(12)
00375

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme

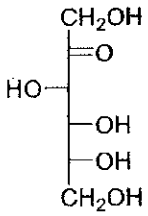
Department	: Chemistry
Level	: 5
Name of the Examination	: Final Examination
Course Code and Title	: CYU5304, Chemistry of Biomolecules
Academic Year	: 2020/2021
Date	: 27/12/2021
Time	: 1.30 p.m.-3.30 p.m.
Duration	: 2 hours
Index number	:

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 4 essay questions in 06 pages.
3. Answer all questions.
4. Answer for each essay question should commence from a new page.
5. Non programmable calculators are permitted.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense.
7. Use blue or black ink to answer the questions.
8. Circle the number of the questions you answered in the front cover of your answer script.
9. Clearly state your index number in your answer script.

1. Answer **all** parts.

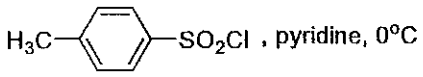
a) Draw the Haworth projections of the anomers of D-fructofuranose.



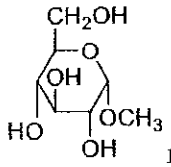
D-fructose

(15 marks)

b) Draw the structures of the major product when methyl α-D-glucopyranoside (**X**) is treated with

(i) 

(ii) Me_3SiCl /pyridine



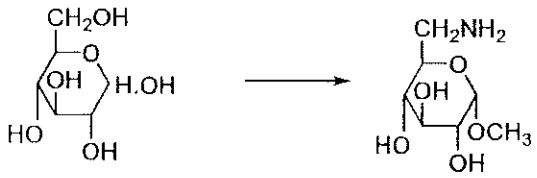
methyl α-D-glucopyranoside (**X**)

(25 marks)

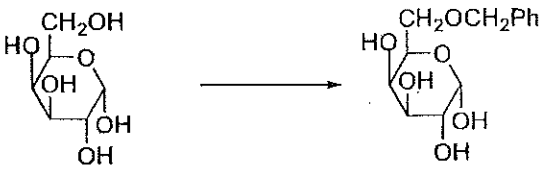
c) Answer **Part I or Part II**.

How would you effect the following conversions?

Part I



Part II



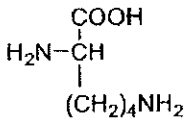
(30 marks)

d) Gentiobiose ($C_{12}H_{22}O_{11}$) undergoes mutarotation and is hydrolysed by β-glycosidase to D-glucose. Methylation followed by hydrolysis yields 2,3,4,6-tetra-O-methyl-D-glucopyranose and 2.3.4-tri-O-methyl-D-glucopyranose. Deduce the structure of gentiobiose.

(30 marks)

2. Answer **all** parts.

a) Write the equilibrium equations for the dissociation of lysine, a basic amino acid and calculate its isoelectric point (pI) given that pK_{a1}=2.18, pK_{a2}=8.95 and pK_{a3}=10.53.



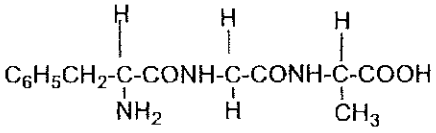
Lysine

(20 marks)

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

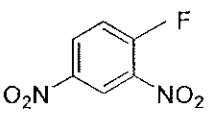
(i) Reacted with 2,4-dinitrobenzene followed by acid hydrolysis.

(ii) Reacted with phenyl isothiocyanate followed by mild acid hydrolysis.



P

Phenyl isothiocyanate



2,4-dinitroflurobenzene

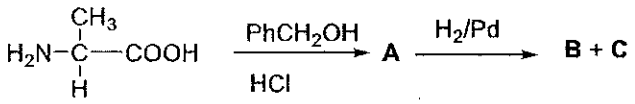
(20 marks)

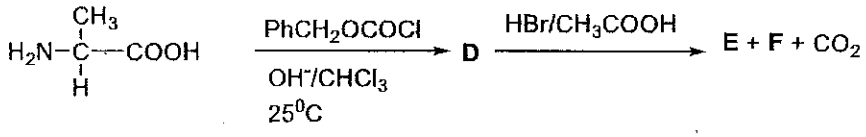
c) How would you effect the following transformation? Give the necessary reagents and write the mechanism for the reaction.

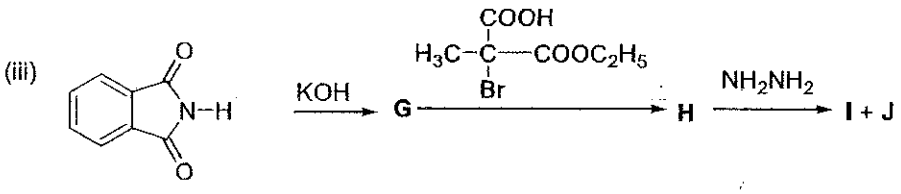
Glycine Phenylalanine

(30 marks)

d) Draw the structures of the products (**A-J**) you would expect in any **TWO (02)** of the following reactions.

(i) 

(ii) 

(iii) 

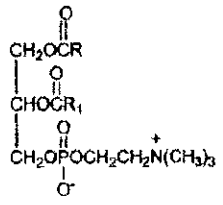
(30 marks)

3) Answer any **Four (04)** parts from (a) – (e).

a) Briefly explain the functions of the following organelles found in an animal cell.
   i) Golgi bodies
   ii) Plasma membrane
   iii) Lysosomes
   iv) Cytoskeleton

(25 marks)

b) Lecithin is categorized as a complex lipid.



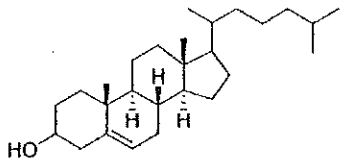
lecithin

i) To which group and subgroup does lecithin belong according to the classification of complex lipids?

ii) Draw the structures of the hydrolysis products of lecithin.

(25 marks)

c) Cholesterol is a sterol found only in animals.



cholesterol

i) Explain why cholesterol is defined as a "sterol".

ii) What are the different types of lipoproteins found in our body?

iii) Which type of the lipoproteins mentioned in c) ii) is responsible for coronary atherosclerosis?

iv) Explain three beneficial effects of cholesterol on human health.

(25 marks)

d) Lipids are insoluble in water.

i) Explain why lipids are insoluble in water.

ii) Explain three basic structures that lipids form upon mixed with water with the aid of suitable diagrams.

(25 marks)

e) Nucleic acids are made up of nucleotides.

i) Deoxycytidine 5'-monophosphate (dCMP) or deoxycytidylate is a nucleotide. Identify the main components of deoxycytidylate.

ii) Name the three main types of RNA present in the cells, give their abbreviation (eg: xRNA) and state their function/s.

iii) List the functions of DNA.

(25 marks)

4. Answer all parts.

(a) Using fully labeled free energy diagrams compare exergonic and endergonic reactions.

(20 marks)

(b) Explain why ATP is a better source of energy than AMP for biochemical reactions.

(10 marks)

(c) Consider the following three biochemical reactions.

Reaction 1	A	$\rightleftharpoons$	B	+	X			ΔG° = + 05 kcal/mol
Reaction 2	X	$\rightleftharpoons$	Y	+	Z			ΔG° = –10 kcal/mol
Reaction 3	A	$\rightleftharpoons$	B	+	Y	+	Z	

Show how Reaction 3 is energetically favorable when Reaction 1 is coupled with Reaction 2.

(20 marks)

(d) Distinguish between any **three** (03) of the following pairs.

i. Substrate and co-substrate
ii. Co-enzyme and prosthetic group
iii. Holoenzyme and apoenzyme
iv. Non-competitive and uncompetitive enzyme inhibitors.

(30 marks)

(e) Vitamin B_6 plays a role in amino acid metabolism.

i. Give the three vitamers of vitamin B_6.
ii. Name the four important stages of amino acid catabolism.

(20 marks)