

B.Sc. (Hons.) 4th Semester Examination, 2022 (CBCS)

Subject: Biotechnology(Hons.)

Paper: CC-10

(Chemistry-II)

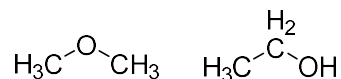
Time: 2 Hours

Full Marks: 40

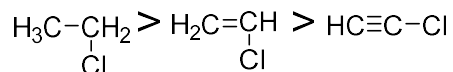
Q.1 Answer any five questions from the following :

$2 \times 5 = 10$

- a) Draw the orbital diagram of acetylene. Why are the hydrogens of acetylene acidic compared to ethane and ethylene?
- b) Which of the following would have higher boiling point and why?



- c) When do the numeric value of optical rotation and specific rotation of an optically active compound become equal and why?
- d) How would you separate a mixture of *ortho*- and *para*- isomers of hydroxybenzaldehydes? Mention the principle of separation.
- e) Conformational isomers of *n*-butane are non-superimposable mirror images—but still they are not optically active. Why?
- f) Draw the Fischer projection formula of the *D*-erythrose and give IUPAC name with *R,S* notation of chiral centres.
- g) Order of dipole moments decreases in the following series— explain.

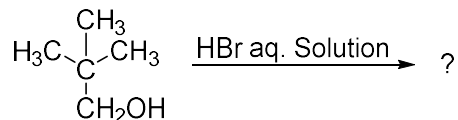


- h) Arrange the following nucleophiles in order of their increasing nucleophilicity in polar aprotic solvents: PhO^- , CN^- , OH^- and EtO^-

Q.2 Answer any two questions from the following :

$5 \times 2 = 10$

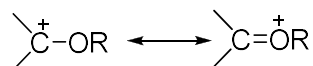
- a) Optically active (*R*)-2-iodooctane when treated with radioactive iodide ion $^{128}\text{I}^-$ the rate of racemization is found to be twice that of initial rate of incorporation of radioactive iodide isotope in the substrate. Explain the above experimental observation. Explain nucleophilic catalysis with suitable example. $3 + 2 = 5$
- b) Predict and explain the formation of the product in the following reaction.



Why are alcohols less acidic than phenols?

3 + 2 = 5

c) Which of the following carbocation represents the most stable canonical form and why?



Arrange the following chloromethanes in the order of decreasing dipole moment and ex

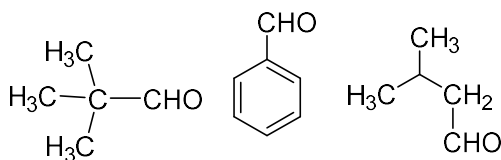
CH_3Cl , CH_2Cl_2 , CHCl_3 , CCl_4

3 + 2 = 5

d) Using Grignard reagent devise a synthetic route for each of the following (any two):

- A primary alcohol
- An unsymmetrical ketone
- A tertiary alcohol

Which among the following would undergo aldol condensation and why?

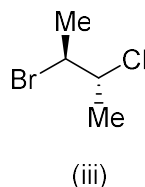
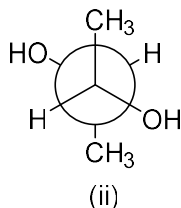
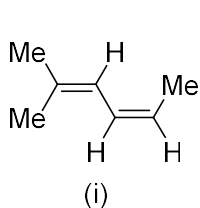


1.5 × 2 + 2 = 5

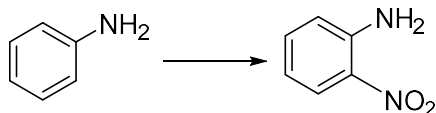
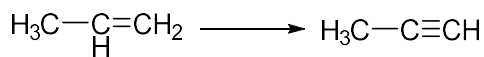
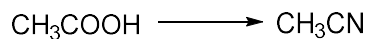
Q.3 Answer any two questions from the following :

10 × 2 = 10

- Draw the energy profile diagram of the different conformers of n-Butane using Newman projection formula and arrange them in the order of decreasing stability.
 - Differentiate between aromatic and *anti*-aromatic compounds (two points only).
 - Trifluoroacetic acid is as strong as sulphuric acid. — Explain.
 - What is 'steric inhibition of resonance'? Explain with example.
- Name the following in (*R*, *S*) or (*E*, *Z*) system of nomenclature where ever applicable:



ii. Convert the following (any two):



iii. State and explain NGP in substitution reaction.

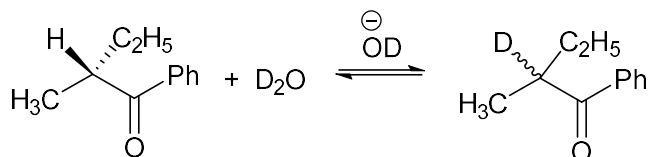
iv. Give an example of ambident nucleophile.

3 + 4 + 2 + 1 = 10b

c. i. Name the respective electrophiles responsible in bringing about the following electrophilic substitution of aromatic species: nitration, sulphonation, Friedel-Craft alkylation and acylation.

ii. Point out three major differences between SN₁ and SN₂ mode of substitution of alkyl halides.

iii. The following optically active ketone undergoes a two-step base catalysed racemization in D₂O as follows.



The ratio of rate of deuterium exchange to racemization is found to be 1:2. — Explain. Identify the slowest step.

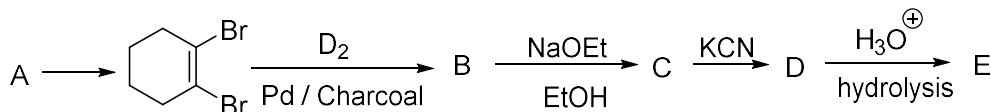
iv. Hyperconjugation is also termed as ‘no-bond resonance’— Why?

2 + 3 + 3 + 2 = 10

d. i. Differentiate between bond energy and bond dissociation energy. Which is more general and why?

ii. Show homotopic, enantiotopic and diastereotopic pairs of hydrogens in a suitable example of your choice.

iii. Identify the compounds A to E in the following reaction sequence.



iv. Draw all the canonical forms of 4-nitroaniline and identify the most stable form.

3 + 3 + 2.5 + 1.5 = 10