

B.Sc. 1st Semester (Honours) Examination, 2019 (CBCS)

Subject : Chemistry

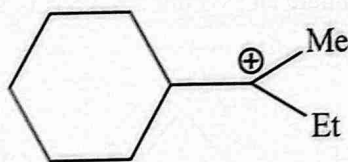
Paper : CC-1

Time: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any five questions from the following: 2×5=10
- Indicate the state of hybridisation in the reactive carbon of a carbocation, a carbanion, a free radical and a singlet carbene.
 - Draw the Fischer projection of (2R, 3S)-3-chloro-2-pentanol.
 - Write the structure of a chiral alkane of lowest molecular weight having no isotopic atom. Draw the structure of another chiral alkane of the same molecular weight.
 - Explain the term 'Homoaromaticity' with a suitable example.
 - Draw the structure of a trans compound with 'Z' configuration and a compound with S-cis configuration.
 - Arrange the bond energies of the following C—H bonds in increasing order with suitable comments.
 $\text{H}_3\text{C—H}$, $\text{MeCH}_2\text{—H}$, $\text{Me}_2\text{CH—H}$
 - Find the total number of contributing structures showing hyper conjugation for the carbocation.

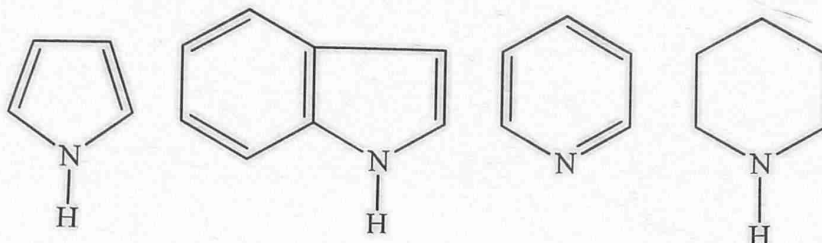


- (h) Write two important applications of inductive effect.

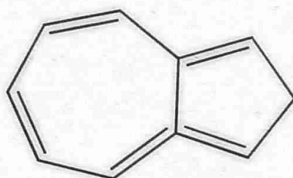
2. Answer any two questions from the following:

5×2=10

(a) (i) Arrange the following heterocycles in increasing order of basicity with reasoning:



(ii) Do you agree with the fact that the following molecule is both polar and aromatic at the same time? Give reasons. 3+2=5



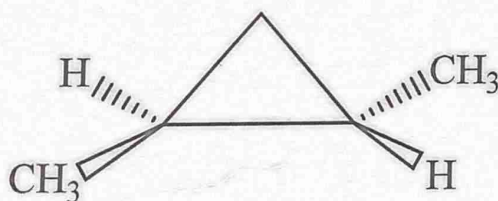
(b) (i) Calculate the Double Bond Equivalent (DBE) of a compound having molecular formula C_9H_7N and draw its probable structure that may have a real existence.

(ii) Guanidine [$HN=C(NH_2)_2$] is an extremely strong base ($pK_a = 13.6$). Explain.

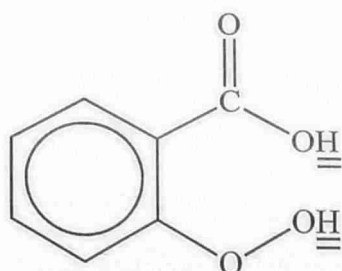
(iii) Draw the SOMO of allyl radical. 2+2+1=5

(c) (i) When a solution of optically active sec-butyl phenyl ketone in aqueous ethanol is treated with acids and bases, the solution gradually loses its optical activity? Explain.

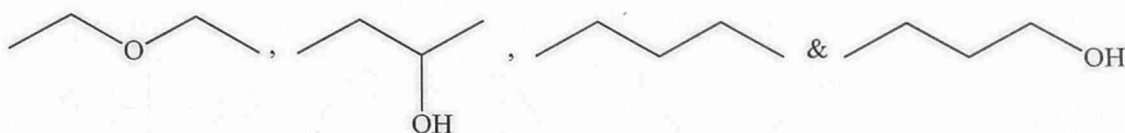
(ii) How can you differentiate an asymmetric molecule from dissymmetric molecules? State whether is asymmetric or dissymmetric. 3+(1+1)=5



- (d) (i) Which of the two marked hydrogens in salicylic acid will get released as H^+ ion to express acidity? Give reasons.



- (ii) Arrange the following compounds in order of increasing boiling points:



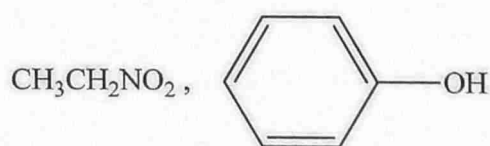
- (iii) Find the point group of $H_2C = C = CH_2$.

2+2+1=5

3. Answer *any two* questions from the following:

10×2=20

- (a) (i) What is tautomerism? Comment whether the following compounds can exhibit tautomerism.



- (ii) Compare the dipole moments of the following pairs:

(I) p-dichloro benzene and p-dihydroxy benzene

(II) o-nitro toluene & p-nitro toluene

- (iii) Cyclopentadiene ($K_a = 10^{-13}$) is much more acidic than cycloheptatriene ($K_a = 10^{-45}$) even though greater number of contributing structures can be drawn for the anion of the later compound. Explain.

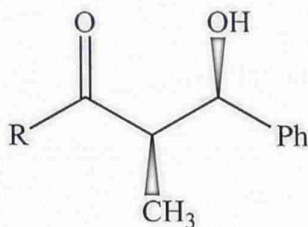
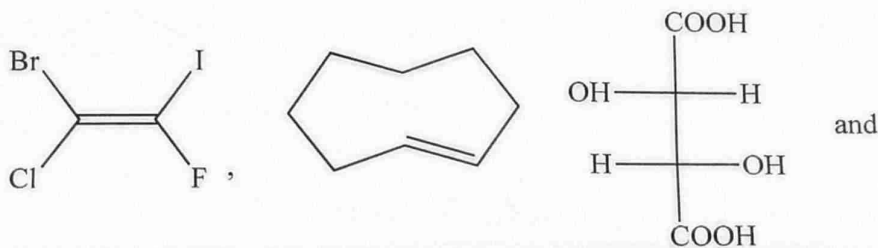
- (iv) How would you explain the order of basicity in gas phase for the following amines? CH_3NH_2 , $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$. Will the order remain the same in aqueous phase? Justify. 2+3+2+3=10

- (b) (i) Give one example for each of the following:

- (I) A chirotopic but non-stereogenic centre.
 (II) A chirotopic as well as stereogenic centre.
 (III) A stereogenic but an achirotopic centre.

Which of the above conditions may be termed as Pseudo asymmetry?

- (ii) Assign E/Z, D/L or syn/anti nomenclature to the following compounds:

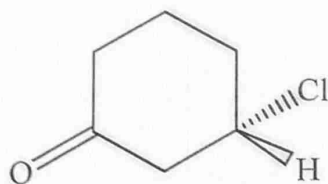


- (iii) Discuss a method for resolution of a racemic amine. 4+4+2=10

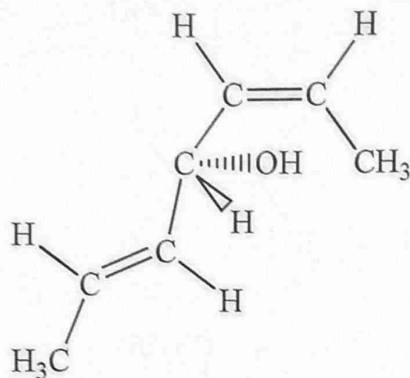
- (c) (i) What do you mean by the term enantiomeric excess (ee) of a racemic modification? Calculate the ee and the specific rotation of a mixture containing 10g of (+)-2-butanol and 6g of (-)-2-butanol. The specific rotation of enantiomerically pure (+)-2-butanol is +13.5.

(ii) Assign R/S designation to the following compounds:

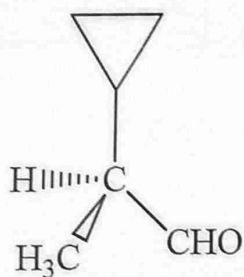
(A)



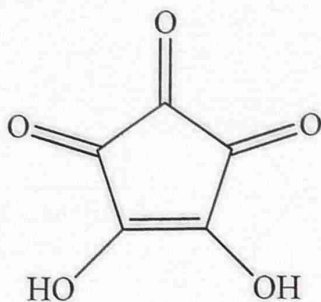
(B)



(C)



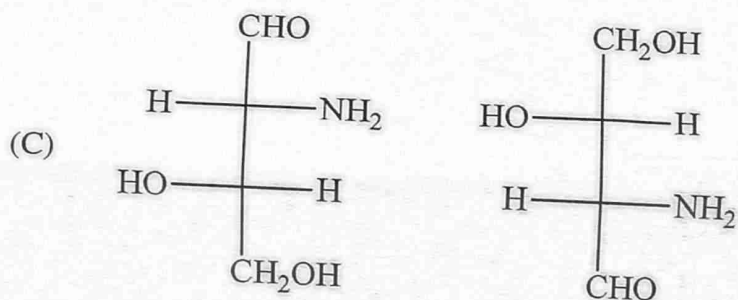
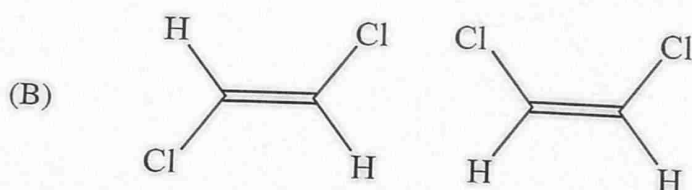
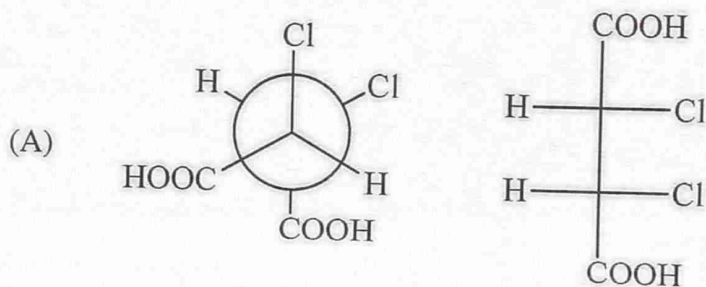
(iii) Account for the observation that croconic acid is an extremely strong acid.



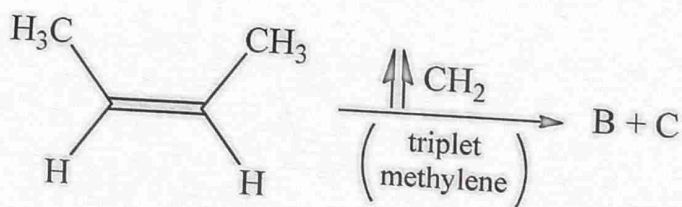
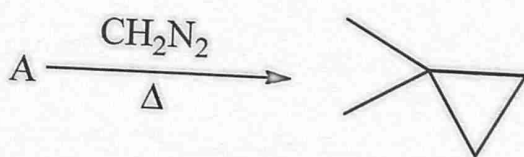
(iv) What are electrophiles? Justify with suitable examples that Lewis acids and some neutral molecules can behave as electrophiles.

(1+2)+3+2+2=10

(d) (i) Label the following pair of structures as homomers, enantiomers and diastereomers.



(ii) State the structures of A, B and C in the following reactions



(iii) What is a non-classical carbocation? Explain with a suitable example.

(7)

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(iv) Which of the two 'C = O' bonds marked A and B is shorter than the other? 3+3+2+2=10

