

B.Sc. Semester-I (Honours) Examination, 2020 (CBCS)
Subject- Chemistry
Paper: CC-1
(Organic Chemistry-I)

Full Marks: 40

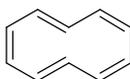
Time: 2 Hours

Candidates are required to give their answers in their own words as far as practicable.

Answer **any eight** questions from the following:

8 × 5 = 40

(1) Why the conformation of cyclodecapentaene ($C_{10}H_{10}$) or [10] annulene given below is unstable even though it contains Hückel number of electrons?

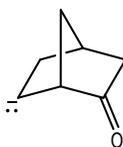


Draw the MOs of allyl system and indicate the bonding, antibonding and non-bonding orbitals, if any. Mark the HOMO and LUMO of allyl cation.

(2) Calculate the formal charge on boron in $[BH_4]^-$. Does it give you an idea of the electron density on boron? The *enol* content of acetyl acetone in hexane is almost six times greater than in water—Explain.

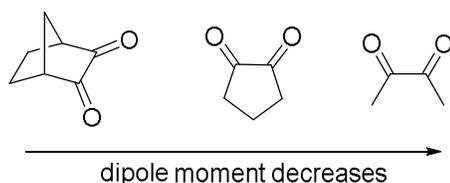
(3) The optical rotation of an optically active compound depends on the concentration of solution but not the specific rotation—justify or criticize in your own words. Do NH_3 and BH_3 belong to the same symmetry point group? Justify your answer. Draw the structure of a molecule having a σ_d plane. Show the plane.

(4) Comment on the stability of the following carbanion.



$CH_2=CH-Cl$ does not give the corresponding alcohol on boiling with aqueous $NaOH$ solution—Why? Give an example of nucleophilic carbene.

(5) Explain the following trend of dipole moments of the di-keto compounds:



What is 'steric inhibition of resonance'? Explain with example.

(6) Draw the structure of the following compounds as directed:

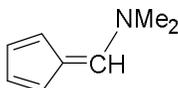
i. (2*R*, 3*r*,4*S*)-trihydroxy glutaric acid (in Fischer Projection)

ii. (1*Z*,3*E*)-penta-1,3-dien-1-ylbenzene (in normal structure drawing format)

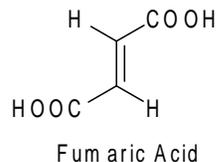
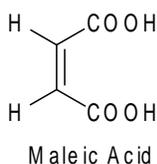
iii. (2*R*,3*S*)-2,3,4-trihydroxybutanal (in Newman Projection)

Give an example of 'internally compensated' optically inactive molecule.

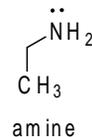
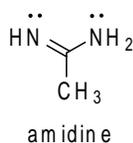
(7) Draw the canonical forms (resonance structures) of the following compound and decide which one of the drawn structures will be most contributing with proper reasoning.



Explain why the difference between two pK_a values of maleic acid is greater than fumaric acid.



(8) Amidines are stronger bases than amines—Explain. Which Nitrogen of amidine is expected to be more basic?



Optical purity of an optically active sample is 95% in which (*R*-) isomer is in excess. Find the percentage of the (*R*-) isomer.

(9) Account for the fact that phenyl *sec*-butyl ketone undergoes easy racemization in alkali solution? Identify the intermediate formed in this case. Cite two basic differences between 'inductive effect and field effect'. Identify and write down the steps for generation of the reactive intermediate when chloroform is heated with an alkali.

(10) Draw an energy profile diagram of a particular reaction where both thermodynamically controlled (TCP) and kinetically controlled (KCP) products are formed. Label them. What is the shape and hybridization of each carbon atom in the given molecule?

