



CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

P.O. Box 62157

00200 Nairobi - KENYA

SPECIAL/SUPPLEMENTARY EXAMINATION Telephone: 891601-6

JANUARY – APRIL 2020 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE (CHEMISTRY)

REGULAR PROGRAMME

CHEM 304: CHEMISTRY OF CARBOHYDRATES AND PROTEINS

Date: APRIL 2020

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) Cellulose and chitin are both abundant naturally occurring polysaccharides formed out of β - (1-4) glycosidic linkages. Depict their structures highlighting their differences. **(6 marks)**
- b) 3- phenylepropanoic acid could be reacted with Bromine water in the presence of excessive ammonia to produce phenylalanine in the lab. Depict this reaction using relevant reaction scheme. **(4 marks)**
- c) Adenosine triphosphate is broken down to adenosine diphosphate and a phosphate ion during energy usage. Using relevant structures, depict this reaction **(4 marks)**
- d) Draw the structures of the following sugars:
i. L-Talose ii. β -D- Glucose iii. α - L- Fructose iv. D- Galactose v. L - Erythrose **(5 marks)**
- e) Acetaldehyde is an appropriate precursor for the synthesis of D-alanine in the Strecker synthesis method. Using the relevant reaction scheme, explain. **(5 marks)**
- f) An analyst is assessing the presence of fructose in a fruit juice extract also containing a mixture of aldohexose sugars. Explain the qualitative test he would use which depends on the rate of reaction. **(6 marks)**

- Q2. a) i. Calculate the number of stereoisomers that are possible from an aldohexose sugar **(2 marks)**
- ii. Draw and name the structures and name D and L enantiomers for any two aldohexose sugars **(4 marks)**
- iii. Using relevant diagrams, describe how D-Fructose could attain a fructofuranose structure according to the Haworth's projection **(4 marks)**
- b) The isoelectric point for arginine is 10.8 while that of aspartic acid is 2.8. Using their titration curves, explain **(6 marks)**
- c) Benzo (a) pyrene is a mutagen capable of disrupting the secondary structure of the DNA. Using structures, explain **(4 marks)**
- Q3. a) Base pairing in the DNA's secondary structure is due to the formation of hydrogen bonds between them in the complementary strands. Using relevant structures, depict the H-Bond pairing between the following bases:
- i. Adenine- Thymine **(3 marks)**
- ii. Guanine-Cytosine **(3 marks)**
- b) Using relevant structures, describe the difference between secondary, tertiary and quaternary structures of proteins **(4 marks)**
- c) Monosaccharides are also called 'reducing sugars' because of their ability to reduce Cu(II) ions to Cu(I) ions. Using a relevant reaction scheme, explain. **(4 marks)**
- d) 'Round-Up', a herbicide inhibits the synthesis of phenylalanine in plants preventing them from making proteins. Explain why its toxicity in humans is relatively low **(6 marks)**
- Q4. a) Draw the Fischer's projection for the following amino acids:
- i. L- phenylalanine
- ii. R- histidine
- iii. D- serine
- iv. S-leucine **(4 marks)**
- b) Cellobiose and maltose are both disaccharides consisting of two glucose units. Using their structures, describe their difference **(4marks)**

- c) The DNA is made up of polynucleotides. Draw the structure of a four nucleotide DNA strand containing the following base sequence: A-C-G-T
(8 marks)
- d) Heavy metal poisoning is brought about by precipitating out of proteins into insoluble salts and disruption of disulfide linkages. Explain.
(4 marks)
- Q5. a) Sucrose is a disaccharide that could be formed using an α, β -(1-2) glycosidic bond. Using a diagram, explain
(4 marks)
- b) Two cysteine amino acids form a cystine residue through disulfide linkages. Depict this reaction using relevant structures.
(4 marks)
- c) Using the structures of adenine and thymine, describe the differences between pyrimidines and purines.
(6 marks)
- d) Cellulose and amylose are both polysaccharides of glucose. Using relevant diagrams, describe their difference
(6 marks)

END