00171

THE OPEN UNIVERSITY OF SRI LANKA

BACHELOR OF SCIENCE DEGREE PROGRMME

LEVEL 5 - ASSIGNMENT TEST I- 2019/2020

CYU5304 – CHEMISTRY OF BIOMOLECULES

Duration: One Hour

Registration No: | | | | | | | | | |

DATE: 11th August 2019 (Sunday) **TIME: 1.00 p.m. to 2.00 p.m.**

This Assignment test paper consists of 06 (six) structured essay questions. Your answer must be written in the space provided.

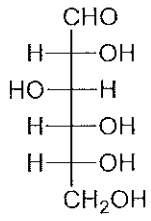
- Answer **ALL** the questions.
- Use a **PEN** (not a pencil) in answering.
- You are **NOT allowed** to keep Mobile phones with you during the examination. **Switch off** and leave them in a safe place.

1. The cyclic forms of sugars can exist in pyranoses and furanose forms.

(a) What is the structural difference between pyranoses and furanose sugars?

(6 marks)

(b) Draw all possible of Haworth projection formulae of cyclic hemiacetals of D-glucose. The Fischer projection formula of D-glucose is given below



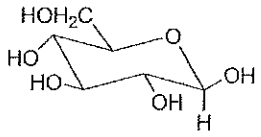
D-glucose

(12 marks)

(c) Circle the free anomeric -OH group if it is available in each of the cyclic structures you have drawn above Q1(b).

(4 marks)

(d) Glycosides or sugar hemiacetals that exist in both α and β forms. "It was reported that the **anomeric effect** destabilizes the β-form of D-glucopyranose sugars". Explain this statement using β-D-glucopyranose sugar structure given below.



β-D-glucopyranose

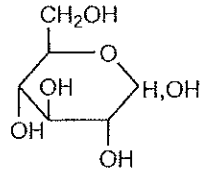
(8 marks)

2. Explain what are reducing sugars by using the reaction of D-glucose with Tollen's reagent.

(8 marks)

3. Identify the products (A, B and C) of the following reactions and draw them in the cage given.

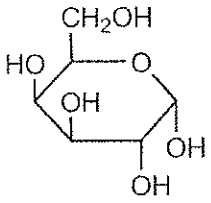
(a)



CH_3COCl / dry CH_3OH / 80 °C ⟶

A

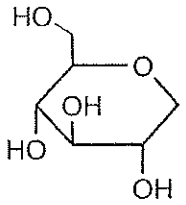
(b)



acetone, anhy. $CuSO_4$ ⟶ conc. H_2SO_4

B

(c)

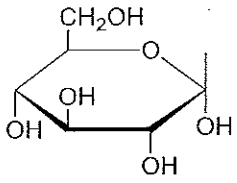


+ PhCHO $\xrightarrow[\text{or anhy. } ZnCl_2]{\text{TSOH}}$

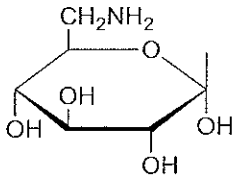
C

(09 marks)

4. How would you attempt to do the following conversion?



⟶

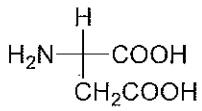


(18 marks)

5. (a) Why do amino acids can act as **ampholytes** compounds?

(10 marks)

(b) State how many ionizable side chains are there in asp molecule? Circle them in the structure given below.



(10 marks)

6. Draw the structures of zwitterion, monoanionic and dianionic of aspartic acid. Given below the pKa values of asp.

Amino acid	**Abbreviation**	**pKa1 COOH**	**pKa2 $+NH_3$**	**pKa3 side chain**	**Isoelectric Point (pI)**
Aspartic Acid	Asp	2.1	9.8	3.9	3.0

(15 marks)

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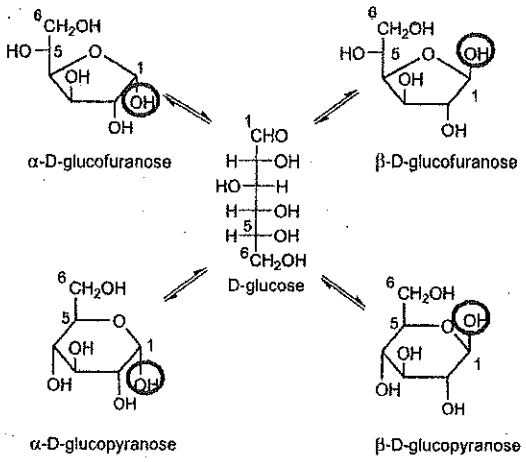
Answer Guide

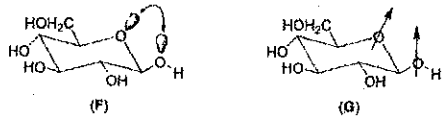
1. (a)

Cyclic sugars that contain a six membered ring are called "***pyranoses***"
Cyclic sugars that contain a five membered ring are called "***furanoses***"

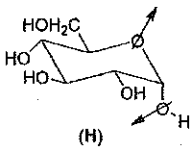
(b)



(d) Anomeric carbon atom ($^4C_1$), it is connected to two oxygen atoms. When the polar group is in the equatorial position there can be repulsion between unshared electrons as shown in or unfavorable dipolar repulsions as shown below. This results in the phenomenon known as **anomeric effect**, which brings about a destabilization of the β-form of the sugars.

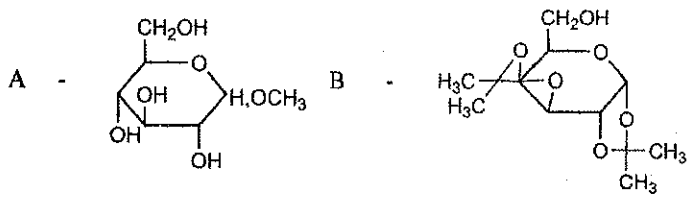


Conversely the anomeric effect stabilizes the α-form of the sugars due to the nonexistence of unfavorable dipolar repulsions as shown in structure

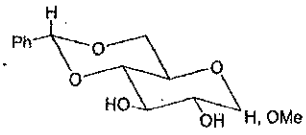


2. D-glucose can reduce metal ions such as silver in alkaline solution. For example, glucose reacts with Tollen's reagent resulting in a silver mirror. During this reaction, the sugar is converted to the corresponding carboxylic acid. This property is known as the reducing property of a carbohydrate. Sugars containing a free anomeric OH group can show this reaction and are called reducing sugars. (After moderation)

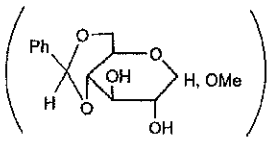
3. (a)



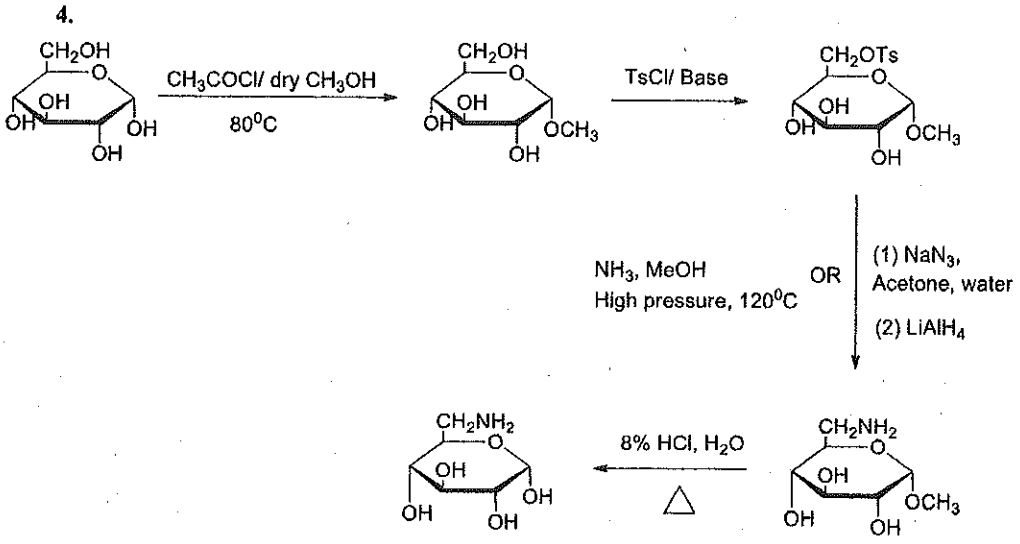
C -



OR

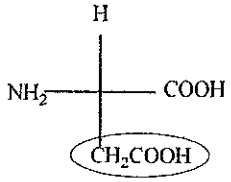


4.



5. **(a)** Amino acids could either act as a proton donor (*i.e.* acid) or a proton acceptor (*i.e.* base) in aqueous solutions as they have a H3N+ group and a COO- group. Hence amino acids are **ampholytes** (*i.e.* compound that could behave as an acid and a base). (10 marks)

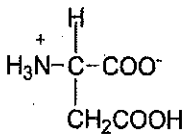
(b)



Number of ionizable side chains = 1

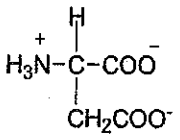
(10 marks)

6.



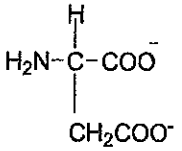
(5 marks)

Zwitter ion



(5 marks)

monoanionic form



(5 marks)

dianionic form