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**NA—10—2023**

**FACULTY OF SCIENCE**

**B.Sc. (Third Year) (Fifth Semester) EXAMINATION**

**NOVEMBER/DECEMBER, 2023**

**(New/CBCS Pattern)**

**CHEMISTRY**

**Paper-XIII (B<sub>1</sub>)**

**(Physical and Inorganic Chemistry)**

**(Tuesday, 5-12-2023)**

**Time : 10.00 a.m. to 12.00 noon**

*Time—2 Hours*

*Maximum Marks—40*

*N.B. :— (i) Attempt all questions.*

*(ii) Figures to the right indicate full marks.*

*(iii) Use of logarithmic table and non-functional calculator is allowed.*

1. Solve any *three* of the following : 3×5=15

(a) Write short notes on :

(i) Electron deficient organometallic compounds.

(ii) Transition metal organometallic compounds.

(b) Write down any *two* methods for the preparation of organolithium and explain the structure of organolithium compound in brief.

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- (c) Write down any *two* methods for the preparation of ferrocene. Explain the effect of the following on ferrocene :
- (i) HCHO in liq. HF.
  - (ii) H<sub>2</sub>SO<sub>4</sub> in acetic anhydride.
  - (iii) CH<sub>2</sub>=CH<sub>2</sub> in the presence of AlCl<sub>3</sub>.
- (d) Write down any *two* methods for the preparation of Ni(O)<sub>4</sub>. Explain in brief the structure of Ni(CO)<sub>4</sub>.
- (e) Define mononuclear and polynuclear metal carbonyls with suitable example.

2. Answer any *three* of the following : 3×5=15

- (a) Explain isotopic substitution effect on rotational spectra of diatomic rigid rotator with diagram.
- (b) Calculate force constant of HCl molecule if fundamental frequency is 3.1 cm<sup>-1</sup> and reduced mass is 1.626 × 10<sup>-27</sup> kg.
- (c) Give the modification of distribution law for association and dissociation of solute in one of the solvent.
- (d) Explain classical theory of Raman scattering.
- (e) Define third order reaction and give its characteristics.

3. Solve any *two* of the following : 2×5=10

- (a) Give the applications of distribution law.

- (b) Derive third order rate equation for equal concentration.
- (c) Explain types of electronic transitions.
- (d) For the distribution of  $I_2$  between  $CS_2$  and  $H_2O$  at  $25^\circ C$ , the following data were obtained :

Conc of $I_2$ in $CS_2$ ( $C_1$ )	41	66	129
Conc of $I_2$ in $H_2O$ ( $C_2$ )	0.100	0.161	0.314

Give comment on molecular state of  $I_2$ .