AC-233609

M.Sc. (Semester-I) Examination, Dec.-Jan., 2025-26

CHEMISTRY

(Inorganic Chemistry-I)

Time Allowed : Three Hours

Maximum Marks : 70

Note : This question paper is divided into four sections. All sections are **compulsory**. Attempt questions as per instructions given in each sections. Distribution of marks is given in each section.

SECTION-A

(Objective Type Questions)

Note : Attempt **all** questions. Each question carries **1** mark.

[10×1=10]

1. (A) Choose the correct alternative :

(i) Which of the following molecule belongs the $D\infty h$ point group?

    (a) H_2O

    (b) NH_3

    (c) CO_2

    (d) CH_4

(ii) The character of an identity operation (E) in a character table is equal to the :

    (a) Order of the group

    (b) Number of Irreducible representations

    (c) Dimensions of the irreducible representations

    (d) Number of symmetry classes

(iii) Which of the following statement is true for $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ based on VBT:

    (a) Both have the same hybridisation

    (b) Both are diamagnetics

    (c) They have different geometries

    (d) They have the same number of unpaired electron

(iv) The experimental value of magnetic moment of metal ion in $[Fe(CN)_6]^{4-}$ will be :

    (a) 5.92 BM

    (b) 4.90 BM

    (c) 0.00 BM

    (d) 2.84 BM

(v) In $[Fe(CN)_5(NO)]^{2-}$ complex ion, oxidation state of Fe is :

    (a) +6

    (b) +2

    (c) +3

    (d) Zero

(vi) The bright yellow colour of $[C_+(Phen)_2]^+$ is due to :

(phen = 1, 10-phenanthroline)

    (a) d-d transition

    (b) Metal to ligand change transfer

    (c) Ligand to metal change transfer

    (d) π to π^α transition in the phenanthroline ligand

(vii) Ferromagnetic behaviour of a substance exist upto a certain temperature which is called :

    (a) Boyle temperature

    (b) Neel temperature

    (c) Curie temperature

    (d) Inversion temperature

(viii) Correct relation is :

    (a) $B = H + 4\pi I$

    (b) $H = B + 4\pi I$

    (c) $B - H = 4\pi I$

    (d) $B + H = 4\pi I$

(ix) Stability of a complex does not depend on :

    (a) Nature of the central metal ion

    (b) Number of chelate rings

    (c) Mass of the complex

    (d) Steric effects

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(x) Which of the following complex has zero CFSE?

    (a) $\left[CO(H_2O)_6\right]^{3+}$, low spin

    (b) $\left[Fe(H_2O)_6\right]^{3+}$, high spin

    (c) $\left[CO(H_2O)_6\right]^{2+}$, high spin

    (d) $\left[Mn(H_2O)_6\right]^{3+}$, high spin

SECTION-B

(Very Short Answer Type Questions)

Note : Attempt any five questions. Each question carries 2 marks. (Word limit : 25-30 words)   [5×2=10]

2. (i) What are the reducible and irreducible representations?

    (ii) Write character table for C_2h point group.

    (iii) Why $K_2\left[PtCl_6\right]$ does not gives white ppt. of agel with $AgNO_3$?

    (iv) Calculate the CFSE for d^7 octahedral complex in both fields.

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(v) Calculate total no. of micro states for d^5 ion.

(vi) Find out the spin only magnetic moment of Ni^2 in $\left[Ni\left(H_2O\right)_6\right]^{2+}$.

(vii) Draw splitting diagram for Square Planar Complexes.

SECTION-C

(Short Answer Type Questions)

Note : Attempt **any five** questions. Each question carries **4** marks. (Word limit : **250** words)   [5×4=20]

3. (i) MnO_4^- and $\left[Ti\left(H_2O\right)_6\right]^{3+}$ are coloured but reason for their colour are different. Explain.

(ii) Why $\left[Ni\left(en\right)_3\right]^{2+}$ is more stable than $\left[Ni\left(NH_3\right)_6\right]^{2+}$?

(iii) What are the rules for the set of the elements to be called group?

(iv) $\left[NiCl_4\right]^{2-}$ is paramagnetic. Explain with the help of VBT.

(v) Describe the representations of group by matrices.

(vi) Calculate Jahn-Teller stabilisation energy for Tetragonally elongated distorted octahedral comlexes.

(vii) Describe orbital contribution to the magnetic moment.

SECTION-D

(Long Answer Type Questions)

Note : Attempt **any three** questions. Each question carries **10** marks.(Word limit : **500** words)   [3×10=30]

4. (i) (a) Describe the great orthogonality Theorem and its importance.

(b) Explain point groups with suitable examples.

(ii) (a) Construct a molecular orbital diagram for octahedral complex (sigma bonding). Highlight the ligand and metal character orbital.

(b) What is the consequence of π bonding on the Δ_0 values in octahedral complexes?

(iii) (a) Determine ground state term symbol for d^3 configuration.

(b) Draw orgel energy level diagram for d^1 and d^9 octrahedral complexes.

(iv) (a) Explain determination of binary formation constant by spectrophotometry.

(b) What is Charge Transfer? Explain MLCT and LMCT with suitable examples.

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