

**UNIVERSITY OF RUHUNA FACULTY OF FISHERIES AND MARINE
SCIENCES & TECHNOLOGY**



Academic Year 2022/2023

Bachelor of Science Honours in Fisheries and Marine Sciences Degree/
Bachelor of Science Honours in Marine and Freshwater Sciences Degree

Level IV Semester I Examination – April/May 2024

CHM 4112: Biochemistry (Theory)

Time: 01 hour and 30 minutes

Answer ^{Three} Two (03) questions only.

1. Answer all parts. (100 marks)

a. Give short answers to the following questions.

- i. State briefly the role of carbohydrates in human body ?
- ii. Categorize carbohydrates into major classes ?
- iii. List two examples for polysaccharides and comment on their main chemical characteristics

(30 marks)

b. Monomers of carbohydrates show chirality and conformational arrangements.

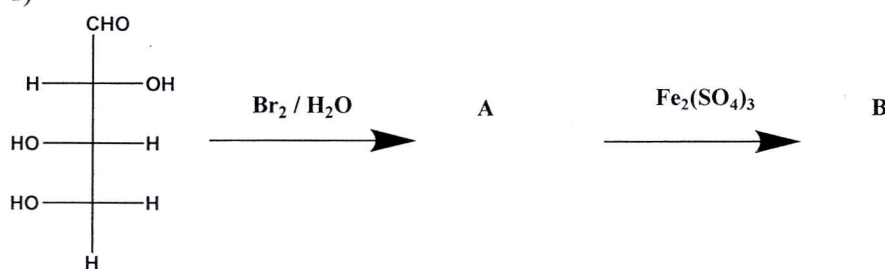
- i. Draw a Fischer Projection for aldohexose.
- ii. Draw two anomers of the pyranose form for the aldohexose using Haworth projections and name them accordingly.
- iii. Draw the chair conformations of pyranose ring structures.

(30 marks)

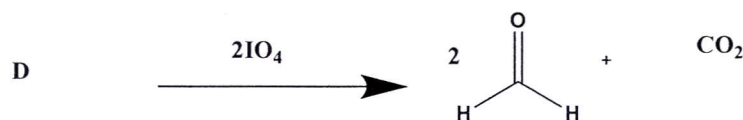
c.

i. Give missing structures and reagents in the reactions below

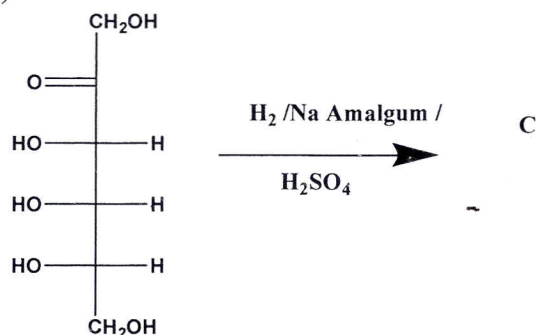
1)



2)



3)



- ii. Fructose gives positive results with Tollen's test and Fehling's test. Explain the reason for this.

(25 marks)

(15 marks)

2. Answer all parts. (100 marks)

- a. Like all other catalysts, enzymes are characterized by two fundamental properties.

- Define catalyst.
- Define an active site of the enzyme.
- Draw a suitable potential energy diagram to explain the catalytic activity of an enzyme.

(25 marks)

- b. Enzymes need right appropriate conditions to act

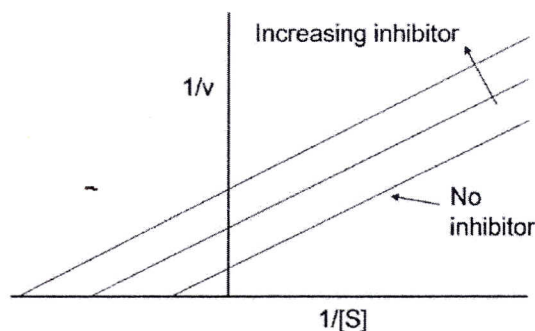
- List 5 factors affecting enzyme activity.
- Cytidine triphosphate (CTP) inhibits CTPase, an enzyme that catalyzes the first reaction in the pathway for CTP synthesis. State that which type of inhibition occurs in this transformation?
- Write an account on "Denaturing of Enzymes"

(35 marks)

- c. Enzyme inhibition can occur when certain substances, called inhibitors, bind to the active site of the enzymes.

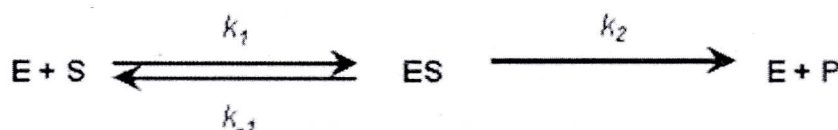
- What are the two main types of inhibitors and write the subcategories of those two.

- ii. Based on the following Lineweaver-Burk plot shown below, briefly describe the nature of inhibition taken place



- iii. Considering the steady state assumption, derive the equation below for the given transformation

$$V = V_{\max} [S] / (K_M + [S])$$



Hint: $K_m = (k_{-1} + k_2) / k_1$
 $V = k_2 \times [ES]$

- iv. By considering derived expression, write two equations when $K_m \gg [S]$ and $K_m \ll [S]$ respectively.

(40 marks)

3. Answer all parts.

a. Give short answers for the following questions.

- Draw the structure of a typical amino acid in biological pH (7.3).
- Draw a tripeptide using the above amino acid structure and specify the peptide plane.
- What does the term "essential amino acids" mean?

(20 marks)

b. Structural and functional proteins are the most diverse and dynamic molecules, and play key roles in biological process.

- List five biological functions of proteins.
- What are the different types of interactions present in the protein structure?
- Briefly explain the secondary structure of proteins.

(30 marks)

c. Determination of sequence of proteins is important for biological studies in different ways.

- i. What are the major steps used in protein sequencing?
- ii. State the importance of isoelectric point in gel-electrophoresis of extracted proteins in a buffer solution.
- iii. An unknown heptapeptide is provided to you to determine the sequence. The results of stepwise treatments for the peptide are shown below, Based on that, determine the sequence of the heptapeptide.

(Val, Met, Gly, Cys, Ile, Arg, Phe)

- I) With the treatment of CNBr, tetrapeptide, and tripeptide were formed after exhaustive hydrolysis.

(Phe, Met, Cys, Arg) AND (Val, Ile, Gly)

- II) With the treatment of papain, the heptapeptide hydrolyzed to free amino acids, a dipeptide and tetra peptide.

(Val – A free amino acid), AND (Arg, Cys - dipeptide), AND (tetrapeptide)

(50 marks)

4. Answer all parts.

a. Major function of nucleic acids involves the storage and expression of genomic information.

- i. What is the monomer unit of nucleic acid?
- ii. What are the structural components of nucleoside?
- iii. Draw the structure of adenosine, and label its main parts.
- iv. Mention the different conformations of adenosine.

(30 marks)

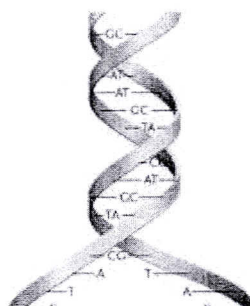
b. Nitrogenous bases are particularly important in biology because they are key components of the building blocks of genetic information.

- i. What are the two types of nitrogenous bases?
- ii. Draw the structures of uracil and thymine.
- iii. Which structural features are common to both uracil and thymine?
- iv. Uracil and thymine are categorized into which group of nitrogenous bases?

(30 marks)

c. There are several similarities between protein synthesis and DNA replication

- i. What enzyme, breaks apart the hydrogen bonds between two strands of DNA, pictured below?



- ii. Write three “stop codons” in the translation process during protein synthesis.
iii. Write short accounts on double strand of deoxyribonucleic acid

(40 marks)

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