

M.Sc. CHEMISTRY
Second Semester
INORGANIC CHEMISTRY-II
(MSC - 203)

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive) =50

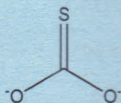
(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

Answer any four from Question no. 2 to 8
Question no. 1 is compulsory.

- (a) Prove that the product of any two group operations must also be a member of the group.
(b) Write short notes on tungsten blue and tungsten bronze. (5×2=10)
- (a) Find the classes of symmetry elements and the point group of the molecule-



- (b) Explain what is Chelate and Macrocyclic effect? (5×2=10)
- (a) If a point has coordinate (x, y, z), and you carry out a rotation C_2 (Z), the new coordinate are say (X', y', z') Express the operation in matrix format.
(b) Explain how to determine the stability constant of a complex by Jobs method. (5×2=10)
4. Explain the structure of Ammonia (NH₃) molecule with symmetry adopted linear combination of atomic orbital. (10)
5. Find the IR and Raman active vibrations of H₂O molecule by finding the reducible and irreducible representations. (10)

6. What is called ion-exchange chromatography? Explain the principle, types and application of this type of chromatography. (10)
7. Explain details of dinitrogen and dioxygen complexes. (5×2=10)
8. (a) What are metal carbonyl complexes? Discuss structure and bonding of these complexes with examples. (5×2=10)
- (b) Find the multiplier associated with the symmetry operation E, C₂, σ_{xz}, σ_{yz}, for a p_y orbital and hence its irreducible representation for C_{2v} point group.

Character table for C_{2v} point group

	E	C ₂ (z)	σ _v (xz)	σ _v (yz)	linear, rotations	quadratic
A ₁	1	1	1	1	z	x ² , y ² , z ²
A ₂	1	1	-1	-1	R _z	xy
B ₁	1	-1	1	-1	x, R _y	xz
B ₂	1	-1	-1	1	y, R _x	yz

Character Table for C_{3v}

C _{3v}	E	2C ₃	3 σ _v	
A ₁	1	1	1	z
A ₂	1	1	-1	R _z
E	2	-1	0	(x, y)(R _x , R _y)

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Duration: 20 minutes

Marks – 20

(PART A - Objective Type)

I. Choose the correct answer:

1×20=20

- For C_{4v} point group what will be the representation if the character values are-
 $X(C_4) = -1$, $X(C_2) = 1$ and $X(\sigma_v) = 1$
(i) A_1 (ii) A_2 (iii) B_1 (iv) B_2
- For D_{3h} point group what will be the representation if the character values are-
 $X(C_3) = +1$ and $X(C_2) = +1$ and $X(\sigma_h) = -1$
(i) A_1' (ii) A_2' (iii) A_1'' (iv) A_2''
- For Sn, n is always 3 or larger because $S_1 = \dots\dots\dots$ and $S_2 = \dots\dots\dots$, respectively are-
(i) C_2, i (ii) i, C_2 (iii) σ, i (iv) i, σ
- The plane of symmetry parallel to the principal rotational axis and bisecting the angle between two C_2 axis is called the-
(i) σ_d (ii) σ_v (iii) σ (iv) σ_h
- Each operation is performed relative to a point, line or.....called a symmetry element.
(i) plane (ii) angle
(iii) rotation (iv) reflection
- Match the point group symmetry of following molecules- CO_2, CH_4, XeF_4, PF_5 .
(i) $D_{ah}, T_d, D_{4h}, D_{3h}$ (ii) $D_{ah}, T_d, D_{3h}, D_{4h}$
(iii) $D_{ah}, D_{3h}, T_d, D_{4h}$ (iv) $D_{ah}, D_{3h}, D_{4h}, T_d$
- For diamagnetic $(1,10\text{-phenanthroline})_3Fe^{(II)}$ complex, $K_3 > K_2$, for the change from bis- to tris- complex, because of-
(i) change in hybridization (ii) steric factor
(iii) statistical factor (iv) high spin - low spin change
- Which is correct Irving Williams's series?
(i) $Mn^{2+} > Fe^{2+} > Co^{2+} > Ni^{2+} > Cu^{2+} > Zn^{2+}$
(ii) $Mn^{2+} > Fe^{3+} > Co^{2+} > Ni^{2+} > Cu^{2+} < Zn^{2+}$
(iii) $Mn^{2+} < Fe^{2+} < Co^{2+} < Ni^{2+} < Cu^{2+} > Zn^{2+}$
(iv) $Mn^{2+} < Fe^{3+} < Co^{3+} < Ni^{2+} < Cu^{2+} > Zn^{2+}$
- The number of IR active ν_{CO} stretching for $M(CO)_6$ complex is-
(i) one (ii) two (iii) three (iv) six

- The Point group symmetry of CH_2ClBr is-
(i) C_1 (ii) C_s (iii) T_d (iv) C_i
- The order of O_h point group is-
(i) 24 (ii) 36 (iii) 48 (iv) 12
- An octahedral complex on elongation or contraction in one C_4 axis changes the point group symmetry to-
(i) D_{2h} (ii) D_{3h} (iii) D_{4h} (iv) O_h
- The commonly used chromatographic methods for qualitative drug analysis are-
(i) GLC (ii) TLC (iii) HPLC (iv) All of the above
- Which of the following are the basic mobile phases for paper chromatography?
(i) Water- phenol (ii) Formamide -chloroform
(iii) Formamide-benzene (iv) All of the above
- Which of the following materials are used as binders in TLC?
(i) Plaster of paris (ii) Starch
(iii) Plastic dispersion (iv) All of the above
- Anion exchange resins with similar inorganic groups are-
(i) Quaternary ammonium salt (ii) Tertiary ammonium salt
(iii) Quarternary sulphonium salt (iv) All of the above
- Column for gas- liquid chromatography can fabricated from-
(i) Glass (ii) Stainless steel
(iii) Copper (iv) All of the above
- Maximum magnetic moment shown by-
(i) d^5 (ii) d^6 (iii) d^7 (iv) d^8
- Which of the following metals has more than one oxidation state?
(i) Ca (ii) Sr (iii) Mn (iv) Zn
- Which of the following does not form isopoly acid in acidification?
(i) Na_2MoO_4 (ii) Na_2WO_4
(iii) Na_2CrO_4 (iv) Na_3VO_4
