

BACHELOR ENGINEERING IN FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING
EXAMINATION, 2018

(1st Year, 2nd Semester, Exam)

Subject: ORGANIC CHEMISTRY

Time: Three hours

Full Marks: 100

Different parts of the same question should be answered together

Q.1. Answer any one from (a) and (b)

5x2=10

- (a) i) Draw the flying-wedge formula of (S)-alanine.
 ii) Write down the Sawhorse formula of Erythro form of 2R,3S-3-bromo-2-butanol.
 iii) Draw the Newman projection formula of trans-2-butene
 iv) Draw the Newman projection formula of most stable conformation of ethylene glycol in vapour state with proper reason.
 V) Show the symmetry elements present in chloroform

OR

- (b) i) Draw the Fischer projection formula of (R)-tartaric acid.
 ii) Write down the Sawhorse formula of threo form of 2R,3R-3-bromo-2-butanol.
 iii) Draw the Newman projection formula (staggered) of (S)-tartaric acid.
 iv) Draw the flying-wedge formula of 1,2-difluoroethane (gauch form)
 v) Show the symmetry elements present in Cis-1,3-dimethyl cyclobutane

Q2. Answer both (a) and (b)

- (a) i) How do chiral molecules rotate the plane of polarized light ? **4+2+2+4=12**
 ii) Specific rotation of an enantiomeric mixture is (+) 15.90 and the specific rotation of the R-enantiomer is -38.90, determine the percentage of each isomer in the mixture.
 iii) Define the term "Optical purity".
 iv) "All compounds having enantiotopic ligands are achiral"- Justify with appropriate example.

[Turn over

- (b) i) Draw the energy diagram for the conformations of ethane arising out of rotation around C(1)-C(2) bond and label maxima, minima with appropriate conformation in Newman projection formula.
- ii) Why does ethylene glycol show finite dipole moment in gaseous state?
- iii) Draw the orbital picture of $\text{CH}_3\text{CH}=\text{C}=\text{CHCl}$. Indicate the state of hybridization of each carbon atom.

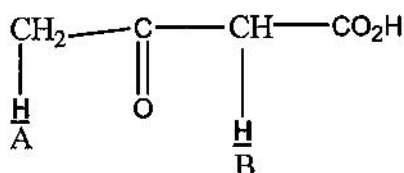
Q3. Answer any two from (a), (b) and (c)

3+2+2.5x2=10

- (a) i) Arrange the following compounds with increasing order of pKa value and give reason.



- ii) Which hydrogen (A or B) in the following compounds is more acidic and why?

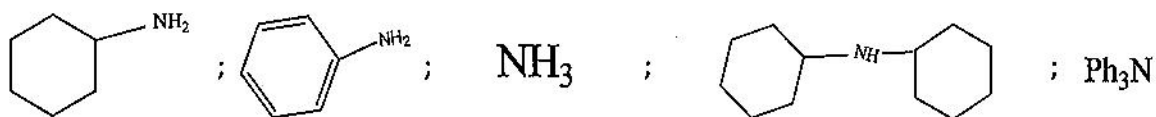


- iii) How can you separate the following compounds from their binary mixture? Mention appropriate reagents and methods.

A) p-toluidine and β -naphthol .

B) Phthalic acid and benzophenone.

- (b) i) Arrange the following compounds with decreasing basicity. Justify your answer. **5+2.5+2.5=10**



- ii) Why picric acid is more acidic than phenol?

- iii) How can you separate the following compounds from their binary mixture? Mention appropriate reagents and methods

Aqueous solution of sodium benzoate and benzyl alcohol.

3+3+2+2=10

(c) i) 2,4,6-trimethyl-N,N-dimethyl aniline is 40000 times stronger base than 2,4,6-trinitro aniline.- Explain.

ii) Explain why PKa_1 for cis-butenedioic acid is 1.92 but PKa_1 for trans-butenedioic acid is 3.02

iii) What product will you get if phthalimide is treated with aqueous potassium hydroxide? Give reasons in support of your answer.

iv) Which one of the following pair is more stable and why?

Formate and acetate

Q.4. Answer any one from (a) and (b)

4+3+3=10

(a) i) How does the heat of hydrogenation ($\Delta H_{\text{hyd}}^{\circ}$) relate with the stability of alkene. Explain with the help of energy profile diagram.

ii) Arrange the following alkenes in order of increasing stability and give reasons for your answer.

1-butene, isobutene, Z-2-butene and E-2-butene

iii) Is it possible to compare the stability of but-2-ene and 1-pentene by heat of hydrogenation? If not, why? What method could you use?

3+4+3=10

(b) i) Draw the energy profile for the hydration of 1-butene and 2-methyl propene. Explain your diagram.

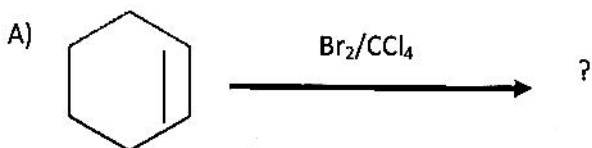
ii) Predict the product(s) (with stereo chemistry) of the reaction between trans-1-phenyl propene ($\text{C}_6\text{H}_5\text{CH}=\text{CHMe}$) and bromine (Br_2) in a solvent which has low dielectric constant (less than 35). Explain your result in the light of reaction mechanism.

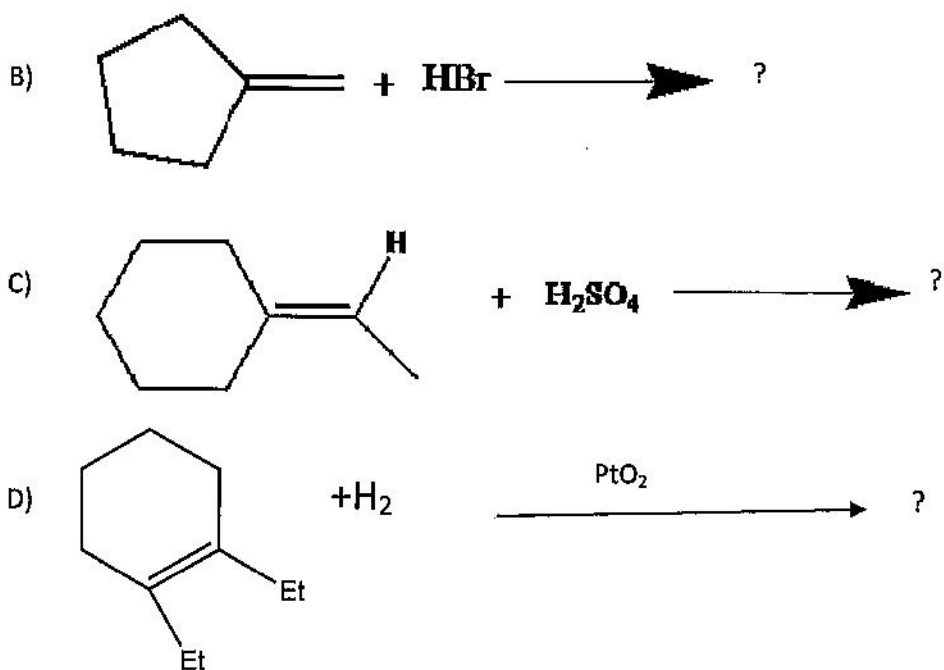
iii) Show the mechanism of addition of HBr into ethene with energy diagram. Also draw the energy diagram of the reaction in which vinyl chloride is reacted with HBr.

Q. 5. Answer all the questions

10+4+1+5+10+3+2+5=40

i) Predict the product (s) with stereochemistry

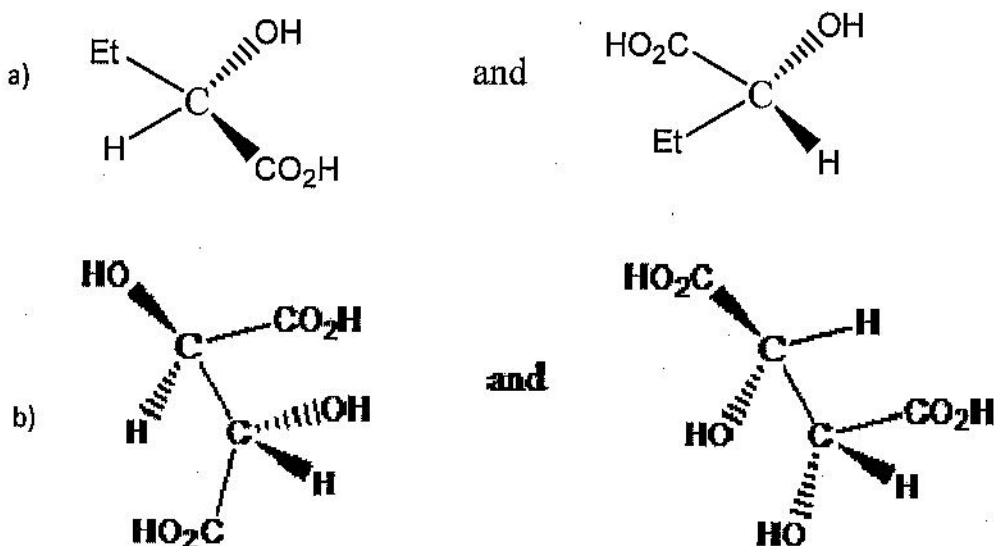




ii) The dehydration of butane -2-ol with acid gives a mixture of 1 and 2-butenes. State which predominates, and give your reasons. Draw the energy profile of the reactions.

iii) What is simplest alkane that is optically active?

iv) Consider the following two structures and state with reason whether they are enantiomers of two molecules of the same compound.



- v) Water, dil HCl, dil NaOH, dil NaHCO₃ are given as a solvent in the laboratory. Mention the solubility of the following compounds in each of the above solvent. Give reason in support of your answer.
- a) Acetic acid, b) p-amino benzoic acid, c) phenol, d) Salicylic acid, e) Benzophenone
- vi) How can you detect phenolic OH group of β -naphthol by back dye test. Mention appropriate reagents and related reactions.
- vii) Give approximate alcohol percentage of beer, wine and spirit.
- viii) How can you detect carbonyl group of ketone or aldehyde? Mention appropriate reagents and related reactions. How can aldehyde and ketone be distinguished by a chemical test.