M. Sc. (Chemistry) Examination, 2022

(2nd Semester, CBCS)

Inorganic Chemistry

Paper – VII

Time : Two hours Full Marks : 40

Use a separate answer script for each Unit.

UNIT – 2071 a & b

1. a) Calculate the *styx* number and draw the VB structure of the following (***any two***):

$B_3H_6^+$, B_4H_{10}, $B_5H_5^{2-}$

b) Predict the structural type with the aid of Wade's rule (***any three***):

$[1,3\text{-}C_2B_7H_{12}]^-$, $[B_9H_{11}S]$, $[InBi_3]^{2-}$, $[Rh_5B(CO)_{15}]$, $[\{Co(\eta^5\text{-}C_5H_5)\}_2C_2H_8H_{10}]$

c) Determine the number of metal–metal bond in the following clusters (***any two***):

$[Re_2Cl_4(PMe_3)_4]$, $[Mo_2(\mu_2\text{-}OAc)_4]$, $[Fe_2Cp_2(CO)_2]_2$

d) Determine the structure of *closo*-parent cluster and number of capping group(s) in $Rh_7(CO)_{16}^{3-}$ and $RuOs_5(CO)_{14}(C_6H_6)$ 3+3+2+2

2. Answer the following questions:

a) Describe the binding modes of dinitrogen with metal ions. 2

b) Comment on the oxidation state of Ir in dioxygen complex of Vaska's compound, $[Ir(PPh_3)_2(CO)(Cl)(O_2)]$. 2

c) State the electronic structure of brown ring complex corresponding to the experimental magnetic moment of 3.9 B.M. 2

d) Outline the mechanism of formation of cyclometalated complexes by C-H activation process. 2

OR

Comment on the linear vs. bent binding mode of NO in metal nitrosyl complexes. 2

e) Remark on the oxidation state(s) of Ru centres in **Creutz-Taube** complex. 2

UNIT – 2072 a & b

3. a) Predict, with explanation, the expected number of lines in the esr spectra of ***any two*** of the following: 2×2

i) methyl radical ($\dot{C}H_3$)

ii) pyridine anion radical ($\dot{C}_5H_5N^-$)

iii) manganate ion (MnO_4^{2-})

b) What is zero field splitting? Explain, with an example, its influence on esr activity. 2+2

c) What is electron diffraction? Find out the wavelength of electron-wave (in pm) for a 200 kV electron microscope. 1+1

4. a) Write a short note on size-exclusion chromatography (SEC). 3

b) Define the term (***any two***): $1\frac{1}{2} \times 2$

i) Retardation Factor (R_f) in case of paper chromatography

ii) Distribution Coefficient in case of solvent extraction

iii) Absolute stability constant and apparent stability constant

c) Calculate the weight of Fe(III) left unextracted from 150 ml of a solution having 500 mg of Fe^{3+} ion in 5 M HCl after three extractions with 15 ml of diethyl ether in each step. [Given: D= 150]. 2

d) Mention two analytical reagents used in solvent extraction along with their specific application. 2