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# SB—16—2022

**FACULTY OF SCIENCE**

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

**MAY/JUNE, 2022**

**(CBCS/New Pattern)**

CHEMISTRY

Paper–XIII

(Physical and Inorganic Chemistry)

**(Wednesday, 8-6-2022)** **Time : 10.00 a.m. to 12.30 p.m.**

*Time*— 2½ *Hours* *Maximum Marks*—40

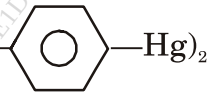
*N.B.* :— (*i*) *All* questions are compulsory.

(*ii*) *All* questions carry equal marks.

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

1. Solve any *three* of the following : 15

(*a*) Solve the following :

(*i*) IUPAC Name of $(C_5H_5)_2$ Ti and 

(*ii*) Explain ionic organometallic compounds.

(*b*) Write down the method of preparation and properties of organolithium compound.

(*c*) Write down any *two* methods of preparation for Ferrocene. explain the aromaticity of Ferrocene giving suitable chemical reactions.

(*d*) Write any *two* methods for the preparation of $Ni(CO)_4$ and explain the structure of $Ni(CO)_4$.

(*e*) Solve the following :

(*i*) Draw the structure of $Fe_3(CO)_{12}$ and $Ir_4(CO)_{12}$.

(*ii*) Define polynuclear metal. Carbonyle. Write down its characteristics.

P.T.O.

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

(*a*) Derive the derivation of moment of Inertia for diatomic molecule as a rigid rotator.

(*b*) The fundamental frequency of HCl is 2890 $cm^{-1}$. Calculate the force constant of this molecule. The atomic masses are $^{1}H = 1.673 \times 10^{-27}$ kg and $^{35}Cl = 58.06 \times 10^{-27}$ kg.

(*c*) State and explain Frank-Condon Principle.

(*d*) Derive an expression for rate constant of third order reaction.

(*e*) State and derive Nernst Distribution law and give its limitations.

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

(*a*) Explain Isotopic effect in diatomic molecule as a rigid rotator with labelled diagram.

(*b*) Discuss the quantum theory of Raman Spectroscopy and show the Raman lines appears in Raman Spectrum of a molecule.

(*c*) The distribution of weak organic acid between water and benzene obtained at 25°C.

| Conc. in water (9/$dm^3$) | Conc. in Benzene (9/$dm^3$) |
|---|---|
| 01.5 | 14.20 |
| 1.95 | 41.20 |
| 2.89 | 96.5 |

Assume that acid is not decomposed in water, determine molecular complexity of the acid in Benzene.

(*d*) Give kinetics of opposing reaction.