THE OPEN UNIVERSITY OF SRI LANKA

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

LEVEL 5-FINAL EXAMINATION

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

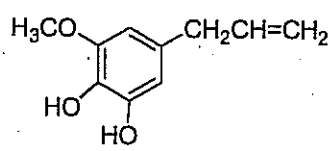
DURATION: 2½ HOURS

Thursday 15th July 2010 1.00 p.m.- 3.30 p.m.

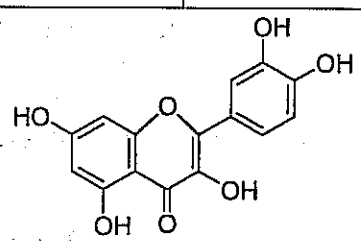
Answer any FOUR questions only.
If you have answered more than four questions, only the first four answers will be marked.

1. (a) Fill the table given below by classifying the compounds **A** and **B** according to the linkage, class of compounds and the biosynthetic pathway(s) from which they are derived.

Compound	Linkage	Class of compound	Biosynthetic pathway(s)
A			
B			



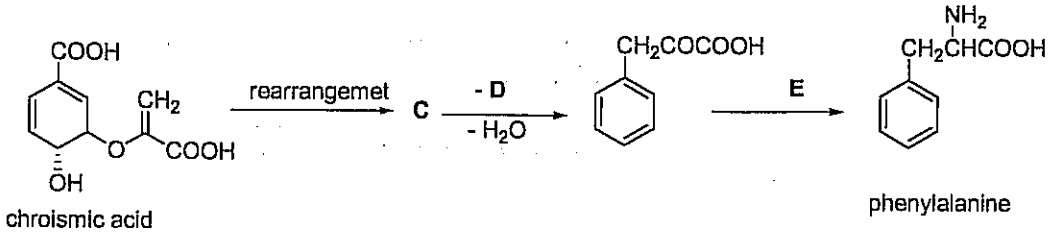
A



B

(30 marks)

(b) Identify the missing compounds **C** - **E** and complete the biosynthetic pathway leading to phenylalanine from chroismic acid.

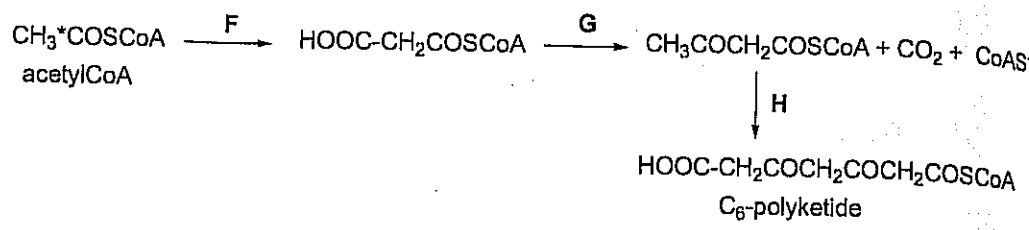


chroismic acid

phenylalanine

(15 marks)

(c) AcetylCoA labeled at C-1 was fed into a plant to investigate the possible pathway by which C_6-polyketide is formed.



*N.B. The carbon atom labelled with ^{14}C is shown by an *C.*

(i) Identify the missing compounds **F – H** and complete the pathway given above.

(15 marks)

(ii) Deduce whether the carbon dioxide formed is labeled with ^{14}C

(05 marks)

(iii) Deduce the position(s) of labeling with ^{14}C in the C_6-polyketide formed.

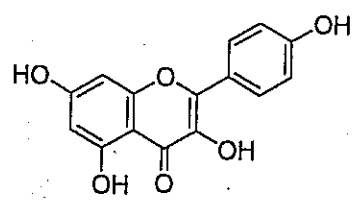
(15 marks)

(d) Explain how tannin acts in
(i) digestion of proteins
(ii) regulation of blood pressure

(20 marks)

2. (a) Kaemferol is a flavanol, UV spectrum of kaemferol in ethanol shows an absorption in the region 250 – 270 nm.
(i) Explain what will happen to this abosorption if you run the spectrum after adding $AlCl_3$.

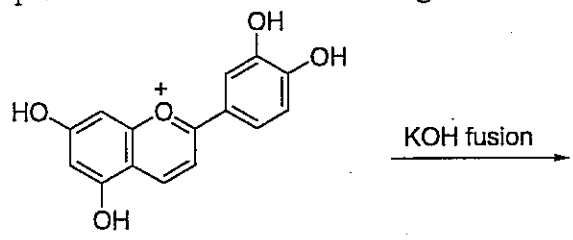
(ii) Of the OH groups at the 5th and 7th position which one would be more acidic. Explain your answer.



Kaemferol

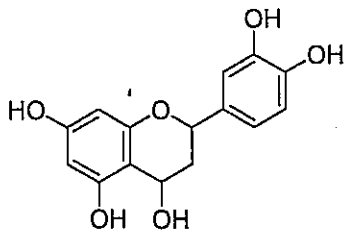
(40 marks)

(b) Identify the products obtained in the following reaction.

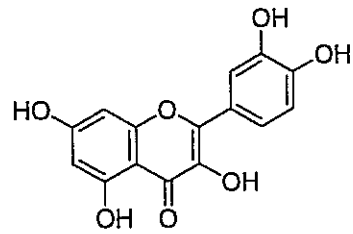


(15 marks)

(c) 'Vanillin in sulphuric acid does not react with quercetin but reacts with catechin to form a red coloured product'. Explain the above statement.
N.B. The structure of the products with vanillin are not expected in the answer.



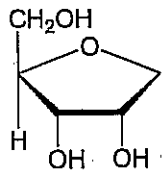
catechin



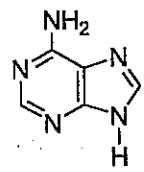
quercetin

(20 marks)

(d) (i) Draw the structure of a nucleotide formed from D-ribose and adenine.



D-ribose



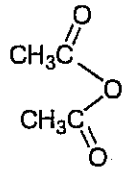
adenine

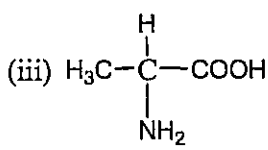
(ii)Explain briefly the functions of *m*-RNA.

(25 marks)

3. (a) Draw the structures of the products (**I** - **N**) you would expect in the following reactions.

(i) $CH_3CHO + NH_3 + HCN \longrightarrow \mathbf{I} \xrightarrow{H^+/H_2O} \mathbf{J}$

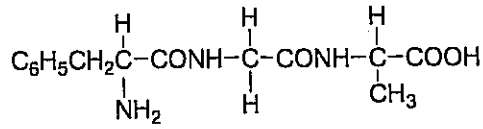
(ii) H_2NCH_2COOH +  $\xrightarrow{\text{heat}} \mathbf{K} \xrightarrow[\text{(ii) } C_6H_5CHO]{\text{(i) } ^-OH} \mathbf{L} \xrightarrow[\text{(ii) } H^+ / H_2O \text{ (hydrolysis)}]{\text{(i) } H_2/Pt} \mathbf{M}$

(iii)  + $(CH_3)_3CCCl \xrightarrow{^-OH} \mathbf{N}$

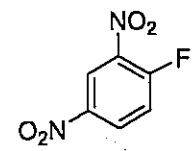
(30 marks)

(b) Identify the products obtained when the peptide **P** is subjected to the following reactions.

(i) Complete acid hydrolysis
(ii) Initial product formed with the enzyme *carboxypeptidase*
(iii) Reacted with 2,4-dinitroflurobenzene followed by acid hydrolysis.
(iv) Reacted with the enzyme *chymotrypsin*.



P



2,4-dinitrofluorobenzene

(50 marks)

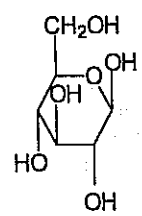
(c) You are provided with as sample containing a mixture of D-alanine and L-alanine. Explain briefly how you would obtain a pure sample of D-alanine from the mixture using a chemical method.

(20 marks)

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

(i) CH_3COCl, dry CH_3OH/ 80^0C.

(ii) excess Ac_2O, pyridine, 120^0C



β-D- glucopyranose

(30 marks)

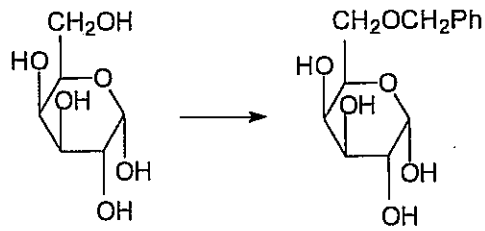
(b) (i) Draw the chair conformation for α and β-D- glucopyranose.
(ii) Why are most naturally occurring glycopyranosides in the form of β-anomers?

(15 marks)

(c) Draw the Fischer projection formulae of (i) a D-aldohexose, (**Q**), which on reduction with $NaBH_4$ gives an optically inactive hexitol and (ii) an isomeric D-aldohexose which gives the same osazone as **Q**. Explain your deduction by giving the chemical reactions.

(30 marks)

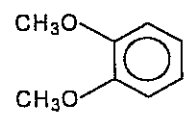
(d) How would you effect the following conversion?

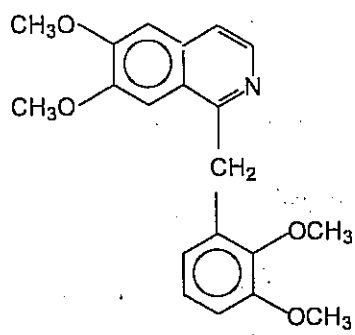


(25 marks)

(5) (a) A plant extract gave a positive response to the Dragendoff and iodoplatinate reagents. What group of natural products answers these tests? How would you separate this group of compounds from the plant extract?
(20 marks)

(b) Outline the synthesis of papavarine starting from

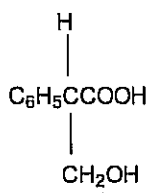




Papavarine

(40 marks)

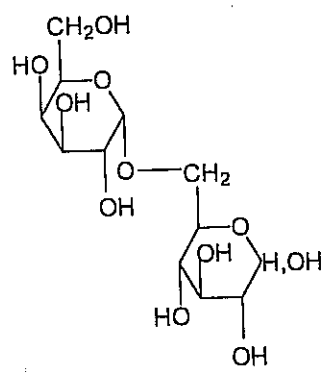
(c) Devise a simple synthesis of tropic acid starting from acetophenone ($C_6H_5COCH_3$).



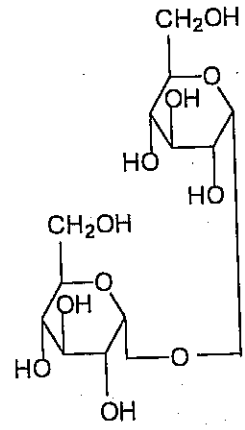
tropic acid

(40 marks)

(6) (a) What differences would you observe when the two disaccharides melibiose (**I**) and trehalose (**II**) are treated with
(i) ammonical $AgNO_3$ (14 marks)
(ii) excess phenylhydrazine and hydrolysed (12 marks)
(iii) bromine water and hydrolysed. (14 marks)
Account for your answer by giving appropriate chemical reactions.

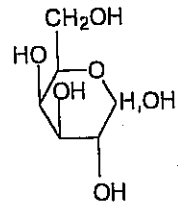


(I)



(II)

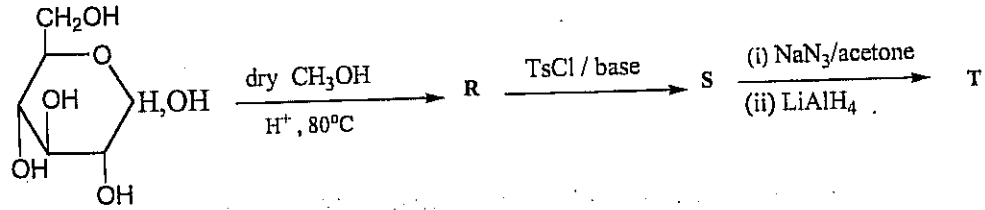
(b) The disaccharide lactose, $C_{12}H_{22}O_{11}$ is hydrolysed by *β-glycosidase* to yield D-glucose and D-galactose. D-Glucose is 4 epimer of D-galactose. Lactose reduces Fehling's solution. Methylation followed by hydrolysis of lactose yielded 2,3,6-tri-O-methyl-D-glucose and 2,3,4,6-tetra-O-methyl-D-galactose. Deduce the structure of lactose.



D-galactose

(30 marks)

(c) Give the structures of compounds **R-T** in the following reaction scheme.



(30 marks)