



NATIONAL OPEN UNIVERSITY OF NIGERIA  
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE  
EXPRESS WAY,  
JABI - ABUJA.  
FACULTY OF SCIENCES  
DEPARTMENT OF CHEMISTRY  
2024 1 EXAMINATION

COURSE CODE: CHM 315

COURSE TITLE: CARBOHYDRATE CHEMISTRY

COURSE UNIT: 2

TIME: 2 HOURS

INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

*Question one score 30 marks with the other two scoring 20 marks each*

**QUESTION ONE**

- (1a) i. Identify the different categories upon which monosaccharides are classified (3 Marks)  
ii. What are Homopolysaccharides? (2 Marks)  
iii. Give the molecular formula of Hexoses (1 Mark)
- (1b) In cyclic form show how glucose react with Pyridine, Hydriodic acid, Nitric acid, Br, H<sub>2</sub>O, HCN and NaBH<sub>4</sub> (6 marks)
- (1c) i. Explain how aminosaccharides are formed (2 Marks)  
ii. Mention the uses of Alginates in Food products (2 Marks)
- (1d) i. Describe the term plaque in reference to dextran (2 marks)  
ii. Name the catalyst used in Williamson synthesis of  $\alpha$ -glucopyranose (1 Mark)  
iii. State the reason why humans cannot digest cellulose but animals such as cattle's does. (3 Marks)
- (1e) i. Give the nomenclature of maltose, gentiobiose and cellobiose (6 Marks)  
ii. What is pectin? (2 Marks)

**QUESTION TWO**

- (2a) i. What polysaccharides is present in jam? (2 Marks)  
ii. Enumerate the usefulness of carbohydrates to both animals and plants (2 Marks)
- (2b) i. State the uses of glucosamine (4 Marks)  
ii. If crystalline  $\alpha$ -D-glucose is dissolved in water, the specific rotation drops gradually from an initial value of  $+112^\circ$  to an equilibrium value of  $+52^\circ$ . These changes in optical rotation are called ... (2 Marks)

- iii. Mention two plants that produce sucrose (2Marks)
- (2c) i. Briefly explain how monosaccharides units are linked (2 Marks)
- ii. Draw the structure of Trehalose and Maltose and identify any two functional groups in both (6 Marks)

### QUESTION THREE

- (3a) i. What do you understand by the term galactosemia? (2 marks)
- ii. When cyclic D-glucose reacts with methanol, what class of compound is formed? Illustrate with appropriate equation of reaction. (4 marks)
- (3b) i. Briefly explain the function of Benedict's reagent. (2 marks)
- ii. What is Glycogen? (2 Marks)
- iii. State how cellulose differs from starch structurally (4 Marks)
- (3c) i. Draw the structure of lactose (4 marks)
- ii. Give four (4) different classes of carbohydrates with at least one examples each (4 marks)

### QUESTION FOUR

- (4a) i. What does it mean when we say sugar is levorotatory? (2 marks)
- ii. State the difference between gluconic and glucaric acid (2 marks)
- iii. Using structure only describe Salicin (2 marks)
- (4b) i. Name three polysaccharides that gives single type of monosaccharides on complete hydrolysis (3 marks)
- ii. Mention the main carbohydrate constituents of honey (2 marks)
- iii. What are Monosaccharides (1 mark)
- (4c) i. Describe arabinoxylans (4 marks)
- ii. Using the Fisher projection formula, write the structural formula for L-aldotetrose (2 marks)
- iii. Draw the structure of  $\alpha$ -D-glucopyranose (2 marks)

### QUESTION FIVE

- (5a) i. Mention two sugars that are components of genetic materials (2 marks)
- ii. Show the reactions of quinoline with acyl and alkyl halides (4 marks)
- (5b) i. What are the similarities between Chitin and cellulose (2 marks)
- ii. What is Glycogen? (2 Marks)
- iii. Identify what is generated when DMF and phosphorus oxychloride are reacted together in the Vilsmeier reaction (2 Marks)
- (5c) i. Briefly explain how to produce smokeless powder from cellulose (3 Marks)
- ii. Using equation only shows the reaction of triethyl orthoformate with indole (5 Marks)