2021

CHEMISTRY (Honours)

Paper Code : IX - A & B

[New Syllabus]

Important Instructions for Multiple Choice Question (MCQ)

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

  Example : Such as for Paper III-A (MCQ) and III-B (Descriptive).

  Subject Code : | III | A | & | B |

  Subject Name : | |

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

  Example — If alternative A of 1 is correct, then write :

  1. — A

- There is no negative marking for wrong answer.

মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

- উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

  উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

  Subject Code : | III | A | & | B |

  Subject Name : [ ]

- পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A) / (B) / (C) / (D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

  উদাহরণ — যদি 1 নম্বর প্রশ্নের সঠিক উত্তর **A** হয় তবে লিখতে হবে :

  1. — A

- ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

Paper Code : IX - A

Full Marks : 15 Time : Thirty Minutes

Choose the correct answer.

Each question carries 1 mark.

1. Correct order of the reactivity of Diene in Diels-Alder reaction is —

I II III IV

(A) I > II > III > IV

(B) I > III > IV > II

(C) I > III > II > IV

(D) III > II > I > IV

2. For 1, 3, 5-hexatriene which of the following statements is incorrect —

(A) Ψ_2 & Ψ_4 : m-antisymmetric + C_2-symmetric and odd number of nodes

(B) Ψ_1 & Ψ_2 : m-antisymmetric + C_2-symmetric and zero/even number of nodes

(C) Ψ_3 & Ψ_5 : m-Symmetric + C_2-antisymmetric and zero/even number of nodes

(D) Ψ_4 & Ψ_6 : m-antisymmetric + C_2-symmetric and odd number of nodes

3. Leuco base is formed during the synthesis of —

(A) Malachite green

(B) Congo red

(C) Alizarin

(D) Phenolpthalein

4. In reference of UV spectra of cis-cinnamic acid (A) and *trans*-cinnamic acid (B) which of the following statement is correct?

(A) λ_{max} of A > λ_{max} of B and ε_{max} of A < ε_{max} of B

(B) λ_{max} of A > λ_{max} of B and ε_{max} of A > ε_{max} of B

(C) λ_{max} of A < λ_{max} of B and ε_{max} of A < ε_{max} of B

(D) λ_{max} of A < λ_{max} of B and ε_{max} of A > ε_{max} of B

5. The total steric interaction in the following molecule is —

(A) 4.5 kcal/mol

(B) 5.4 kcal/mol

(C) 9.0 kcal/mol

(D) 10.6 kcal/mol

6. Which of the compound will have multiplets in their NMR spectra?

(A) 2-Methyl propene

(B) 2-Chloropropene

(C) 1,4-dichloro benzene

(D) Methyl chloride

7. Which of the following pairs give positive Tollen's test?

(A) Glucose, Sucrose

(B) Glucose, Fructose

(C) Hexanal, Acetophenone

(D) Fructose, Sucrose

8. To separate the mixture of Glutamic acid (pI=3.2), arginine (pI= 10.8), and threonine (pI=6.5) by electrophoresis the suitable pH is —

(A) 3.2

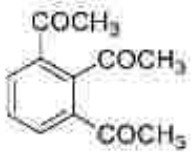
(B) 10.8

(C) 6.5

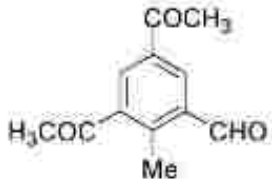
(D) 7.0

9. Which of the following compound shows only two singlets in ^1H NMR spectrum and a strong IR band at ~1690 cm^{-1}?

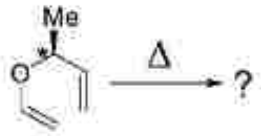
(A) 

(B) 

(C) 

(D) 

10. The product of the following reaction —



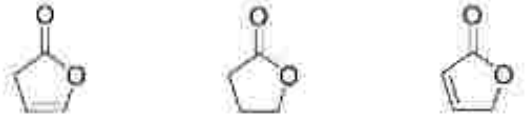
(A) (*E*)-4-Hexenal

(B) (*Z*)-4-Hexenal

(C) (*E*)-4-Hexenol

(D) (*Z*)-4-Hexeoal

11. Arrange in the decreasing order of carbonyl frequency —



I II III

(A) II > III > I

(B) I > III > II

(C) II > I > III

(D) I > II > III

12. If *HCN* approaches the (S)-isomer of *MeCOCH(Me)Ph* from *Re-S* face the product will have configuration —

(A) (3R, 2S)

(B) (2R, 3S)

(C) (3R, 2R)

(D) (3S, 2S)

13. The synthetic equivalent of α-carbanion of cyclohexanone is —

(A) 2-chlorocyclohexanone

(B) 1-cyclohexenol

(C) Enamine of cyclohexanone

(D) 2-methylcyclohexanone

14. The number of signals in ^1H *NMR* spectrum of (S)-2-Bromobutane is —

(A) 3

(B) 4

(C) 5

(D) 6

15. With respect to ethylene oxide molecule find out the correct statement —

(A) Two sets of H's are enantiotopic + Four Sets of H's are homotopic

(B) Two sets of H's are homotopic + Four Sets of H's are enantiotopic

(C) Two sets of H's are enantiotopic + Four Sets of H's are diastereotopic

(D) Two sets of H's are diastereotopic + Four Sets of H's are enantiotopic

2021

CHEMISTRY (Honours)

Paper Code : IX - B

[New Syllabus]

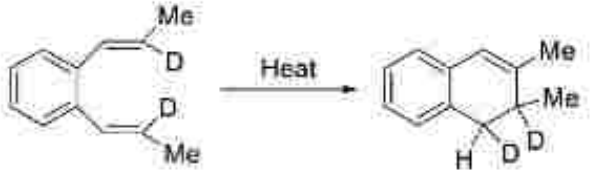
Full Marks : 50 Time : Two Hours Thirty Minutes

The figures in the margin indicate full marks.

Answer any *five* questions, taking at least *two* questions from each group.

Group - A

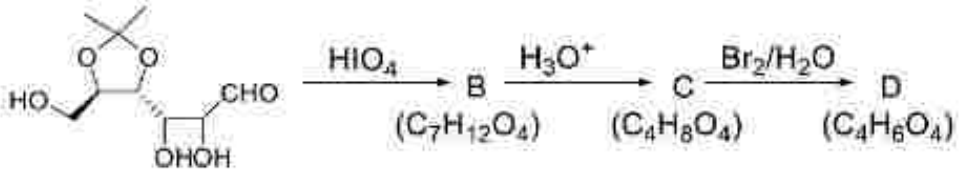
1. (a) Account for the following transformation and predict the correct stereochemistry of the product molecule with proper mechanism.



(b) Both Azulene and Naphthalene are aromatic systems with 10π electrons. While Naphthalene is white in colour with λ_{max} below 300nm, Azulene is deep blue is colour and absorbs at much longer wavelength with λ_{max} above 500nm. Explain.

(c) Convert benzene to 1-methylisoquinoline.

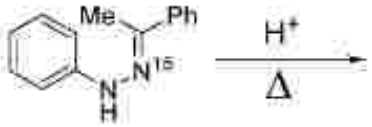
(d) Suggest structural formulas, including stereochemistry, for compounds **B**, **C**, and **D** of following reactions.



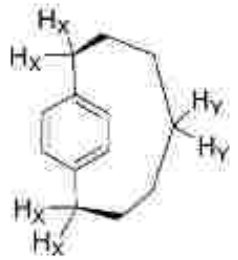
3–2–2–3

2. (a) In benzene, the amount of α-D-Methyl Glucoside is 82%, whereas it lowers to 52% in water. How will you interpret it from mechanistic point of view?

(b) Predict the product with mechanism



(c) Which of the defined sets of protons (X & Y) in the following compound will exhibit a chemical shift at δ (ppm) 2.3 and 1.0 and why?



(d) 2,6-Di *tert* butyl phenol and 4-tert butyl phenol show *O-H* stretching at 3643 and 3608 cm^{-1} respectively but 2-*tert* butyl phenol displays *O-H* stretching at 3605 and 3643 cm^{-1}. 2+3+2+3

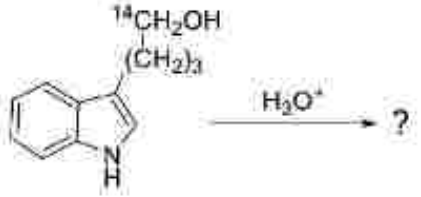
3. (a) By the help of PMO approach show that [1,5]-shift of a chiral alkyl group will be photochemically allowed if the migrating group goes through inversion of configuration.

(b) Explain why o-chloro acetophenone shows two $\nu_{C=O}$ stretching frequencies in IR spectroscopy.

(c) An organic compound $C_8H_{12}O_4$ decolourises bromine water. It does not give positive test with $NaHCO_3$. Its IR spectrum shows bands at 2940-2860, 1740 and 1680cm^{-1}. Its ^1H NMR spectrum shows the following signals (δ ppm) : 1.30 (**t**, 6H, J = 7Hz), 4.20 (**q**, 4H, J = 7Hz), 6.20 (**s**, 2H). Deduce the structure of the compound with proper justification.

(d) Di-isopropylidene derivative of D-Glucose can be O-methylated at C-3, but that of D-Galactose cannot give the same result.

(e) Predict the Product(s) in the following reaction :



2+2+2+2+2

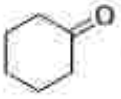
4. (a) Furan undergoes Diels — Alder reaction but pyrrole does not — Explain.

(b) Predict the product(s) from the following reaction :

(E)-2-Butene + (Z)-2-Butene $\xrightarrow{h\nu}$

(c) Predict the products from following reaction (Any *One*) :

(i)



1. NH_2OH
2. NH_2OH, Acetyle
KOH, DMSO

?

(ii)

1. $NaNH_2/NH_3(l)$
2. $NaNO_2$/Dil HCl, 5°C
3. CuCN
4. CH_3MgBr
5. H_3O^+

?

(d) Assuming the D-Configuration identify **A, C & D**.

An Aldopentose **A** $\xrightarrow{\text{Dil } HNO_3 \text{ acid}}$ An Aldaric Acid, Optically Inactive (**B**)

Killiani-Fischer Synthesis

Two Aldohexoses { **C** $\xrightarrow{\text{Dil } HNO_3 \text{ acid}}$ An Aldaric Acid, Optically Active (**E**)
+
D $\xrightarrow{\text{Dil } HNO_3 \text{ acid}}$ An Aldaric Acid, Optically Inactive (**F**)

2+3+2+3

Group - B

5. (a) How will prepare the following diastereomeric *cis*-diols starting from the same starting molecule?

(b) What is meant by specific base pairing in double helix structure of a DNA molecule? Why the other base pairing has not been observed in DNA double helix structure?

(c) How will perform the following conversion? Explain with mechanism of important step(s)

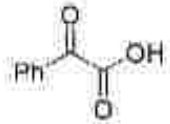
(d) Write down the preparation and uses of each of the following compounds:

(i) Aspirin

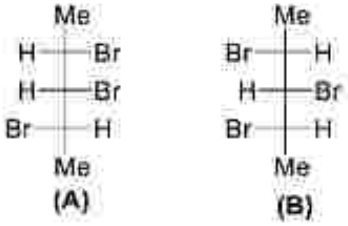
(ii) Alizarin

(e) Give the method of preparation of sulfadiazine. 2+2+2+3+1

6. (a) How will you synthesise (S)-2-hydroxy-2-phenylpropanoic acid from the following molecule?

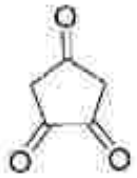


(b) Among the following molecules which one is containing pseudo-asymmetric centre and which one is containing prochiral centre? Are those two centres stereogenic? Justify your answer.



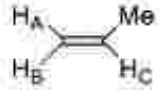
(c) A Tripeptide (**X**) on complete hydrolysis yields 2 moles of "**Glu**", 1 mole of "**ala**" and 1 mole of NH_3. When (**X**) treated with carboxypeptidase, "**ala**" is released first. Suggest the structure for (**X**) with explanation.

(d) Using Claisen ester condensation reaction, how would you prepare the following compound?



2+3+3+2

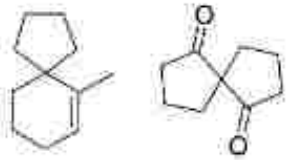
7. (a) Is any prochiral element present in the following molecule? If so, designate it by appropriate stereochemical descriptor. Also assign correct stereochemical descriptor to H_A and H_B. Justify your answer with proper argument.



(b) Predict the major and minor product with proper stereochemistry, mechanism and designate the chiral centre with R-/S-notation.

(c) *cis*-1,2-dimethyl cyclohexane is non-resolvable but *cis*-1-ethyl-2-methyl cyclohexane is resolvable at room temperature. Justify your answer.

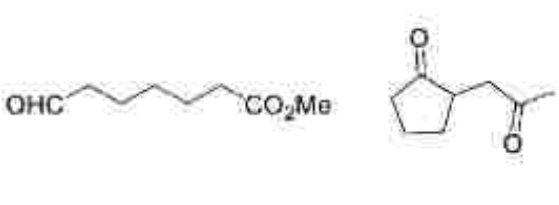
(d) How will you prepare the following compound (any *one*) :



3+3+2+2

8. (a) What product is formed if 1,2,3-trihydroxy benzene is treated with ethyl acetoacetate in presence of phosphorous pentoxide. Explain.

(b) Make retrosynthesis planning for the following molecules and accordingly sketch their synthesis (any *two*) :



(c) Carry out the following transformations :

(i) EAA ⟶ Cyclopentylmethyl Ketone

(ii) DEM ⟶ 

2+2+2+2+2
