2020

CHEMISTRY (Honours)

Paper Code : I - 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 : I - A

Full Marks : 10 Time : Twenty Minutes

Answer *all* the Questions.

Choose the Correct Answer.

Each Question Carries 1 Mark.

1. The number of C_2 axis of symmetry in benzene is —

   (A) 2

   (B) 3

   (C) 4

   (D) 6

2. The nitration of cinnamic acid with conc. HNO_3 and H_2SO_4 gives mainly —

   (A) 3-nitro cinnamic acid

   (B) 4-nitro cinnamic acid

   (C) 2, 4 –dinotrocinnamic acid

   (D) 3, 5-dinitrocinnamic acid

3. The strongest nucleophile among the following is —

   (A) CH_3COO^-

   (B) EtS^-

   (C) CF_3COO^-

   (D) PhO^-

4. Which of the following methods is best suited for the separation of a mixture containing naphthalene and benzoic acid —

(A) Crystallisation

(B) Chromatography

(C) Sublimation

(D) Distillation

5. Find the incorrect statement for a nucleophile —

(A) Soft bases are good nucleophiles

(B) Hard bases are good nucleophiles

(C) Good nucleophiles have high HOMO energy

(D) Nucleophilicity is sensitive to steric factors

6. How many structural isomers are possible if one hydrogen in diphenylmethane is replaced by chlorine?

(A) 8

(B) 4

(C) 7

(D) 6

7. Dimethoxycarbene is —

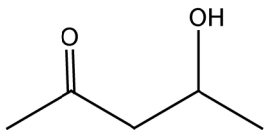
(A) an electrophilic carbene

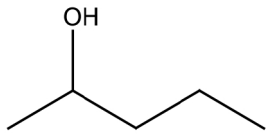
(B) a nucleophilic carbene

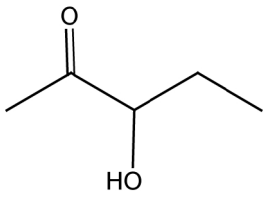
(C) an ambiphilic carbene

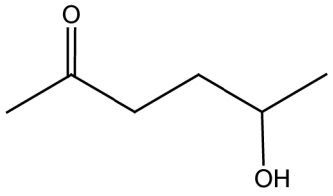
(D) none of these

8. Which one of the following will most readily be dehydrated in acidic conditions?

(A) 

(B) 

(C) 

(D) 

9. For the conversion of propyne to propanal, which one of the following is the most appropriate reagent.

(A) 20% H_2SO_4, $HgSO_4$, H_2O, 60-70°C

(B) i.B_2H_6/THF, ii.H_2O_2/NaOH

(C) PCC

(D) OsO_4

10. Difference between the number of stereoisomers of 2-bromo-3-chlorobutane and 2, 3-dichlorobutane is —

(A) 2

(B) 3

(C) 1

(D) 0

2020

CHEMISTRY (Honours)

Paper Code : I - B

[New Syllabus]

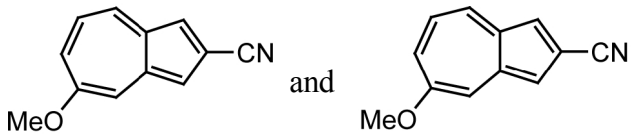
Full Marks : 40 Time : One Hour Fourty Minutes

The figures in the margin indicate full marks.

Answer any *four* questions taking *two* from each group.

Group - A

1. (a) Compare the dipole moments of the following compounds with reason. 2

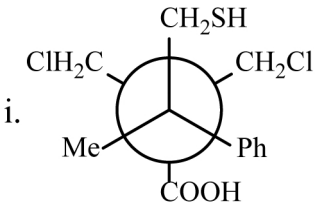


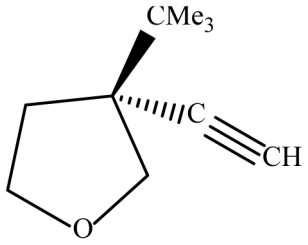
(b) Explain why compound (I) is more acidic than compound (II) 2

(I) (II)

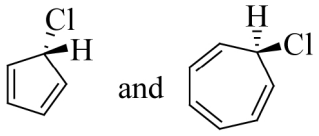
(c) Write down all the stereoisomers of MeCH=CHCH(OH)Me. Find out the stereoisomeric relationship among them. 4

(d) Assign R/S configurational descriptors to the following compounds. 2

i. 

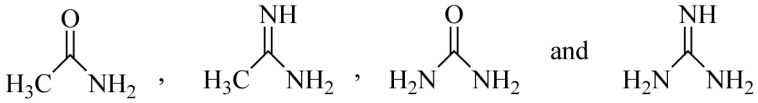
ii. 

2. (a) Which of the following compounds will react more readily with alcoholic silver nitrate solution? Explain your choice. 2

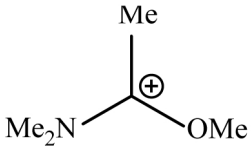


(b) Dipole moment of 4-nitroaniline is greater than the sum of dipole moments of aniline and nitrobenzene. Offer an explanation. 2

(c) Arrange the following compounds in increasing order of basicity with reason : 4



(d) Write down all the possible canonical forms of the following and indicate the most important contributor to the resonance hybrid. 2



3. (a) The first dissociation constant of maleic acid is higher than fumaric acid but the 2nd dissociation constant of maleic acid is lower than that of fumaric acid. Explain. 2

(b) Draw an energy profile for rotation about C_2–C_3 of *meso*-2,3-butandiol. Comment on the relative stability of the conformers. 4

(c) Justify or contradict the following statements with reasons (any *one*) : 2

(i) A centre of stereogenicity must also be a centre of chirality.

(ii) (+) sc conformer of *n*-butane can be represented by Fischer projection.

(d) Boiling point of *n*-pentane is greater than that of neo-pentane. Explain. 2

4. (a) Me_3CCl undergoes both S_N1 solvolysis and E_2 dehydrochlorination at a faster rate than $(CD_3)_3CCl$. Do you think that the same type of kinetic isotope effect is involved in both the cases? Explain your answer. 3

(b) Draw the energy profile for a reaction in which the free energy of activation for the first step is greater than that of the second step but the second step is the rate determining step of the reaction. Explain your answer. Cite an example of such a reaction. 4

(c) Between specific and molecular rotation which one is more reliable for comparison of the rotatory power of a molecule? Explain. 2

(d) Draw the orbital picture for a singlet carbene. 1

Group - B

5. (a) What is the difficulty in the conversion of $Me_3CCH=CH_2$ into $Me_3CCH(OH)Me$ through acid catalysed hydration? How can this conversion be actually accomplished? 3

(b) Chlorine in 2,6-dimethyl-4-nitrochlorobenzene is more easily displaced by a nucleophile than the chlorine in 3,5-dimethyl-4-nitrochlorobenzene. Offer an explanation. 3

(c) Outline the Bogert-Cook synthesis of Phenanthrene. How can you minimize the formation of the undesired spirocyclic product in this synthesis? 4

6. (a) The reaction of $C_2H_5SCH_2CH_2Cl$ with ethanol proceeds at a much faster rate than the reaction of $C_2H_5OCH_2CH_2Cl$ with ethanol under identical conditions. Explain. 2

(b) Photo induced bromination of isobutane is much more selective than its chlorination under identical conditions. Explain in terms of Hammond's postulate. 4

(c) Classify the following as aromatic, anti-aromatic and non-aromatic with reason: Cyclobutadiene, Cycloheptatrienyl cation, Cyclopentadienyl anion and Cyclooctatetraene. 4

7. (a) Explain the following observations : 2×4

(i) Allyl chloride reacts with sodium cyanide at a faster rate than propyl chloride.

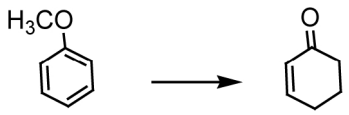
(ii) Peroxide effect is observed only for the addition of HBr to an unsymmetrical alkene.

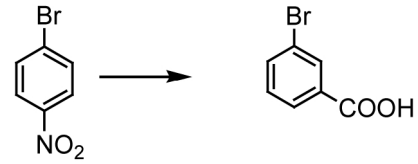
(iii) In the ozonisation of 2, 3-dimethyl-2-butene in presence of formaldehyde ozonide of isobutene is isolated as one of the products.

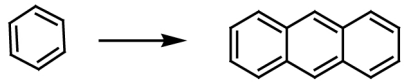
(iv) 9, 10 Positions of anthracene are more attractive to electrophiles than other positions

(b) How can you convert 2-aminobenzoic acid into 1-naphthol? 2

8. (a) Show, with mechanism, how can you achieve the following transformations? (any *two*) 3+3

(i) 

(ii) 

(iii) 

(b) What happens when 1-nitro naphthalene and α-naphthylamine are separately oxidized with potassium permanganate? Explain your answer. 2

(c) 1, 3-Butadiene is more reactive than ethylene towards electrophilic addition. Explain in terms of M.O theory. 2