

B.Sc. Semester - 5 (Remedial) (NEP-2020) Examination

March/April-2026

CHE: Higher Chemistry-302 (Major-12)

Time: 2:00 Hours

Marks:50

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

Que.1 Any two out of three questions (10)

1. Give the synthesis of metal carbonyls
2. Calculate number of ligands in
(A) $\text{Os}_4(\text{CO})_x$, Number of M-M bond = 4 (B) $\text{Ir}_4(\text{CO})_x$, Number of M-M bond = 6
3. Explain the structure of $\text{Fe}_2(\text{CO})_9$

Que.2 Any two out of three questions (10)

1. Discuss different fundamental vibrations (mode of vibrations) of IR with illustration.
2. Explain different types of electronic transition in UV spectra in detail.
3. The compound having molecular formula $\text{C}_{11}\text{H}_{12}$ and IR absorptions at 3310, 3045, 2925, 2130, 1605, 1500, 1430, 1380, 1360, 1230, 1070, 840 cm^{-1} . Derive the structure of the compound.

Que.3 Any two out of three questions (10)

1. Explain the shielding and deshielding effect in NMR spectra.
2. Give the number of ^1H NMR signals for following molecules.
A) Ethylene glycol B) Mesitylene C) 2-Bromo Butane
D) Cis-1,2- dimethyl cyclo propane E) Di- iso propyl ether
3. Compare the ^1H NMR spectra of cyclohexane at room temperature and at lower temperature.

Que.4 Any two out of three questions (10)

1. Deduce the structure of compound whose molecular formula is $\text{C}_5\text{H}_{10}\text{O}$ whose spectroscopic data is as follow:

UV	$\lambda_{\text{max}} = 240\text{nm}$, $\epsilon_{\text{max}} = 60$			
IR(cm^{-1})	2950, 2850, 1720			
^1H NMR	No. of Signals	No. of Protons	Mult.	δ_{ppm}
	a	1H	s	9.5
	b	9H	s	0.9

Draw the structure of compound with IUPAC name.

2. Give detailed explanation of standard hydrogen electrode.
3. Deduce the structure of compound whose molecular formula is $\text{C}_7\text{H}_6\text{O}_3$ whose spectroscopic data is as follow:

UV	$\lambda_{\text{max}} = 205\text{nm}$, $\epsilon_{\text{max}} = 65$			
IR(cm^{-1})	3460, 3055, 1705, 750			
^1H NMR	No. of Signals	No. of Protons	Mult.	δ_{ppm}
	a	1H	s	11.2
	b	4H	s	7.5
	c	1H	s	5.2

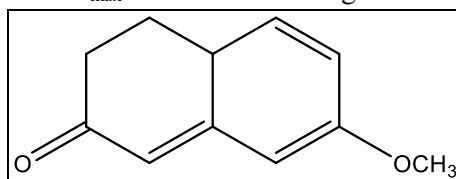
Draw the structure of compound with IUPAC name.

Que.5

Any two out of Four questions

(10)

1. Explain bonding in metal nitrosyls.
2. Calculate the $\lambda_{\max}$ value for following molecule.



3. Deduce the structure of compound whose molecular formula is $C_9H_8O_2$ whose spectroscopic data is as follow:

UV	$\lambda_{\max} = 206\text{nm}$, $\epsilon_{\max} = 1300$			
IR(cm^{-1})	3010, 1705, 1625			
$^1\text{H NMR}$	No. of Signals	No. of Protons	Mult.	δ_{ppm}
	a	1H	s	10.9
	b	1H	d	7.7
	c	5H	m	7.6
	d	1H	d	6.5

Draw the structure of compound with IUPAC name.

4. A compound has molecular formula $C_{12}H_{14}O_4$. The $^1\text{H NMR}$ data shows: Identify the compound (6H, t, $\delta=1.11$), (4H, q, $\delta=4.1$), (4H, s, $\delta=7.9$)

Spectral Data

NMR: δ values

0.9-1.2 Alkyl groups
 2.0-2.5 Ar-R groups,
 2.0-2.5 CO-R,
 4.0 NH₂, 6-8 Ar-H
 9-10 CHO
 10-11 COOH

IR: ν cm⁻¹

3440(d) -NH₂
 3100-3000 C-H stretching arenes
 2900-3000 C-H stretching alkanes,
 2850-2750 C-H stretching aldehyde
 1650-1750 C=O str
 1550-1650 N-H bending 1623, 1510, 1451
 1380-1350 C-H stretching isopropyl/tert.butyl

1200-1350- C-N stretching for aromatic

810 p-Di substitution

UV: λ

Base value Enone -C=C-CO-Z, Arone Ar-CO-Z
 -Simple Diene =217 215 Arone Z=C 246
 Homo annular diene =253 205 Z=H 250
 Heteroannular diene =215 210/ Z= OH/OR 230
 Z=H 210

Z=OH/OR 195

Substituent:

Cl: 00

NH₂: ortho-13, meta-13 para-58