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00264

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2009/2010

LEVEL 5-FINAL EXAMINATION

CHU 3130/CHE 5130-INTRODUCTION TO NATURAL PRODUCTS CHEMISTRY

Time: 2½ HOURS

Wednesday 30th December 2009 **9.30a.m.- 12.00 noon**

Answer any FOUR (04) 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 the colour observed in each case.

Class of compound	Spray Reagent	Colour Observed
Coumarins		
Steroids		

(16 marks)

(b) Fill the table given below by stating the biosynthetic pathway and precursor from which the given class of natural products are biosynthesized

Class of natural products	Biosynthetic pathway	Precursor
Coumarins		
Terpenoids		

(16 marks)

(c) (i) What structural features differentiate a gram positive bacteria from a gram negative bacteria.

(ii) Name a gram positive and a gram negative bacteria.

(iii) Name the enzyme responsible for bacterial growth.

(iv) Explain briefly how penicillin acts as an antibacterial agent.

(28 marks)

(d) Name the co-enzyme involved in the following biosynthetic reactions.

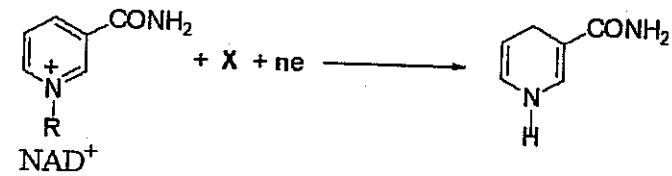
(i) Carboxylation

(ii) Acyl transfer

(20 marks)

contd... ..2

(e) (i)Identify the missing number **n** and the compound **X** in the reaction scheme given below where the starting material is NAD^+.



(10 marks)

(ii) Explain the term allosteric effect

(10 marks)

2. (a) (i) Name the amino acid found abundantly in plants that have adopted to drought.

(ii) What property of the name amino acid in your answer to part (i) above, is made use of by plants in adopting to drought?

(20 marks)

(b) (i) State **two** problems encountered in elucidating the biosynthetic pathway of secondary metabolites by feeding experiments using isotopic labelled compounds.

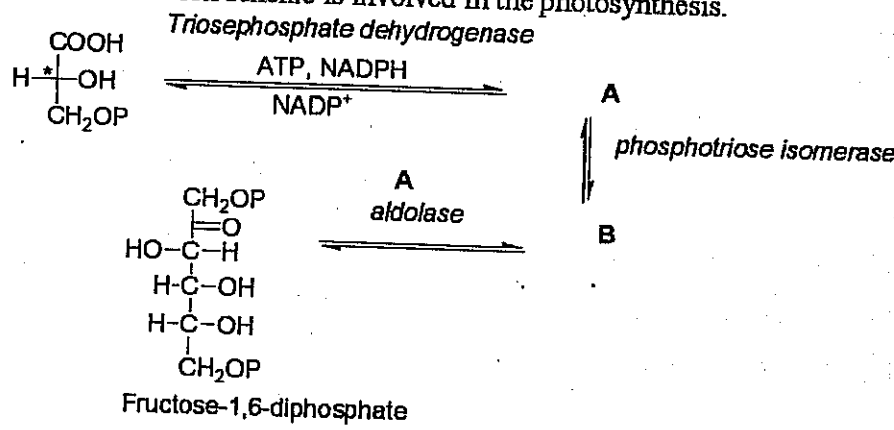
(ii) Name **three** different groups of secondary metabolites biosynthesized from polyketides.

(iii) Name **three** different benefits of citric acid cycle.

(40 marks)

(c) Complete the following reaction by identifying the missing compounds **A** – **B** in the reaction scheme given below.

N.B. The reaction scheme is involved in the photosynthesis.

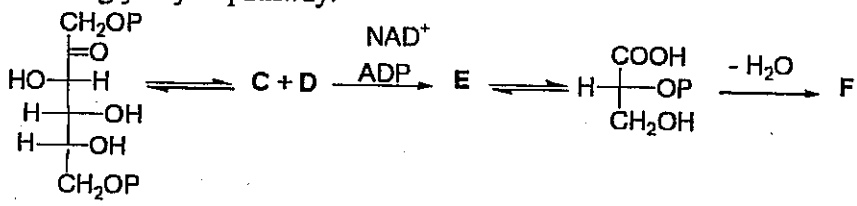


Indicate the position of the labeled atom(s) in the fructose-1,6-diphosphate formed by *.

(20 marks)

contd....3

(d) Identify the missing compounds **C** - **F** in the following reaction scheme met in the glycolysis pathway.

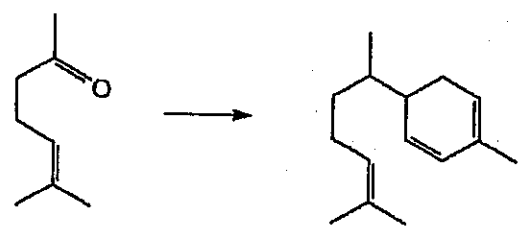


Compounds **C** and **D** are sugars with three carbon atoms

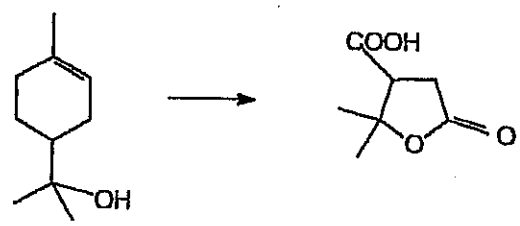
(20 marks)

3. (a) Indicate by means of equations and essential conditions how **two** of the following conversions may be effected.

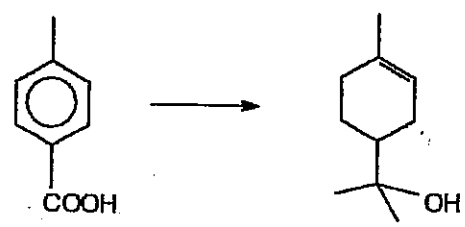
1.



2.

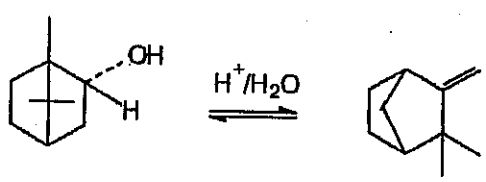


3.



(60 marks)

(b) Outline the mechanism of the following conversion.



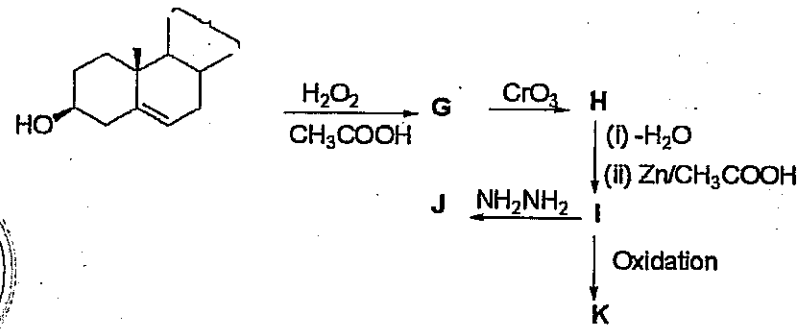
(20 marks)

(c) Give **five** examples to show that terpenoids are biologically important.

(20 marks)

contd....4

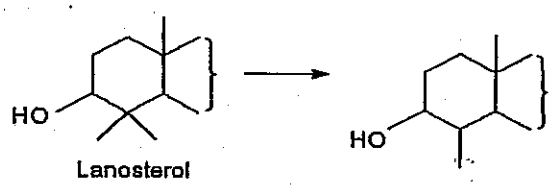
4. (a) Cholesterol undergoes the following reaction sequence.



Identify **G, H, I, J, K** in the following reaction sequence and explain this reaction sequence can help in the structural elucidation of cholesterol.

(40 marks)

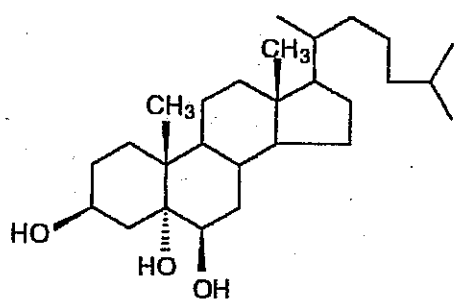
(b) Show how one of the methyl group at C-4 of lanosterol is lost during the formation of cholesterol.



Lanosterol

(30 marks)

(c) Explain why cholestane-3β,5α,6β-triol undergoes esterification reaction with ClCOOEt to form the 3β-monocathylate (3β-mono ester). On the other hand the corresponding 3β, 5α, 6α-triol forms the 3β, 6α-dicathylate (3β, 6α-di ester) under the same condition.

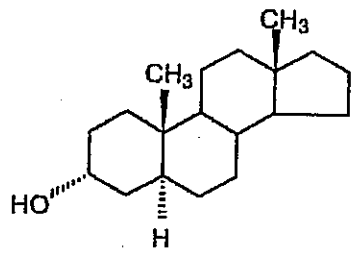


cholestane -3β,5α,6β-triol

(30 marks)

contd...

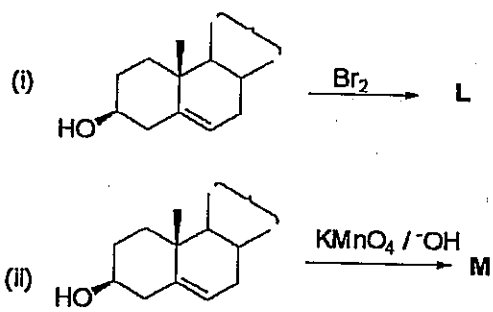
(5) (a) Explain why 5α-androstan-3α-ol is more rapidly oxidized than 5α-androstan-3β-ol by chromic oxide (CrO_3) and glacial acetic acid.



5α-androstan-3α-ol

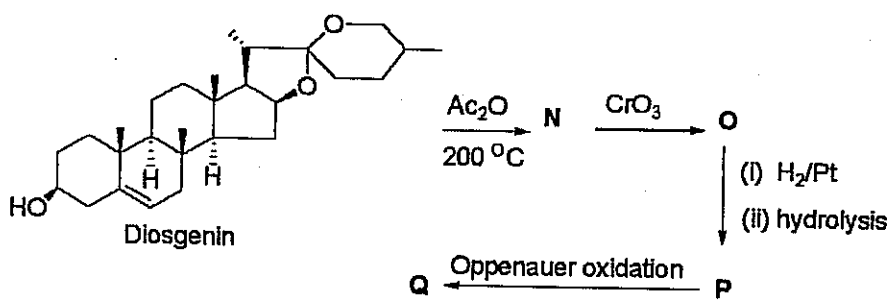
(30 marks)

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



(30 marks)

(c)Diosgenin underwent the following reaction sequence in the synthesis of progesterone **Q**.

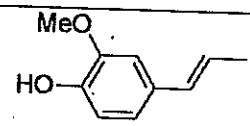
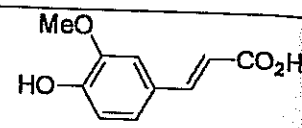


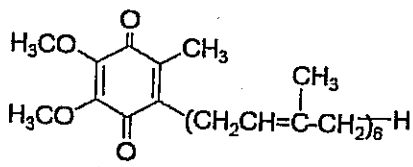
Propose structures for **N**, **O**, **P** and **Q** of this reaction.

(40 marks)

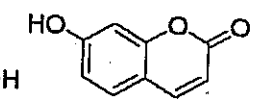
contd... ..6

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

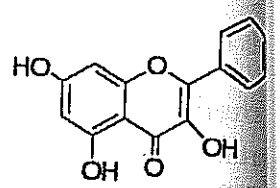
	Example	
		
Basic skeleton	$C_6 - C_3$	$C_6 - C_3$
Class	Phenyl propene	Hydroxycinnamic acid



(I)



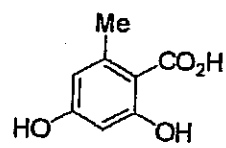
(II)



(III)

(30 marks)

(b) (i) Draw the structure of the polyketide **R** involved in the biosynthesis of orsellinic acid.



Orsellinic acid

(ii)Indicate the mechanism involved in the biosynthesis of orsellinic acid from the polyketide.

(20 marks)

(c) (i) Draw the structure of the prostaglandin $PGF_{2\alpha}$.

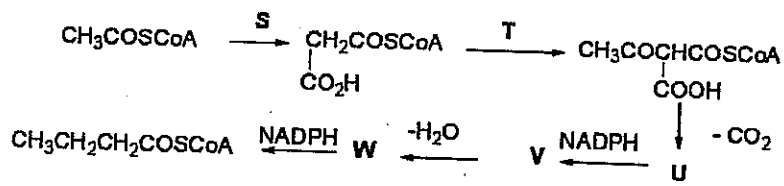
(ii) Name the fatty acid involved in the biosynthesis of prostaglandin.

(iii)Give a beneficial and non-biological effects of thyomboxine A_2

(iv)Name the amino acid present in leukotriene LTC_4 that is responsible for its bronchoconstrictiction effect.

(20 marks)

(d) Identify the missing compounds **S** - **W** involved in the following reaction scheme leading to the biosynthesis of fatty acids.



(30 marks)