# THE OPEN UNIVERSITY OF SRI LANKA

**B.Sc DEGREE PROGRAMME/ STAND ALONE COURSES 2006/2007**
**LEVEL 5- CONTINUOUS ASSESMENT TEST II**
**(NO BOOK TEST)**

## CHU 3130 INTRODUCTION TO NATURAL PRODUCTS CHEMISTRY

**(2 1/2 HOURS)**

Date: Saturday 9th September 2006 Time: 10.30 am – 12.00 noon

**ANSWER ALL QUESTIONS IN THE SPACE CPROVIDED**

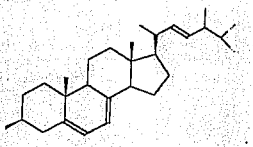
Index Number

| Question | Marks |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| Total | |

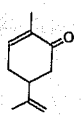
1. (a) What is the difference between steam distillation and steam water istillation in isolation of terpenoids from natural sources? Which method has more advantages?

(8 marks)

(b) Calculate the $\lambda_{max}$ of the following compounds. [basic value for homo annular diene = 253 nm, basic value for hetero annular diene = 214 nm, basic value for α, β-unsaturated ketone = 215 nm, increments: for each C substituent or ring residue = +5 nm, for each exocyclic double bond = +5 nm, for each extending conjugation = +30 nm, C substituent at α position +10 nm, C substituent at β position = +12 nm, C substituent at γ or higher position = +18 nm]



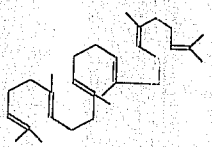
(i)




(ii)

(12 marks)

2. (a) Squalene is the key intermediate in preparation of terpenoids and steroids. Identify all the isoprene units of squalene and the bond connected two isoprene units in tail to tail manner.



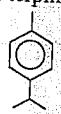
(10 marks)

(b) Molecular formula of α-terpineol is $C_{10}H_{18}O$. It is optically active tertiary alcohol. What can you infer from the following reactions about α-terpineol?

(i) α-terpineol reacts with 1 mol of bromine and gives dibromo adduct.

(4 marks)

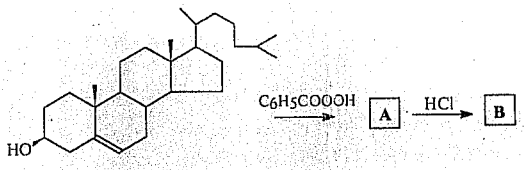
(ii) When heated with $H_2SO_4$, α-terpineol is converted to p-cymene.



p- cymen

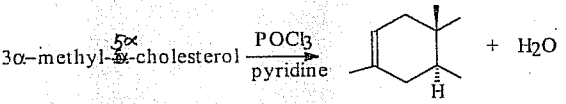
(6 marks)

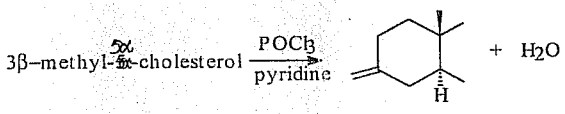
3. (a) Give the structures of **A** and **B**. Explain the stereochemistry of **A** and **B**.




(10 marks)

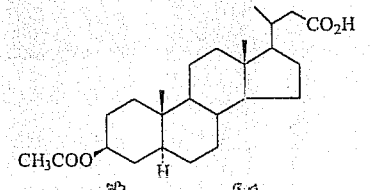
(b) Explain the following reactions.




(10 marks)

3. The molecular formula of stigmasterol is $C_{29}H_{48}O$. It forms a monoacetate. On hydrogenation it produces stigmastanol ($C_{29}H_{52}O$). The acetate of stigmastanol on oxidation with $CrO_3$ forms a known compound, the acetate of 3β-hydroxynor-5α-cholanic acid. Stigmasterol on ozonolysis gave ethyl isopropylacetaldehyde as one of the products. Stigmasterol on hydroxylation with $H_2O_2$ in $CH_3CO_3H$ gave a triol which on oxidation with $CrO_3$ gave a hydroxylketone. This hydroxyketone on dehydration followed by reduction formed a dione. The dione with hydrazine gave a pyridazine (6-membered ring with two adjacent N atoms) derivative. Using the above data suggest a structure for stigmasterol. In the infrared spectrum stigmasterol showed a band at 970 $cm^{-1}$.




acetate of 3β-hydroxynor-5α-cholanic acid

(20 marks)

5. (a)What is the difference between a hormone and a pheromone?

(4 marks)

(b) Give example for terpenoids which is responsible for ;

(i) vision

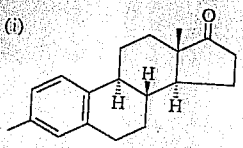
(ii) important biosynthesis intermediates

(iii) plant growth hormones

© What aglycones of saponins are called, (6 marks)

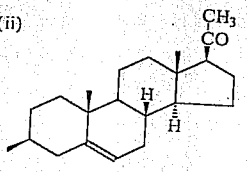
(d) Give the products of the following (4 marks)

(i)




$HC \equiv CH$
$K, NH_3$
?

(ii)




oppenauer oxidation
?

(6 marks)

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***Answer Guide to Assignment Test II***
**CHU 3130 – INTRODUCTION TO NATURAL PRODUCTS CHEMISTRY**

1. (a) Steam water distillation-

High pressure steam is generated in an outside steam generator. Usin g this steam the water inside the distillation plant contain the plant material is boiled Low pressure steam then generated in the still moves upwards through the plant m terial, vaporizing the volatile substances as it moves upwards. Here the plant material is not direct contact with a fire source.

Steam distillation-

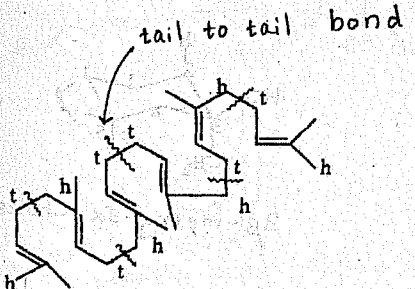
Here also steam is generated in a separate steam generator is passed th rough the plant material. But the plant material is not in contact with the boiling water Here also the plant matter is not directly contacted with the fire source.

More advantages one is steam distillation, because thermal decomposition is minin ized.

1b). i) basic value for homo annular diene = 253 nm
4 carbon substituents – 20 nm
2 exocyclic double bonds = 10 nm
λmax = 283 nm

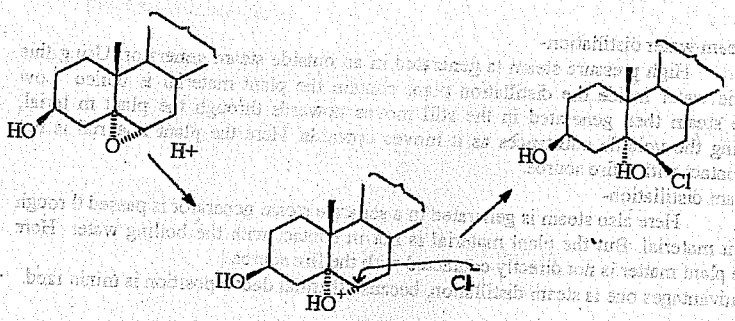
ii)basic value forα,β-unsaturated ketone = 215 nm
C-substituent at αC – 10 nm
" at βC = 12 nm
λmax = 237 nm


2.a)



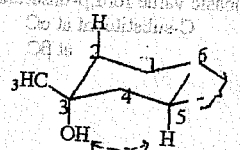
(b) i) only one double bond present.
ii) p-cymene & α-terpeneol contain p-menthane type carbon skeleton.

3.a)



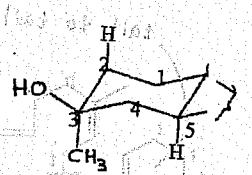

Explanation-
The epoxide ring is opened by the attack of chloride ion from the β-face.And lso it attacks at the more open 6th position.

b)
1,3 interaction between C-3 hydroxyl and C-5 hydorgen.therefore diaxial elimination can occur.
2-ene derivative formed.




3α-methyl-5α-Choleste

No 1,3 interaction between OH and C-5 hydrogen.3-methelene derivative Is formed.




3β-methyl-5α Cholestel

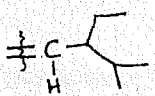
$O_3$ ($C_{29}H_{48}O$) (Stigmasterol) $H_2$

mono acetate (one) OH group present.

OHC — ethylisopropyl acetaldehyde.

∴ one double bond should be in the side chain at $C_{17}$.

∴ Side chain should be



Stigmastanol ($C_{29}H_{52}O$)

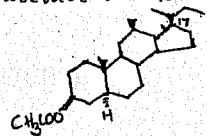
∴ 2 double bonds present.

↓ acetylation

Stigmastanyl acetate.

↓ $CrO_3$

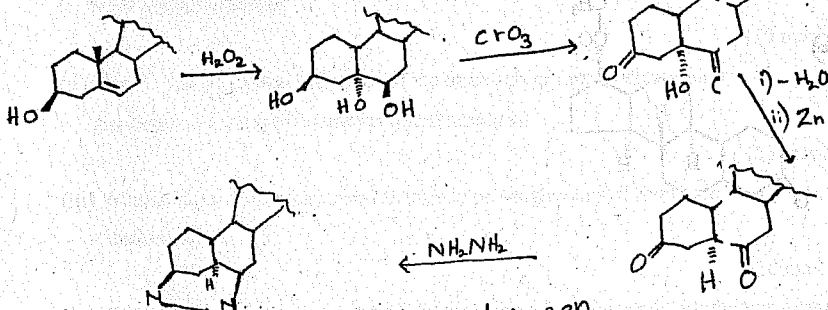
acetate of 3β-hydroxy nor-5α-cholanic acid



∴ identical nuclei should be in Stigmasterol.

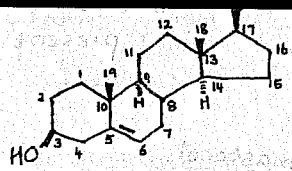
∴ position of OH can be identified. OH should be at C-3

Position of the side chain also can be identified, it should be at $C_{17}$



∴ 2nd double bond should be between $C_5$ and $C_6$.

band at 970 $cm^{-1}$ indicate the double bond in the side chain should be in trans configuration.



Stigmasterol

5.a) Hormone is a substance synthesized in a specialized cell,released and transmitt d to remote target cells of the same animal to control their activity.Whereas Pheromone s a substance secreted by animals to communicate with or control the behavior of other members of the same species.

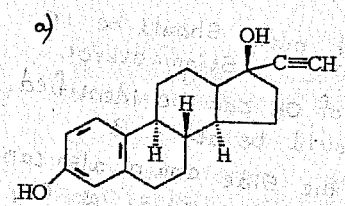
b)

i) Vitamin A
ii) Squalene, lanosterol
iii) Gibberalins

c) Sapogenins

d)

a)



b)