THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2013/2014

LEVEL 5-FINAL EXAMINATION

CHU 3131/CHE 5131
THE CHEMISTRY OF AMINO ACIDS, SUGARS AND RELATED COMPOUNDS

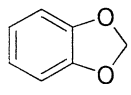
DURATION: 2 HOURS

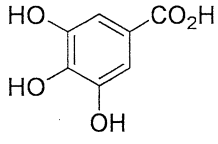
Wednesday 26th November 2014 9.30a.m.- 11.30 a.m.

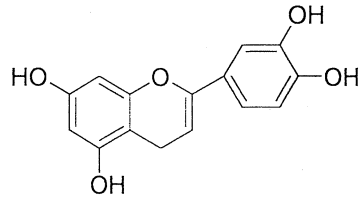
Answer any FOUR questions only.

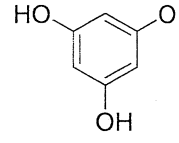
If you have answered more than four questions, only the first four answers will be marked.

1. (a) Phenolic compounds given below are derived from different biosynthetic pathways. Name the possible biosynthetic pathway for each of them.

i. 

ii. 

iii. 

iv. 

(20 marks)

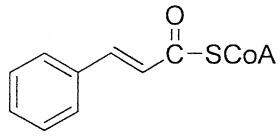
(b) Chalcones are biosynthesized via the polyketide formed by joining of two C_9 and C_6 fragments.

i. Starting with acetyl-CoA labelled with ^{14}C at the methyl carbon, show how the C_6 fragment is biosynthesized.

$^{*}CH_3CO\text{-}SCoA$ $\quad\quad$ $^{*}C = {}^{14}C$

acetyl CoA

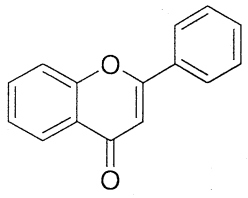
ii. Write down the scheme for the formation of chalcone.

C_9 = 

(30 Marks)

(c) Flavonoids have characteristic absorption bands in their UV-Vis spectrum.

i. For the flavone given below, draw the structures which correspond to Band I and Band II in its UV-Vis spectrum.



ii. Explain the differences you expect to observe in UV-Vis spectra of an isoflavone and the above flavone.

(30 marks)

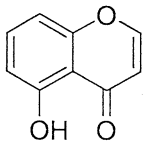
(d) Give explanations for the following statements.

i. Lignin acts as a sequestrant in plant micronutrient systems.

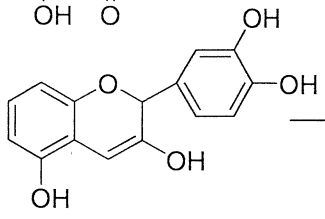
ii. Tannins in food can decrease intestinal absorption of amino acids.

(20 marks)

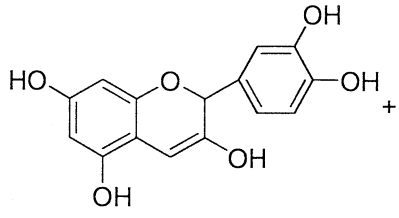
2. (a) Give the structures of the products resulting from the reactions of following phenolic compounds.

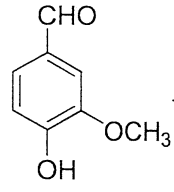
i. 

$\xrightarrow{Mn^{2+}}$ **A**

ii. 

$\xrightarrow[\text{fusion}]{KOH}$ **B + C+ D**

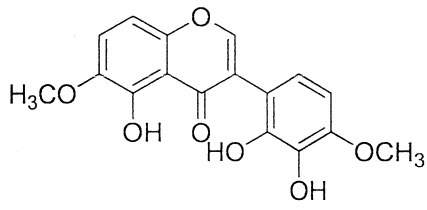
iii. 

+ 

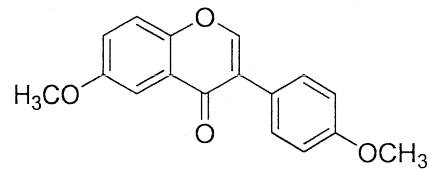
$\xrightarrow{H^+}$ **E**

(40 marks)

(b) Structures of flavonoids can be elucidated by their ^{13}C and ^{1}H NMR. Explain the major differences in the ^{1}H NMR spectra of the following two isoflavones.



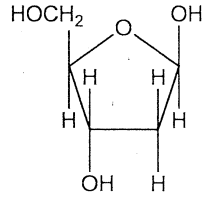
isoflavone 1



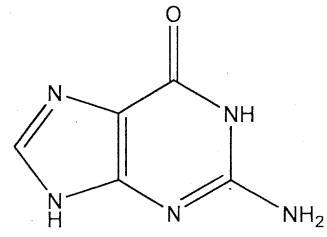
isoflavone 2

(30 marks)

(c) (i) Draw the structure of nucleotide, 2'-deoxyguanosine-5'-monophophate formed from 2'-deoxyribose, guanine and phosphate.



2'-Deoxyribose

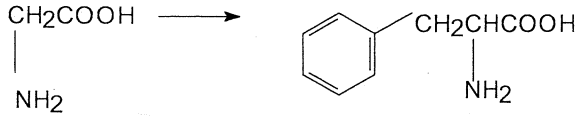


Guanine

(ii) Explain briefly the functions of m-RNA.

(30 marks)

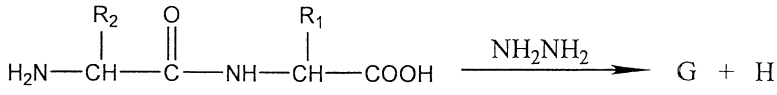
3.(a) How would you effect the following transformation? Give the necessary reagents and write the mechanism for the reaction.

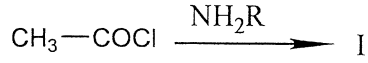


glycine phenylalanine

(30 marks)

(b) Identify the compounds G, H and I you would expect from the following reactions.

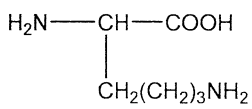
(i) 

(ii) 

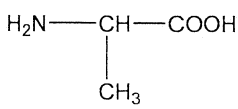
(30 marks)

(c) (i) Write the structural formula for the tripeptide Ala.Lys.Gly.

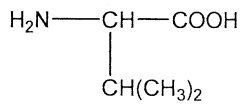
(ii) 2,4-Dinitroflurobenzene is used for N-terminal analysis of peptides. Write down the reactions involved when the tripeptide Val.Ala.Gly is treated with 2,4-dinitroflurobenzene and then hydrolysed with 6N HCl.



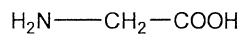
Lysine



Alanine



Valine



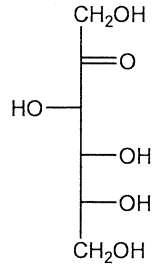
Glycine

(40 marks)

4. (a) Write down the Fischer projection formulae of all the D-pentoses having the structural formula $OHC(CHOH)_3CH_2OH$. Which of these on oxidation with nitric acid give optically inactive dicarboxylic acids? Explain your answer briefly.

(25 marks)

(b) Draw the Haworth projections of the anomers of D-fructofuranose.



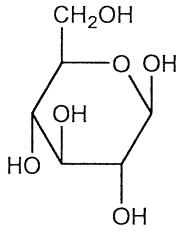
D-fructose

(15 marks)

(c) Draw the structures of the major product when β-D-glucopyranose is treated with

(i) Excess $(CH_3CO)_2O$, pyridine, 120°C

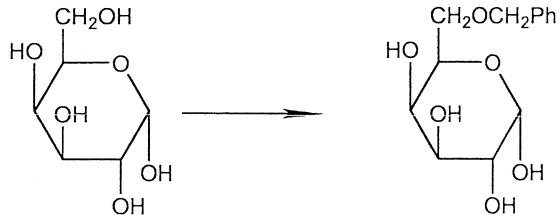
(ii) $CH_3COOH/AC_2O/HBr$



β-D-glucopyranose

(30 marks)

(d) How would you effect the following conversion?

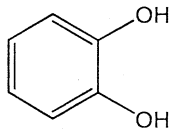


(30 Marks)

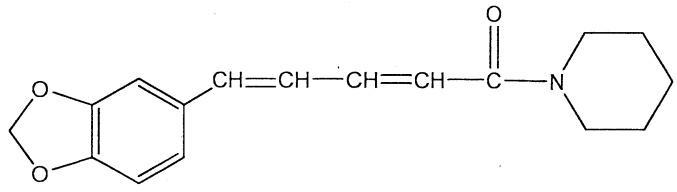
5. (a) How can you detect the presence of an alkaloid in a given sample?

(20 Marks)

(b) Outline the synthesis of piperine starting from catechol.



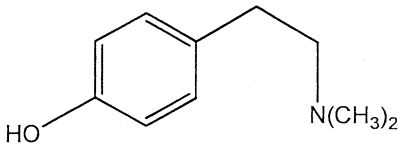
Catechol



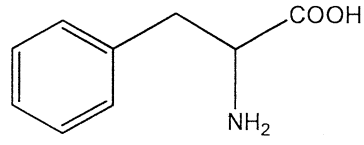
Piperine

(50 Marks)

(c) Postulate the biosynthetic pathway leading to hordenine from phenylalanine.



Hordenine



Phenylalanine

(30 marks)

6. (a) Deduce the structure of the disaccharide, the common table sugar isolated mainly from sugar cane and beet, from the following. Explain each observation.

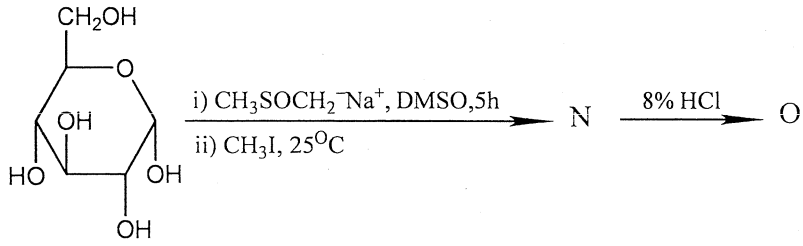
(i) I t does not reduces Fehling's reagent and does not mutarotate.

(ii) It is hydrolysed by maltase, or emulsin to D-glucose and D-fructose.

(iii) Methylation followed by hydrolysis gives 2,3,4.6-tetra-O-methyl-D-glucopyranose and a tetra-O-methyl-D-fructofuranose.

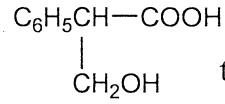
(40 Marks)

(b) Give the structures of compounds **N** and **O** in the following reaction.



(30 marks)

(c) Device a simple synthesis of tropic acid starting from acetophenone.



tropic acid

(30 marks)