NRT/KS/19/2171

Bachelor of Science (B.Sc.) Semester—VI Examination
CH-601 : INORGANIC CHEMISTRY
Compulsory Paper—1
(Chemistry)

Time : Three Hours]　　　　　　　　　　　　　　　　　　[Maximum Marks : 50

N.B. :— (1) All *five* questions are compulsory and carry equal marks.

　　　　(2) Write equations and draw diagrams wherever necessary.

1. (A) What are the postulates of CFT ? How does the 'd' orbitals splitting of octahedral complexes takes place ? Explain with suitable example. 　　5

　　(B) State and explain the following with examples :

　　　　(i) Laporte selection rule

　　　　(ii) Spin selection rule and

　　　　(iii) Hole formalism principle. 　　5

OR

　　(C) On the basis of CFT, explain, why tetrahedral complexes have lower 10 Dq than octahedral complexes ? 　　2½

　　(D) Calculate CFSE for the following :

　　　　(i) d^7 weak field octahedral and

　　　　(ii) d^5 tetrahedral. 　　2½

　　(E) Discuss the visible absorption spectrum of $[Cu(H_2O)_6]^{2H}$ with respect to intensity and width of band. 　　2½

　　(F) Write a note on spectrochemical series. 　　2½

2. (A) Explain the following using CFT :

　　　　(i) $[CoF_6]^{3-}$ is paramagnetic, while $[Co(NH_3)_6]^{3+}$ is diamagnetic and

　　　　(ii) $[Ni(CN)_4]^{2-}$ is diamagnetic while $[NiCl_4]^{2-}$ is paramagnetic. 　　5

　　(B) (i) What is chelate effect ? How does it affect the stability of the complexes ?

　　　　(ii) Explain the thermodynamic and kinetic stability of complexes with suitable example. 　　5

OR

　　(C) Identify the following configurations which have quenching towards orbital moments :

　　　　(i) $t2g^2$

　　　　(ii) $t2g^3eg^2$

　　　　(iii) $t2g^3$

　　　　(iv) $t2g^4eg^2$. 　　2½

　　(D) Describe the method for determination of magnetic susceptibility of metal complex by Gouy's method. 　　2½

　　(E) Explain why stability constant value decreases in order :

　　　　$[Cu(trien)]^{2+} > [Cu(en)_2]^{2+} > [Cu(NH_3)_4]^{2+}$ 　　2½

　　(F) Derive relationship between stepwise and overall stability constant. 　　2½

3. (A) State Beer-Lambert's law. Write its mathematical expression. The molar absorptivity of the solution is 2.5×10^2 dm^3 mol^{-1} cm^{-1}. If a solution has an absorbance of 0.85 in a cell of 1 cm length. Calculate :
    (i)   Transmittance and
    (ii) Concentration of solution.   5

    (B) Define chromatography. Give the principle and technique involved in ascending paper chromatography.   5

OR

    (C) Define the following terms :
    (i)   Elution
    (ii) Retardation factor and
    (iii) Mobile phase.   2½

    (D) Draw a well labelled schematic diagram of single beam spectrophotometer.   2½

    (E) Define ion-exchange capacity. How is ion exchange capacity determined for cation exchange resin ?   2½

    (F) Discuss qualitative applications of photoelectric colorimeter in estimation of Cu(II) as copper ammonia complex.   2½

4. (A) What do you mean by silicones ? Explain synthesis of straight chain and cross-linked silicones.   5

    (B) (i) Discuss structure and bonding in $(NPCl_2)_3$.
        (ii) What are poly-phosphazenes ? What is the action of the following on triphosphonitrilic chloride ?
             (a) Alcohol and
             (b) Excess of ammonia.   5

OR

    (C) Give one method for preparation of silicone resins. Write its two uses.   2½

    (D) Write a note on silicone elastomer.   2½

    (E) Give uses of phosphonitrilic halides.   2½

    (F) What is the action of the following :
        (i) Benzene and
        (ii) Sodium alkoxide on $(NPCl_2)_3$?   2½

5. Attempt any **ten** of the following :
    (i)   Define degenerate orbitals.
    (ii)   How does CFSE varies with change in oxidation state of central metal ion ?
    (iii) Why is $[Ti(H_2O)_6]^{3+}$ purple coloured ?
    (iv)   Calculate magnetic moment of Cr^{3+} (Z = 24).
    (v)   Define molar magnetic susceptibility.
    (vi)   Why are octahedral complexes of Co(III) more stable than Co(II) ?
    (vii) Define optical density and transmittance.
    (viii) Calculate absorbance if %T is 60%.
    (ix)   Define solvent extraction technique.
    (x)   Give the chemical formula of the following silane :
           (a) Methyltrichlorosilane
           (b) Dimethylsilanol.
    (xi)   What is RTV and HTV ?
    (xii) What do you mean by liquid rubber ?   1×10=10