THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME / STAND ALONE COURSE 2014/2015

LEVEL 5-FINAL EXAMINATION

CMU 3124
BIOMOLECULES
MODEL FINAL EXAMINATION

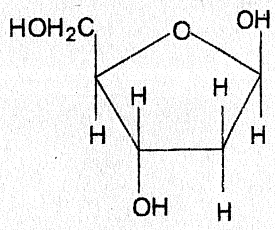
DURATION: 2 HOURS

Date..... Time.....

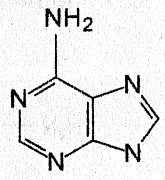
Answer any FOUR questions only.

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

1.(a) (i) Draw the structure of nucleotide, deoxyadenosine 5'-mono phosphate formed from 2'-deoxyribose, adenine and phosphate.



2'-Deoxyribose



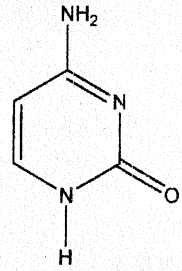
adenine

(20 marks)

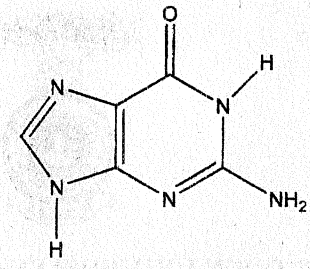
(ii) Explain the statement, "Golgi apparatus is referred to as the sorting, processing and packing system for the secretory proteins in the cell.

(10 marks)

(b) (i) Draw the H-bonding that could take place between a cytosine and guanine base in a dinucleotide formed by these bases.



Cytosine

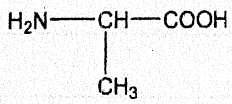


Guanine

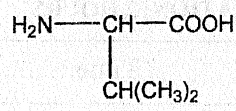
(10 marks)

(ii) Explain briefly the functions of DNA and RNA (m-RNA, t-RNA, r-RNA).
(30 marks)

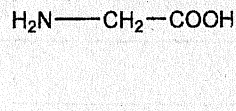
(c) (i) Write the structural formula for the tripeptide Val.Ala.Gly.



Alanine



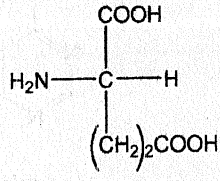
Valine



Glycine

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

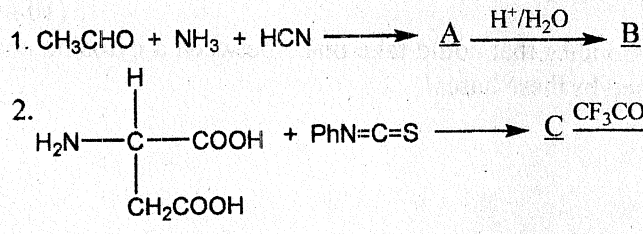
2. (a) (i) Draw the predominate form of glutamic acid at pH =0, 3, 8, 11 given that pI = 3.22, pK_{a1} = 2.19, pK_{a2} = 9.67 and pK_{a3} (side chain) = 4.20.



glutamic acid

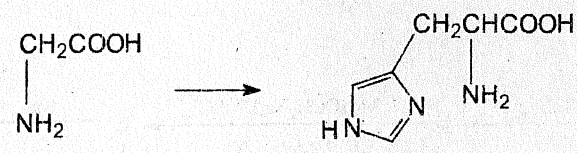
(20 marks)

(ii) Indicate the missing reagents and products in the following synthesis scheme.



(20 marks)

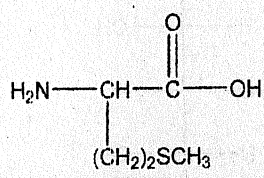
(b) How would you effect the following transformation? Give the necessary reagents and write the mechanism for the reaction.



glycine histidine

(40 marks)

(c) Show how you would synthesize DL-methionine using phthalimide synthesis.



Methionine

(20 marks)

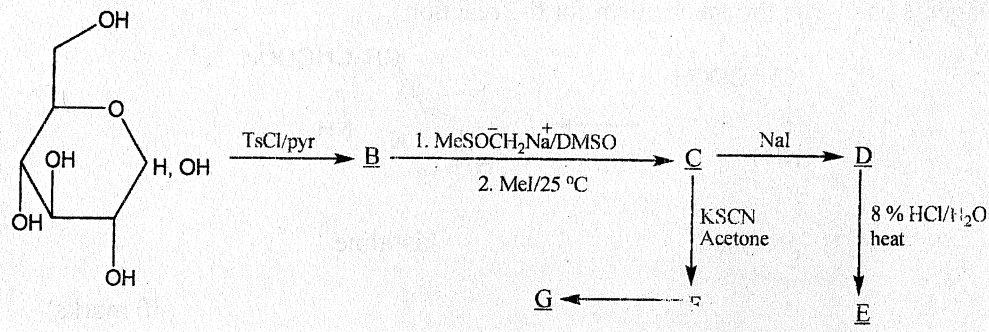
3. (a) (i) What is meant by "mutarotation"?
(ii) Taking D-glucose as an example, explain what happens during mutarotation.

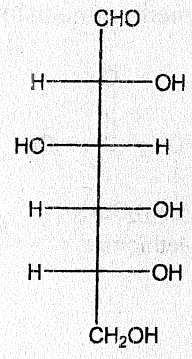
(30 marks)

(b) D-galactose is the C-4 epimer of D-glucose.
(i) Draw the Fischer projection formula of D-galactose.
(ii) Draw the chair conformation of methyl-α-D-galactopyranoside.
(iii) Draw the Harworth projection formula of methyl-b-D-galactofuranoside.
(iv) Give the structure of the product when D-galactose reacts with excess phenylhadrazine.
(v) Another aldohexose A, give the same product as D-galactose when treated with excess phenylhydrazine. Giving reasons predict the structure of aldohexose A.

(40 marks)

(c) Give the structures of compounds B-G in the following reaction scheme.



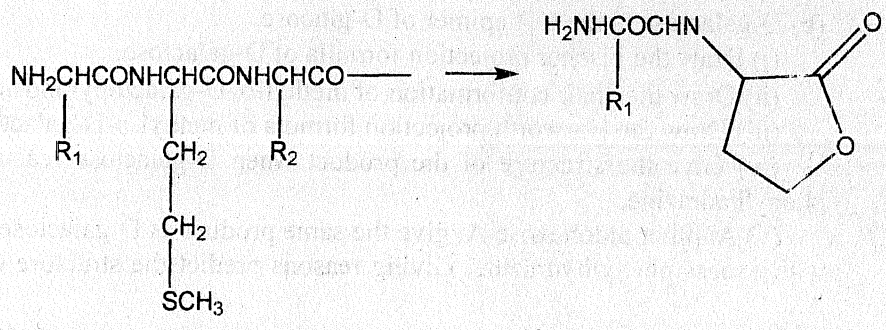


D-glucose

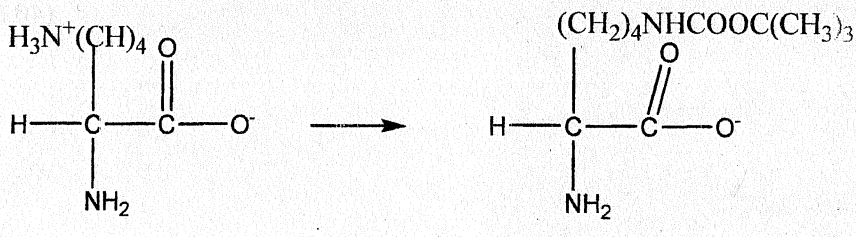
(30 marks)

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

1)

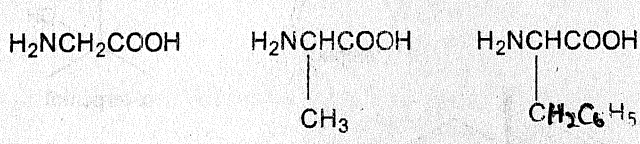


2)



(60 marks)

(d) Write down the st re of the pentapeptide Ala.Gly.Ala.Phe.Gly. Give the structure only of t DNP derivative obtained when the pentapeptide Ala.Gly.Ala.Phe.Gly is ted with 2,4-dinitroflurobenzene and then hydrolysed with 6N HCl. What is t structure of the reaction product obtained when the pentapeptide is treated with phenylisothiocyanate followed by mild acid hydrolysis? Give the mechanism of the reaction.



Glycine (Gly) Alanine (Ala) Phenylalanine (Phe)

(50 marks)

5. (a) (i) Give the products that you could expect if the Oleic acid $CH_3(CH_2)_7CH{=}CH(CH_2)_7COOH$ (*cis*) is partially hydrogenated.

(ii) What are *trans*-fats? What are the health risks caused by heavy consumption of *trans*-fats?

(30 marks)

(b) Write short notes on the following.

(i) Structure of a nucleotide
(ii) Primary structure of DNA.

(20 marks)

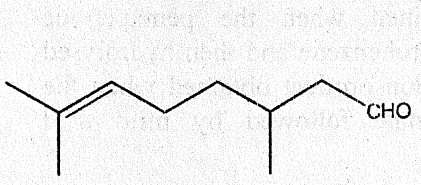
(c) Explain briefly the biological function of phospholipids.

(15 marks)

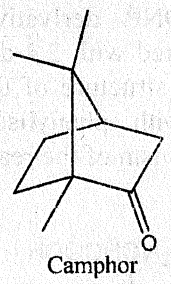
(d) Give reasons to show why the following sex hormones are biologically active.
(i) Androgens :
(ii) Estrogen :
(iii) Progesterone :

(10 marks)

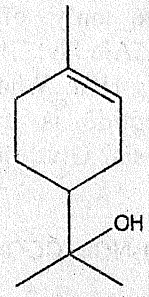
(e) (i) What is the structure of isoprene?
(ii) State the isoprene rule.
(iii) Show the position of isoprene units in the following natural products.



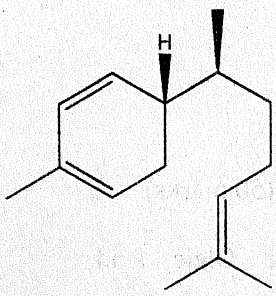
Citronella



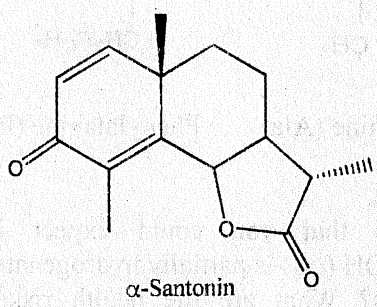
Camphor



α-terpeniol



Zingiberine



α-Santonin

(25 marks)

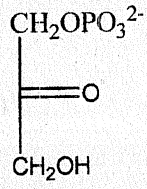
6. (a) (i) Explain why the hydrolysis of acetyl CoA is more favourable than acetate in hydrolysis.

(ii) Give the mechanism of reaction of,

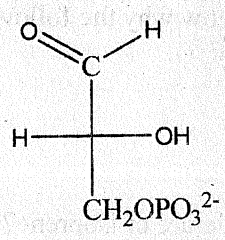
Oxaloacetate + $CH_3CoSCoA \rightarrow$ Citric acid

(30 marks)

(b) Give the mechanism for the formation of fructose 1,6-diphosphate from dihydroxyacetone phosphate and glyceraldehyde-3-phosphate by aldolase.



dihydroxyacetone phosphate



glyceraldehyde-3-phosphate

(20 marks)

(c) (i) Explain the term "allosteric interaction".

(ii) Explain the importance of Co-enzyme and list two types of Co-enzymes.

(iii) Describe the role of Coenzyme A and the nicotinamide Coenzymes in metabolic pathways. (30 marks)

(d) (i) Explain the difference between a prosthetic group and a Co-substrate.

(ii) Explain what is meant by the following terms.

(i) Competitive inhibition

(ii) Noncompetitive inhibition