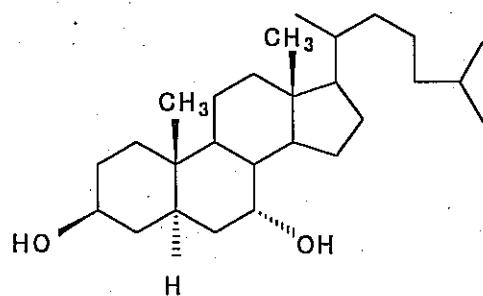


(20 marks)

- (d) Give five examples to show that terpenoids are industrially important.

(20 marks)

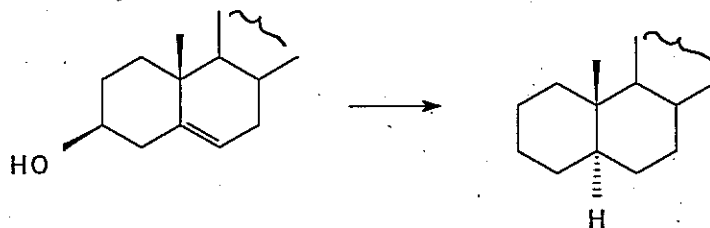
4. (a) Explain why 5 α -cholestane-3 β ,7 α -diol undergoes esterification reaction with ClCOOC₂H₅ to form 3 β -monocathylate. On the other hand the corresponding 5 α -cholestane-3 β ,7 β -diol forms the 3 β ,7 β -dicathylate under the same condition.



5 α -cholestane-3 β ,7 α -diol

(30 marks)

- (b) Show how you would effect the conversion of cholesterol into 5 α -cholestane.

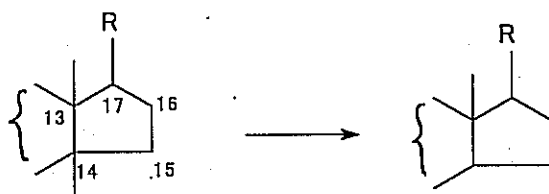


Cholesterol

5 α -cholestane

(30 marks)

- (c) Show how the methyl group at C-14 of lanosterol is lost during the biosynthesis of cholesterol.



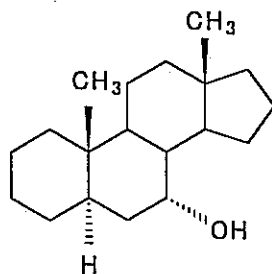
Lanosterol

(30 marks)

- (d) Write a brief account on three biologically active steroids.

(10 marks)

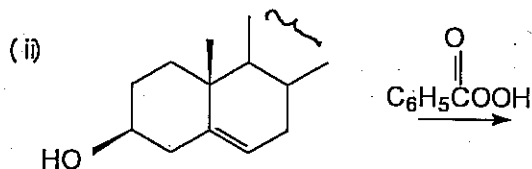
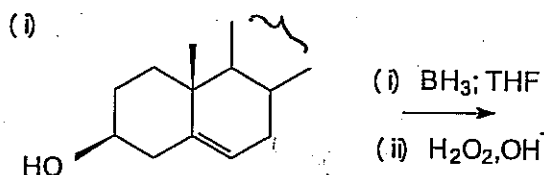
5. (a) Explain why 5 α -androstan-7 α -ol is oxidized to the ketone by CrO₃-aqueous acetic acid hundred times faster than 5 α -androstan-7 β -ol.



5 α -androstan-7 α -ol

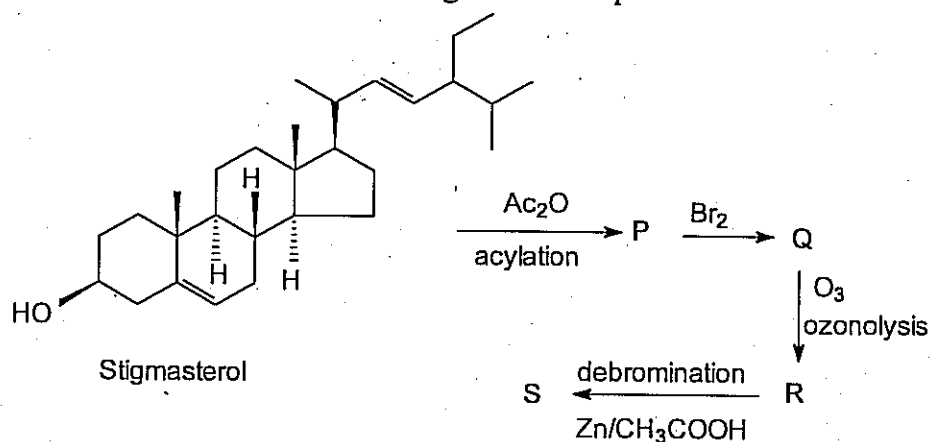
(30 marks)

(b) Give the structures of the products (with their stereochemistry) of the following reactions.



(30 marks)

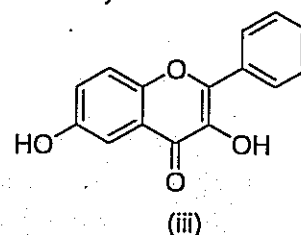
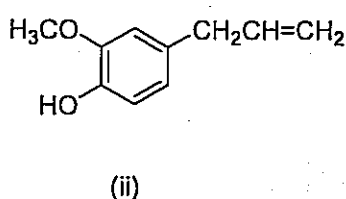
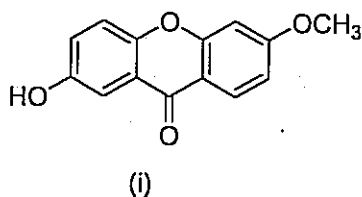
(c) Stigmasterol underwent the following reaction sequence.



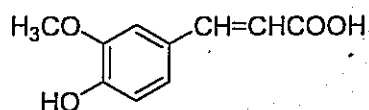
Propose structures for P, Q, R and S of this reaction.

(40 marks)

6.(a) Clearly state the basic skeleton giving the appropriate carbon number and the class of the following compounds. (See example worked below).



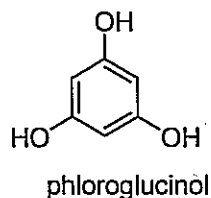
Example



Basic skeleton : $\text{C}_6\text{-C}_3$
 Class : hydroxycinnamic acid

(18 marks)

- (b) (i) Draw the structure of the polyketide (T) involved in the biosynthesis of phloroglucinol.

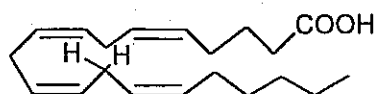


- (ii) Indicate the position of labeling of the polyketide T if it is biosynthesized from labeled acetyl CoA ($\text{CH}_3^*\text{COSCoA}$) and malonyl CoA ($\text{HOOCCH}_2^*\text{COSCoA}$).
- (iii) Indicate the mechanism by which phloroglucinol is formed from T.

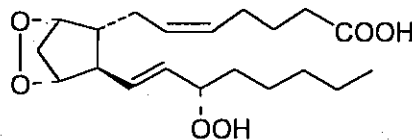
(25 marks)

- (c) (i) How many double bonds are present in the carbon chain of the prostaglandin PGE_2 .

- (ii) Indicate the mechanism of the reactions involved in the biosynthesis of the prostaglandin PGG_2 from arachidonic acid, stating the name of the enzyme involved in the reaction.



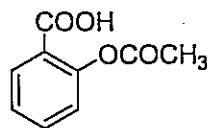
arachidonic acid



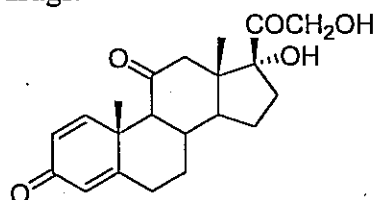
PGG_2

(37 marks)

- (d) Aspirin and prednisolone are used as anti-inflammatory drugs. Explain briefly how they act as anti-inflammatory drugs.



aspirin



prednisolone

(20 marks)