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St. WILFRED'S P.G. COLLEGE
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Academic Calendar (Session 2022-23)

Date	Day	Particular	College Activity (Proposed)
7/1/2022	Friday		Career and Counselling Session for School Students
7/2/2022	Saturday		
7/10/2022	Sunday	Id-ul-Zuha(Bakrid)/RH	
7/13/2022	Wednesday	Guru Purnima	Guru Purnima Celebration on 13 July / Guidance and Counselling Session for School Students
7/14/2022	Thursday		
7/18/2022	Monday		Faculty Development Program
7/19/2022	Tuesday		
7/20/2022	Wednesday		
7/21/2022	Thursday		
7/22/2022	Friday		
7/25/2022	Monday		Career Guidance Session for School Students / Starting of the Session for UG II, III Year Students and PG Final Year Students
7/29/2022	Friday		Felicitation of BSc II Students
7/30/2022	Saturday		Career Guidance Session for School Students
8/2/2022	Tuesday		Welcome and Orientation Day for New UG Students
8/3/2022	Wednesday		Starting of New Session (2022-23) for UG Students
8/6/2022	Saturday		Alumni Association Cell meeting
8/8/2022	Monday		Orientation Day for New PG Students
8/9/2022	Tuesday	Muharram Holiday/RH	Plantation Day by NSS Wing
8/10/2022	Wednesday		Rakhi Making Competition
8/11/2022	Thursday	Raksha Bandhan Holiday	
8/13/2022	Saturday		Lecture on Gender Sensitization and Women Empowerment in Institutes of Higher Education
8/15/2022	Monday		Independence Day Celebration
8/16/2022	Tuesday		Regular Competitive Classes
8/18/2022	Thursday		Celebration of Janmashtmi
8/19/2022	Friday	Janmashtmi Holiday	
8/20/2022	Saturday		Special Motivational Lecture
8/24/2022	Wednesday		Sports Activity

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8/27/2022	Saturday		Resume Building Session by Training & Placement Cell
8/31/2022	Wednesday	Ganesh Chaturthi RH	Ganesh Chaturthi Celebration
9/3/2022	Saturday		Personality Development and Professional Ethics Session by Student Development Cell
9/5/2022	Monday		Teacher's Day Celebration / Commencement of Value Added Course on Certificate in Vocal/ Instrumental)
9/6/2022	Tuesday		Orientation Programme of NSS
9/12/2022	Monday		Commencement of value added course "Certificate in Artificial intelligence"
9/14/2022	Wednesday		Essay Writing on Hindi Divas/ Commencement of value added courses (Certificate program in Digital Marketing, Life Skills for Computer Professionals, Personality Development and Inter - Personal Skill Course)
9/16/2022	Friday		One Day Seminar "How To Crack Interview"
9/17/2022	Saturday		Remedial Classes
9/24/2022	Saturday		Celebration of NSS Day/ Blood Donation Camp by NSS Wing
9/26/2022	Monday	Navratri Sthapana Holiday	
9/28/2022	Wednesday		Road Safety Awareness Programme
10/1/2022	Saturday		Dandia & Garba Night
10/3/2022	Monday	Durgashtmi Holiday	
10/4/2022	Tuesday		Swachh Bharat Abhiyan by NSS Wing
10/5/2022	Wednesday	Dussehra Holiday	
10/7/2022	Friday		Wild Life Week Celebration
10/8/2022	Saturday		Remedial Classes
10/12/2022	Wednesday		Free Vaccination Camp by NSS Wing / Fashion Show
10/21/2022	Friday		Rangoli Competition & Diwali Celebration
10/22/2022	Saturday	Dhanteras Holiday	Diwali Break
10/23/2022	Sunday	Chhoti Diwali Holiday	
10/24/2022	Monday	Diwali Holiday	

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10/25/2022	Tuesday	Goverdhan Pooja Holiday	
10/26/2022	Wednesday	Bhai Dooj	
10/28/2022	Friday		Academic Audit
11/8/2022	Tuesday	Guru Nanak's Jayanti/RH	
11/12/2022	Saturday		Picnic for UG & PG Students
11/14/2022	Monday		Children's Day Celebration
11/15/2022	Tuesday		Yoga and Stress Management Program by NSS and Student Development Cell
11/17/2022	Thursday		Sports Activity
11/18/2022	Friday		
11/19/2022	Saturday		Fresher's Party (November 19th, 2022)
11/22/2022	Tuesday		Internal Assessment for UG & PG Students/Samvidhan Divas by NSS Wing (November 26th, 2022)
11/23/2022	Wednesday		
11/24/2022	Thursday		
11/25/2022	Friday		
11/26/2022	Saturday		
12/1/2022	Thursday		International AIDS Day- Rally and Poster Competition
12/2/2022	Friday		PTM for All Streams
12/3/2022	Saturday		Free Vaccination Camp by NSS Wing / Remedial Classes
12/5/2022	Monday		Blood Donation Camp by NSS Wing
12/10/2022	Tuesday		Happy Nagari Activity by Psychology Department
12/11/2022	Sunday		Mountaineering Programme for NCC Wing (Jhalana Doongri/Nahargarh)
12/14/2022	Wednesday		Educational Trip (Masoori-Dehradoon) for UG & PG Students
12/15/2022	Thursday		
12/16/2022	Friday		
12/17/2022	Saturday		
12/19/2022	Monday		Awareness Rally for Organ & Eye Donation Campaign (NCC Wing)
12/22/2022	Thursday		Mathematics Day Celebration
12/24/2022	Saturday		Christmas Day Celebration
12/25/2022	Sunday	Christmas Day Holiday	
12/31/2022	Saturday	Winter Holiday	

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1/2/2023	Monday		New Year Celebration
1/3/2023	Tuesday		Disaster Management One Day Workshop by NSS Wing / Launch of College Annual Magazine
1/12/2023	Thursday		National Youth Day Celebration by NSS wing/ Inter-college Commerce and Management Quest: COMXPLORE
1/13/2023	Friday		Lohri Celebration
1/14/2023	Saturday	Makar-Sankranti Holiday	
1/17/2023	Tuesday		Workshop on Chemical free environment/ Chemistry Olympiad Inter-College Competition (Poster, Quiz & Collage)
1/21/2023	Saturday		Inter College Science Exhibition(SCIENTIA-2023)
1/26/2023	Thursday	Republic Day Holiday	Republic Day & Basant Panchami Celebration
1/27/2023	Friday		FDP on Soft Skills and Research methodology (27, 28 and 30th January 2023)
1/28/2023	Saturday		Youth Parliament Activity done by Political Science Department
1/30/2023	Monday		Academic Audit
2/1/2023	Wednesday		Pre University Examination for All Stream/ National Webinar on IPR Awareness (Feb 4th, 2023)
2/2/2023	Thursday		
2/3/2023	Friday		
2/4/2023	Saturday		
2/5/2023	Sunday		
2/6/2023	Monday		
2/7/2023	Tuesday		
2/8/2023	Wednesday		
2/9/2023	Thursday		Webinar on "NEP 2020" from 07 February to 14 February
2/11/2023	Saturday		PTM for All Streams
2/15/2023	Wednesday		Commencement of UOR Practical Examination
2/16/2023	Thursday		Alumni Meet for UG
2/17/2023	Friday		Alumni Meet for PG
2/18/2023	Saturday	Mahashivratri Holiday	
2/25/2023	Saturday		National Seminar on "NEP 2020: A Futuristic Approach for Youth Empowerment"
2/28/2023	Tuesday		PANACHE- 2023 Inter College Cultural Fest
3/1/2023	Wednesday		
3/2/2023	Thursday		

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3/3/2023	Friday		Farewell Party for UG and PG Department (Science, Arts, Commerce)
3/5/2023	Sunday		India Largest Science Talent Search Examination Vidyarthi Vigyan Manthan
3/6/2023	Monday		Holi Celebration
3/7/2023	Tuesday	Holi Holiday	
3/8/2023	Wednesday	Dhulandi Holiday	
3/13/2023	Monday		Submission of Dissertation by Students
3/14/2023	Tuesday		Commencement of Preparation Leave for University Examination for UG students
3/15/2023	Wednesday		Commencement of Preparation Leave for University Examination for PG students
4/17/2023	Monday		Campus interview for students and Internship opportunity by Training and Placement Cell and Department of Computer Science
5/29/2023	Monday		Career Counselling session for school students
5/30/2023	Tuesday		
5/31/2023	Wednesday		Workshop on "No Tobacco Day"
6/05/2023	Monday		Plantation day on World Environment Day
6/14/2023	Wednesday		Placement Drive
6/16/2023	Friday		AWS Training
6/17/2023	Saturday		AWS Training
6/21/2023	Wednesday		International Yoga Day celebration
6/26/2023	Monday		Career Counselling session for school students
6/27/2023	Tuesday		
6/30/2023	Friday		Final Result Declaration

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Academic Calendar (Session 2022-23)

Department of Science

Date	Day	Particular	College Activity (Proposed)	Department Activity (Science)
7/1/2022	Friday		Career and Counselling session for school students	
7/2/2022	Saturday			
7/10/2022	Sunday	Id-ul-Zuha (Bakrid)/RH		
7/11/2022	Monday			Department Academic Committee meeting
7/13/2022	Wednesday	Guru Purnima	Career Guidance Session for School Students	
7/18/2022	Monday		Faculty Development Program	
7/19/2022	Tuesday			
7/20/2022	Wednesday			
7/21/2022	Thursday			
7/22/2022	Friday			
7/25/2022	Monday		Career Guidance Session for School Students / Starting of the Session for UG II, III year Students and PG final year students	
7/29/2022	Friday		Felicitation of UG II Students	
7/30/2022	Saturday		Career Guidance Session for School Students	
8/2/2022	Tuesday		Welcome and Orientation Day for New UG Students	
8/3/2022	Wednesday		Starting of New Session (2022-23) for UG Students	
8/6/2022	Saturday		Alumni association cell meeting	
8/8/2022	Monday		Orientation Day for New PG Students	
8/9/2022	Tuesday	Muharram Holiday/RH	Plantation Day by NSS Wing	
8/10/2022	Wednesday		Rakhi Making Competition	
8/11/2022	Thursday	Raksha Bandhan Holiday		

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8/12/2022	Friday			Video Lecture by Department of Psychology for UG students
8/13/2022	Saturday		Lecture on Gender Sensitization and Women Empowerment in Institutes of Higher Education	
8/15/2022	Monday		Independence Day Celebration	
8/16/2022	Tuesday		Regular Competitive Classes	
8/17/2022	Wednesday			PPT Presentation by Department of Physics for UG I students
8/18/2022	Thursday		Celebration of Janmashtmi	
8/19/2022	Friday	Janmashtmi Holiday		
8/20/2022	Saturday		Special Motivational Lecture	
8/24/2022	Wednesday		Sports activity	
8/27/2022	Saturday		Resume Building Session by Training & Placement Cell	
8/31/2022	Wednesday	Ganesh Chaturthi RH	Ganesh Chaturthi Celebration	
9/1/2022	Thursday			Video Lecture by Department of geography for UG students
9/3/2022	Saturday		Personality Development and Professional Ethics Session by Student Development Cell	
9/5/2022	Monday		Teacher's Day Celebration / commencement of value added course on certificate in Vocal/ Instrumental)	
9/6/2022	Tuesday		Orientation Programme of NSS	
9/7/2022	Wednesday			Video Lecture by Department of Chemistry
9/8/2022	Thursday			PPT Presentation by Department of

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				Chemistry for UG I students
9/9/2022	Friday			Lecture by Alumni
9/12/2022	Monday		Commencement of value added course on certificate in Artificial intelligence)	
9/14/2022	Wednesday		Essay Writing on Hindi Divas/ Commencement of value added courses (Certificate program in digital marketing, life skills for computer professionals, Personality development and Inter - personal skill course)	
9/16/2022	Friday		One Day Seminar "How To Crack Interview"	
9/17/2022	Saturday		Remedial Classes	Lecture by Alumni
9/21/2022	Wednesday			Video Lecture by Department of Botany
9/22/2022	Thursday			Visit to Botanical Garden for B.Sc. I Students
9/24/2022	Saturday		Celebration of NSS Day/ Blood Donation Camp by NSS Wing	Remedial Classes
9/26/2022	Monday	Navratri Sthapana Holiday		
9/28/2022	Wednesday		Road Safety Awareness Programme	
9/29/2022	Thursday			Video Lecture by Department of Botany for UG students
9/30/2022	Friday			PPT Presentation by Department of Mathematics for UG I students
10/1/2022	Saturday		Dandia & Garba Night	
10/3/2022	Monday	Durgastmi Holiday		
10/4/2022	Tuesday		Swachh Bharat Abhiyan by NSS Wing	
10/5/2022	Wednesday	Dussehra Holiday		
10/6/2022	Thursday		Wild Life Week Celebration	Celebrate Wild Life Week Nahargarh Biological Park
10/7/2022	Friday			
10/8/2022	Saturday		Remedial Classes	Remedial Classes

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10/12/2022	Wednesday		Free Vaccination Camp by NSS Wing / Fashion Show	Debate Competition (Inter Class) for B.Sc. I Students
10/13/2022	Thursday			Guest Lecture by Eminent Educationist for B.Sc. I Students
10/17/2022	Monday			PPT Presentation by Department of Botany for UG I students
10/18/2022	Tuesday			Video Lecture by Department of Physics
10/21/2022	Friday		Rangoli Competition & Diwali Celebration	
10/22/2022	Saturday	Dhanteras Holiday	Diwali Break	
10/23/2022	Sunday	Chhoti Diwali Holiday		
10/24/2022	Monday	Diwali Holiday		
10/25/2022	Tuesday	Goverdhan Pooja Holiday		
10/26/2022	Wednesday	Bhai Dooj		
10/28/2022	Friday		Academic Audit	
10/31/2022	Monday			Video Lecture by Department of Zoology for UG students
11/3/2022	Thursday			PPT Presentation by Department of Environmental Science for UG I students
11/8/2022	Tuesday	Guru Nanak's Jayanti/RH		PPT Presentation by Department of Physics
11/9/2022	Wednesday			Department Academic Committee meeting
11/12/2022	Saturday		Picnic for UG & PG Students	
11/14/2022	Monday		Children's Day Celebration	
11/15/2022	Tuesday		Yoga and Stress Management Program by NSS and Student Development Cell	
11/16/2022	Wednesday			PPT Presentation by Department of Mathematics
11/17/2022	Thursday		Sports Activity	
11/18/2022	Friday			
11/19/2022	Saturday		Fresher's Party (November 19th, 2022)	
11/21/2022	Monday		Internal Assessment for UG & PG Students/Samvidhan	
11/22/2022	Tuesday			
11/23/2022	Wednesday			
11/24/2022	Thursday			

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11/25/2022	Friday		Divas by NSS Wing (November 26th, 2022)	
11/26/2022	Saturday			
11/28/2022	Monday			Video Lecture by Department of Physics for UG students
11/30/2022	Wednesday			PPT Presentation by Department of Zoology for UG I students
12/1/2022	Thursday		International AIDS Day-Rally and Poster Competition	
12/2/2022	Friday		PTM for All Streams	
12/3/2022	Saturday		Remedial Classes / Free Vaccination Camp by NSS Wing / Remedial Classes	Remedial Classes
12/5/2022	Monday		Blood Donation Camp by NSS Wing	
12/6/2022	Tuesday			
12/7/2022	Wednesday			PPT Presentation by Department of Psychology for UG I students
12/10/2022	Saturday			Problem Solving Classes
12/11/2022	Sunday		Mountaineering Programme for NCC Wing (Jhalana Doongri/Nahargarh)	
12/12/2022	Monday			Video Lecture by Department of Statistics for UG students
12/14/2022	Wednesday		Educational Trip (Masoori-Dehradoon) for UG & PG Students	
12/15/2022	Thursday			
12/16/2022	Friday			
12/17/2022	Saturday			
12/19/2022	Monday		Awarness Rally for Organ & Eye Donation Campaign (NCC Wing)	
12/22/2022	Thursday		Mathematics Day Celebration	Video Lecture by Department of Geology
12/23/2022	Friday			PPT Presentation by Department of Zoology
12/24/2022	Saturday		Christmas Day Celebration	
12/25/2022	Sunday	Christmas Day Holiday		
12/28/2022	Wednesday			Industrial Tour by UG & PG by Chemistry Department

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12/30/2022	Friday			Educational Trip (Kulish Smriti Van, Jaipur) for UG & PG Students by Life Science Department
12/31/2022	Saturday	Winter Holiday		
1/2/2023	Monday		New Year Celebration	
1/3/2023	Tuesday		Disaster Management One Day Workshop by NSS Wing /	Guest Lecture Delivered by Eminent Prof. from UOR by Chemistry & Mathematics Department
1/5/2023	Thursday			Video Lecture by Department of Mathematics for UG students
1/7/2023	Saturday			Guest lecture Delivered by Eminent Prof. from UOR (Department of Botany and Zoology)
1/9/2023	Monday			PPT Presentation by Department of Geology for UG I students
1/12/2023	Thursday		National Youth Day Celebration by NSS wing/ Inter-college Commerce and Management Quest: COMXPLORE	
1/13/2023	Friday		Lohri Celebration	
1/14/2023	Saturday	Makar-Sankranti Holiday		
1/16/2023	Monday			PPT Presentation by B.Sc. Part-I students
1/17/2023	Tuesday		Workshop on Chemical free environment	Chemistry Olympiad Inter-College Competition (Poster, Quiz & Collage)
1/19/2023	Thursday			Guest Lecture Delivered by Eminent Prof. from UOR by Zoology Department
1/21/2023	Saturday		Inter College Science Exhibition(SCIENTIA-2023)	Inter College Science Exhibition(SCIENTIA-2023)
1/23/2023	Monday			Department Academic Committee meeting
1/25/2023	Wednesday			Video Lecture by Department of Chemistry for UG students
1/26/2023	Thursday	Republic Day Holiday	Republic Day & Basant Panchami Celebration	

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1/27/2023	Friday		FDP on Soft Skills and Research methodology (27, 28 and 30th January 2023)	Guest Lecture Delivered by Eminent Prof. from UOR by Department of Zoology
1/28/2023	Saturday		Youth Parliament Activity done by Political Science Department	
1/30/2023	Monday		Academic Audit	PPT Presentation by B.Sc. Part-I students
2/1/2023	Wednesday		Pre University Examination for All Stream/ National Webinar on IPR Awareness (Feb 4th, 2023)	
2/2/2023	Thursday			
2/3/2023	Friday			
2/4/2023	Saturday			
2/5/2023	Sunday			
2/6/2023	Monday			
2/7/2023	Tuesday			
2/8/2023	Wednesday			
2/9/2023	Thursday		Webinar on "NEP 2020" from 07 February to 14 February	
2/11/2023	Saturday		PTM for All Streams	
2/13/2023	Monday			PPT Presentation by B.Sc. Part-II students
2/15/2023	Wednesday		Commencement of UOR Practical Examination	
2/16/2023	Thursday		Alumni Meet for UG	
2/17/2023	Friday		Alumni Meet for PG	
2/18/2023	Saturday	Mahashivratri Holiday		
2/21/2023	Tuesday			PPT Presentation by students of B.Sc. Part III
2/25/2023	Saturday		National Seminar on"NEP 2020: A Futuristic Approach for Youth Empowerment"	
2/28/2023	Tuesday		PANACHE- 2023 Inter College Cultural Fest	
3/1/2023	Wednesday			
3/2/2023	Thursday			
3/3/2023	Friday		Farewell Party for UG and PG Department (Science, Arts, Commerce)	
3/5/2023	Sunday		India Largest Science Talent Search Examination Vidyarthi Vigyan Manthan	
3/6/2023	Monday		Holi Celebration	
3/7/2023	Tuesday	Holi Holiday		
3/8/2023	Wednesday	Dhulandi Holiday		

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3/13/2023	Monday		Submission of dissertation by Students	Seminar Presentation by students M.Sc. Zoology
3/14/2023	Tuesday		Commencement of Preparation Leave for University Examination for UG students	
3/15/2023	Wednesday		Commencement of Preparation Leave for University Examination for PG students	
3/16/2023	Thursday			Seminar Presentation by students M.Sc. Chemistry
4/17/2023	Monday		Campus interview for students and Internship opportunity by Training and Placement Cell and Department of Computer Science	
5/29/2023	Monday		Career Counselling session for school students	
5/30/2023	Tuesday			
5/31/2023	Wednesday		Workshop on "No Tobacco Day"	
6/05/2023	Monday		Plantation day on World Environment Day	
6/14/2023	Wednesday		Placement Drive	
6/16/2023	Friday		2 Days AWS Training	
6/17/2023	Saturday			
6/21/2023	Wednesday		International Yoga Day celebration	
6/26/2023	Monday		Career Counselling session for school students	
6/27/2023	Tuesday			
6/30/2023	Friday		Final Result Declaration	

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NAME OF DEPARTMENT: CHEMISTRY

Subject Choice Performa

Name of Faculty: Dr. Neetu Gaur **Session: 2022-23**

1. Qualification: M.Sc. · Bed. · PhD
2. Specialization: Inorganic Chemistry
3. Total experience: 11 years
4. Special training / FDP/Certification on concern and allied subject.

S.No.	Name of subject	Year	Name of Class	Experience in subject	Preference (1,2,3,4)	Result of Previous Year
1.	Inorganic Chemistry	2022-23	B.Sc I yr	11 years	4	85%
2.	Inorganic Chemistry	2022-23	B.Sc II yr	11 years	3	87%
3.	Inorganic Chemistry	2022-23	B.Sc III	11 years	2	91%
4.	Inorganic Chemistry	2022-23	M.Sc (Pr)	10 years	6	93%
5.	Ino. EVS	2022-23	M.Sc (F)	7 years	5	84%
6.	Bio-Inorg.	2022-23	M.Sc (F)	7 years	1	82%

Faculty HOD Principal

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DEPARTMENT OF CHEMISTRY

PG TIME TABLE

MSc Previous (chemistry)

Effective from - 6 October 2022

Room No: 311

Day/Time	8-9:00	9:- 10:00	10- 12:00	12-1:00	1-2:00	2-3:00	3-4:00	4-5:00
Monday	Paper-2 NJ	Paper-5 NG	LAB Paper-2 NJ	LIBRARY	Paper-1 NG	Paper-6 NJ	Paper-4 KR	Value Added Course
Tuesday	Paper-2 NJ	Paper-5 NG	LAB Paper-2 NJ	LIBRARY	Paper-1 NG	Paper-6 NJ	Paper-4 KR	Value Added Course
Wednesday	Paper-2 NJ	Paper-1 NG	LAB Paper-3 MS	LIBRARY	Paper-3 NJ	Paper-3 MS	Paper-4 KR	Value Added Course
Thursday	Paper-2 NJ	Paper-1 NG	LAB Paper-3 MS	SPORTS	Paper-3 NJ	Paper-3 MS		Value Added Course
Friday	Paper-2 NJ	Paper-1 NG	LAB Paper-1 NG	SPORTS	Paper-6 KR	Paper-6 NJ		Value Added Course
Saturday	Paper-2 NJ	Paper-1 NG	LAB Paper-1 NG	SPORTS	Paper-6 KR	Paper-6 NJ		Value Added Course

MS-Dr. MRIDULA SHARMA NJ- Dr. NUPUR JAIN NG- Dr. NEETU GAUR KR- KANHA RAM SAIN

Faculty Signature **HOD** **Principal**

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INDIVIDUAL TIME TABLE - Dr. Neetu Gaur

Room No: 311

Time Days	09:00-10:00	10:00-12:00	12:00-1:00	1:00-2:00
Monday	Paper-5 Green Chemistry NG		LIBRARY	Paper-1 Inorganic Chemistry NG
Tuesday	Paper-5 Green Chemistry NG		LIBRARY	Paper-1 Inorganic Chemistry NG
Wednesday	Paper-1 Inorganic Chemistry NG		LIBRARY	
Thursday	Paper-1 Inorganic Chemistry NG		SPORTS	
Friday	Paper-1 Inorganic Chemistry NG	LAB Paper-1 NG	SPORTS	
Saturday	Paper-1 Inorganic Chemistry NG	LAB Paper-1 NG	SPORTS	

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Syllabus

M.Sc. I YEAR (PREVIOUS)

Paper I : CH - 401 Inorganic Chemistry
(4 hrs. or 6 periods / week)

Exam Duration : 3 hrs. **Max. Marks: 100**

Unit-I

Symmetry and Group Theory in Chemistry

Symmetry elements and symmetry operation, definition of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schonflies symbols, representations of groups by metrics (representation for the C_n, C_{nv}, D_{nh}, etc., groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their uses; spectroscopic derivation of character table for C_{2v} and C_{3v} point group. Symmetry aspects of molecular vibrations of H_2O molecule.

Unit-II

Stereochemistry and Bonding in Main Group Element Compounds

VSEPR, Walsh diagram [tri-atomic (AH_2 type) and penta-atomic (CH_3I) molecules]. $d\pi$-$p\pi$ bond. Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

Metal-Ligand bonding : Limitations of crystal field theory. Molecular orbital theory: octahedral, tetrahedral and square planar complexes and π-bonding complexes.

Metal Clusters : Higher boranes, carboranes, metalloboranes and metallocarboranes, compounds with metal-metal multiple bonds.

Unit-III

Electronic Spectra and Magnetic Properties of Transition Metal Complexes

Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), calculations of $D\alpha$, B and β parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover.

Unit-IV

Reaction Mechanism of Transition Metal Complexes

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, trans effect, mechanism of the substitution reaction. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Unit-V

Nuclear and Radiochemistry:

Laws of radioactive decay; Detection of radiations; Geiger-Nuttal rule; GM tubes and their characteristics; Ionization chamber, Proportional counters, Scintillation counters; Solid state detectors; Calibration of counting equipments; Determination of absolute disintegration rates.

Activation analysis: Principles; Various methods of activation; Methodology; Advantages, limitations and applications.

Books Suggested:

1. Chemical Applications of Group Theory. F A. Cotton.

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(Academic)
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List of Books (M.Sc. Previous)

S.N.	Name of Book	Author's Name	Books Available in Library
1	Advanced Inorganic Chemistry	F.A Cotton	Yes
2	Structured methods in Inorganic Chemistry	G. Wilkinson	Yes
3	Chemical Application of Group Theory	A.F. Albert Cotton	Yes
4	Synthetic methods of Oregano Metallic and Inorganic Chemistry	Herrmann, Brauer	Yes
5	Concise Inorganic Chemistry	Wiley's J.D. Lee	Yes
6	Inorganic Chemistry (Reaction and Mechanism)	Bernard Wilde	Yes
7	Inorganic Chemistry Concepts and Applications	Warren Gibbs	Yes
8	Inorganic Chemistry	Hamilton Perkins	Yes
9	Inorganic Chemistry Principles of structure and reactivity	Keiter Huheey, James E	Yes
10	Principles of Inorganic Chemistry	Dennis Close	Yes
11	Inorganic Chemistry	Atkins	Yes
12	Inorganic Chemistry	Miessler, Tarr	Yes

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VISION

"Where the mind is without fear, where the head is held high."

Be like a Diamond precious and rare work hard till success comes your way hurdles will soon fade away and you will surely have your way. Being a prime institute of the city we aspire that every student of institution should touch the pinnacle of his/her respective stream. We envisage that every seed sown by us should flourish into a giant tree. Beyond this we implore divine for His Grace that we may accomplish our desired destination.

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MISSION

- St. Wilfred's PG College believes in providing high quality education to the students.
- We foster knowledge, skills, and overall development of the student to meet the corporate needs.
- To provide quality and excellence in education on global level.
- We bestow the best educational experience to the students within affordable range.
- We try to enhance the knowledge and skills of the students along with inculcating moral and ethical education.
- We enhance the basic skill proficiency of the students so as to make him/her a future leader and entrepreneurs.
- We focus on strengthening their critical thinking for their successful completion of opted course and certificates in the college.
- We build responsible citizens who have knowledge about every discipline.
- We provide vibrant and multi-cultural campus for students to make them learn aesthetic values.

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OUR STRENGTHS

- The most high-tech campus to match global standards, a serene, friendly place with one of the finest natural environments. The college is UGC recognized under section 2(F) & 12(B)
- Awarded Education Excellence Award from 2013 to 2022, 21st Rank in Top 40 colleges of India, awarded 16th Rank in the Best Overall Excellence Award 2017 by Nielsen Survey, Overall Excellence Award in 2018, Ranked amongst 200 Best Colleges of India by Ministry of Education, NIRF in 2019, 2020, 2021.
- Academically sound, with highly qualified and experienced faculties, imparting practical and value based education.
- State-of-the-Art Infrastructure include spacious and airy learning rooms.
- Innovative Programs such as National and International Seminars, Conferences, Workshops, Presentations, Symposia and Interaction with renowned Professors.
- Emphasis on three Es- Efficiency, Excellence and Effectiveness.
- Dedicated and diligent placement cell to ensure 100% placement.
- A team of experienced and expert counsellors to provide the students in-depth information of the career options.
- Separate girls and boys hostel with adequate amenities.

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Vision, Mission statements of the department

Vision

To be recognized as a department of excellence by stimulating a learning environment in which students and faculty will thrive and grow to achieve their professional, institutional and societal goals.

Mission

- To provide high quality technical education to students that will enable life-long learning and build expertise in Chemical Science.
- To promote research and development by providing opportunities to solve complex engineering problems in collaboration with industry and government agencies.
- To encourage professional development of students that will inculcate ethical values and leadership skills while working with the community to address societal issues.

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MASTER OF SCIENCE
COURSE OUTCOMES
M.Sc. PREVIOUS (CHEMISTRY)
Paper 1: INORGANIC CHEMISTRY

CO1.	Understand multiplication tables, irreducible representations, orthogonality theorem.
CO2	Students can analyze kinetics and mechanism of substitution reactions in octahedral Co (III) and square planar Pt (II) complexes.
CO3	Able to analyze valence bond treatment of planar, tetrahedral and square planar hybrid orbitals.
CO4.	Able to understand preparation, properties, structure and applications of alkyl and aryls of Lithium, Beryllium, Magnesium, Aluminum, Mercury and Tin.
CO5	Student will learn Walsh diagram, dπ– pπ bonds, Bents rule, Study free ions in tetrahedral, octahedral and square planar crystal fields, Orgel diagrams, Tanabe Sugano diagrams.

Mapping of PO, PSO & CO

Name of Programme: M.Sc. Previous	**Name of Subject :Chemistry**											
Course/Paper Number: 1	**Name of Course : Inorganic Chemistry**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	2	2	3	1							3	
CO2	2	3				2		1	1		2	
CO3	1	2		1	1		1				2	1
CO4	2	1		1		1				3	3	
CO5	2	2	2		1					2	2	

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Lecture Plan

Lecture Plan

M.Sc. (Previous) Inorganic chemistry

S.No.	Schedule Date	Day	Particulars of Topic covered	Teaching Methodology	Date of execution	Remark/ Evaluation Technique
1	8-8-2022	Monday	Orientation		8/8/22	
2	9-8-2022	Tuesday	Introduction to Symmetry and Group Theory	Black Board	9/8/22	Class Test
3	10-8-2022	Wednesday	Symmetry elements and symmetry operation	Black Board	10/8/22	Class Test
4	12-8-2022	Friday	definition of group	Black Board	12/8/22	Class Test
5	13-8-2022	Saturday	subgroup, relation between orders of a finite group and its subgroup	Black Board	13/8/22	Class Test
6	16-8-2022	Tuesday	Conjugacy relation and classes	Black Board	16/8/22	Class Test
7	17-8-2022	Wednesday	Point symmetry group	Black Board	17/8/22	Oral test
8	18-8-2022	Thursday	Schonflies symbols	Black Board	18/8/22	Class Test
9	20-8-2022	Saturday	Schonflies symbols	Black Board	20/8/22	Oral test
10	22-8-2022	Monday	representations of groups by metrics	Black Board	22/8/22	Class Test
11	24-8-2022	Wednesday	Character of a representation	Black Board	24/8/22	Oral test
12	27-8-2022	Saturday	The great orthogonality theorem and its importance	Black Board	27/8/22	Class Test
13	31-8-2022	Wednesday	The great orthogonality theorem and its importance	Black Board	31/8/22	Class Test

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14	02-9-2022	Friday	Character tables and their uses	Black Board	2/9/22	Class Test
15	03-9-2022	Saturday	spectroscopic derivation of character table for Cv and Cs point group	Black Board	3/9/22	Oral test
16	05-9-2022	Monday	Symmetry aspects of molecular vibrations of H2O molecule	Black Board	5/9/22	Class Test
17	06-9-2022	Tuesday	Stereochemistry and Bonding in Main Group Element Compounds	Black Board	6/9/22	Oral test
18	07-9-2022	Wednesday	VSEPR	Black Board	7/9/22	Class Test
19	08-9-2022	Thursday	Walsh diagram [tri-atomic (AH_2 type)	Black Board	8/9/22	Class Test
20	10-9-2022	Saturday	penta-atomic (CH_3L) molecules	Black Board	10/9/22	Class Test
21	12-9-2022	Monday	d π -p π bond	Black Board	12/9/22	Oral test
22	14-9-2022	Wednesday	Bent rule and energetics of hybridization	PPT	14/9/22	Student Presentation
23	16-9-2022	Friday	Bent rule and energetics of hybridization	PPT	16/9/22	Student Presentation
24	17-9-2022	Saturday	some simple reactions of covalently bonded molecules	Black Board	17/9/22	Class Test
25	20-9-2022	Tuesday	Introduction of Metal-Ligand bonding	Black Board	20/9/22	Oral test
26	24-9-2022	Saturday	Limitations of crystal field theory	Black Board	24/9/22	Class Test
27	28-9-2022	Wednesday	Limitations of crystal field theory	Black Board	28/9/22	Class Test
28	01-10-2022	Saturday	Molecular orbital theory	Black Board	1/10/22	Class Test
29	04-10-2022	Tuesday	Molecular orbital theory	Black Board	4/10/22	Class Test

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30	06-10-2022	Thursday	octahedral, tetrahedral and square planar complexes and -bonding complexes	Black Board	6/10/22	Class Test
31	07-10-2022	Friday	octahedral, tetrahedral and square planar complexes and -bonding complexes	Black Board	7/10/22	Oral test
32	08-10-2022	Saturday	Introduction to Metal Clusters	Black Board	8/10/22	Class Test
33	11-10-2022	Tuesday	Higher boranes	Black Board	11/10/22	Class Test
34	12-10-2022	Wednesday	carboranes	Black Board	12/10/22	Class Test
35	18-10-2022	Tuesday	metalloboranes and metallocarboranes	Black Board	18/10/22	Oral test
36	21-10-2022	Friday	compounds with metal-metal multiple bonds	Black Board	21/10/22	Class Test
37	28-10-2022	Friday	Introduction to Electronic Spectra and Magnetic Properties of Transition Metal Complexes	Black Board	28/10/22	Oral test
38	31-10-2022	Monday	Spectroscopic ground states	Black Board	31/10/22	Class Test
39	01-11-2022	Tuesday	Spectroscopic ground states	Black Board	1/11/22	Oral test
40	03-11-2022	Thursday	correlation	Black Board	3/11/22	Class Test
41	05-11-2022	Saturday	correlation	Black Board	5/11/22	Class Test

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42	07-11-2022	Monday	Orgel and Tanabe-Sugano diagrams for transition metal complexes (d'-d° states)	Black Board	7/11/22	Class Test
43	08-11-2022	Tuesday	Orgel and Tanabe-Sugano diagrams for transition metal complexes (d'-d° states)	Black Board	8/11/22	Oral test
44	09-11-2022	Wednesday	calculations of D α, β and β parameters	Black Board	9/11/22	Class Test
45	12-11-2022	Saturday	calculations of D α, β and β parameters	Black Board	12/11/22	Class Test
46	14-11-2022	Monday	charge transfer spectra	Black Board	14/11/22	Class Test
47	15-11-2022	Tuesday	spectroscopic method of assignment of atsolute configuration in optically active metal chelates and their stereochemical information	Black Board	15/11/22	Class Test
48	17-11-2022	Thursday	spectroscopic method of assignment of atsolute configuration in optically active metal chelates and their stereochemical information	Black Board	17/11/22	Oral test
49	18-11-2022	Friday	spectroscopic method of assignment of atsolute configuration in optically active metal chelates and their stereochemical information	Black Board	18/11/22	Class Test
50	19-11-2022	Saturday	anomalous magnetic moments	Black Board	19/11/22	Class Test

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51	21-11-2022	Monday	anomalous magnetic moments	PPT	21/11/22	Student Presentation
52	22-11-2022	Tuesday	magnetic exchange coupling and spin crossover	PPT	22/11/22	Student Presentation
53	23-11-2022	Wednesday	magnetic exchange coupling and spin crossover	Black Board	23/11/22	Class Test
54	24-11-2022	Thursday	Reaction Mechanism of Transition Metal Complexes	Black Board	24/11/22	Class Test
55	25-11-2022	Friday	Reaction Mechanism of Transition Metal Complexes	Black Board	25/11/22	Class Test
56	26-11-2022	Saturday	Energy profile of a reaction	Black Board	26/11/22	Class Test
57	28-11-2022	Monday	reactivity of metal complexes	Black Board	28/11/22	Class Test
58	01-12-2022	Thursday	reactivity of metal complexes	Black Board	1/12/22	Class Test
59	02-12-2022	Friday	inert and labile complexes	Black Board	2/12/22	Class Test
60	03-12-2022	Saturday	kinetic application of valence bond	Black Board	3/12/22	Class Test
61	05-12-2022	Monday	crystal field theories	Black Board	5/12/22	Open Book Test UG
62	06-12-2022	Tuesday	kinetics of octahedral substitution	Black Board	6/12/22	Open Book Test UG

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63	09-12-2022	Friday	kinetics of octahedral substitution	Black Board	9/12/22	Open Book Test UG
64	10-12-2022	Saturday	acid hydrolysis	Black Board	10/12/22	Open Book Test UG
65	12-12-2022	Monday	factors affecting acid hydrolysis	PPT	12/12/22	Student Presentation
66	13-12-2022	Tuesday	base hydrolysis	PPT	13/12/22	Student Presentation
67	14-12-2022	Wednesday	conjugate base mechanism	Black Board	14/12/22	Class Test
68	15-12-2022	Thursday	direct and indirect evidences in favour of conjugate mechanism	Black Board	15/12/22	Class Test
69	16-12-2022	Friday	direct and indirect evidences in favour of conjugate mechanism	Black Board	16/12/22	Oral test
70	17-12-2022	Saturday	anation reactions	Black Board	17/12/22	Class Test
71	19-12-2022	Monday	reactions without metal ligand bond cleavage	Black Board	19/12/22	Class Test
72	22-12-2022	Thursday	reactions without metal ligand bond cleavage	Black Board	22/12/22	Class Test
73	24-12-2022	Saturday	Substitution reactions ni square planar complexes	Black Board	24/12/22	Oral test
74	02-01-2023	Monday	Substitution reactions ni square planar complexes	Black Board	2/1/23	Class Test

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75	03-01-2023	Tuesday	trans effect, mechanism of the substitution reaction	Black Board	3/1/23	Class Test
76	06-01-2023	Friday	trans effect, mechanism of the substitution reaction	Black Board	6/1/23	Class Test
77	07-01-2023	Saturday	trans effect, mechanism of the substitution reaction	Black Board	7/1/23	Oral test
78	09-01-2023	Monday	Redox reactions	Black Board	9/1/23	Class Test
79	12-01-2023	Thursday	Redox reactions	Black Board	12/1/23	Class Test
80	13-01-2023	Friday	electron transfer reactions	Black Board	13/1/23	Class Test
81	16-01-2023	Monday	electron transfer reactions	Black Board	16/1/23	Oral test
82	17-01-2023	Tuesday	mechanism of one electron transfer reactions	Black Board	17/1/23	Class Test
83	19-01-2023	Thursday	mechanism of one electron transfer reactions	Black Board	19/1/23	Class Test
84	20-01-2023	Friday	outer sphere type reactions, cross reactions and Marcus-Hush theory	Black Board	20/1/23	Oral test
85	21-01-2023	Saturday	Inner sphere type reactions	Black Board	21/1/23	Class Test
86	23-01-2023	Monday	Laws of radioactive decay; Detection of radiations; Geiger-Nuttal rule	Black Board	23/1/23	Class Test

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87	24-01-2023	Tuesday	GM tubes and their characteristics; Ionization chamber, Proportional counters	PPT	24/1/23	Student Presentation
88	27-01-2023	Friday	Scintillation counters	PPT	27/1/23	Student Presentation
89	28-01-2023	Saturday	Solid state detectors; Calibration of counting equipments	Black Board	28/1/23	Class Test
90	30-01-2023	Monday	Determination of absolute disintegration rates	Black Board	30/1/23	Class Test
91	09-02-2023	Thursday	Activation analysis: Principles; Various methods of activation	Black Board	9/2/23	Class Test
92	11-02-2023	Saturday	Methodology; Advantages, limitations and applications	Black Board	11/2/23	Class Test
93	14-02-2023	Tuesday	Revision class	Black Board	14/2/23	Class Test
94	15-02-2023	Wednesday	Revision class	Black Board	15/2/23	Class Test
95	16-02-2023	Thursday	Revision class	PPT	16/2/23	Oral test
96	17-02-2023	Friday	Revision class	Black Board	17/2/23	Class Test
97	21-02-2023	Tuesday	Revision class	Black Board	21/2/23	Class Test

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Content Beyond Syllabus

ELEMENTARY CHEMISTRY 1

1. Chemical Reactions and strategies to balance them
2. The relative quantities of reactants and products
3. The fundamental properties of atoms, molecules, and the various states of matter
4. The fundamentals of acid/base chemistry, including pH calculations, buffer behavior, and acid/base titrations
5. Molecular interactions and chemical reactions in the body
6. Proper laboratory safety and techniques

ELEMENTARY CHEMISTRY 2

1. The Structures and properties of organic and biomolecular species
2. The principles influencing reactivity, including acid-base behaviors and reaction networks important in nutrition and metabolism
3. The quantitative assessment of data
4. How to communicate the results of their experiments primarily via written laboratory reports

GENERAL CHEMISTRY 1

1. The Fundamental properties of atoms, molecules, and the various states of matter with an emphasis on the particulate nature of matter
2. How to predict molecular geometries of selected molecular species
3. Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters
4. The "gas laws" governing the physical/chemical behavior of gases
5. General practical 1

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NOTES

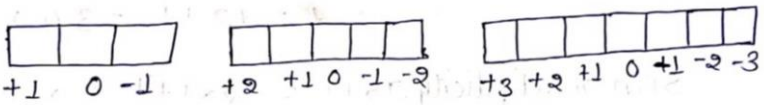
• SPECTROSCOP MICROSTATES •

$n = 1, 2, 3, 4, 5, 6$

$l = (n-1)$

$0, 1, 2, 3, 4, 5, 6, 7$ ------

S, P, D, F, G, H, I, J

M = 

$S = +\frac{1}{2}, \frac{1}{2}$

(1), (V)

$11 \Rightarrow \frac{1}{2} + \frac{1}{2} = 1$

$1V \Rightarrow \frac{1}{2} - \frac{1}{2} = 0$

SPIN MULTPLICITY :-

$(2S+1 L_J)$

$J = (L+S) \text{ ---- } (L-S)$

$S=1, L=2 \rightarrow \quad 2+1 \qquad 2-1$

Possible value of J : 3, 2, 1

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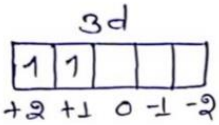
Ex:- ① V^{3+} ⇒

$23 = 3d^3\ 4s^2$

$V^{3+} \rightarrow 3d^2$



$S = \frac{1}{2} + \frac{1}{2} = 1$

$L = +2 + 1 = 3\ (F)$

Spin multiplicity $= 2S+1 = 2\times1+1 = 3$

$J = (L+S)\ (L-S)$

$(3+1)\ (3-1)$

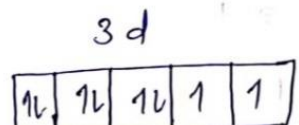
$J = 4, 3, 2$

$^{2S+1}L_J = {}^3F_4, {}^3F_3, {}^3F_2$

② Ni^{+2} ⇒

$Ni = 28 = 3d^8\ 4s^2$

$Ni^{+2} = 3d^8$



$S = \frac{1}{2} + \frac{1}{2} = 1$

$L = +2+2+1+1+0+0-2-2$

$L = 3$

Spin multiplicity $= 2S+1 = 2\times1+1 = 3$

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$J = (L+S)\ (L-S)$

$(3+1)\ (3-1)$

$J = 4, 3, 2$

$^{2S+1}L_J = {}^3F_4, {}^3F_3, {}^3F_2$

③ $N \Rightarrow 1s^2\ 2s^2\ 2p^3$

$2p^3$

1	1	1
+1	0	-1

$S = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{3}{2}$

$L = 1 + 0 - 1 = 0$

Spin multiplicity $= 2S+1 = 2\times\frac{3}{2} + 1 = 4$

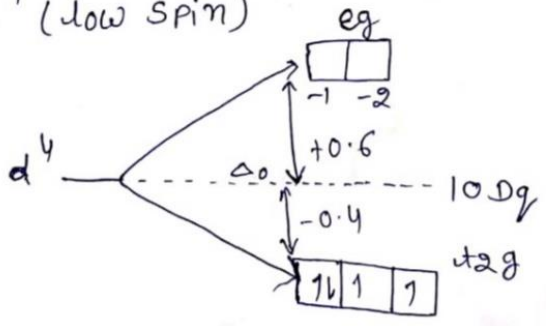
$J = (L+S)\ (L-S)$

$(0+\frac{3}{2})\ (0-\frac{3}{2})$

$J = \frac{3}{2}\quad -\frac{3}{2}$

$^4S_{3/2}$

Ex:- d^4 (low spin)



$\Delta_o > \Pi \longrightarrow$ Strong feild ligand

$\Delta_o < \Pi \longrightarrow$ Weak feild ligand

$^{2S+1}L_J = 3$

$S = \frac{1}{2} + \frac{1}{2} = 1$

$L = 5$

$J = (S+1)\ (S-1)$

$6, 5, 4$

$^3H_6, {}^3H_5, {}^3H_4$

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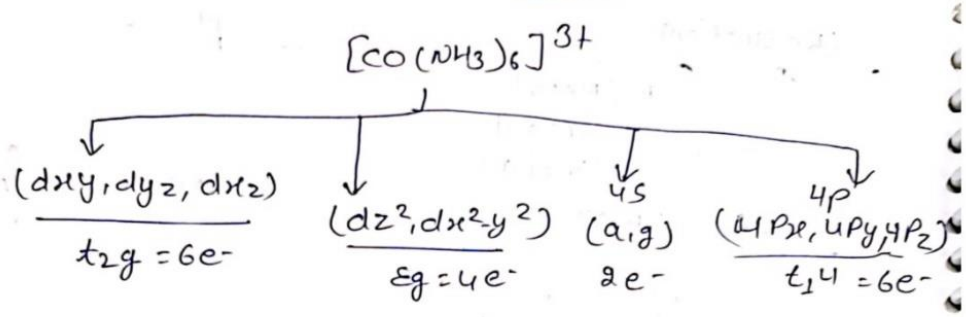

a = Signgly degenrated
t_{2g} = Tsiply degenrated
Eg = Doubly degenrated

gn this complex NH_3 molecule behave as a ligand in which N-atom is sp^3 hybridized. These 6 NH_3-ligand over lap with vacant d-orbitals of Co and get d^2sp^3 hybride orbitals.

→ gn octahydral complex Co^{3+} ion have nine valence shall atomic orbital ($3d_{xy}, 3d_{yz}, 3d_{xz}, 3d_{z^2}, 3d_{x^2-y^2}$, 4S, $4P_x$, $4P_y$, $4P_z$)

→ gn this complex out of nine atomic orbitals only six atomic orbitals are overlap with the axis. These are called ligand group orbitals.

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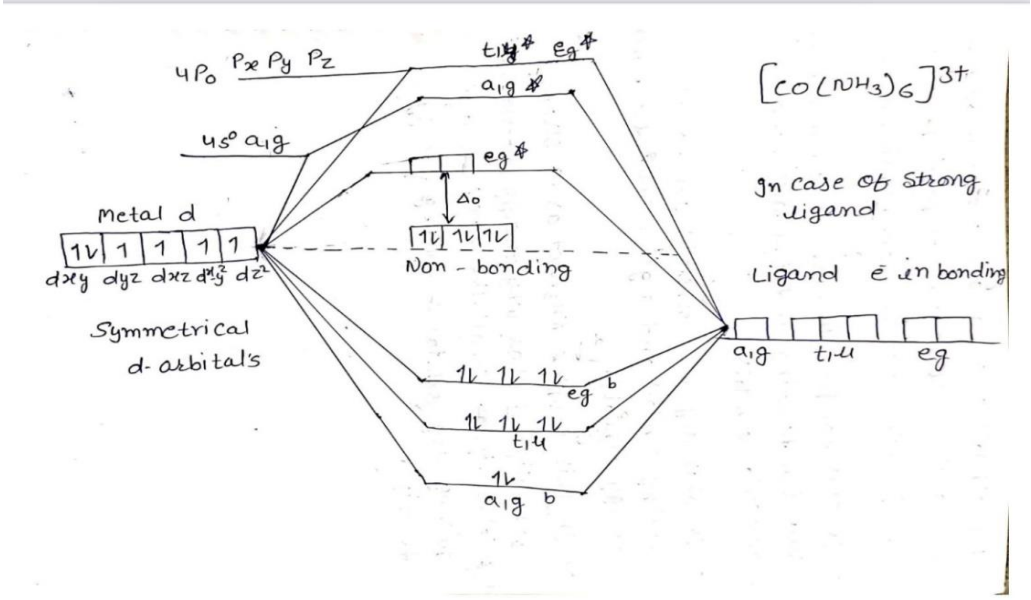

Scanned with CamScanner

→ t_{2g} Orbitals of metal are located into b/w the axis. So these are not participet over lapping. These are in non-bonding area.

→ In this complese 4p-orbitals metal overlap with t_{1u} bonding and t_{1u} anti bonding molecular orbitals.

→ In this a_{1g} & t_1 orbital's are lower energy orbitals and a_{1g}^* & t_{1u}^* are higher energy orbitals.

→ In this complese NH_3 act as a strong field ligand that why energy differance $t_{2g}(\Delta o)$ is higher. So all the electrons are $+e_g$ pairing t_{2g} orbital & pairing energy should be high.

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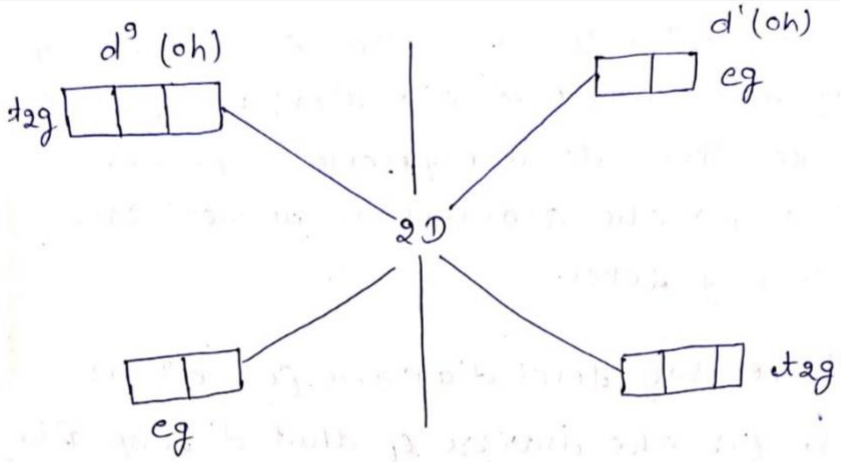

In a free gases metal ion the five d-orbital are degenerate and therefor electronic transition are possible.

In d^1 compled for ex:- $[Ti(H_2O)_6]^{3+}$ the spiliting of d-orbital is take place orbital are devided t_{2g} & eg. one unpair electron is fill in the t_{2g} ground state.

In d^9 confujaration - ex:- $[Cu(H_2O)_6]^{2+}$ the unpair electrone is field in eg orbital. so hall is transfered to the t_{2g} orbital by giving some energy in the form of light.

Thus the transition in d^1 case coresponds to

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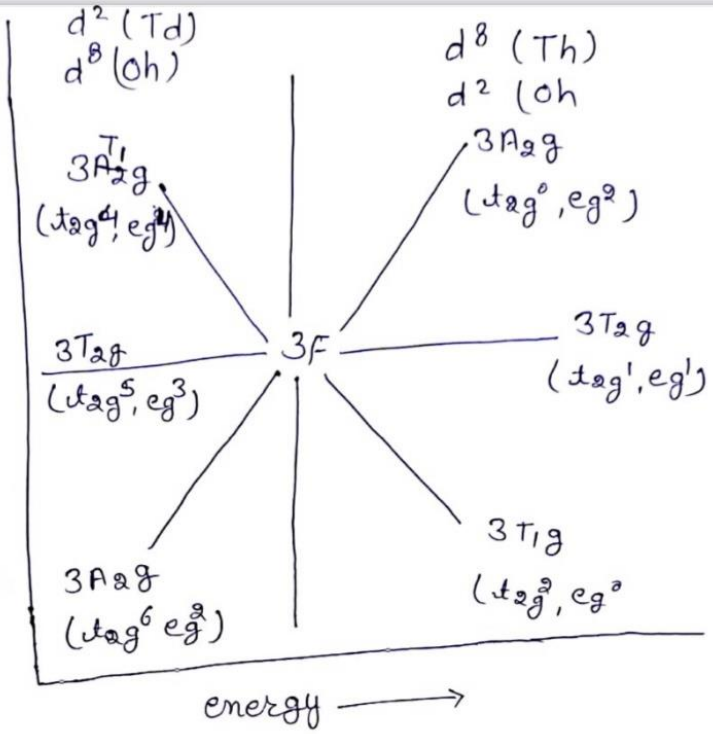

The complexes of metal with d^8 configuration can be treated similler to d^2 oh complexes.

In such cases there are two holes in eg level and their for promotion of one e^- transfering eg to t_{2g} level this is invers of d^2 case.

d^2 oh energy level diagram is similar to the high spin d^7 oh and d^3 (Td) cases.

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*TANABE SUGANO DIAGRAM:-

Given by 'Yukito Tanabe and Satoru Sugano's'

→ As orgal diagram consider only weak field ligands. Tanabe and sugano give diagram which consider both strong field ligand. This diagram is called Tanabe sugano diagram.

→ These are more useful than orgal diagram b/c gt take into consideration of both strong and weak field ligands. gt has considered

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→ This scale consider metal ion with the some electrone configaration and allow for different ligands both vertical and horizontal scale are divieded value of parameter which is known as Racah parameter. Sugano with the help of Tanabe and [illegible] diagram. It is easier to calculate the (E/B) above ground state b/c a standered reference point was choosen as horizental line and difference can be calculated.

* **charge transfer spectra:-**

Electronic transition can be of following two types.

(1) **d-d transition:-**

According to CFT it is assumed that metal d- orbitals split into two level on complest formation. As the ligand contact with metal the d- orbitals split into two levels. and electron can be transfer from lower level to the higher level with the absorpation of appropriate amount of Energy. This transfer are called d- d transition.

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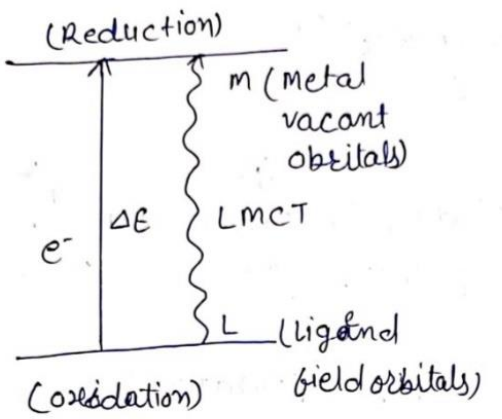
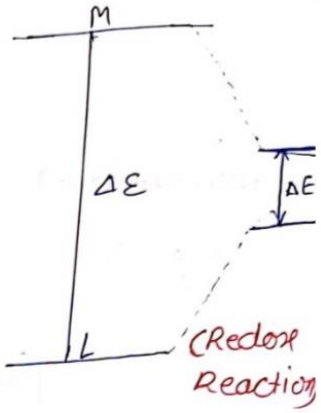
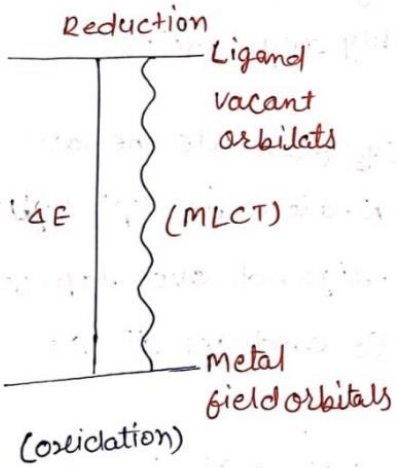
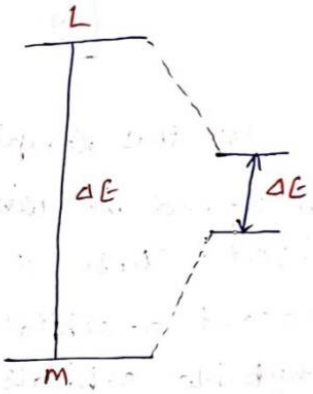








Ex:-

$[Co(NH_3)_6]^{3+}$

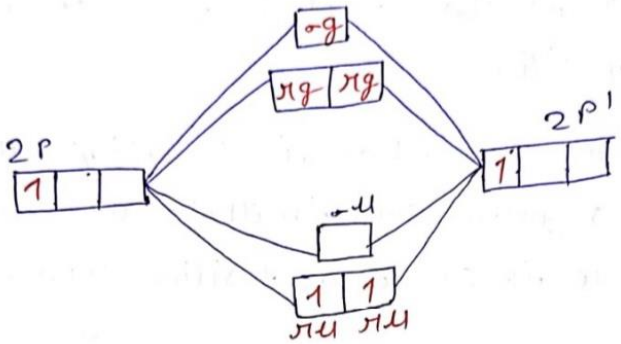
$Co \rightarrow +3 \rightarrow 3d^6$

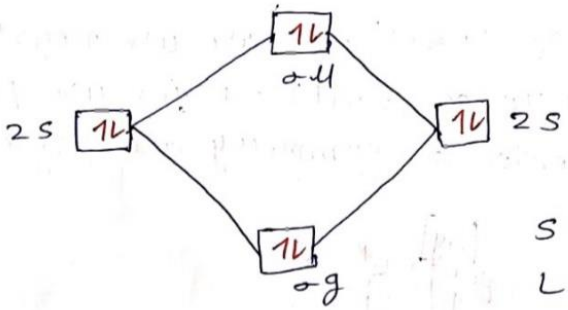
$m \rightarrow 6$

$L \rightarrow 2 \times 6 = 12e^-$

$M+L = 12+6e^- = 18e^-$

B_2 :- $1s^2\ 2s^2\ 2p^1$





S = 1

L = 0 (Σ)

2S+1 = 3

$^3\Sigma g^-$

* ORGAL DIAGRAME:-

Orgal diagrames used for interpositition of spin allowed bands of d-d transition in the ~~exited state~~ electronic spectra of tetrahydral & octahydral transition metal complexes.

→ σ orbital हमेशा $L=0$

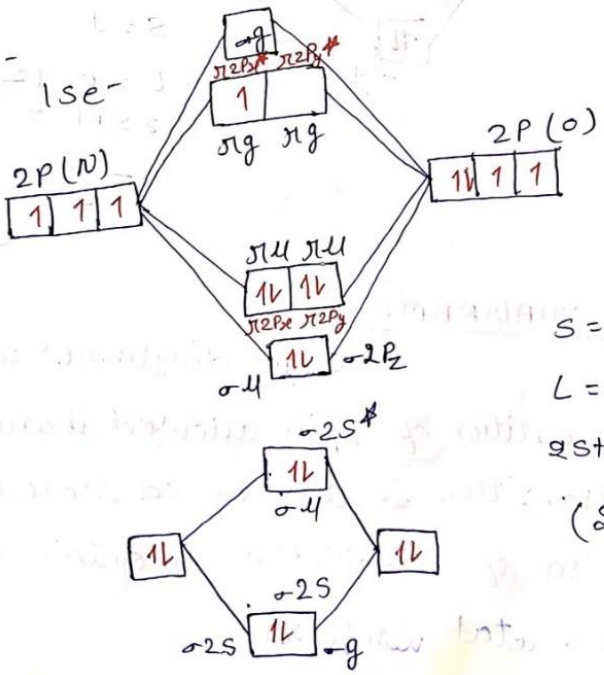
→ यदि σ term is than $(2S+1)$ in value of σ is always positive.

→ यदि orbital is π than in $(2S+1)$ if value of is three negative sign in there and यदि $(2S+1)$ value is one than positive sign is there

→ यदि value of $(2S+1)=3$ we use negative sign. if value of $(2S+1)=1$ we use positive sign. if center of symmetry are present

NO:-

Ise-



$S = \frac{1}{2}$

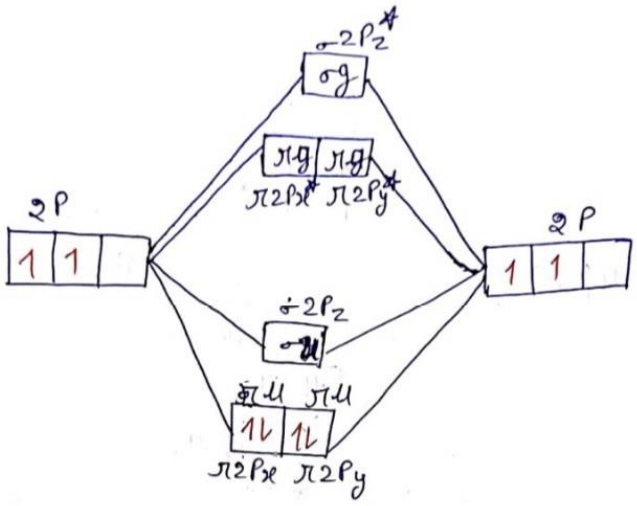
$L = 1 = \pi$

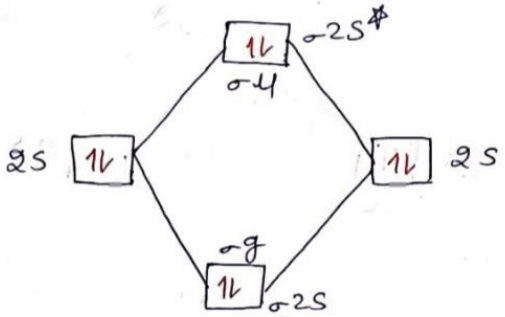
$2S+1 = 2$

(2π)

$C_2 \Rightarrow 1s^2\ 2s^2\ 2p^2$

$\Rightarrow 12e^-$



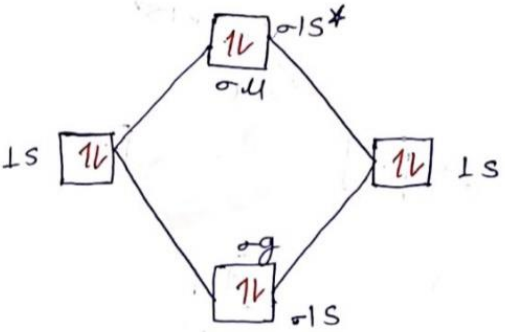


$S = 0$

$L = 1$

$(2S+1) = 1$

$J =$



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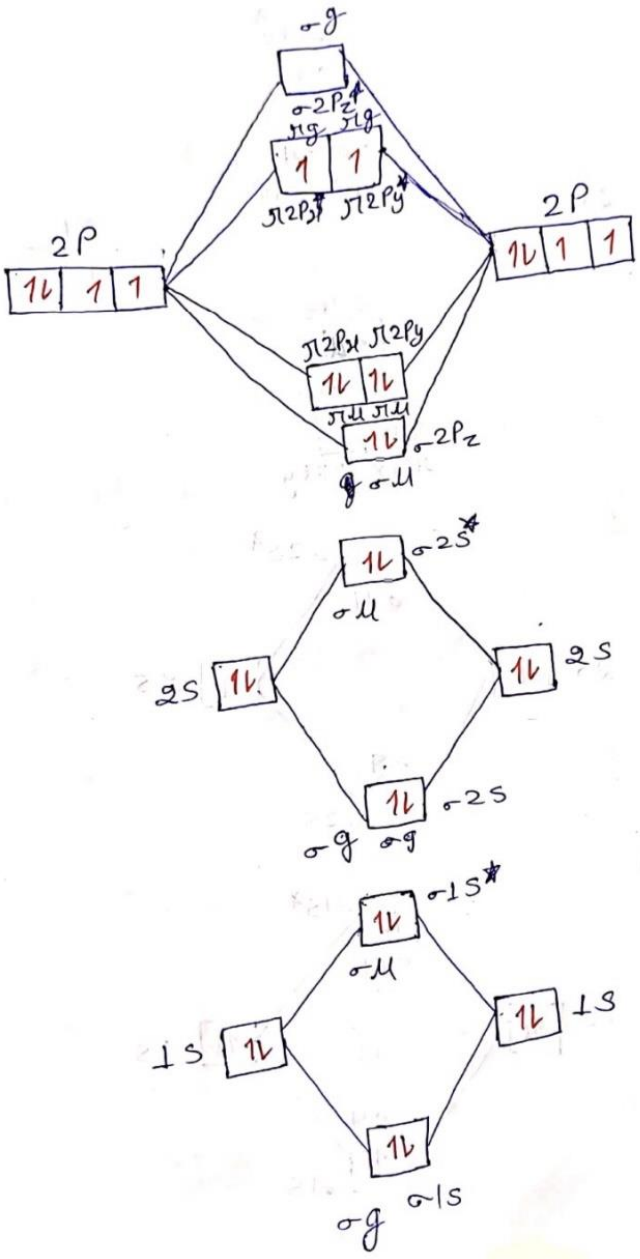
Ex:- O_2 (16e⁻)



$\pi g^{+1} = \pi g^{-1}$
1 1

$S = \frac{1}{2} + \frac{1}{2} = 1$

$L = 0$

$2S+1 = 3$

$J = 4, 3, 2$

$3\Sigma g^-$

$L = 0$	S	Σ
$L = 1$	P	Π
$L = 2$	D	Δ
$L = 3$	F	Φ

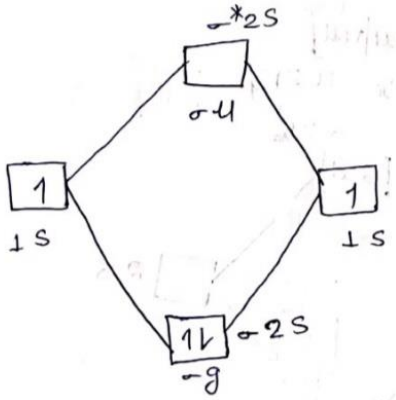
→ $g \times g \rightarrow g$

$u \times u \rightarrow g$

$u \times g \rightarrow u$

$g \times u \rightarrow u$

Ex:- H_2 -



If molecule has central of symetry than consider g and u. If molecule has not central of symmetry than doesn't consider g and u.

Assignment

Date

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[Nuclear And Radiochemistry]

Radiochemistry is the chemistry of radioactive materials, where radioactive isotopes of elements are used to study the properties and chemical reactions of non radioactive isotopes.

All radioactive isotopes are unstable isotopes of elements - undrgo nuclear decay and emit some form of radiation. The radiations emmited can be of several types including alpha, beta, gamma radiations, proton & and neutron emmision along with neutrino and antiparticle emmision decay pathway.

(1) α (alpha) radiation :— The emmision of an alpha particle (which Contains 2 protons and 2 neutrons) from an atomic nucleus. When this occurs, the atoms atomic mass will decreases by 4 units and atomic no. will decrease by 2 units.

(2) β (beta) radiation :— The transmutations of neutron into an electron and proton. After this happens, the electron is emmited from the nucleus into the electron cloud.

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(3) γ (gamma) radiations:— The emmision of electromagnetic energy from the nucleus of an atom. This usually occurs during alpha or beta radioactive decay.

These three types of radiation can be distinguish by their different in penetrating power.

[The radioactive decay law]

The radioactive decay law is an universal law that describes the statistical behaviours of an large no. of nuclides — Radioactive decay is a random process at the level of single atoms, in that according to quantum theory, it is impossible to predict when a particular atom will decay. In other words — a nucleus of a radionuclides has no "memory". A Nucleus does not "age" with the passage of time. Thus probablity of its breaking down does not increase with time; but stays constant + no matter how long the nucleus has exited

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During its unpredictable decay this unstable nucleus spontaneously and randomly decomposes to form a different nucleus giving off radiation in the form a atomic particles or high energy rays.

The radioactive decay law states that the probability per unit of time that a nucleus will decay is a constant, independent of time.

This constant is called decay Constant and is denoted by λ "lambda"

The radioactive decay of certain no. of atoms (masses) is exponential in time.

[Radioactive decay law $N = N_0 \cdot e^{-\lambda t}$]

The rate of nuclear decay is also measured in terms of half-lives. The half life is the amount of time take for given isotopes to lose half of its radioactivity.

No. of Nuclei — $N = N_0 \cdot e^{-\lambda t}$ (Activity)

$A = A_0 \cdot e^{\lambda t}$ (Mass) $m = m_0 \cdot e^{-\lambda t}$

Where N (no of particles) in a Sample

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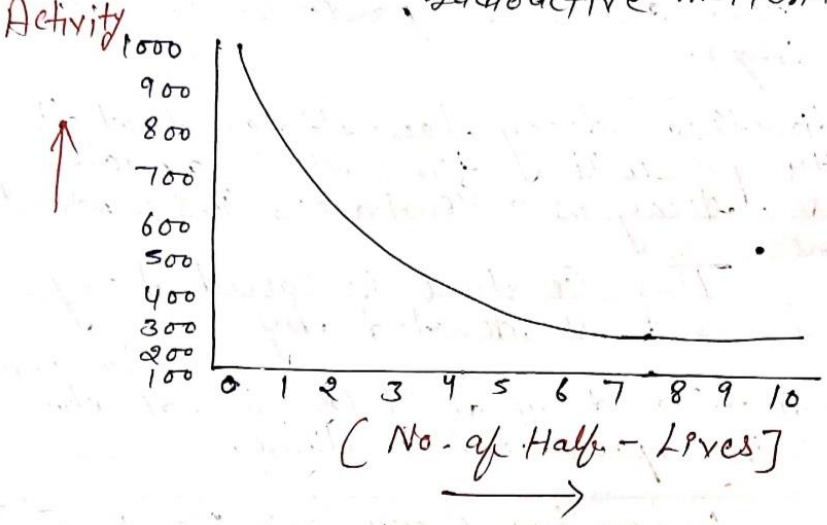
A = Total activity (is the no. of decay / unit) time of a radioactive sample.

m = is the mass of remaining radioactive material.



A measure of radioactivity is based on Counting of disintegrations per second.

The SI unit of activity is the becquerel (Bq) equal to one reciprocal second.

Units of activity :—

Becquerel → SI unit of radioactivity one becquerel (1 Bq) is equal to 1 disintegration per second.

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22g of ^{22}Na Contains 6.023×10^{23} isotopes

$N = 4.36 \times 10^{12}$ particles

$1g = \frac{6.023 \times 10^{23}}{22}$ particles

$N = \frac{22 \times 4.36 \times 10^{12}}{6.023 \times 10^{23}}$ $g = 1.59 \times 10^{10} g$

[Geiger – Nuttal law]:—

Geiger – Nuttal law relates the decay Constant of a radioactive isotope with the energy of the alpha particle emitted. Roughly speaking it states that short – lived isotopes emit more energetic alpha particles than long lived ones.

The relationship also shows that half – lives are exponentially dependent on decay energy, so that very large changes in half – life make Comparatively small

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(2) Curie :— SI unit of radioactivity.
1 Curie — ($1\ Ci = 3.7 \times 10^{10}$) disintegrations per second

(3) Rutherford :— (Rd) → SI unit of radioactivity.
One million nuclei / decay per second.

[Decay Constant and Half-Life] :—

In Calculation of radioactivity one of two parameters (decay Constant or Half life) which characterised the rate of decay, must be known.

There is a relationship b/w the half-life ($t_{1/2}$) and the decay Constant λ.

The relationship can be derived from decay law by setting $N = \frac{1}{2} N_0$ at t

Half life ($t_{1/2}$) → $\ln 2 / \lambda$

for eg :— [^{22}Na]

^{22}Na has a half-life of 2.6 years, what is the

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decay Constant? Mass no – 22

$$\lambda = \frac{\ln 2}{t_{1/2}} = \frac{\ln 2}{2.6\,y} = 0.27\,y^{-1}$$

$[1y = 3.14 \cdot 10^7 s]$

$$\lambda = \frac{\ln 2}{2.6 \times 3.14 \cdot 10^7} = 8.5 \times 10^{-9} s^{-1}$$

Radioactive decay laws :—

$$A(t) = \lambda \cdot N(t)$$

A ^{22}Na source has an activity of $1\,\mu Ci = 10^{-6} Ci$

$[(1\,Ci = 3.7 \cdot 10^{10}$ decays/s$]$

$$N = \frac{A}{\lambda} = \frac{10^{-6}\,Ci}{8.5 \times 10^{-9} s^{-1}} = \frac{10^{-6} \times 3.7 \times 10^{-10} s^{-1}}{8.5 \times 10^{-9} s^{-1}}$$

$$= [4.36 \times 10^{12}]$$

[How many grams of ^{22}Na are in the source]

A gram of isotope with mass no A Contains N_A · Isotopes.

N_A = Avogadro's No $= 6.023 \cdot 10^{23}$

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[Chemical Rxn of s-block elements]

① Reactivity :-

differences in decay energy, and thus alpha particle energy

In practice, this means that alpha particles from all alpha emitting isotopes across many order of magnitude of difference in half life, all nevertheless have about the same decay energy.

formulated in 1911 by Hans Geiger and John Mitchell Nuttal in its modern form the Geiger Nuttal law is

$$\log_{10}\lambda = -q_1\frac{Z}{\sqrt{E}} + q_2$$

where λ = is the decay constant

(λ = ln2 / half life)

Z = The atomic no.

E = The total Kinetic energy (of alpha particle and the daughter nucleus).

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$q_1 \& q_2 \rightarrow$ Constant

The law works best for Nuclei with even atomic no. and even atomic mass. The trend is still there for [even odd] - [odd even] and [odd - odd] nuclei but not as pronounced.

[Cluster Decays]

The Geiger - Nuttal law has been extended to describe cluster decay. decays where atomic nuclei larger than helium are released, eg:- Silicon and Carbon

A simple way to derive this law is to consider a alpha particle in the ~~box~~ atomic nucleus as a particle in a box.

The particle is in a bound state because of the presence of the strong interaction potential. It will constantly bounce from one side to the other, and due to the possibility of quantum tunnelling by wave through the potential barrier, each time it bounces, there

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Geiger Mueller Tube

A Geiger Mueller Tube is an instrument used for detecting and measuring ionizing radiation. Also known as a Geiger – Mueller Counter. It is widely used in application such as radiation dosimetry, radiological protection, experimental physics, and the nuclear industry. This is also used as particle detector.

Investigator – Hans Geiger
Walther Mueller.

It detects ionizing radiation such as alpha particles, beta particles, and gamma rays using the ionization effect produced in a Geiger – Mueller tube, which gives its name to the instrument. It is perhaps one of the world's best known radiation detection instruments.

It has been very popular due to its

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A Geiger Counter Consists of Geiger-Mullers tube (the sensing element which detects the radiations) and processing electronics, which displays the result.

The Geiger-Muller tube is filled with an inert gas such as helium, neon or argon at low pressure, to which a high voltage is applied. The tube briefly conducts electrical charge, when a particle or photon of incident radiation makes the gas conductive by ionization. The ionization is considerably amplified within the tube by the Townsend discharge effect to produce an easily measured detection pulse, which is fed to the processing and display electronics.

This large pulse from the tube makes the Geiger Tube relatively cheap to manufacture, ~~as the~~.

To stop the discharge in the Geiger-Muellers tube a little halogen gas or organic material (alcohol) is added to the gas mixture.

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Result :—

There are two types of detected radiation readout : Counts or radiation dose.

The Counts display is the simplest and is the no. of ionizing events detected displayed either as a Count rate ; such as "Counts per minute" or "Counts per second" or as a total no of Counts over a set time period. The Counts readout is normally used when alpha or beta particles are being detected. Second is radiation dose which is normally used for measuring gamma or x-ray dose rates. A Geiger Muller tube can detect the presence of radiation, but not its energy which influence the radiations ionizing effect.

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There is an option to produce audible click representing the no. of ionization events detected. This is the distinctive sound normally associated with handheld or portable Geiger – Counters. The purpose of this is to allow the user to concentrate on manipulation of the instrument whilst retaining auditory feedback on the radiation rate.

Limitations :-

(1) There are two main limitations of the Geiger Counter. Because the output pulse from a Geiger – Muller tube is always of the same magnitude the tube can not differentiate b/w radiation types.

(2) Secondly, the inability to measure high radiation rates due to the "dead time" of the tube.

Modern versions of the Geiger tube use

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the halogen tube invented in 1947 by Sidney H. Liebson. It superseded the earlier Geiger – Muller tube because of its much longer life and lower operating voltage typically 400 – 900 volts.

[Characteristics of the GM Counter]:

Put a radioactive source below the GM tube. put the counter in counting mode and raise the voltage until counts are observed. Note the shape of the pulse and what happens as the voltage on the GM tube increased. What is the min. voltage pulse necessary to activate the Counter? Measure the pulse height with the oscilloscope. Sketch the picture :—

Every GM. tube has a characteristic response of counting rate V.S. voltage applied to the tube. A curve representing the variation of counting rate with voltage is called a plateau curve because of its appearance. The plateau curve of every tube

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Expt. No. _____ Page No. (4)

that is to be used for the first time. Should be drawn in order to determine the optimum operating voltage.
find the plateau curve for your tube using the procedure outlined below —

(a) Check to see that the high voltage as indicated by the meter on the instrument is at its min. value.

(b) Insert a radioactive source into one of the shelves of the counting chamber. Turn on the count switch and slowly increase the high voltage until counts just begin to be recorded by the scaler. The voltage at which counts just begin is called the "Starting Voltage" of the tube. Using the oscilloscope, measure the min. signal size necessary to trigger the scaler.

(c) Set Counting time 30 sec. Beginning at the starting voltage, take counts every 40 volts. Choose shelf such that you have at least 1000 counts when the high voltage is about 50 V above the starting voltage. Reset scales to zero before each count. Continue taking

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Counting until the voltage is reached where a rapid increase in counts is observed Do not continue raising the voltage beyond that point – reduce voltage to about 200V above starting voltage.

(d) plot the data of (c). Identify the "plateau"

[Ionisation chamber]:-

The ionisation chamber is the simplest of all gas-filled radiation detectors, and is widely used for the detection and measurment of certain types of ionising radiation X-rays, gamma rays. and β-particles.

Ionisation chamber is detector which collect all the charges created by direct ionization within the gas through the application of an electric field.

Ion chamber have good uniform response to radiation over a wide range of energies and the preferred means of measuring high levels of gamma radiation

List of Students

Class : M.SC. PREV.(CHEMISTRY) Stream : SCIENCE				
45505	ABHISHEK PARIHAR	NANURAM PARIHAR	8529358299	8769805985
45547	AFREEN BEE	ABDUL AMEEN KHAN	9413807510	
45840	ANKIT DHAYAL	LALA RAM DHAYAL	952188s1889	
45575	ASHOK	RAMJEEVAN		7877952584
45202	AVADHESH KUMAR GAUD	BRAJVASI GAUD	7734839904	
45429	BAJRANG	HAJARI LAL		8708421504
45576	BAJRANG PUNIA	VAGATA RAM JI		8824454779
44247	DEEKSHA SAINI	KRISHAN KANAHIYA	94137409057	9414784438
45274	DOLAT AGARWAL	SURESH KUAMR AGARWAL	9145826008	9982986097
45454	DUSHYANT KUMAR SEN	RAKESH KUMAR SEN	9571607010	7737983731
45278	HIMANI PUROHIT	RAJENDRA PUROHIT	8619018863	9602796153
44900	JINENDRA JAIN	PURAN MAL JAIN	9672964881	9413718716
45548	JOYA AKHTAR	ABDUL SHAMIM KHAN	9784114619	
45178	MADHU BALA	SURESH KUMAR	7976877939	
45546	MAHAK RANI PATEL	MOHAMMAD NASAIR KHAN	8302204353	
45545	MANOJ CHOUDHARY	KAILASH CHAND CHOUDHARY	9782079775	
45864	MEGHA RAM BHAHRI	DIYALA RAM BHARI		
45431	MUDIT MUDGAL	DINESH KUMAR SHARMA	9982189061	8058013106
45082	NAVEEN	MAHENDER SINGH	8307505839	7404259794
45712	NEERAJ YADAV	ROOP CHAND		
44685	NIKITA YADAV	SHISHPAL YADAV	8094128169	
45150	NISHA GURJAR	RAMLAL GURJAR	8302929087	8080320896
45687	PAWAN JALUTHARIYA	MANGAL RAM JALUTHARIYA		9521119427
45569	PINTU LAL BAIRWA	RAM BHAROSI BAIRWA	7374902856	
45179	POOJA NAGAR	NARAYA LAL NAGAR	9785917257	
45461	PRACHI GIDWANI	ANIL GIDWANI	9214992000	9351471000
45559	PREETI YADAV	SHER SINGH YADAV	6377990259	
45495	PUSHPA	DHARMVEER		
45727	SATISH KUMAR	NARESH KUMAR		8295669426
Total Class Students : 29				

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Time Table of Remedial Classes

Department of Chemistry (PG)

M.Sc. Previous (Time – 12:00 pm – 1:00 pm)

S.No.	Date	Day	Topic Name
1	12-8-2022	Friday	Symmetry elements and symmetry operation
2	13-8-2022	Saturday	subgroup, relation between orders of a finite group and its subgroup
3	20-8-2022	Saturday	representations of groups by metrics
4	27-8-2022	Saturday	The great orthogonality theorem and its importance
5	02-9-2022	Friday	Stereochemistry and Bonding in Main Group Element Compounds
6	10-9-2022	Saturday	Bent rule and energetics of hybridization
7	17-9-2022	Saturday	octahedral, tetrahedral and square planar complexes and -bonding complexes
8	01-10-2022	Saturday	Orgel and Tanabe-Sugano diagrams for transition metal complexes (d'-d° states)
8	08-10-2022	Saturday	spectroscopic method of assignment of atsolute configuration in optically active metal chelates and their stereochemical information
10	21-10-2022	Friday	magnetic exchange coupling and spin crossover

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Measures taken for weak learners

S.No.	Students Name
1	Bajrang
2	Jinendra Jain
3	Madhu Bala
4	Manoj Choudhary
5	Mudit Mudgal
6	Naveen
7	Nisha Gurjar
8	Pintu Lal Bairwa
9	Pushpa
10	Satish Kumar

Action taken for weak learners

1. Remedial classes taken
2. Hard topics notes given
3. PPT presentations of 3 dimensional topics
4. Class Test

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INITIATIVES IN TEACHING/ LEARNING

- PPT-Presentation by Students
- National Conferences
- Guest-Lectures by Eminent Professors
- Field Trips
- Seminars
- Science Exhibition
- Remedial Classes
- Group discussion
- Assignments
- Class test

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Result Analysis

Department of Science

Result Analysis (2022-23)
M.Sc. Previous Chemistry

Subjects	I	II	III	IV	V	VI	PRAC
No. of Students	26	26	26	26	26	26	26
No. of Students Passed	22	17	22	18	22	24	26
No. of Students 1st Division	10	8	9	15	18	17	26
No. of Students 2nd Division	5	4	7	9	3	5	0
No. of Students 3rd Division	4	0	6	4	3	3	0
No. of Students Failed	4	9	4	8	4	2	0
% Pass	84.61	65.38	84.61	69.23	84.61	92.3	100

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Department of Science

Result Analysis (2022-23)

M.Sc. Previous Chemistry

Paper Code	Subjects	% Pass
I	Inorganic Chemistry	84.61
II	Organic Chemistry	65.38
III	Physical Chemistry	84.61
IV	Spectroscopy and Diffraction Methods	69.23
V	Green and Sustainable Chemistry	84.61
VI	Analytical Technical	92.3
PRATICAL-I		100

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List of Toppers (M.Sc. Previous Chemistry)

S	Name of Toppers	Percentage
1	MAHAK RANI PATEL	80
2	PRACHI GIDWANI	78
3	NAVEEN	73
4	PUSHPA YADUVANSHI	72

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Question Bank

1. (a) What do you understand by term lanthanides and actinide. The oxidation state of +3 are shown by all lanthanide. Why ?
   (b) Discuss the paramagnetic behaviour of lanthanide and give its reason. Why the orbital moment effect in lanthanide is not quenched by ligand field.
2. What are Boranes ? How are they classified ? Give the structure and bonding in any four of them.
3. State and explain Bent rule with a suitable example. Apply Bent rule in the prediction of bond angles in H – C – H in $CH_3 - C \equiv CH$ molecule.
4. (a) Explain the shape and hybridization of the following :—
   (i) XeF_6 (ii) SO_3 (iii) NH_4^+ ion
   (b) Why two chlorine atoms of Pcl_5 are more reactive than the rest three.
5. Describe ion exchange method for the separation of lanthanides from one another. Why is the colour of lanthanides compounds are so similar.
6. Explain reducible and irreducible representation. Write the Orthogonality theorem and consequences.
7. Draw Molecular orbital diagram of Co_2 and Co_3^{--}. Explain the bond pair and magnetic property on the basis of the M.O. diagram.
8. What is Scintillation ? Describe scintillation counter operation to detect radiation caused due to radio active substances. What are its advantages over Geiger-Muller Counter.
9. Explain why the molecule of CO_2 and methane presses zero dipole moment.
10. Write the Bohr theory of compound nucleus. Discuss the nuclear reaction of different types. Explain the Q-value and cross-section of nuclear reaction.

* * *

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Time : 3 Hours]

Answer any FIVE Questions. All questions carry equal marks.

1. (a) Describe the shell-model and liquid-drop model of a nucleus.
   (b) Write a note on Geiger-Muller counter.
2. Draw the molecular orbital diagrams of NO_2^- ion and CO_2. Discuss the bond order and magnetic property on the basis of M.O. diagram.
3. Describe Wade's Rule in short and use this rule to establish the structure of $[B_6H_6]^{2-}$ from its formula and from its electron count.
4. How are the lanthanide separated by Solvent Extraction method ? Discuss spectral properties of lanthanides and actinides.
5. Construct the character table for the point group C_{2v} and C_{3v}.
6. Describe the ways in which the actinides resemble their counterpart in lanthanides ? Give an account of the chemistry of Neptunium and Plutonium ? How are Neptunium and Plutonium Synthesized.
7. Explain the terms Moderator and Reflector, Reactor Coolant and controll Materials with examples.
8. Write notes on the following :—
   (a) Carborones
   (b) Uses of some radioisotopes in medical science.
9. Write symmetry operations in the following molecules :—
   H_2O, BF_3, H_2, CH_3Cl, Hcl, CH_4, NH_3
10. Explain $d\pi - P\pi$ bonding by giving suitable examples and write short notes on Bent Rule.

* * *

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All questions carry equal marks.

1. State and explain bent rule with suitable examples. Apply Bent rule in the predication of bond angles in $H-C-H$ in $CH_3-C\equiv CH$ molecule.

2. Describe Wade's Rule and use this rule to establish the structure of $[B_6H_6]^{2-}$ from its formula.

3. How are lanthanide separated by solvent extraction method ? Discuss spectral properties of Lanthanide and actinides.

4. (a) Why two chlorine atoms of PcI_5 are more reactive than the rest three.
   (b) Explain the shape and hybridization of the following :—
   (i) So_3 (ii) NH_4^+ *ion* (iii) X_eF_6

5. Construct the character table for the point group C_{2v} and C_{3v}.

6. Explain the terms moderator and Reflector, Reactor Coolant an Control materials with examples.

7. What is Scintillation ? Describe the Scintillation Counter operation to detect radiation caused due to radio active substances. What are its advantages over Geiger-Muller Counter.

8. Write symmetric operation in the following molecules :—
   HcI, NH_3, CH_4, H_2O, CH_3Cl, BF_3, H_2

9. Explain $d\pi - P\pi$ bonding by giving suitable examples and write short notes on Bent rule.

10. Write short notes on the following :—
   (a) Bhore's theory of Compound nucleus.
   (b) Paramagnetic behaviour of lanthanide.

* * *

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Pre University Question Paper

M.Sc. (Previous) Examination, 2023

CHEMISTRY

First Paper-CH-401

(Inorganic Chemistry)

Time Allowed: Three Hours Maximum Marks:100

Unit – I

1. What is Symmetry operations? Write some general rules for multiplication of symmetry operations. (CO1) 10+10

OR

2. (a) Explain symmetry elements with suitable examples. 10+10
(b) Derive character table for C_{2v} point group and write the uses of character table.

Unit – II

3. (a) Draw and discuss the Walsh diagram of tri-atomic (AH_2 type) molecule.

(b) Discuss dπ – Pπ bonding in main group elements compound. (CO5) 10+10

OR

4. (a) Discuss the Molecular Orbital Theory of Coordination complexes with suitable examples.

(b) Explain Metalloboranes with suitable examples. (CO3) 10+10

Unit – III

5. (a) Explain Tanabe- Sugano diagrams for transition metal complexes with d'state.
(b) Explain spectroscopic method of assignment of absolute configuration in optically active metal chelates. (CO5) 10+10

OR

6. (a) Explain magnetic exchange coupling and spin crossover with a suitable example.
(b) What do you know about charge transfer spectra? Illustrate your answer with suitable example. (CO5) 10+10

Unit – IV

7. What are inert and labile complexes? Write the mechanism of acid hydrolysis and base hydrolysis. 10+10

OR

8. What is trans effect? Explain the mechanism of substitution reaction in square planar complexes. (CO2) 10+10

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Unit – V

9. Explain the laws of radioactive decay. How does GM tube count particles? 10+10

OR

10. Write principle, Various methods of activation and its applications. (CO4) 10+10

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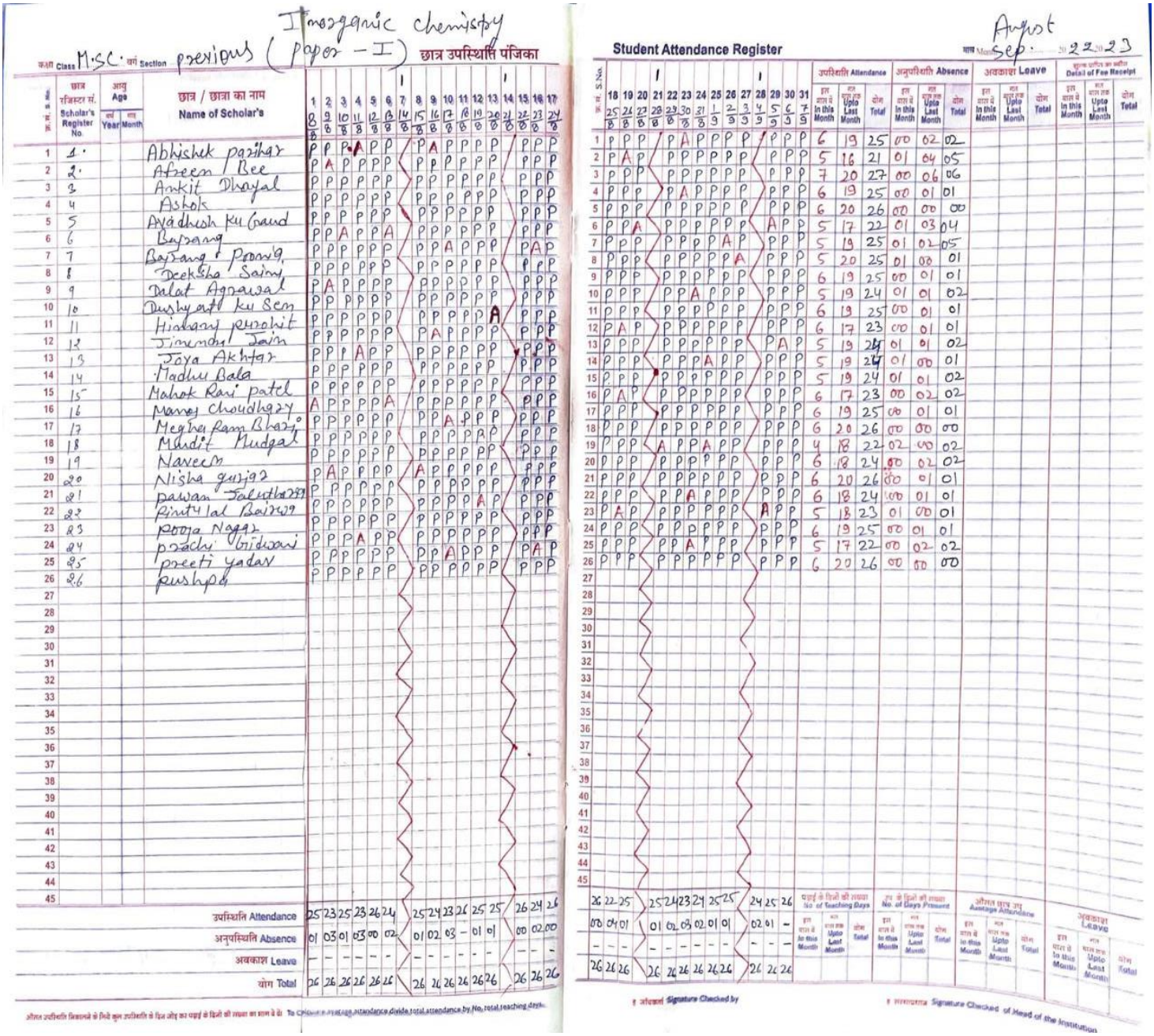
Attendance Register



Answer Sheets

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Internal

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68/100

SESSION - 2012 - 2013

Name/Roll No. Jaya Akanksha Class M.Sc. P.C. Section

Subject Inorganic Chemistry Paper I

Day Date Invigilator Signature Pallavi

1	2	3	4	5	6	7	8	9	10	Total
12			15		14		14	13		68

Marks Obtained 68 Max Marks 100 Examiners Signature

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(01)

Ans. 1. a. Symmetry element ⇒ It is a geometrical entity such as a point a line or a plane about which a symmetry operation is performed.

b. Symmetry operation ⇒ A symmetry operation is the movement of a molecule about the symmetry element in such a manner that the resulting configuration of the molecule is indistinguishable from the original.

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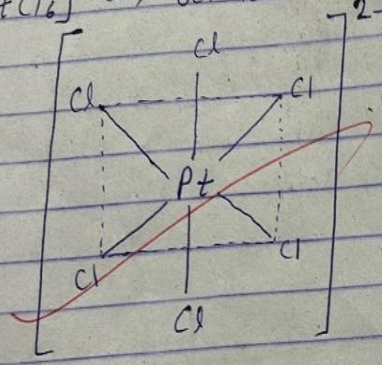
$\sigma h = 1$

$S_3^1, S_3^2, S_3^3 = E = 2$

ii) $[PtCl_6]^{2-}$ → Octahedral



Point group : Oh

Sym Symmetry element - $E, {}^3C_4, {}^4C_3, {}^3S_4, {}^3C_2$

Both coincident with the C_4 axis, ${}^6C_2, 5S_6, 3\sigma_h, 6\sigma_d$

Symmetry operation, $E = 1$

$C_4^1, C_4^2 = C_4^1, C_4^3, C_4^4 = E = 3 \times 3 = 9$

$C_3^1, C_3^2, C_3^3 = E = 8$

$C_2^1, C_2^2 = E = 6$

$3\sigma_h = 3$

$S_4^1, S_4^2 = C_2^1, S_4^3, S_4^4 = E = 2 \times 3 = 6$

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3.4 Structure and Synthesis of metal carbonyles ⇒

The compounds formed by the combination of CO molecules with transition metal atoms in low oxidation states are called metal carbonyls.

Depending on the number of metal atoms in a given carbonyl, carbonyl have been classified into the following two types :-

① Mononuclear carbonyls ⇒ These carbonyl contain only one metal atom per molecule and are of the type $M_x(CO)_y$, Here $x = 1$.
e.g. → $V(CO)_5$, $Cr(CO)_6$ etc.

2. Polynuclear carbonyls ⇒ These contain two or more metals per molecule and are of the type $M_x(CO)_y$. These carbonyl contain two metal atoms as bridged carbonyls.

e.g. → $[Fe_3(CO)_{12}]$, $[Mn\,Re(CO)_{10}]$

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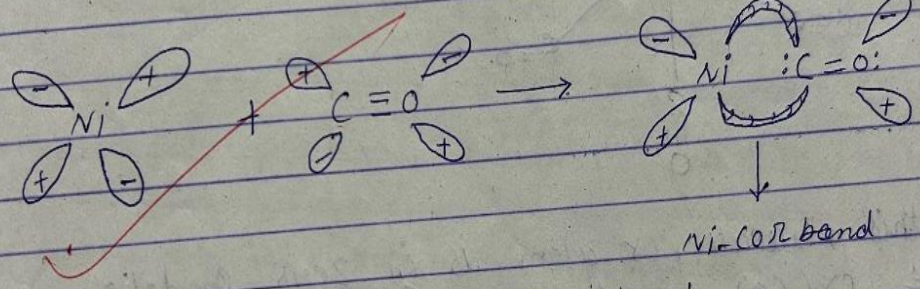
empty sp^3 hybrid orbitals on Ni-atom

$Ni + C\equiv O \longrightarrow Ni{:}C{=}O{:}$

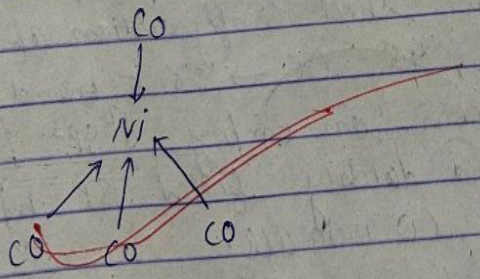
Ni–CO σ bond

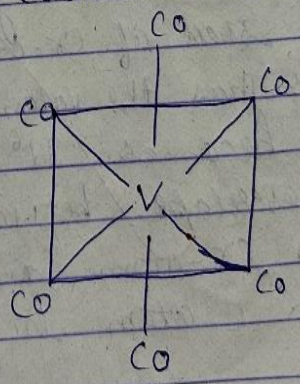
filled sp hybrid orbital on carbon atom



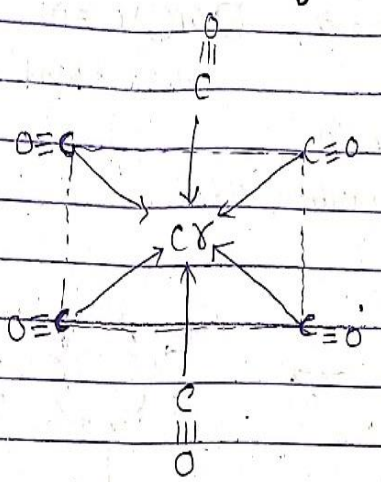
Ni–CO π bond

formation of one Ni ⟶ CO π bond





Structure and bonding in $Cr(CO)_6$ ⇒



In this molecule, Cr atom is in zero oxidation state and since $Cr(CO)_6$ is diamagnetic, all the six electrons in the valance shell of Cr-atom ($Cr = 3d^5, 4s^1$) get paired in 3d-orbitals. Thus the valance shell configuration of Cr-atom in $Cr(CO)_6$ becomes $3d^6, 4s^0$, OC → Cr σ bond results from the overlap between an empty d^2sp^3 hybrid orbital on Cr-atom and doubly filled sp hybrid orbital on C atom in CO molecule.

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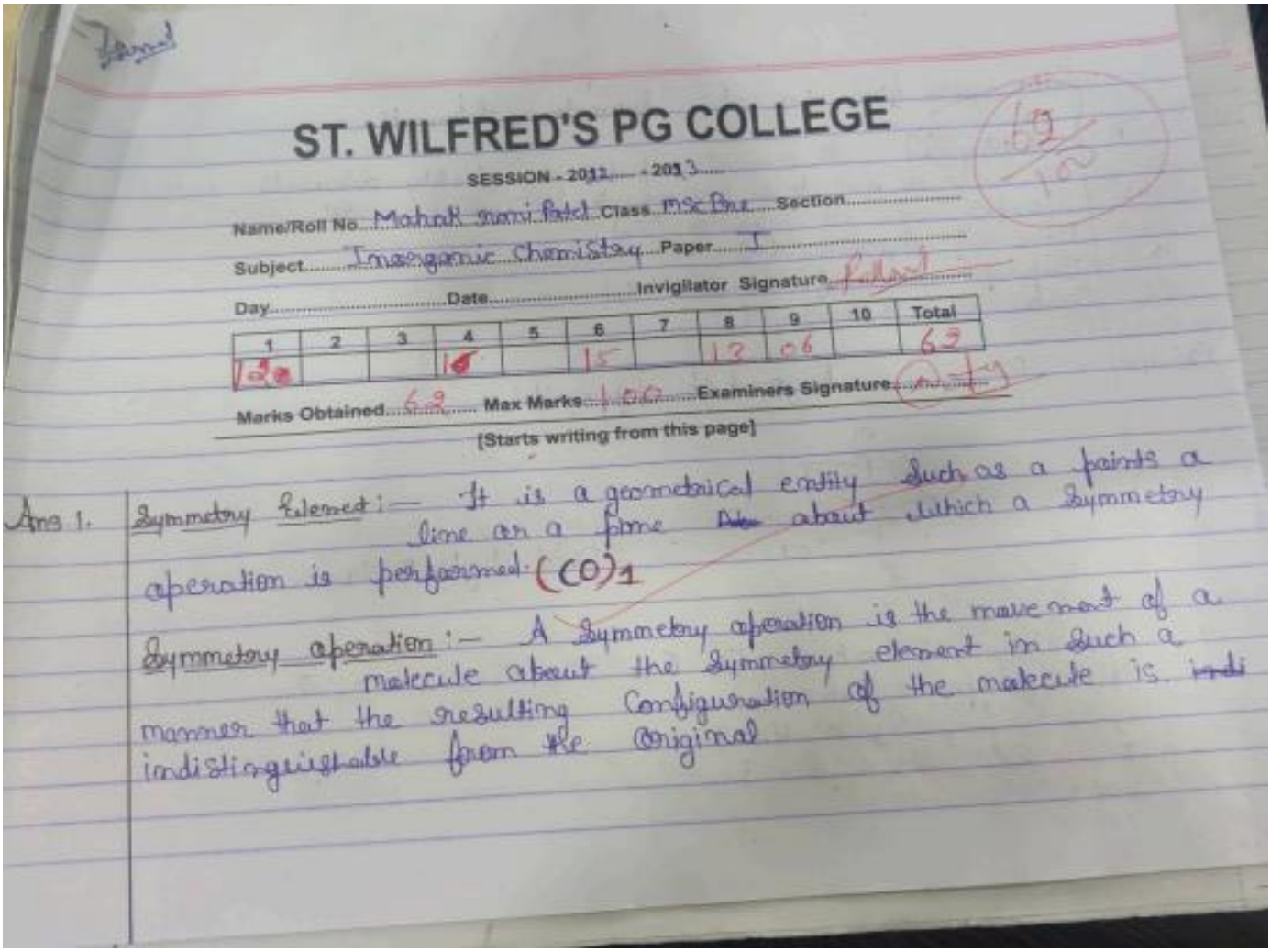

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SESSION - 2012 - 2013

Name/Roll No. Mahak mani Patel Class M.Sc Part Section

Subject Inorganic Chemistry Paper I

Day Date Invigilator Signature

1	2	3	4	5	6	7	8	9	10	Total
12			16		15		13	06		62

Marks Obtained 62 Max Marks 100 Examiners Signature

[Starts writing from this page]

Ans 1. Symmetry Element :— It is a geometrical entity such as a points a line or a plane about which a symmetry operation is performed. (CO)1

Symmetry operation :— A symmetry operation is the movement of a molecule about the symmetry element in such a manner that the resulting configuration of the molecule is indistinguishable from the original

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ii) Kinetic Stability ⇒ This refers to the speed with which transformations leading to the attainment of equilibrium will occur.

formation constant ⇒ when a metal ion in aqueous solutions interacts with a neutral and monodentate ligand, the system at equilibrium may be described by the equation

$$[M(H_2O)_x]^{n+} + L \rightleftharpoons [M(H_2O)_{x-1}L]^{n+} + H_2O$$

$$M + L \rightleftharpoons ML$$

$$K_f = \frac{[ML]}{[M][L]}$$ K_f → formation constant

Experimental determination of formation constant

i) Spectrophotometric method ⇒ most of the complexes absorb light differently than the metal ions from which they are formed.

⇒ Beer's law which is given as:

$$A = \varepsilon \cdot l \cdot c.$$

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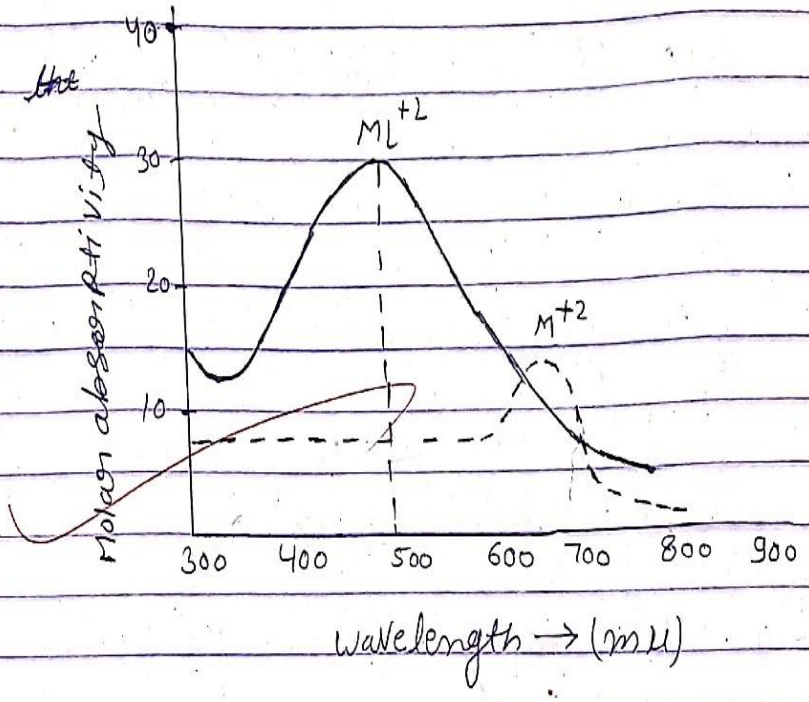
where ε = molar extinction Coefficient
l = length of the absorption cell
C = concentration of the complex



The value of K_f (formation constant) for the reaction:

$$M^{+2} + L \underset{}{\overset{K_f}{\rightleftharpoons}} ML^{+2}$$

will be given by

$$K_f = \frac{[ML^{+2}]}{[M^{+2}][L]} \quad -(1)$$

we know that

$$C_M = [M^{+2}] + [ML^{+2}] \quad \text{---} \quad (2)$$

$$C_L = [L] + [ML^{+2}] \quad \text{---} \quad (3)$$

$$A = \varepsilon [ML^{+2}]^{1} \cdot l \cdot [ML^{+2}] \quad \text{---} \quad (4)$$

$$[ML^{+2}] = \frac{A}{\varepsilon [ML^{+2}]^{1}} \quad \text{---} \quad (5)$$

where C_M = Total Concentration of the metal ion

C_L = Total concentration of the ligand

put the value of ML^{+2} obtained from equation (5) in equation (2) and (3) to get the values of $[ML^{+2}]$ and $[L]$

Thus:

$$[M^{+2}] = C_M - \frac{A}{\varepsilon [ML^{+2}]^{1} \cdot l}$$

$$[L] = C_L - \frac{A}{\varepsilon [ML^{+2}]^{1} \cdot l} \quad \text{---} \quad (6)$$

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Thus if we put the values of $[ML^{+2}]$, $[M^{+2}]$ and $[L]$ as obtained from equation (4), (5) and (6) respectively in equation (1), we shall get the values of K_f. for the equation of evaluation of the values of K_f, the values of A, $a[ML^{+2}]$, L, C_M and C_L must be known. The constancy of K_f is checked by repeating the measurements at different C_M and C_L values.

UNIT-V

ns. 9.@ **law of radioactive decay** :- Radio activity was discovered in 1896 by the french Scientist Henry Becquerel while working with phosphorescent materials. A substance which possessed the property of emitting such active rays was called radioactive substance and the property was called radio activity.

Theory of radioactive disintegration:- Rutherford and Soddy formulated the theory of radioactive disintegration, according to this theory :-

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Ans. 9(b) **Geiger - nuttal rule** :- Geiger and nuttal found that those materials which decay slowly emit α particles of short range while those which disintegrate rapidly.

A relationship b/w the decay constant λ and the range R_1 was discovered by Geiger and nuttal in 1921.

$$\log \lambda = A + B \log R \quad - (1)$$

(A and B = constant)

A plot of $\log \lambda$ against $\log R$ will give a straight line. where R is the range in standard air.

Eq^n (1) is known as Geiger nuttal law. This is only approximation.

The range of R is related to the energy of α particles in the form.

$$R = aV^3$$

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UNIT-IV

Ans. 6. **Acid Hydrolysis** ⇒ These are the substitution reac in which a ligand is replaced by water or by OH^- group.

The reaction in which an aqua complex is formed as a result of the replacement of a ligand by H_2O molecules are called acid hydrolysis.

Acid hydrolysis reactions occaur in neutral and acidic solution (Ph < 3)

$$[Co(NH_3)_5Cl]^{+2} + H_2O \rightarrow [Co(NH_3)_5(H_2O)]^{+3} + Cl^-$$

It has been observed that NH_3 or ammines like ethylene diamine or its derivatives co-ordinated to Co(III) are replaced very slowly by H_2O and hydrolysis of the reaction is first order.

$$K = k'[H_2O] = k'[55.5]$$

$$Rate = K[Co(NH_3)_5X]^{+2}$$

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ii) Effect of chelation:- rate of aquation of the complex is ↓ as chelation ↑; The rates of aquation is slowed down by chelation because of ↓ stability of the transition state due to less efficient solvation.

does not distinguish between S_N1 and S_N2 mechanism.

iii) Effect of substitution on Ethylenediamine steric hindrance:-

when H atom on C atom or on N atom of en group of trans $[Co(en)_2Cl_2]^+$ are replaced by the alkyl group like CH_3 the ligand become more bulky.

Since the removal of one Cl^- ion from the complex reduces the congestion around the metal, Thus the intermediate is less stained than the complex.

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(iv) Effect of leaving group :- The rate of equation of $[Co(NH_3)_5X]^{+2}$ corresponding to the replacement of X^- with H_2O molecules depends on the nature of X^- because the bond breaking step is important in rate determing step.

$HCO_3^- > NO_3^- > I^- > Br^- > Cl^- > SO_4^{2-} > F^- > CH_3 >$

$COO^- > SCN > NO_2^-$

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According to this theory -

i) Radioactive elements are continuously emitting α, β and γ rays and produce new radio active product.

ii) The rate of disintegration is not affected by external factors as temp, pressure But depends upon the number of atoms.

$A \longrightarrow B$

$$-\frac{dN}{dt} \propto N$$

$$-\frac{dN}{dt} = \lambda N$$

$$-\lambda dt = \frac{dN}{N}$$

If $dt = 1$, $\lambda = -\frac{dN}{N}$

$$\int \frac{dN}{N} = -\int \lambda \cdot dt$$

$$\ln N = -\lambda t + C$$

At $t = 0$

$$\boxed{C = \ln N_0}$$

Unit - IV

Ans.8. **Acid Hydrolysis :-** These are those ~~Substan~~ substitution reaction in which a ligand is Replaced by 'OH⁻ group or water.
The reaction in which a aqua complex is formed as a result of the replacement of a ligand by H_2O molecules are called acid hydrolysis.
Acid hydrolysis reaction occur in ~~neut~~ neutral and acidic solution (pH < 3)

$$[Co(NH_3)_5Cl]^{+2} + H_2O \longrightarrow [Co(NH_3)_5(H_2O)]^{+3} + Cl^-$$

In this Rxn that NH_3 are ~~are~~ or ammines like ethylene diamine or its derivatives co-ordinated to Co (III) are replaced very slowly by H_2O and hydrolysis of the reaction is first order.

$$k = k'[H_2O] = 1k1\ [55.5]$$

$$\text{Rate} = 1k\ [Co(NH_3)_5X]^{+2}$$

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A Relationship between the decay constant and the range R, was discovered by Geiger & Geiger and Nuttal in 1901.

$$\log \lambda = A + B \log R \quad -(1)$$

A plot of $\log \lambda$ against $\log R$ will give a straight line. where R is the range in standard air.

$$\log \lambda = A + B \log R$$

This eq. known as Geiger - Nuttal law. This is only approximation.

The range of R is related to the energy of α particles in the form.

$$R = aV^3$$

$$E = \frac{1}{2} mv^2 = \frac{1}{2} \frac{m \cdot R^{2/3}}{a^{1/3}} = qR^{2/3}$$

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$K^1 [Co(NH_3)_5X]^{+2} [H_2O]$

~~$K^1 [Co$~~

$K^1 [Co(NH_3)_5X]^{+2} [55.5]$

Factors affecting Acid Hydrolysis :-

1) Effect of leaving group :- The Rate of eq. $[Co(NH_3)_5X]^{+2}$ corresponding to the replacement of $X^\ominus$ with H_2O molecules depends on the nature of $X^\ominus$ B/c The bond breaking step is B is importance in rate determining step.

order :- $HCO_3^- > NO_3^- > F^- > Br^- > Cl^- > SO_4^{2-} > (H_2O)$
$COO^\ominus > SCN > NO_2^-$

2.) effect of Charge on the complex :- decrease in rate as the charge of the complex,

Charge on the complex increase in Cl dissociation SN1 process seems to be operative.

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SESSION - 201..... - 201.....

Name/Roll No.....Class.....Section.....

Subject.....Paper.....

Day.....Date.....Invigilator Signature.....

1	2	3	4	5	6	7	8	9	10	Total

Marks Obtained.....Max Marks.....Examiners Signature.....

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Unit - III

Ans (b) Spectrophotometric method :- When the terms stability is used without qualification it means that the complex exists and under suitable condition it may be stored for a long time.

i) Thermodynamic Stability :- This is a measure of the extent to which the complex will form or will be transformed into another species, when the

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The acid Hydrolysis of divalent complex like

$[Co(NH_3)_4Cl_2]^+ \xrightarrow{-Cl^-} [Co(NH_3)_4Cl]^{+2} + Cl^-$

$[Co(NH_3)_4Cl]^{+2} \xrightarrow{+H_2O} [Co(NH_3)_4Cl(H_2O)]^{+2}$

iii) effect of chelation:- Rate of aquation of the complex is decreasing as the chelation effect increasing. The rate of aquation is slowed down by chelation B/C of decreased stability of the transition state due to less efficient solvation. It doesn't distinguish between S_N1 and S_N2 mechanism.

iv) Effect of substitution on ethylene diamine steric hindrance:- When H atom on N atom or on C atom of en. group of trans $[Co(en)_2Cl_2]^+$ are replaced by the alkyl group like CH_3 the ligand become more bulky.

since the removal of one Cl^- ion from the complex reduces the congestion around the metal, Thus the intermediate is less strained than the complex.

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Experimental determination of formation Constant :-

1) Spectrophotometric method :- most of the complex absorb light differently then the metal ion form which they are formed.

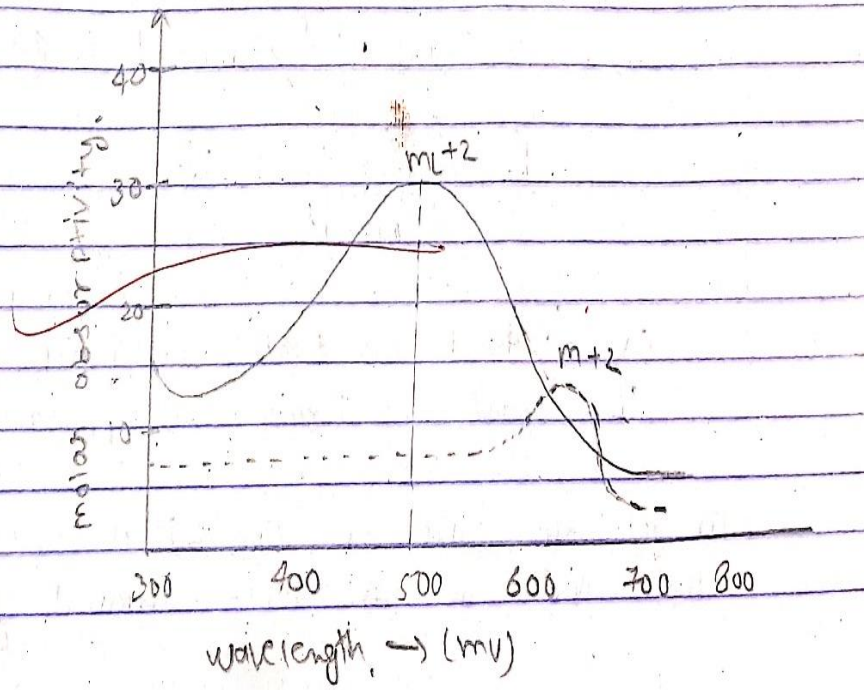
According to Beer's law :- ~~A = E.l.c.~~

$$A = E.l.c.$$

E = molar extinction cofficient

C = Concentration of complex.

l = length of the absorption cell.



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System has reached equilibrium.

ii) Kinetic Stability :- This refers to the speed with which transformed leading to the attain attainment of equilibrium will occur.

formation constant :- When a metal ion in aqueous solution interacts with a neutral and monodentate ligand, the system at equilibrium may be described by the equation.

$$[M(H_2O)_x]^{n+} + L \rightleftharpoons [M(H_2O)_{x-1}L]^{n+} + H_2O$$

$$M + L \rightleftharpoons ML$$

$$K_f = \frac{[ML]}{[M][L]}$$

K_f = formation constant

Journal

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SESSION - 2012 - 2013

Name/Roll No. Mahak Rani Patel Class M.Sc Part Section

Subject Inorganic Chemistry Paper I

Day Date Invigilator Signature

1	2	3	4	5	6	7	8	9	10	Total

Marks Obtained Max Marks Examiners Signature

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60/100

Ans 1. Symmetry Element :- It is a geometrical entity such as a points a line or a plane about which a Symmetry operation is performed.

Symmetry operation :- A Symmetry operation is the movement of a molecule about the Symmetry element in such a manner that the resulting Configuration of the molecule is indistinguishable from the original.

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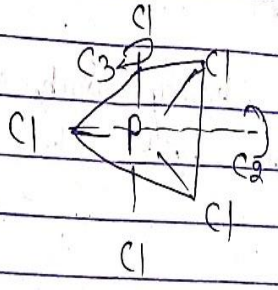
There are five types of Symmetry Elements :-

(i) Identity [E] - All molecules passes an identity elements which do not do any thing to the molecule.
(ii) Proper axis of rotation (C_n)
(iii) Plane of Symmetry (σ)
(iv) Improper axis of Rotation (S_n)
(v) Centre of Symmetry (i)

Example :- PCl_5 = Trigonal bi-pyramidal



sp^3d hybridisation

(i) Symmetry Element - $E, C_3, 3C_2, 3\sigma_V, \sigma_h, 2S_3$
Point group - D_{3h}
$C_3, C_3^2, C_3 = E = 2$
$C_2, C_2^3, C_2 = E = 3$
$3\sigma_V = 3$

in eq. (2) and (3) ~~to get the values of [m+2]~~

$$[m+2] = cm - \frac{A}{\varepsilon [m_L+2] \cdot l}$$

$$[L] = CL - \frac{A}{\varepsilon [m_L+2] \cdot l} \quad - (6)$$

Thus if he put the values of $[m_L+2]$, $[m+2]$ and $[L]$ as obtained from eq. (4), (5) and (6) respectively in eq. (1) we shall get the values of Kf. for the eq. of evalution of the values of Kf, the values of A, $[m_L+2]$, l, cm and CL must be known. The Captancy of Kf is cm and CL values.

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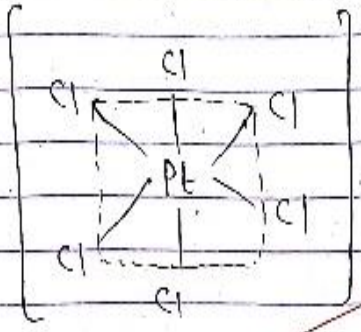
$\sigma_h = 1$

$S_3^1, S_3^2, S_3^3 = E = 2$

$[PtCl_6]^{2-}$ → Octahedral



Point group :- O_h

Symmetry Element - E, $^3C_4$, $^4C_3$, $^3S_4$, $^3C_2$

Both Coincident with the C_4 axis, $^6C_2$, $^5S_6$, $3\sigma_h$, $6\sigma_d$

Symmetry operation $E = 1$

$C_4^1, C_4^2 = C_4^1, C_4^3, C_4^4 = E = 3 \times 3 = 9$

$C_3^1, C_3^2, C_3^3 = E = 8$

$C_2^1, C_2^2 = E = 6$

$3\sigma_h = 3$

$S_4^1, S_4^2 = C_2^1, S_4^3, S_4^4 = E = 2 \times 3 = 6$

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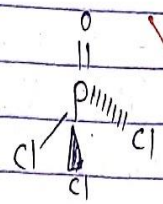
S_6^1, $S_6^2 = C_3^1$, $S_6^3 = C_2^1$, $S_6^4 = C_3^2$, $S_6 = E = 2 \times 4 =$
$6\sigma_d = 6$
$i = 1$

(iii) $POCl_3$ → trigonal pyramidal

Point group - C_{3V}
Symmetry element E, C_3, $3\sigma_v$
operation $= E = 1$
C_3^1, C_3^2, C_2^2 = $E = 2$
$3\sigma_v = 3$



(iv) m - dinitrobenzene :-
Point group = C_{2V}
element = E, C_2, $2\sigma_v$
operation $E = 1$
$C_2 = 1$
$2\sigma_v = 2$

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General methods of Preparation :-

(i) By direct Synthesis :-

$$Fe + 5CO \xrightarrow[100\ Atm\ p]{200^\circ C} Fe(CO)_5$$

$$Ni + 4CO \xrightarrow[1Atm\ p]{Room\ temp} Ni(CO)_4$$

(ii) By Carbonylating the metallic Salts with Co in presence of a Reducing agent

$$CrCl_3 + Co + LiAlH_4 \xrightarrow[70\ Atm\ p]{115^\circ C} Cr(CO)_6 + LiCl + AlCl_3$$

$$2FeS + 10CO + 2Cu \xrightarrow[300\ Atm\ p]{200^\circ C} 2Fe(CO)_5 + Cu_2S$$

$$2MnI_2 + 10Co + 2Mg \xrightarrow[210\ Atm\ p]{25^\circ C} Mn_2(CO)_{10} + 2MgI_2$$

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S4. **Structure and Synthesis of metal Carbonyles** :- The Complex formed by the Combination of Co molecules with transition metal atoms in low oxidation States are called metal Carbonyls.

Depending on the number of metal atoms in a given Carbonyl, Carbonyl have been classified into the following two types -

(1) **mono nuclear Carbonyls** :- These Complex Contain only one metal atom per molecule and are of type $M_x(CO)_y$, Here $x=1$

Ex $V(CO)_5$, $Cr(CO)_6$ etc

(2) **Poly nuclear Carbonyls** :- These Contain two or more metals per molecule and are of the type $M_x(CO)_y$. These Carbonyl Contain two metal atoms as bridged Carbonyls.

Ex $[Fe(CO)_{12}]$, $[Mn_2Re(CO)_{10}]$

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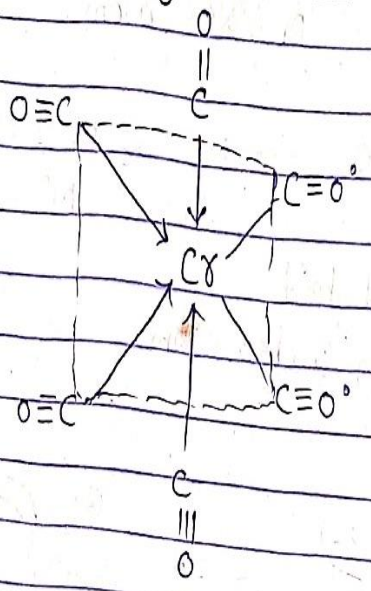
Structure and bonding in $Cr(CO)_6$:-



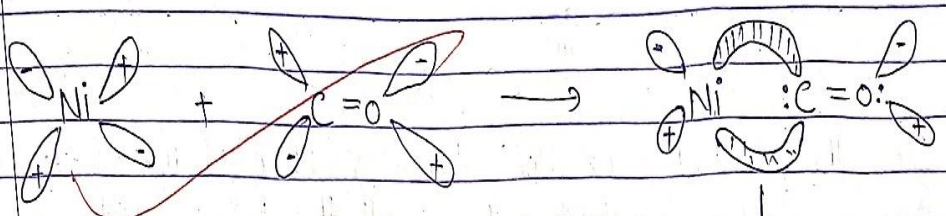
In this molecule, Cr atom is in zero oxidation state and since $Cr(CO)_6$ is diamagnetic, all the six electrons in the valance shell of Cr-atom ($Cr = 3d^5, 4s^1$) get paired in 3d-orbitals. Thus the valance shell configuration of Cr-atom in $Cr(CO)_6$ becomes $3d^6, 4s^0$, $OC \rightarrow Cr$ σ bond results from the overlap b/w an empty d^2sp^3 hybrid orbital on Cr-atom and doubly filled SP hybrid orbital on C-atom in Co molecule.

Bonding and Structure :- → empty sp^3 hybrid orbitals on Ni- atom.

$\ominus Ni \oplus + \oplus C \equiv O \longrightarrow \ominus Ni \leftarrow C = O:$

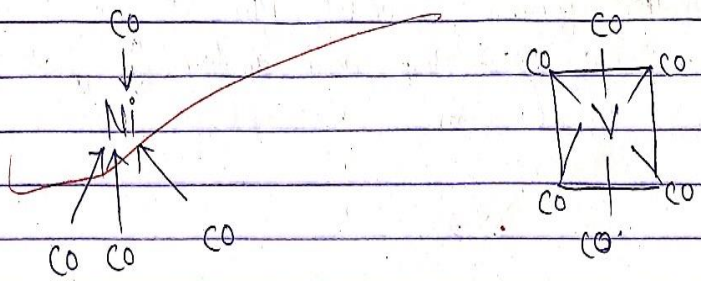
filled SP hybrid orbital on Carbon atom

Ni - Co σ bond



Ni - Co π bond

formation of one Ni → Co π bond



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Day..... Date..... Invigilator Signature.....

1	2	3	4	5	6	7	8	9	10	Total

Marks Obtained..... Max Marks..... Examiners Signature.....

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UNIT-V

Ans 9.(a) law of radio active decay :- Radio activity was discovered in 1886 by the French Scientist Henry Becquerel while working with Phosphorescent materials. A substance which possessed the property of emitting such active rays was called radio active substance and the property was called radio activity.

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Theory of radioactive disintegration :- Rutherford and So formulated the theory of radi active disintegration, according to this theory -

(i) Radio active ~~elements~~ elements are constly emitting α, β, γ rays and produce new radioactive products.

(ii) The rate of disintegration is not affected by external fa as temp, pressure but it depends upon the number of atoms.

$A \longrightarrow B$

$$-\frac{dN}{dt} \propto N \Rightarrow -\frac{dN}{dt} = \lambda N$$

$$-\lambda dt = \frac{dN}{N} \qquad (\lambda = \text{Velocity Const})$$

If $dt = 1$, $\lambda = -\frac{dN}{N}$

$$\int \frac{dN}{N} = -\int \lambda dt$$

$$\ln N = -\lambda t + C$$

At $t = 0$ ~~$N = N_0$~~ $N = N_0$

$$C = \ln N_0$$

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Ans 9(b) **Geiger - nuttal rule :-** Geiger and nuttal found that those radials which decay slowly emit α- particles of short range while those which disintegrate rapidly.

A relationship b/w the decay Const λ and the range R, was discovered by ~~Geiger~~ Geiger and nuttal in 1921.

$$\boxed{\log \lambda = A + B \log R} \quad -(1)$$

(A & B = Const)

A plot of $\log \lambda$ against $\log R$ will give a straight line. where R is the range in Standard air.

Eqn (1) is known as Geiger - Nuttal law. This is only approximation.

The range of R is related to the energy of α- particles in the form.

$$\boxed{R = aV^3}$$

$$E = \frac{1}{2} mv^2 = \frac{1}{2} m \cdot \frac{R^{2/3}}{a^{2/3}} = \boxed{gR^{2/3}}$$

there must be a similar connection b/w the half-life and the disintegration energy E ⇒

$T_{1/2} R^B = \lambda$

$\frac{3}{2} B \log E + B' = \log \lambda$

UNIT - IV

Acid Hydrolysis :- These are the substitution reaction in ~~which~~ which a ligand is replaced by a water or by OH^- group.

The reaction in which an aqua complex is formed as a result of the replacement of a ligand by H_2O molecules are called Acid Hydrolysis

Acid hydrolysis reactions occour in neutral and acidic solution (Ph < 3).

$$\left[Co(NH_3)_5Cl\right]^{2+} + H_2O \longrightarrow \left[Co(NH_3)_5(H_2O)\right]^{+3} + Cl^-$$

It has been observed that NH_3 or ammines like ethy diamine or its derivatives Co-ordinated to Co(III) are replaced very slowly by H_2O And hydrolysis of the reaction is first order.

$$K = K'[H_2O] = K'[55.5]$$

$$\text{Rate} = K[Co(NH_3)_5X]^{2+}$$

$$K'[Co(NH_3)_5X]^{2+}[H_2O]$$

$$\boxed{K'[Co(CH_3)_5X]^{2+}[55.5]}$$

Factors affecting Acid hydrolysis :-

(1) Effect of Charge on the Complex :- ① i.in rate as the Charge of the Complex

(A) in Cl dissociation S_N1 process seems to be operative.

The acid hydrolysis of divalent complex like $[Co(NH_3)_4(H_2O)Cl]^{2+}$ also takes place in two steps.

$$[Co(NH_3)_4Cl_2]^{+} \xrightarrow{-Cl^-} [Co(NH_3)_4Cl]^{2+} + Cl^-$$

$$[Co(NH_3)_4Cl]^{+2} \xrightarrow{+H_2O} [Co(NH_3)_4Cl(H_2O)]^{2+}$$

(i) Effect of Chelation:- rate of aquation of the complex is (I) as Chelation (A). The rates of aquation is slowed down by Chelation because of (I) Stability of the transition state due to less efficient solvation.

does not disintguish between S_N1 and S_N2 mechanism.

(iii) Effect of Substitution on Ethylenediamine Sterichindrance:-

When H atom on C atom or on N atom of en group of trans $[Co(en)_2Cl_2]^+$ are replaced by the alkyl group like CH_3 the ligand become more bulky.

Since the removal of one Cl^- ion from the Complex reduces the Congestion around the metal. Thus the intermediate is less strained than the Complex.

(iv) Effect of leaving group :- The rate of Equation of $[Co(NH_3)_5X]^{2+}$ Corresponding to the replacement of X^- with H_2O molecules depends on the nature of X^- because the bond breaking step is important in rate determining step.

$HCO_3^- > NO_3^- > I^- > Br^- > Cl^- > SO_4^{2-} > F^- > CH_3COO^- > SCN^- > NO_2^-$

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SESSION - 201..... - 201.....

Name/Roll No.....Class.....Section.....

Subject.....Paper.....

Day.....Date.....Invigilator Signature.....

1	2	3	4	5	6	7	8	9	10	Total

Marks Obtained.....Max Marks.....Examiners Signature.....

[Starts writing from this page]

UNIT-3

Ans 6. When the term Stability is used without qualification it means that the Complexe exists and under Suitable Condition it may be stored for a long time.

Two Kinds of Stability of Complexes has Shown which are as follows :-

(i) Thermodynamic Stability :- This is measure of the extent to which the Complex will form or will be

transformed into another species.

(ii) Kinetic Stability :- This refers to the speed with which the formations leading to the attainment of equilibrium will occur.

formation constant :- When a metal ion in aqueous solution interacts with a neutral and monodentate ligand.

$$[M(H_2O)_x]^{n+} + L \rightleftharpoons [M(H_2O)_{x-1}L]^{n+} + H_2O$$

We may write the equilibrium reaction simplified.

$$M + L \rightleftharpoons ML$$

$$K_f = \frac{[ML]}{[M][L]}$$

K_f is called the formation constant of the complex.

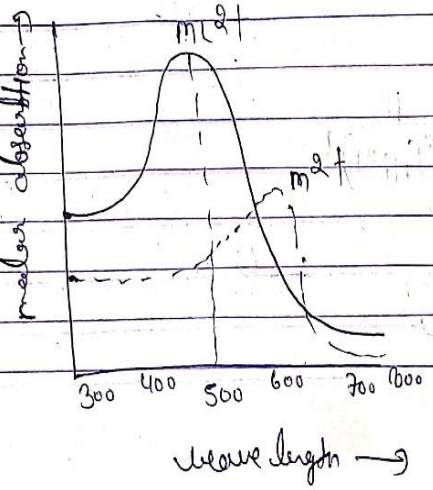
Experimental determination of formation Constant -

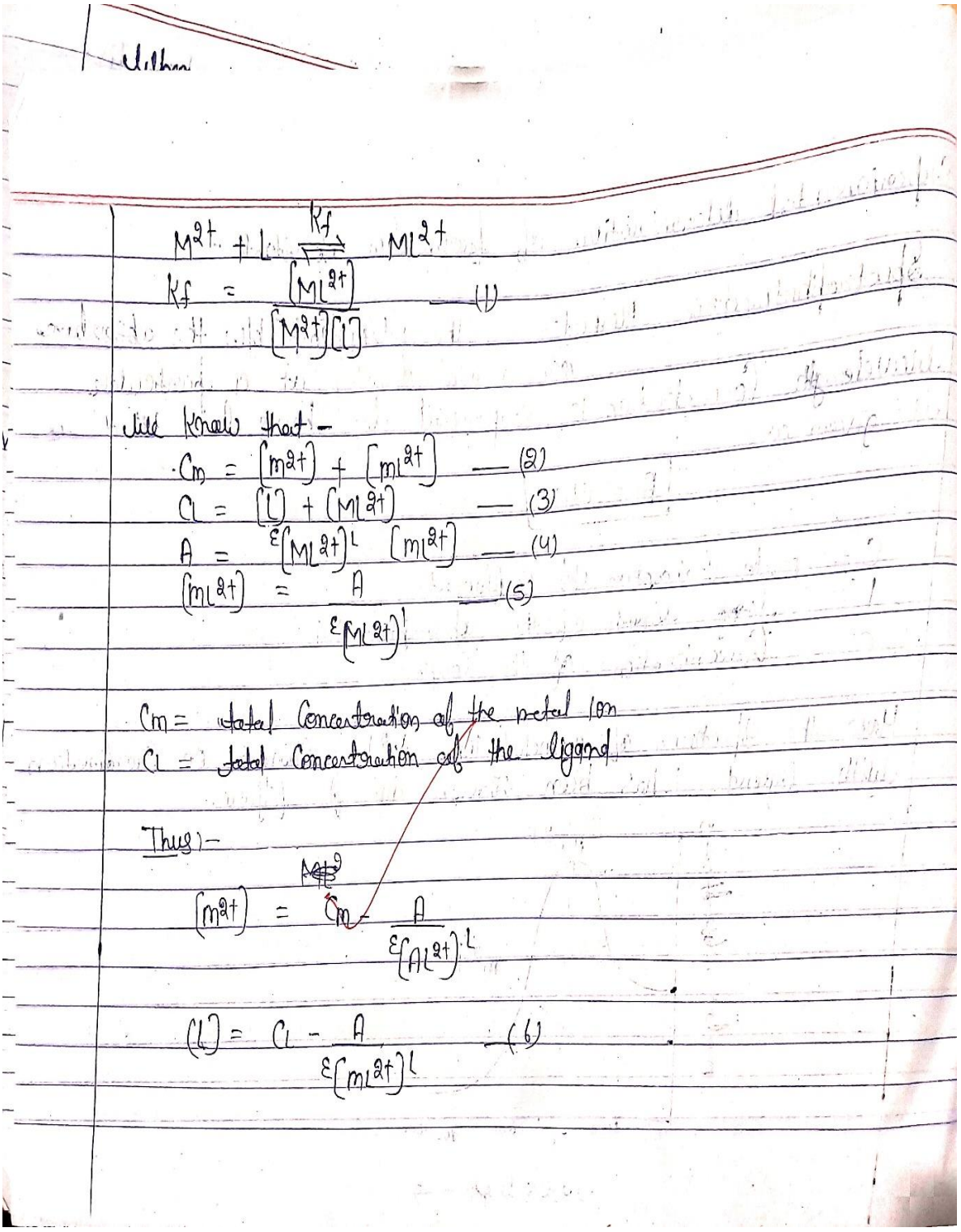
Spectrophotometric Method:- The relationship b/w the absorbance or optical density at a particular wavelength Concentration is expressed by beer's law which is given as.

$$A = \varepsilon l c$$

ε = mole extinction Coefficient
l = length of the absorption cell
c = Concentration of the Complex

How the Spectrum of a metal ion M^{2+}, Changes on Coordination with ligand, L has been shown in figure.





$$M^{2+} + L \underset{}{\overset{K_f}{\rightleftharpoons}} ML^{2+}$$

$$K_f = \frac{[ML^{2+}]}{[M^{2+}][L]} \quad \text{— (1)}$$

We know that -

$$C_m = [m^{2+}] + [ML^{2+}] \quad \text{— (2)}$$

$$C_L = [L] + [ML^{2+}] \quad \text{— (3)}$$

$$A = \varepsilon [ML^{2+}]^1 \, [ML^{2+}] \quad \text{— (4)}$$

$$[ML^{2+}] = \frac{A}{\varepsilon [ML^{2+}]^1} \quad \text{— (5)}$$

C_m = total Concentration of the metal ion

C_L = total Concentration of the ligand

Thus -

$$[m^{2+}] = C_m - \frac{A}{\varepsilon [ML^{2+}] \cdot l}$$

$$[L] = C_L - \frac{A}{\varepsilon [ML^{2+}]^1} \quad \text{— (6)}$$

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Potentiometric method:- When the ligand is a weak base or acid for the ligand Can be used for the determination of the formation Const.

Competition b/w hydrogen ions and metal ions

$L + H^+ \xrightleftharpoons{Ka} HL^+$

$Ka = \frac{[HL^+]}{(L)(H^+)}$

$L + M^+ \xrightleftharpoons{Kf} ML^+$

$Kf = \frac{(ML^+)}{(L)(M^+)}$

$C_H = [H^+] + [HL^+]$

$C_M = [M^+] + [ML^+]$

$C_L = [L] + [ML^+] + [HL^+]$

$$\boxed{Kf = \frac{(ML^+)}{(M^+)(L)}}$$

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