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Sardar Patel University

B. Sc. (Semester – V) Examination

Date: 12th November 2013 Time: 10:30am to 01:30pm

Industrial Chemistry Vocational

COURSE NO: US05CICV01 (Organic Chemistry)

Notes: Figures to the right indicate full marks. Total marks: 70

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Q.1 Answer the following Multiple Choice Questions. (**All are compulsory**) (10)

1. Heterolytic cleavage of a carbon-carbon bond produces ____
   a. Two carbonium ions
   b. Two free radicals
   c. One cation and one anion
   d. A free radical and carbanion
2. What is the state of hybridization of carbon in carbanion?
   a. sp
   b. sp^2
   c. sp^3
   d. sp^3d
3. The decreasing order of the size of the three hybrid orbitals would be....
   a. Sp>sp^2>sp^3
   b. sp^2>sp>sp3
   c. sp^3> sp^2>sp
   d. None of these.
4. In a base catalyzed reaction, ά-diketones are converted to ά-hydroxy acids are called _____reaction.
   a. Diels–Alder Reaction.
   b. Pinacol–Pinacolone Rearrangement
   c. Benzilic Acid Rearrangement
   d. Fries Rearrangement
5. Phenolic esters on heating with aluminum trichloride give o- and p- acyl phenol is known as _____ reaction.
   a. Fries rearrangement
   b. Meerwein–Ponndorf–Verley Reduction
   c. Aldol condensation
   d. Diels–Alder Reaction
6. _____ compounds doesn't undergo Aldol Condensation reaction.
   a. HCHO
   b. CH_3CHO
   c. CH_3CH_2CHO
   d. $CH_3CH_2CH_2CHO$
7. _____ reagent is prepared by refluxing anhydrous isopropyl alcohol with aluminum amalgam in the presence of a small amount of CCl_4 as a catalyst.
   a. $(Me_2CHO)_3Al$
   b. NBS
   c. $LiAlH_4$
   d. OsO_4
8. Lead tetra acetate is an important ____ reagent.
   a. Oxidizing
   b. Acetoxylatingc.
   c. Methylating.
   d. All of these
9. How many NMR signals do you expect from Acetone and Ethanol?
   a. 1 & 1 respectively
   b. 1 & 3 respectively
   c. 2 & 3 respectively
   d. None of these
10. The DBE value For molecular formula – $C_7H_{10}O_2$ is
    a. 1
    b. 3
    c. 5
    d. None of these

Q.2 Answer the following short questions (Any Ten) (20)

1. What are electrophiles? Give an examples.
2. Define term nucleophile? Give an example.
3. What are free radicals? Hoe they are generated?
4. Differentiate the Aldol and Cross-Aldol condensation reaction.
5. Give uses of Meerwein–Ponndorf–Verley Reduction.
6. Define term Reaction and Rearrangement.
7. Give synthesis of NBS reagent.
8. Write properties and uses of Selenium dioxide
9. Give synthesis and uses of Lead tetra acetate.
10. Write about information obtained from IR Spectroscopy.
11. Enlist the information obtained from H^1NMR Spectroscopy.
12. Predict the signal pattern of the -CH_3 protons in the NMR spectra of the $CH_3CH_2Br_2$.

Q.3

a. What are different types of reaction intermediates formed by homolytic and heterolytic fission of a covalent bond? Explain with examples. (06)
b. Giving suitable example write about electrophilic substitution reaction. (04)

OR

Q.3

a. Write short note on structure stability of Carbanions and Free radicals. (06)
b. Give an outline of Discuss the Elimination reaction. (04)

Q.4 Write notes on following: (10)

a. Friedel–Craft's Reaction.
b. Diels–Alder Reaction.

OR

Q.4 Give types of Molecular Rearrangement and write Pinacol – Pinacolone Rearrangement. (10)

Q.5 Write notes on following reagents of synthetic Importance. (10)

a. Lithium aluminium hydride
b. Osmium Tetraoxide

OR

a. Sodium Borohydride.
b. Aluminiumisopropoxide.

Q.6 From the following sets of N.M.R., IR and UV data, give a structure consistent with each of the following : (10)

1. Molecular weight: **100 gm/mol**; %age: C=72.00%, H=12.0%.; UV: λmax: 292nm; IR: 2930, 1712, 1261cm-1.; NMR: δ 1.60 (singlet, 23.20sq), δ 1.45 (doublet, 15.00sq), δ 1.25 (multiplate, 7.50sq) and δ 0.92 (doublet, 45.00sq).
2. Molecular weight: **90 gm/mol**; %age: C=26.67%, H=2.22%, O=71.11%; UV: λmax: 292nm; IR: 2500-3000, 1720, 1120cm-1.; NMR: δ 10.92 (singlet, 2H).

OR

1. Molecular weight: **88 gm/mol**; %age: C=54.54%, H=13.64%, N=31.82%; UV: λmax: 220nm; IR: 2860, 1120cm-1.; NMR: δ 3.6 (singlet, for all protons).
2. Molecular weight: **113gm/mol**; %age: C=31.86%, H=5.31%, Cl=62.83%.; IR: 2900, 1380, 300-500cm-1.; NMR: δ 1.8 (quintet, 6.5sq), δ 3.0 (triplet, 12.9sq).

Characteristic Infrared Absorption Frequencies.

Bond	Compound type	Frequency range cm^{-1}
C-H	Alkanes.	2850-2960, 1350-1470.
C-H	Alkenes.	3020-3080 (*m*), 675-1000.
C-H	Aromatic rings.	3000-3100 (*m*), 675-870.
C-H	Alkynes.	3300
C=C	Alkenes.	1640-1680 (*v*)
C≡C	Alkynes.	2100-2260 (*v*)
C=C	Aromatic rings.	1500, 1600 (*v*)
C-O	Alcohols, Ethers, Carboxylic acids, Esters.	1080-1300
C=O	Aldehyde, Ketones, Carboxylic acids, Esters.	1690-1760
O-H	Monomeric alcohols, Phenols	3610-3640 (*v*)
	Hydrogen bonded alcohols, Phenols.	3200-3600 (*broad*)
	Carboxylic acids.	2500-3000 (*broad*)
N-H	Amines.	3300-3500 (*m*)
C-N	Amines.	1180-1360.
C≡N	Nitriles.	2210-2260 (*v*)
$-NO_2$	Nitro compounds	1515-1560, 1345-1385

Double Bonds	
Structure unit	Frequency cm^{-1}
C=C	1620-1680
C=O	
Aldehydes and ketones	1710-1750
Carboxylic acids	1700-1725
Acid anhydrides	1800-1850 & 1740-1790
Acyl halides	1770-1815
Esters	1730-1750
Amides	1680-1700
Substituted derivatives of Benzene	
Mono substituted	730-770 & 690-710
Ortho-disubstituted	735-770
Meta-disubstituted	750-810 & 680-730
Para-disubstituted	790-840

Characteristic Proton Chemical Shift

Type of Proton		Chemical shift, δ, ppm	Type of Proton		Chemical shift, δ, ppm
Cyclopropane		0.2	Alcohols	H-C-OH	3.4 – 4
Primary	$R-CH_3$	0.9 -1.8	Ethers	H-C-OR	3.3 – 4
Secondary	R_2CH_2	1.3	Esters	RCOO-C-H	3.7 – 4.1
Tertiary	R_3CH	1.5	Esters	H-C-COOR	2 – 2.2
Vinylic	C=C-H	4.6 -5.9	Acids	H-C-COOH	2 – 2.6
Acetylenic	C≡C-H	2 - 3	Carbonyl compounds	H-C-C=O	2 – 2.7
Aromatic	Ar-H	6 - 8.5	Aldehydic	RCH=O	9 – 10
Benzylic	Ar-C-H	2.2 - 3	Hydroxylic	RO-H	1 – 5.5
Allylic	C=C-C-H	1.7	Phenolic	ArO-H	4 – 12
Fluorides	H-C-F	4 - 4.5	Enolic	C=C-O-H	15 – 17
Chlorides	H-C-Cl	3 - 4	Carboxylic	RCOO-H	10.5 – 12
Bromides	H-C-Br	2.5 – 4	Amino	$R-NH_2$	1 – 5

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