THE OPEN UNIVERSITY OF SRI LANKA

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

LEVEL 5-FINAL EXAMINATION

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

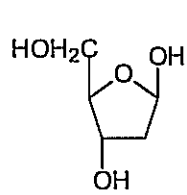
DURATION: 2½ HOURS

Saturday 02nd July 2011 9.30a.m.- 12.00 noon.

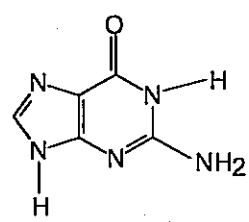
Answer any FOUR questions only.

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

1. (a) (i) Draw the structure of nucleotide, formed from 2'-deoxyribose, guanine and phosphate.



2'-Deoxyribose



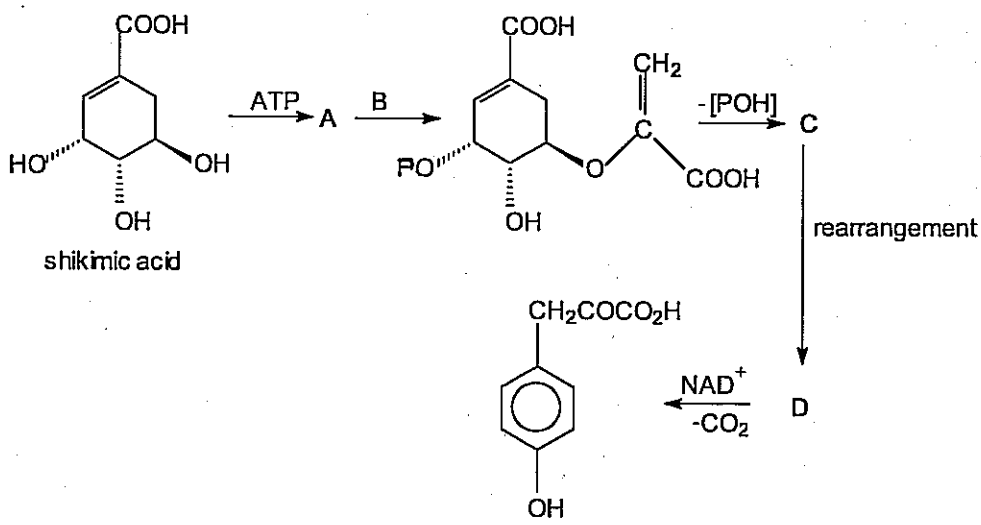
Guanine

(20 marks)

(ii)Explain briefly the functions of DNA.

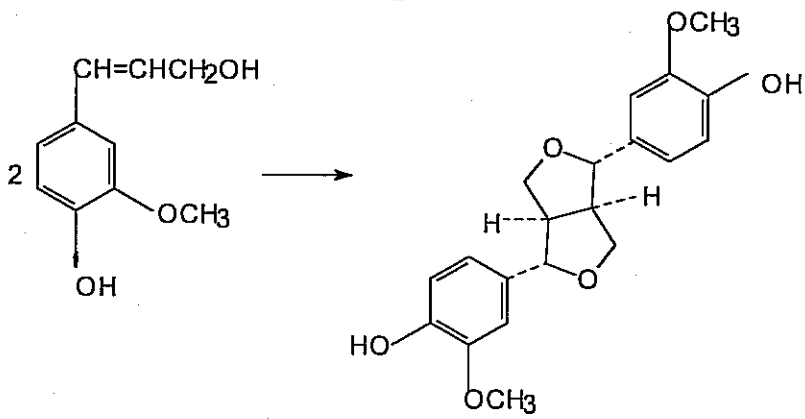
(10 marks)

(b) Identify the missing compounds **A-D** and complete the biosynthetic pathway leading to *p*-hydroxyphenyl pyruvic acid from shikimic acid.



(40 marks)

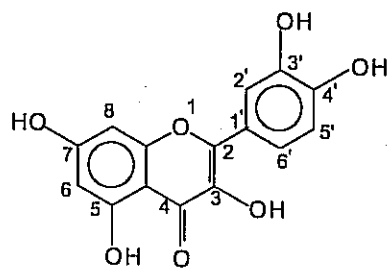
(c) Give the mechanism involved in the biosynthesis of compound **W** from **V** indicating the enzyme involving.



(30 marks)

V **W**

(2)(a) Quercetin (**E**) is a flavonoid. Ethanolic solution of (**E**) shows a UV absorption band in the region 250-270nm.



Quercetin (**E**)

(i) (a) Indicate the shift observed in the UV spectrum of quercetin (**E**), when $AlCl_3$ is added.
(b) Explain your observation.
(c)Draw the structure of the complex that is responsible for the shift.

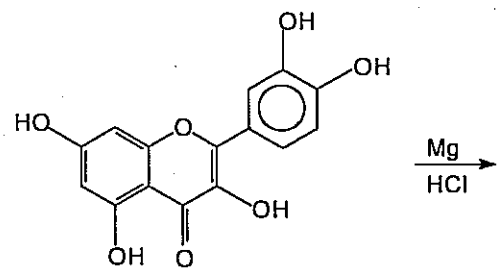
(ii) What change would you expect in the UV spectrum of (**E**) when alcoholic NaOAc is added? Explain your answer.

(iii) Indicate clearly the carbon atoms that contain hydrogen atoms which could show ortho and meta coupling in the ^{1}H-NMR spectrum of quercetin (**E**).

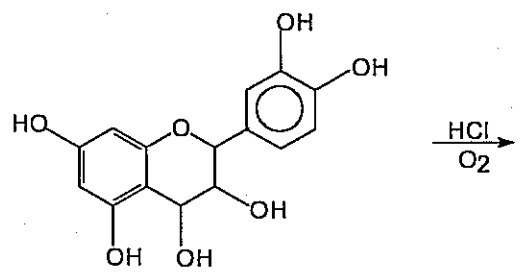
(50 marks)

(b). Predict the products you would expect from the following reactions.

(i)

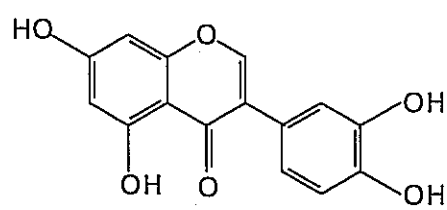


(ii)



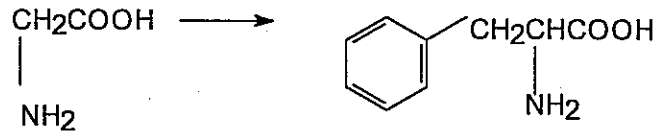
(30 marks)

(c) Name the two pathways by which the isoflavanoid shown below is biosynthesised. Label the rings as A, B,and C and clearly indicate the rings formed by each pathway.



(20 marks)

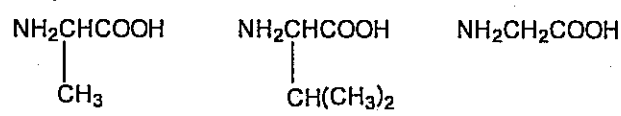
3.(a) How would you effect the following transformation? Give the necessary reagents and write the mechanism for the reaction.



glycine phenylalanine

(30 marks)

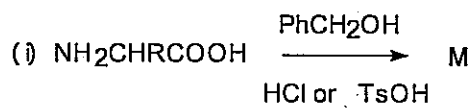
(b). 2,4-Dinitroflurobenzene and phenylisothiocyanate are both used for N-terminal analysis of peptides. Write down the reaction involved and explain the most important difference between the two methods. Use the tripeptide Val.Ala.Gly to illustrate your answer.

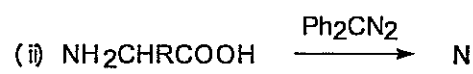


Alanine Valine Glycine

(40 marks)

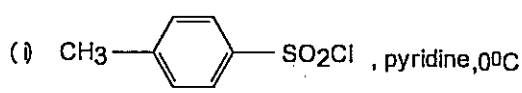
(c) Identify the compounds **M** and **N** you would expect from the following reactions.



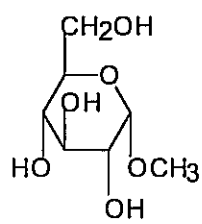


(30 marks)

4. (a) Draw the structures of the major product when methyl α-D-glucopyranose (**I**) is treated with



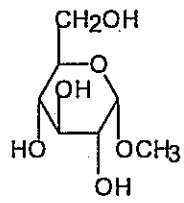
(ii) $PhCH_2Br/NaH.DMF$



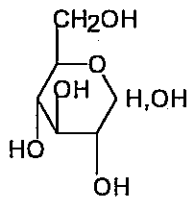
methyl α-D-glucopyranose (**I**)

(30 marks)

(b) Explain one chemical test which may be used to distinguish between α-D-glucopyranose (II) and methyl α-D-glucopyranose (I).



(I)



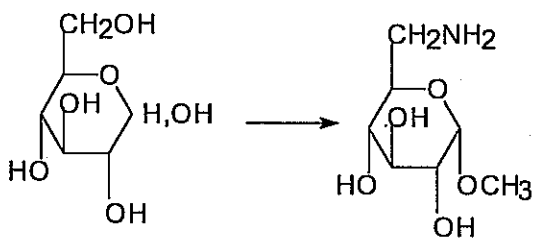
(II)

(15 marks)

(c) Write down the Fischer projection formula 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 briefly your answer.

(25 marks)

(d) How would you effect the following conversion?

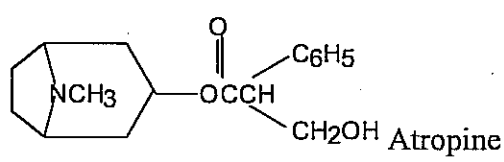


(30 Marks)

5. (a) Outline, using a flow chart, how you would isolate the alkaloid fraction from a methanol extract of a plant.

(20 Marks)

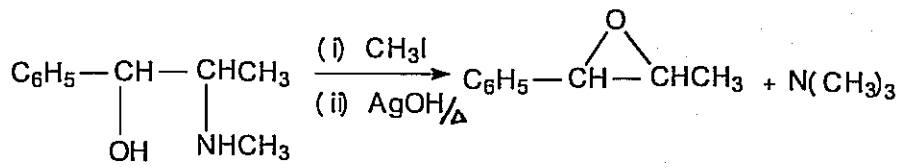
(b) (i)Devise a simple synthesis of atropine using acetonedicarboxylic acid $HOOCCH_2COCH_2COOH$, tropic acid $C_6H_5CH(CH_2OH)COOH$, succindialdehyde $OHCCH_2CH_2CHO$ and methylamine CH_3NH_2, as the only organic starting materials.



Atropine

(25 Marks)

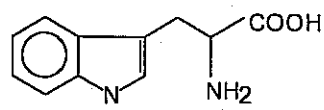
(ii) Indicate the mechanism for the following reaction.



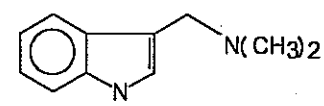
ephedrine

(25 marks)

(c) Postulate the biosynthetic pathway leading to gramine from tryptophan.



Tryptophan



Gramine

(30 marks)

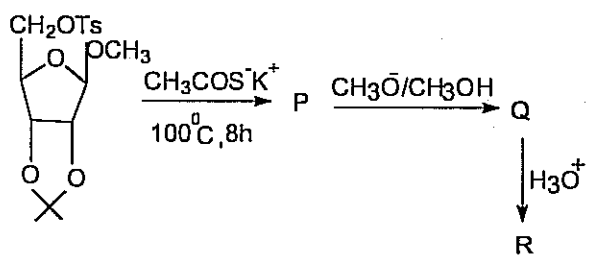
6. (a) (i) Maltose (X) is hydrolysed to D-glucose by maltase, a specific enzyme for α-glycosidase.

(ii) Compound (X) reduces Fehling's solution, undergoes mutarotation and is oxidized by Br_2 in H_2O to D-maltobionic acid, $C_{11}H_{21}O_{10}COOH$ (Y).

(iii) D-maltobionic acid (Y),reacts with Me_2SO_4 and NaOH to form an Octamethyl derivative (Z) that is then hydrolysed to 2,3,4.6-tetra-O-methyl-D-glucose and 2,3,5.6-tetra-O-methyl-D-gluconic acid. Give the structures of X, Y, Z, 2,3,4.6-tetra-O-methyl-D-glucose and 2,3,5.6-tetra-O-methyl-D-gluconic acid.

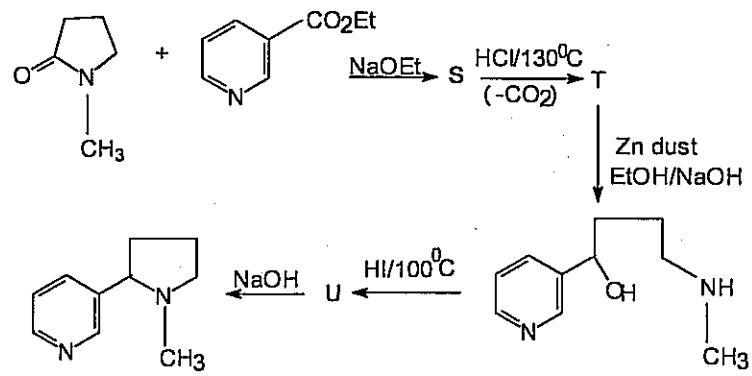
(40 Marks)

(b) Give the structures of compound **P-R** in the following reaction scheme.



(30 marks)

(c) Reactions involved in the synthesis of nicotine are given below.Identify the compounds **S-U** in the reaction scheme.



(30 marks)