M. Sc. (Chemistry) Examination, 2023

(2nd Semester)

Inorganic Chemistry

Paper – VII

Time : Two hours Full Marks : 40

Use a separate answer script for each Unit.

UNIT – 2071 a & 2071 b

1. Answer the following questions:
   a) Calculate the *styx* number and draw the VB structure of the following :
   B_3H_9. $B_3H_6^+$ and $B_6H_6^{2-}$
   b) Predict the structural type with the aid of Wade's rule (***any three***):
   $[B_9H_{12}(NH)]^-$, $[Bi_5]^{3+}$, $[Rh_5P(CO)_{21}]^{2-}$, $[\{(OC)_4Cr\}_2C_2B_8H_{10}]$
   c) Determine the number of metal-metal bonds in the following clusters (***any two***):
   $[Os_5(CO)_{16}]$, $[Rh_2(OAc)_4]$, $[W_2Cl_9]^{3-}$
   d) Determine the structure of *closo*-parent cluster and number of capping group(s) in $[PtRh_8(CO)_{19}]^{2-}$ and $[RuOs_5(C)(CO)_{14}]^{2-}$ 3+3+2+2
2. Answer the following questions:
   a) Compare the ligating behavior of N_2 and CO. Describe the possible binding modes of N_2 with transition metals.

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

c) Describe the synthetic procedure of Creutz–Taube complex. Comment on the oxidation state(s) of Ru in the complex.

d) What are the binding modes of NO in metal nitrosyl complexes? Compare υ(NO) in different binding modes. (2+2)+2+2+2

UNIT – 2072 a & 2072 b

3. a) Predict, with explanation, the expected number of lines in the esr spectra of ***any two*** of the following:
   i) phenyl radical 2×2
   ii) pyrazine anion radical
   iii) $[VO(acac)_2]$

   b) What is TEMPO? Draw its structure and describe its esr spectral features and application. 3

   c) Naphthalene diradical shows a three-line esr spectrum. Describe the origin of the three lines, and also comment on their observed intensities. 2+1

4. a) Write a short note on Synergistic extraction. 2

   b) Define (***any two***): 3
   i) Retardation Factor (R_f) in case of paper chromatography

ii) Distribution Coefficient and Distribution Ratio in case of solvent extraction

iii) Absolute stability constant and apparent stability constant

c) In the extraction of Ce(IV) with 2-thenoyltrifluoroacetone in benzene, the distribution ratio was 999. If the volume of organic phase was 15 ml and that of aqueous phase 60 ml, what is the percentage of extraction? 2

d) How will you determine the exchange capacity of cation exchange resin? 2

e) Mention a noteworthy application of Size Exclusion Chromatography (SEC). 1