'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 6th Semester Examination, 2023

CC14-CHEMISTRY

ORGANIC CHEMISTRY

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.

GROUP-A

1. Answer any ***five*** questions from the following: 1×5 = 5

   (a) What is the effect of hybridization of carbon on the stretching frequency of C–H bond?

   (b) Why *cis*- and *trans*- isomers exhibit different λ_{max} in UV spectroscopy?

   (c) What is gyromagnetic ratio?

   (d) How many types of protons one would expect in the ^{1}H-NMR spectrum of cyclopropyl chloride?

   (e) What do you mean by the term "mutarotation" in carbohydrate chemistry?

   (f) Why do aldoses react with Fehling's solution but not with $NaHSO_3$?

   (g) Phenolpthalein is used as an acid-base indicator — Explain briefly.

   (h) How would you distinguish between $PhCOCH_2CH_3$ and $PhCH_2COCH_3$ by their IR spectra?

GROUP-B

2. Answer any ***three*** questions from the following: 5×3 = 15

   (a) Define the following with suitable examples — $2\frac{1}{2}\times2=5$

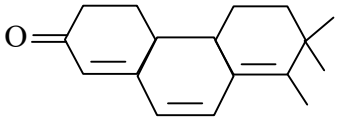
   Mordant dyes and Vat dyes.

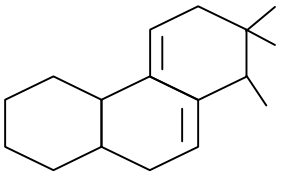
   (b) Outline the synthesis of dyes: $2\frac{1}{2}\times2=5$

   (i) Congo red and (ii) Alizarin

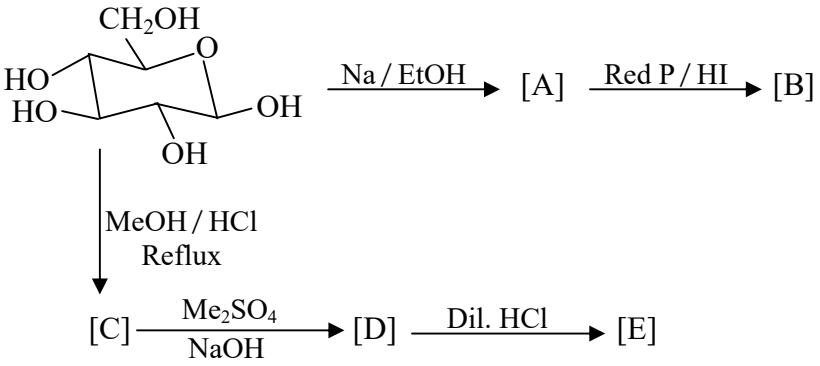
   (c) In ^{1}H-NMR, the alkyne protons appears at δ 1.5-3.5, while protons attached with alkene carbon appear at higher δ values. Explain. 5

(d) Using Woodward Fieser Rules, calculate the λ_{max} of the following two compounds and rationalize your answer: $2\frac{1}{2}\times2=5$

(i) 

(ii) 

(e) Identify [A] - [E]: 5



GROUP-C

3. Answer any ***two*** of the following: $10\times2 = 20$

(a) (i) A compound of molecular formula $C_5H_{10}O$ shows ^{1}H-NMR spectrum ($CDCl_3$): 6+4

δ 6.25 (1H, dq, *J* = 16, 1 Hz), 4.81 (1H, dq, *J* = 16, 6 Hz), 4.13 (2H, q, *J* = 7 Hz), 1.88 (3H, dd, *J* = 6, 1 Hz) and 1.24 (3H, t, *J* = 7 Hz)

Suggest a possible structure and assign each signals along with coupling patterns and coupling constant (*J*) values, stereochemistry (if any) with proper explanations.

(ii) An ester of molecular formula $C_{10}H_{12}O_2$ exhibits strong IR band at 1748 cm^{-1}. Its ^{1}H-NMR in $CDCl_3$:

δ 7.28 (m, 5H), 4.23 (q, 2H, *J* = 7 Hz), 3.60 (s, 2H), 1.23 (t, 3H, *J* = 7 Hz)

Deduce the probable structure of the compound and explain.

(b) (i) *β*-D-glucopyranose undergoes oxidation by bromine water at much faster rate than *α*-D-glucopyranose — Explain. 3+3+2+2

(ii) Sucrose does not exhibit mutarotation when dissolved in water but sucrose is warmed with dilute acid, its rotation changes from positive to negative value. Explain the facts.

(iii) Outline the synthesis of 2,3,4,6-tetra-*O*-methyl-3-glucopyranose.

(iv) How many *γ*-lactones are obtained during the lactonisation of aldaric acid from D-mannose? What are their structures?

(c) (i) Define the following in IR spectroscopy: 3×3+1

Fermi Resonance

Overtones

Bending vibrations

(ii) How many different types of protons are observed in ^{1}H-NMR spectrum of allyl bromide?

(d) (i) Chloromethane, bromomethane and iodomethane have absorption bands λ_{max} at 172 nm, 204 nm and 258 nm respectively. What type of transition is responsible for each band? How can you explain the trend in absorption? 3+3+2+2

(ii) IR spectroscopy can be used to distinguish intra- and inter-molecular H-bonding. Explain the facts with suitable examples.

(iii) Diazotization reaction is important in dye industry. Explain with suitable example.

(iv) Define Ruff degradation with an example.

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