

P.G. Semester-IV Examination, 2023

CHEMISTRY

Course ID : 41453

Course Code : CHEM-403E

Course Title : Inorganic Chemistry Special

Time : 2 Hours

Full Marks : 40

The figures in the right-hand margin indicate marks.

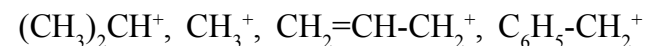
Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** of the following questions:

2×5=10

- Name the diseases caused by the deficiency of Cu and Zn.
- Define Nitrogen rule and explain with a suitable example.
- What is symmetric top and assymetric top molecule? Give one example of each type.
- Mention the main cause of Anemia and Minamata disease.
- What do you mean by the term 'polarizability'?
- What is hyponatremia and hypokalemia?

g) Arrange the following in the order of stability:



2. Answer any **four** of the following questions:

5×4=20

- Explain McLafferty rearrangement with a suitable example. 5
- How do you remove mercury toxins? Why Selenium is toxic? 3+2=5
- Draw the diagram of mass spectrometer and show the each part. Write the principle of magnetic sector analyzer in mass spectrometry. 3+2=5
- Write the point group of N_2O , BF_3 and $\text{Cu}(\text{H}_2\text{O})_6$. What is mutual exclusion principle? 3+2=5
- What is chelation therapy? Write the characteristics of ideal chelating ligand. Name of the chelating ligands used for Cu, Pb, As and Au poisoning. 1+2+2=5
- Write down the principle of Atomic Absorption Spectroscopy. What is the difference between atomic absorption and emission spectroscopy? How do you differentiate superoxide- and peroxide- complexes by IR spectroscopy?

$1\frac{1}{2}+2+1\frac{1}{2}=5$

3. Answer any **one** of the following questions:

$$10 \times 1 = 10$$

- a) i) Write down the different modes of vibration of AB_2 type molecules.
- ii) Calculate the number of stretching and bending vibrational modes in H_2O and NH_3 .
- iii) How IR spectroscopy can be used to determine the different binding modes of nitrosyl group?
- iv) Calculate the total number of IR and Raman active modes in the molecule PCl_5 . Character table and Reducible representation are given below: $2+2+3+3=10$

D_{3h}	E	$2 C_3$	$3 C_2$	σ_h	$2 S_3$	$3 \sigma_v$		
A'_1	1	1	1	1	1	1		$x^2 + y^2, z^2$
A'_2	1	1	-1	1	1	-1	R_z	
E'	2	-1	0	2	-1	0	(x, y)	$(x^2 - y^2, xy)$
A''_1	1	1	1	-1	-1	-1		
A''_2	1	1	-1	-1	-1	1	z	
E''	2	-1	0	-2	1	0	(R_x, R_y)	(xz, yz)

- b) i) Calculate the ratio of M, (M+1) and (M+2) of BrCl in Mass spectrometry.
- ii) Identify the fragments corresponding to the peaks observed at $m/Z = 55.9401$, 121.0103 and 186.0132 in mass spectrum of ferrocene.

iii) Show the species corresponding to the peaks observed at $m/Z = 58, 43$ and 29 in mass spectrum of butane.

iv) Predict the mass spectral fragmentation pattern for C_7H_7NO . $2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} = 10$
