

B. SC. CHEMISTRY EXAMINATION, 2023

(1st Year, 1st Semester)

CHEMISTRY (GE)**PAPER: GE/CHEM/TH/01**

Time : Two Hours

Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

UNIT - 101G - I

1. Answer **any two** questions : $2 \times 2\frac{1}{2}$
- a) Write the IUPAC nomenclature of the following complex compounds (**any two**):
 $[\text{Co}(\text{NH}_3)_6][\text{CoCl}_6]$, $[\text{Ni}(\text{CO})_4]$, $\text{Na}_2[\text{Al}(\text{OH})_4]$,
 $\text{K}_2[\text{Fe}(\text{CO})_4]$
- b) How did Alfred Werner establish the geometry (shape) of hexa-coordinated ML_6 compound.
- c) Calculate CFSE of the following complex ions (**any two**): $[\text{NiCl}_4]^{2-}$, $[\text{CoCl}_4]^{2-}$, $[\text{CoF}_6]^{3-}$, $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- d) Match the following ligands with most preferred metal oxidation state(s) with justification.

Ligands	Metals	Justification
O^{2-} , CO, H_2O	Cr(0)	
	Cr(III)	
	Cr(VI)	

[Turn over

[2]

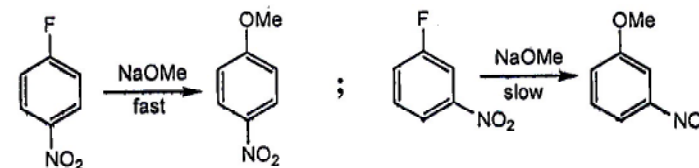
2. Answer **any two** questions : $2 \times 2\frac{1}{2}$
- Briefly explain the bonding in B_2H_6 by valence bond (VB) and molecular orbital approach.
 - How do you prepare XeF_2 and XeF_4 ? Write with proper reaction conditions.
 - Briefly explain the following properties of alkali metals when dissolved in liquid ammonia.
 - The dilute solutions have much lower density than the pure solvent.
 - The dilute solutions are paramagnetic with susceptibility corresponding to one free electron per metal atom.

3. Answer **any two** questions : 2×5
- For the molecules or molecular ions in the problem, give the formula type (Example: AX_2E), the steric number (SN), the geometry with. (Example: bent), and expected bond angles. (*any three*) 5

Compound	Formula type	SN	Geometry	Bond angle(s)
(a) ClF_3				
(b) $[XeF_3]^+$				
(c) SF_4				
(d) IF_5				

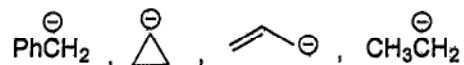
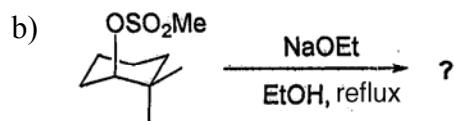
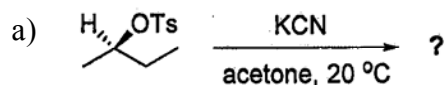
[5]

- d) 4-Nitrofluorobenzene shows high reactivity towards nucleophilic aromatic substitution reaction with NaOMe compared to 3-nitrofluorobenzene. Explain the reason.



- How will you prepare benzaldehyde from toluene?
- Discuss the mechanism of nitration of benzene for the preparation of nitrobenzene.

[4]

6. Predict the product of the following reactions: $1\frac{1}{2} \times 2$ 7. Predict the product of the following reactions: (any *two*) $1\frac{1}{2} \times 2$ 8. Answer any *five* of the following questions. 2×5

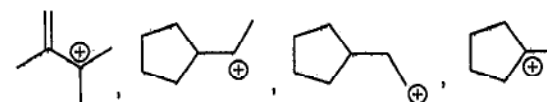
- Discuss the mechanism of pinacol-pinacolone rearrangement.
- How will you detect the presence of aromatic amine in an organic compound by the help of diazo-coupling reaction?
- Describe the cumene hydroperoxide method for the preparation of phenol.

[3]

- Calculate the ionization energy of H atom.
 - Calculate the de Broglie wavelength of a bullet ($m = 2 \times 10^{-3}$ kg) moving with a speed of 300 m s^{-1} .
 - What is the pH of pure water at 100°C ? K_w at 100°C is 5.45×10^{-13} . 1+2+2
- Calculate the size of the He^+ ion from Bohr's theory.
 - Calculate the minimum uncertainty in the location of a 1 g mass moving with a speed of 1.5 m s^{-1} . 2+3
- What are the merits and demerits of Bohr's model?
 - What is the minimum uncertainty in the velocity determination of an electron if we want to locate it within 0.01 \AA of the first Bohr radius in a hydrogen atom? 2+3

UNIT - 101G - O

4. Arrange the following carbocations in increasing stability order with proper justification:
- 2



5. Arrange the following carbanions in decreasing stability order with proper justification:
- 2

[Turn over