6. a) MnO_2 is fused with fusion mixture and pinch of KNO_3 is added followed by extraction in dil. H_2SO_4. Give balanced chemical reactions and explain with reasons of colour changes. **2**

    b) What happens when CH_3I is added to THF solution of $Fe(CO)_5$ in presence of metallic sodium and $AlEt_3$ at dry oxygen free condition followed by passage of CO and addition of mineral acid ? Write chemical reaction of the steps. **3**

    c) Write notes on "Oxygen evolving complexes". **2**

7. a) Why Ni(II) or Pt(II) always forms four coordinated compound and attempt to produce six coordination complexes are mostly failed. Discuss mentioning the geometry of the aforesaid coordination compound. **2**

    b) In case of $[ML_6]^{n+}$ compound, show the molecular orbital energy diagram considering six ligand group orbital. Also show the relevance of the CFT approach with this MO diagram. **2+1**

    c) What is octahedral site selection energy ? Considering the said energy how do you comment on the stability of octahedral/tetrahedral coordination compounds of Fe(II) and Fe(III). **2**

FINAL B. SC. EXAMINATION, 2019

(1st Semester)
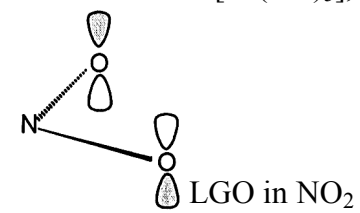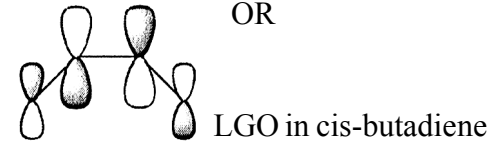
CHEMISTRY (HONOURS)

INORGANIC CHEMISTRY

PAPER - XIII

Time : Two hours   Full Marks : 50

1. a) Find out the Symmetry Point group of the following species :

    i) H_2O_2 **OR** cis-$[Co(en)_3]^{3+}$

    ii) S_4N_4 **OR** $[IO_2F_6]^{2-}$ **2**

    b) Find out orbital symmetry of the AO/LGO with justification :

    i) $3dz^2$ AO of Fe in $[Fe(CO)_5]$,

    ii) LGO in NO_2 **2**

OR

    i) LGO in cis-butadiene,

    ii) 3p AO of P in PCl_5 **2**

c) Determine the group multiplication table of C_{2h} point group using matrix multiplication method. 2

d) How do you convert a perfect octahedral MA_6 complex to C_{2v} point by substitution with a different ligand, B ? 1

2. a) $[CrF_6]^{3-}$ exhibits three bands at 14900, 22700 and 34400 cm^{-1} respectively. Assign the bands and hence calculate 10 Dq, the Racah parameter, B, and configurational interaction, C. 4

b) Why the experimental magnetic moments of $[CoI_4]^{2-}$, $[CoBr_4]^{2-}$ and $\left[CoCl_4\right]^{2-}$ have been recorded as 4·77, 4·65 and 4·59 BM respectively, which is quite higher than the $\mu_{s.o.}$ (3·87 BM) of the metal ion. 2

c) Why the pertechnetate, $[TcO_4]^-$ ion is pale red while permanganate, $[MnO_4]^-$ ion is intense purple. 1

3. a) Discuss the procedure with reactions, in appropriate cases, of the isolation of ruthenium, osmium, rhodium, iridium, palladium and platinum from the 'Anode sludge'.

3

b) Discuss about monomer-oligomer equilibria of nickel complexes with appropriate examples. Comment on the change of magnetic behavior. 2

c) Cite main features of Type 1 and Type 2 copper proteins with examples. 2

4. a) Mention two reasons why the mechanism for alpha decay could not be explained by classical mechanics ? How was it explained ? With suitable assumptions, derive the mathematical expression for the decay constant λ for the process. $1 + \frac{1}{2} + 1\frac{1}{2}$

b) Name the energy terms associated with the liquid drop model of the nucleus. Which of these change significantly when a nucleus undergoes fission ? $1\frac{1}{2} + \frac{1}{2}$

c) Mention two difference between fission and spallation. 1

d) Show that the temperature necessary to initiate fusion, is of the order $\sim 10^8$ K ; with suitable assumptions. 1

5. a) What is Zeigler-Natta catalyst ? Discuss the probable mechanism for its functioning. 2+1

b) How very pure titanium can be extracted from its important ore (give flow-chart only) ? 1

c) Magnetic susceptibility measurement indicates that chromium(II) acetate monohydrate is diamagnetic in nature. How will you take into account the observed result ? 2

d) Write a short note on polyvanadates. 2