Bharath

INSTITUTE OF HIGHER EDUCATION AND RESEARCH

Declared as **Deemed-to-be-University** u/s 3 of the UGC Act, 1956

B.Tech Civil Engineering

U20CYBJ01 - Engineering Chemistry

Course File

Bharath
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School of Civil and Infrastructure Engineering

Vision and Mission of the Department

Vision

The Department of Civil Engineering is striving to become as a world class academic centre for quality education and research in diverse areas of civil engineering, with a strong social commitment.

Mission

Mission of the department is to achieve international recognition by:

M1: Producing highly competent and technologically capable professionals.

M2: Providing quality education in undergraduate and post graduate levels, with strong emphasis on professional ethics and social commitment.

M3: Developing a scholastic environment for the state – of –art research, resulting in practical applications.

M4: Undertaking professional consultancy services in specialized areas of civil engineering.

Program Educational Objectives (PEOs)

PEO1: PREPARATION

Civil Engineering Graduates are in position with the knowledge of Basic Sciences in general and Civil Engineering in particular so as to impart the necessary skill to analyze, synthesize and design civil engineering structures.

PEO2: CORE COMPETENCE

Civil Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics, related to recent developments in civil and environmental engineering.

PEO3: PROFESSIONALISM

Civil Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative insight so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL

Civil Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS

Civil Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

PROGRAMME OUTCOMES (POs)

On completion of B.Tech in Civil Engineering Programme, Graduates will have to

1) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex civil engineering problems

2) **Design/Development of Solutions:** Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

3) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

4) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

5) **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

6) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

7) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

8) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

9) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

10) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

11) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

12) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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COURSE FILE

FACULTY	**Dr. G.NITHYA**	**FACULTY DEPT**	**CHEMISTRY**
SUBJECT	**ENGINEERING CHEMISTRY**	**SUBJECT CODE**	**U20CYBJ01**
YEAR	**2022 - 2023 (TERM I)**	**SEMESTER**	**ODD**
DEG &BRANCH	**B.TECH (ECE)**	**DURATION**	**90 Hours**

SL.NO	**DETAILS IN COURSE FILE**	**REMARKS**
1.	LEARNING OUTCOMES	✓
2.	LESSON PLAN	✓
3.	CO-PO MAPPING	✓
4.	INDIVIDUAL TIME TABLE	✓
5.	SYLLABUS WITH COURSE OUTCOMES	✓
6.	LECTURE NOTES (FOR ALL UNITS)	✓
7.	CLA I - QUESTION PAPER	✓
8.	CLA I - KEY	✓
9.	CLA I – SAMPLE ANSWER SHEETS	✓
10.	CLA II - QUESTION PAPER	✓
11.	CLA II - KEY	✓
12.	CLA II - SAMPLE ANSWER SHEETS	✓
13.	CLA III - QUESTION PAPER	✓
14.	CLA III - KEY	✓
15.	CLA III - SAMPLE ANSWER SHEETS	✓
16.	ASSIGNMENT QUESTIONS	✓
17.	SAMPLE ASSIGNMENTS	✓
18.	END SEMESTER QUESTION PAPER	✓
19.	END SEMESTER ANSWER KEY	✓
20.	TEXT BOOK AND REFERENCE BOOK	✓
21.	QUESTION BANK	✓
22.	STUDENT PERFORMANCE RECORD	✓
23.	STUDENT ATTENDANCE RECORD	✓
24.	COURSE END SURVEY	✓
25.	CO ATTAINMENT	✓

G. Nithya

Course Coordinator

HOD

LEARNING OUTCOMES

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(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)

SCHOOL OF BASIC SCIENCES

DEPARTMENT OF CHEMISTRY

LEARNING OUTCOMES

Course Name: ENGINEERING CHEMISTRY (2022-23 R)

Course Code: U20CYBJ01

The learning of Engineering chemistry helps:

- Acquire knowledge about atomic and molecular orbitals.
- Identify the structure of unknown/new compounds with the help of spectroscopy.
- Demonstrate adequate acquired knowledge of the techniques to characterize surfaces and materials.
- Understand the causes of corrosion, its consequences and methods to minimize corrosion and to improve industrial designs.
- Apply thermal analysis techniques to determine thermal stability of solids and thermodynamic transitions of the specimen.
- Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions.

LESSON PLAN

LESSON PLAN

Name of the Department	:	**CHEMISTRY**
Name of the School	:	**SCHOOL OF BASIC SCIENCES**
Program Name/Code	:	**B.TECH (ALL BRANCHES) / FIRST YEAR**
Academic Year / Semester	:	**2022-2023/ ODD SEMESTER**
Course Name/Code	:	**ENGINEERING CHEMISTRY/U20CYBJ01**
a. **No. of Credits**	:	**5**
b. **Total Contact Hours**	:	**70 (Theory) + 20 (Experiment)**
Staff Name / ID	:	**Dr. G.NITHYA / 5343**

Hours	**Topic**	**CO**	**Reference**	**Teaching Tool**	**Proposed Date**	**Completed Date**	**Blooms Taxonomy Level**
UNIT- I **Atomic and Molecular structure**							
1	Introduction to Atom and molecules	CO1	R1	T2	10.10.2022	10.10.2022	1
1	Schrodinger equation	CO1	R1	T1	11.10.2022	12.10.2022	2
1	Particle in a box solution	CO1	R1	T1	12.10.2022	13.10.2022	4
1	Molecular orbitals theory	CO1	R1	T1	13.12.2022	14.10.2022	2
1	MOT diagram of diatomic molecules	CO1	R1	T2	17.10.2022	17.10.2022	4
1	MOT diagram of hetero nuclear diatomic molecules	CO1	R1	T2	18.10.2022	19.10.2022	4
1	Huckel's rule	CO1	R1	T2	19.10.2022	20.10.2022	2
2	π-molecular orbitals of butadiene and benzene	CO1	R1	T3	20.10.2022	21.10.2022 & 26.10.2022	4
1	Introduction to Crystal Field Theory	CO1	R1	T2	26.10.2022	27.10.2022	2
1	CFT Diagram of Octahedral complex	CO1	R1	T1	27.10.2022	28.10.2022	4
1	CFT Diagram of Octahedral complex	CO1	R1	T1	31.10.2022	31.10.2022	4
1	Energy level diagrams for transition metal ions	CO1	R1	T3	01.11.2022	03.11.2022	4
1	Magnetic properties of transition compounds.	CO1	R1	T3	02.11.2022	04.11.2022	4
UNIT –II **Fundamentals and Applications of Spectroscopy**							
1	Spectroscopy Introduction & Electro Magnetic Spectrum	CO2	R2	T2	02.11.2022	07.11.2022	2

1	UV-Visible spectroscopy	CO6	R2	T2	03.11.2022	07.11.2022	2
1	Electronic Transition Level of UV-Visible spectroscopy	CO6	R2	T2	07.11.2022	09.11.2022	3
1	Instrumentation and working procedure of UV-Visible Spectroscopy	CO6	R2	T2	08.11.2022	10.11.2022	3
1	Applications of Electronic spectroscopy	CO2	R2	T1	09.11.2022	16.11.2022	3
1	Principles of Rotational spectroscopy	CO2	R2	T2	10.11.2022	17.11.2022	2
1	Principles of Vibrational spectroscopy	CO2	R2	T2	14.11.2022	18.11.2022	2
1	Instrumentation and working procedure of IR Spectroscopy	CO2	R2	T2	15.11.2022	21.11.2022	3
1	Applications of IR Spectroscopy	CO2	R2	T1	16.11.2022	23.11.2022	2
1	Selection rules and Applications of rotational and Vibrational spectroscopy	CO2	R2	T2	17.11.2022	24.11.2022	3
1	Principle of Nuclear magnetic resonance spectroscopy	CO2	R2	T2	18.11.2022	24.11.2022	3
1	Instrumentation and working procedure of NMR Spectroscopy	CO2	R2	T2	21.11.2022	25.11.2022	3
1	^{1}H and ^{13}C NMR Chemical shift in NMR Spectroscopy	CO2	R2	T2	22.11.2022	28.11.2022	2
1	Applications of Nuclear magnetic resonance spectroscopy	CO2	R2	T1	23.11.2022	29.11.2022	3
UNIT –III **Surface characterization and Ionization Energy**							
1	Introduction of X-ray Photoelectron Spectroscopy (XPS)	CO3	R3	T2	24.11.2022	30.11.2022	4
1	Application of X-ray Photoelectron Spectroscopy (XPS)	CO3	R3	T1	28.11.2022	01.12.2022	2
1	Introduction of X-ray Diffraction Spectroscopy (XRD)	CO3	R3	T2	29.11.2022	02.12.2022	4

1	Applications of X-ray Diffraction Spectroscopy (XRD)	CO3	R3	T1	30.11.2022	06.12.2022	2
1	State equation of Real gases	CO3	R3	T1	01.12.2022	07.12.2022	3
1	Critical phenomena	CO3	R3	T1	05.12.2022	8.12.2022	3
1	Effective nuclear charge, penetration of orbitals	CO3	R3	T1	06.12.2022	12.12.2022	4
1	Electronic configurations, Aufbau principle, Hunds Rule and Pauling exclusion principle,	CO3	R3	T2	07.12.2022	13.12.2022	1
2	Atomic and Ionic Size according to periodic table	CO3	R3	T2	08.12.2022	14.12.2022 & 15.12.2022	2
1	Ionization energies, Electron affinity & Electronegativity and the periodic trends	CO3	R3	T2	12.12.2022	16.12.2022	2
1	Polarizability of diatomic, poly atomic molecules and Oxidation states	CO3	R3	T2	13.12.2022	19.12.2022	4
1	Coordination numbers and geometries	CO3	R3	T2	14.12.2022	20.12.2022	4
1	Geometries in Coordination Compounds with examples	CO3	R3	T2	15.12.2022	21.12.2022	4
UNIT- IV **Thermodynamics and Corrosion**							
1	Hard soft acids and base concept	CO4	R4	T2	19.12.2022	22.12.2022	1
1	Application of hard soft acids and base	CO4	R4	T2	20.12.2022	23.12.2022	3
1	Introduction of thermodynamic functions energy, entropy and free energy	CO4	R4	T2	21.12.2022	26.12.2022	2
1	Applications of Energy, Entropy and free energy	CO4	R4	T1	22.12.2022	27.12.2022	3
2	EMF Cell potentials	CO6	R4	T2	26.12.2022	29.12.2022	3
1	Nernst equation	CO6	R4	T2	27.12.2022	30.12.2022	3
1	Oxidation reduction solubility equilibria	CO4	R4	T2	28.12.2022	02.01.2023	2

1	solubility equilibria in water	CO4	R4	T2	29.12.2022	03.01.2023	2
2	Water Chemistry	CO4	R4	T2	02.01.2023	04.01.2023 & 05.01.2023	3
1	Introduction to Corrosion	CO4	R4	T2	03.01.2023	06.01.2023	2
1	Corrosion and its types	CO4	R4	T2	04.01.2023	09.01.2023	3
1	Demonstrate the Methods of corrosion control with examples	CO4	R4	T2	05.01.2023	11.01.2023	3
UNIT –V **Synthesis of Organic compounds, Reactions and Mechanisms**							
1	Discover the Mechanism of substitution reactions (SN1)	CO5	R5	T3	09.01.2023	12.01.2023	1
1	Discover the Mechanism of substitution reactions (SN2)	CO5	R5	T3	10.01.2023	17.01.2023	1
1	Discuss the Addition reactions and Elimination reactions (E1)	CO5	R5	T1	11.01.2023	18.01.2023	2
1	Discuss the Addition reactions and Elimination reactions (E2) Mechanism)	CO5	R5	T1	12.01.2023	19.01.2023	2
1	Classify the Oxidation, reduction reactions	CO6	R5	T2	17.01.2023	23.01.2023	3
1	Classify the cyclization and ring opening reactions	CO6	R5	T2	18.01.2023	24.01.2023	2
1	Explain the optical activity, absolute configuration and Conformational analysis	CO5	R5	T2	19.01.2023	25.01.2023	2
1	Discuss the Structural isomers with examples	CO5	R5	T2	23.01.2023	30.01.2023	3
1	Discuss the Stereoisomers with examples	CO5	R5	T2	24.01.2023	31.01.2023	2
1	Explain the Configurations, symmetry, and chirality	CO5	R5	T3	25.01.2023	01.02.2023	2
1	Discuss the Enantiomers with examples	CO6	R5	T3	30.01.2023	03.02.2023	2
1	Discuss the diastereomers with examples	CO6	R5	T3	31.01.2023	06.02.2023	2
2	Represent the Synthesis of commonly used drug molecules with Examples.	CO6	R5	T1	01.02.2023	07.02.2023	3

HOURS	LAB EXPERIMENTS	CO	Reference	Teaching Tool	Proposed Date	Completed Date	Blooms Taxonomy Level
2	Determine the hardness (Ca^{2+}) of water using EDTA – Complexometric method Analyze the amount of calcium present in given water sample using titration method	CO2	R6	T4	14.10.2022	13.10.2022	C
2	Estimate the amount of chloride content in a water sample. Analyze the amount of chloride present in given water sample using Argentometric method	CO2	R6	T4	28.10.2022	20.10.2022	C
2	Determine the strength of an acid using pH meter Determine strength of HCl using standard NaOH by measuring the pH changes.	CO4	R6	T4	04.11.2022	27.10.2022	B
2	Determine the strength of an acid by conductometry. Determine strength of HCl acid using standard NaOH by measuring conductometry method.	CO4	R6	T4	11.11.2022	03.11.2022	B
2	Determine the strength of a mixture of acetic and hydrochloric acid by conductometry Find out the strength of a mixture of acid by measuring conductometry method.	CO4	R6	T4	18.11.2022	10.11.2022	B
2	Determine the ferrous ion using potassium dichromate by potentiometric titration.	CO2	R6	T4	25.11.2022	17.11.2022	C

	Find out the ferrous ion present in the given solution by potentiometric titration.						
2	Determine the molecular weight of a polymer by viscosity average method Analyze the molecular weight of given polymer solution	CO4	R6	T4	02.12.2022	24.11.2022	B
2	Determine adsorption of oxalic/acetic acid from aqueous solution by activated carbon Find out the adsorption of acids in aqueous solution by activated carbon	CO4	R6	T4	09.12.2022	08.12.2022	B
2	Determine the rate constant of acid hydrolysis of an ester. Find out the rate constant acid hydrolysis of an ester.	CO4	R6	T4	16.12.2022	15.12.2022	B
2	Determine the amount of sodium carbonate, sodium hydroxide in a mixture by titration. Find out the mixture of bases in titration method	CO4	R6	T4	23.12.2022	29.12.2022	B

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY

Bharath Institute of Higher Education and Research (BIHER)

Reference Code	Description
R1	Concise Inorganic Chemistry: 5th Edition by J.D. Lee, Wiley, 2008
R2	William Kemp, Organic Spectroscopy, 3rdEdition., Macmillan, 2009
R3	Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition,1983
R4	Peter Atkins, Julio de Paula, and James Keeler Atkins Physical Chemistry, 11th Edition, 2017.
R5	Morrison R.T. and Boyd R.N., Organic Chemistry, 6th Edition, New York, 1976
R6	Chemistry Laboratory – I & II, Dr. A. P. Srikanth, R. Komalavalli, Shreem Bhuvaneswari publications , Ch-44, 2009

CO-PO MAPPING

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BTECH ELECTRONICS AND ELECTRICAL ENGINEERING
ACADEMIC YEAR 2022-2023 (TERM I) - ENGINEERING CHEMISTRY - U20CYBJ01
PO / PSO DIRECT ATTAINMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	-	2	-	-	-	-	-
CO2	3	-	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	2	-	-	-	-	-	-	2	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	95.37	-	95.37	-	-	-	-			95.37				-	
CO2	89.39	-	-	89.39	89.39	-	-							-	
CO3	-	95.68	-	-	-	-	-			95.68				-	
CO4	93.08	93.08	-	93.08	-	-	-							-	
CO5	-	90.84	90.84	-	-	-	-							-	
CO6			97.97							97.97					
AVERAGE	92.61	93.20	94.73	91.24	88.93	0.00	0.00	0.00	0.00	96.34	0.00	0.00	0.00	0.00	0.00

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ATTAINME	92.61	93.20	94.73	91.24	88.93	0.00	0.00	0.00	0.00	96.34	0.00	0.00	0.00	0.00	0.00

INDIVIDUAL TIME TABLE

Bharath Institute of Higher Education and Research

B.Tech, First Year 2022-2023 – TERM I

Individual Time Table

DEPARTMENT OF CHEMISTRY

Dr. P. KAMARAJ, **SEE – D1, H1, K1 (9 Hours)**

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON			BREAK			LUNCH			
TUE		SEE Sec K1							
WED							SEE Sec H1		
THUR		SEE Sec K1		SEE Sec H1					
FRI					SEE Sec H1			SEE Sec K1	

Dr. G. MATHUBALA, **SEE – D, II Year CSE, MECH (12 Hours)**

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON			BREAK		SEE M4	LUNCH		SEE M3	II Year CSE
TUE		Engg. Chemistry Lab Sec S		Engg. Chemistry Lab Sec S				II Year MECH SEE M3	
WED				II Year MECH SEE M3			SEE Sec D		II Year CSE
THUR					SEE Sec D			II Year MECH SEE M4	SEE M4
FRI		SEE Sec D							II Year CSE

Dr. DAISY RANI, **Engg Chem S & T, SEE – R & H (18 Hours)**

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Engg. Chemistry Sec T	SEE Sec R	**BREAK**			**LUNCH**		SEE Sec H	Engg Chemistry Sec S
TUE							Engg. Chemistry Sec T		Engg Chem Sec S
WED	Engg Chem Sec S				Engg. Chemistry Sec T		SEE Sec H		Foundation of Chemistry
THUR	SEE Sec H			SEE Sec R	Engg Chem Sec S				
FRI	Engg. Chemistry LAB Sec T			Engg. Chemistry LAB Sec T			Engg. Chemistry Sec T		SEE Sec R

NEW STAFF, **Engg Chem: D, E1; SEE- M – (17 Hours)**

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Engg. Chemistry Lab Sec D		**BREAK**	Engg. Chemistry Lab Sec D		**LUNCH**			
TUE									
WED	Engg. Chemistry Lab Sec E1			Engg. Chemistry Lab Sec E1					
THUR									
FRI									

Dr. SIVARANJAN, Sections: Engg Chem: F, G1; SEE- K – (17 Hours)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Engg. Chemistry Sec F		B R E A K			L U N C H	Engg. Chemistry Sec G1		
TUE		SEE Sec K		Engg. Chemistry Sec G1			Engg. Chemistry LAB Sec F		
WED		SEE Sec K					Engg. Chemistry LAB Sec G1		
THUR				Engg. Chemistry Sec G1				Engg. Chemistry Sec F	
FRI	Engg. Chemistry Sec F			SEE Sec K			Engg. Chemistry Sec F	Engg. Chemistry Sec G1	

Dr. V. L. CHANDRA BOSS, Engg Chem - H, J1; SEE- B1 – (17 Hours)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Engg. Chemistry Sec H		B R E A K			L U N C H	Engg. Chemistry/B1 LAB Sec J1		
TUE				SEE Sec B1	Engg. Chemistry Sec H			Engg. Chemistry Sec J1	
WED		Engg. Chemistry Sec H		Engg. Chemistry Sec J1			SEE Sec B1		
THUR	Engg. Chemistry Sec J1			SEE Sec B1			Engg. Chemistry LAB Sec H		
FRI		Engg. Chemistry Sec H						Engg. Chemistry Sec J1	

Dr. S. ROSY CHRISTY, Sections: Engg Chem: K, L1; SEE- F1 – (17 Hours)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON			BREAK		Engg. Chemistry Sec K	LUNCH	Engg. Chemistry LAB Sec L1		
TUE	SEE Sec F1			Engg. Chemistry Sec L1			Engg. Chemistry LAB Sec K		
WED	Engg. Chemistry Sec L1	SEE Sec F1							
THUR		Engg. Chemistry Sec L1			Engg. Chemistry Sec K			Engg. Chemistry Sec K	
FRI		SEE Sec F1			Engg. Chemistry Sec K				Engg. Chemistry Sec L1

Dr. G. Nithya, Sections: Engg Chem: P, A1, SEE – B, F (17 Hours)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Engg. Chemistry Sec A1		BREAK	SEE Sec F		LUNCH		SEE Sec B	Engg. Chemistry Sec P
TUE				SEE Sec F				Engg. Chemistry Sec P	
WED	SEE Sec B			Engg. Chemistry Sec P	Engg. Chemistry Sec A1				
THUR	Engg. Chemistry Sec A1	Engg. Chemistry LAB Sec P		Engg. Chemistry LAB Sec P					
FRI		Engg. Chemistry Sec A1			SEE Sec B		Engg. Chemistry Sec P	SEE Sec F	

Dr. Senthil Kumar – Sections - D & P1

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON			BREAK			LUNCH			
TUE									P1
WED							D	P1	
THUR				M	D				P1
FRI		D			M				

DR. BALU

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON	Eng. Chem/P1		BREAK	SEE N1		LUNCH		SEE Sec P	
TUE	Eng. Chem/P1			Eng. Chem/P1				Engg. Chemistry Sec D	
WED	SEE Sec P				Eng. Chem/P1				Engg. Chemistry Sec D
THUR	SEE N1	Engg. Chemistry Sec D			Eng. Chem/P1			SEE Sec P	
FRI		Eng. Chem/P1		Engg. Chemistry Sec D				SEE N1	

DR. MANJULA Sections: Engg Chem: B, C1, E1 SEE-M1 – (21 Hours)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON		SEE Sec M1	BREAK		Engg. Chemistry Sec C1	LUNCH	Engg. Chemistry Sec E1		Engg. Chemistry Sec B
TUE	Engg. Chemistry Sec E1	SEE Sec M1			Engg. Chemistry Sec B			Engg. Chemistry Sec C1	
WED		Engg. Chemistry Lab Sec C1		Engg. Chemistry Lab Sec C1					Engg. Chemistry Sec B
THUR		Engg.			SEE			Engg.	Engg.

Dr. K. Rajendran - **Engg Chem: M, R & A1 (Lab) – (17 Hours)**

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON		Engg. Chemistry Lab Sec A1	B R E A K	Engg. Chemistry Lab Sec A1		L U N C H	Engg. Chemistry Sec M		
TUE					Engg. Chemistry Sec M			Engg. Chemistry Sec R	
WED				Engg. Chemistry Sec R					Engg. Chemistry Sec M
THUR		Engg. Chemistry Sec R			Engg. Chemistry Sec M		Engg. Chemistry LAB Sec R		
FRI					Sec R Engg. Chemistry		Engg. Chemistry LAB Sec M		

Dr. John Santhosh Kumar: SEE: P & J1 (6 Hrs)

Day/ Period	I 9.00 AM – 9.50 AM	II 9.50 AM – 10.40AM		III 10.50 AM – 11.40 AM	IV 11.40 AM – 12.30 PM		V 1.30 PM – 2.20 PM	VI 2.20 PM – 3.10 PM	VII 3.10 PM – 4.00 PM
MON			B R E A K			L U N C H			
TUE				SEE Sec J1					
WED							SEE/ SEC M		
THUR					SEE Sec J1				
FRI					SEE Sec J1				

SYLLABUS WITH COURSE OUTCOMES

Profile of an Individual Course

Part A- Introduction of the Course

Engineering chemistry course focuses on introduction to the atoms, molecules and their characterisation using spectroscopic techniques, as well as thermodynamic functions and principles involved in corrosion and its control, followed by organic reaction mechanisms, its isomerism, optical activity and synthesis of common drug molecules are discussed.

Course Code	Course Category	Course Title	L	T	P	C
U20CYBJ01	Basic Science	**ENGINEERING CHEMISTRY**	3	1	2	5
Name of the Course Co-ordinator		Dr. G.NITHYA	Pre-requisite +2			
Course Offering Dept/School		Department of Chemistry	Contact Hrs: 90 Hours			
			Total Marks: 100			

Course Objective and Summary

The main objective of the course is to understand the concepts of chemistry to lay the groundwork for subsequent studies in the fields such as mechanical, civil, electrical and electronics engineering etc. To develop the interest among the students regarding chemistry and their applications in engineering. They learn the use of fundamental principles and tools used to predictions of molecules. To introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques

COURSE OUTCOMES(COs)		Bloom's level
CO1	Analyze atomic, molecular orbitals of organic, inorganic molecules to identify structure, bonding, molecular energy levels	4
CO2	Utilize the principles of Spectroscopic technique in analysing and explaining the structure and properties of molecules	3, C
CO3	Rationalize bulk properties using thermodynamic consideration and periodic properties of elements	4
CO4	Utilize the concept of thermodynamics in understanding and executing thermodynamically driven chemical reactions	3, B
CO5	Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries	2
CO6	Utilize the concepts in chemistry for technological and apply in quantitative analyses and estimations for physical and chemical characteristics	3

Imitation (A), manipulation (B), precision (C), articulate (D), naturalisation (E) --Psychomotor

Mapping / Alignment of Cos with PO & PSO
(H/M/L indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	Cos /PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
2	CO1	**3**	-	**3**	-	-	-	-	-	-	**2**	-				
	CO2	**3**	-	-	**3**	**3**	-	-	-	-	-	-				
	CO3	-	**3**	-	-	-	-	-	-	-	**2**	-				
	CO4	**3**	**3**	-	**3**	-	-	-	-	-	-	-				
	CO5	-	**3**	**3**	-	-	-	-	-	-	-	-				
	CO6	-	-	**2**	-	-	-	-	-	-	**2**	-				
3	Category	**Basics Science(BS)**														

(Tick mark or level of correlation: 3-High, 2-Medium, 1-Low)

Part B- Content of the Course

COURSE CONTENT

UNIT I - Atomic and Molecular structure

Schrodinger equation– Introduction -- Derivation – Particle in a box solution – Applications for conjugated molecules – Forms of the hydrogen atom wave functions – Plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules- Homonuclear – Heteronuclear diatomic molecules- Equations for atomic orbital – Equation for molecular orbitals – Energy level diagrams of diatomic. Introduction – Explanation –π-molecular orbitals of butadiene – π-molecular orbitals benzene – Aromaticity – Introduction – Explanation – Crystal field theory – Introduction –Explanation – Energy level diagrams for transition metal ions –Magnetic properties of transition compounds.

(Contact Hours – 14)

UNIT II - Fundamentals and Applications of Spectroscopy

Spectroscopy – General introduction and Explanation; Types of Spectroscopy – Basic concepts and Principles of Electronic spectroscopy, Rotational spectroscopy and Vibrational spectroscopy – Applications of rotational and vibrational spectroscopy of diatomic molecules – Selection rules – Nuclear magnetic resonance spectroscopy – Introduction, principle, Instrumentation and applications.

(Contact Hours – 14)

UNIT III - Surface characterization and Ionization Energy

XPS (X-ray Photoelectron Spectroscopy) – Introduction – Explanation – Diffraction and Scattering of solids – Explanation – Ionic, dipolar interaction – Vander waals interaction – Equation of state of real gases – critical phenomena – Effective nuclear charge, penetration of orbitals – Variations of s, p, d and f orbital energies of atoms in the periodic table – Electronic configurations, atomic and ionic sizes – Ionization energies, electron affinity and electronegativity – Polarizability, oxidation states – Coordination numbers and geometries.

(Contact Hours – 14)

UNIT IV –Thermodynamics and Corrosion

Hard soft acids and bases – Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry – Corrosion and its control.

(Contact Hours – 14)

UNIT V - Synthesis of Organic compounds, Reactions and Mechanisms

Introduction to type of reactions involving substitution-Addition-Elimination, oxidation and reduction reactions- Cyclization and ring opening reactions. Optical activity, Absolute configurations-Conformational analysis-Isomerism in transition metal complex. Representation of 3 dimensional structures – Structural isomers and stereoisomers – Configurations and symmetry and chirality – Enantiomers, diastereomers. Introduction-Synthesis of commonly used drug molecules-Examples.

(Contact Hours – 14)

Chemistry Laboratory (Contact Hours – 20)

List of Experiments

1. Determine the hardness (Ca2+) of water using EDTA – Complexometric method (CO2).
2. Estimate the amount of chloride content in a water sample (CO2).
3. Determine the strength of an acid using pH meter (CO4).
4. Determine the strength of an acid by conductometry (CO4).
5. Determine the strength of a mixture of acetic and hydrochloric acid by conductometry (CO4).
6. Determine the ferrous ion using potassium dichromate by potentiometric titration (CO2).
7. Determine the molecular weight of a polymer by viscosity average method (CO4).
8. Determine adsorption of oxalic/acetic acid from aqueous solution by activated carbon (CO4).
9. Determine the rate constant of acid hydrolysis of an ester (CO4).
10. Determine the amount of sodium carbonate, sodium hydroxide in a mixture by titration (CO4).

2. Alignment of topics of the courses with Co's – learning outcome

U20CYBJ01 - ENGINEERING CHEMISTRY

S.NO.	Summary of the Course Content	Hours (L)	Hours (T)	Alignment to CO
UNIT – 1 ATOMIC AND MOLECULAR STRUCTURE				
1.	Remember the atomic and molecular level, quantum numbers for derivation of Time dependent and Time Independent Schrodinger equation	2		CO1
2.	Explain of Particle in a box solution (one dimensional) and illustrating the conjugated molecules	2		CO1
3.	Introduction of Molecular orbitals theory for diatomic molecules	2		CO1
4.	Demonstrate of MOT diagram of homo and hetero nuclear diatomic molecules with examples	1		CO1
5.	Analyse the Energy level diagrams of diatomic molecules, Equations for atomic and molecular orbitals	2		CO1
6.	Explain of π-molecular orbitals of butadiene and benzene	1	1	CO1
7.	Examine the CFT Diagram of Octahedral complex	1		CO1
8.	Explain of CFT Diagram for Tetrahedral Complex	Assignment		CO1
9.	Correlate the Energy level diagrams for transition metal ions and Magnetic properties of transition compounds.	2		CO1
UNIT II FUNDAMENTALS AND APPLICATIONS OF SPECTROSCOPY				
10.	Introduction and Types of Spectroscopy	1		CO2
11.	Discuss the basic concepts, Principles of UV-Visible spectroscopy and Electronic Transition Level	1		CO6
12.	Demonstrate the Instrumentation and working procedure of UV-Visible Spectroscopy	1		CO6
13.	Applications of Electronic spectroscopy	1		CO6
14.	Discuss the basic concepts and Principles of Rotational and Vibrational spectroscopy	2		CO2
15.	Demonstrate the Instrumentation and working procedure of IR Spectroscopy	2		CO2
16.	Explain of selection rules and Applications of rotational and Vibrational spectroscopy of diatomic molecules	2		CO2
17.	Introduction and principle of Nuclear magnetic resonance spectroscopy	1		CO2
18.	^1H and ^{13}C NMR Chemical shift in NMR Spectroscopy	1	1	CO2
19.	Applications of Nuclear magnetic resonance	1		CO2

	spectroscopy			
	UNIT III **SURFACE CHARACTERIZATION AND IONIZATION ENERGY**			
20.	Introduction of X-ray Photoelectron Spectroscopy (XPS) & its applications	2		CO3
21.	Instrumentation and application of XRD	Assignment		CO3
22.	Explain of Ionic, dipolar and Vander Waals interaction	2		CO3
23.	Deduce the equation of state of real gases – critical phenomena	2		CO3
24.	Explain of Effective nuclear charge, penetration of orbitals	1		CO3
25.	Express the electronic configurations, Hund rule	1		CO3
26.	Explain Atomic and Ionic Sizes according to periodic table	1	1	CO3
27.	Express the Ionization energies, Electron affinity, Polarizability and Oxidation states	2		CO3
28.	Analyse the Coordination numbers and geometries	1		CO3
29.	Analyse the geometries in Coordination Compound	1		CO3
	UNIT IV **THERMODYNAMICS AND CORROSION**			
30.	Remember the Hard soft acids and bases with examples	2		CO4
31.	Explain the thermodynamic terms: system, surroundings and universe	1		CO4
32.	Establish the entropy and free energies	1		CO4
33.	Introduction and Explanation of EMF Cell potentials	1	1	CO6
34.	Solve the Nernst equation and applications	1		CO6
35.	Explain the Acid base, oxidation reduction and solubility equilibria	2		CO4
36.	Introduction and explanation of water Chemistry	2		CO4
37.	Classify the types of corrosion and its significant	2		CO4
38.	Demonstrate the Methods of corrosion control with examples	1		CO4
	UNIT V **SYNTHESIS OF ORGANIC COMPOUNDS, REACTIONS AND MECHANISMS**			
39.	Discover the Mechanism of substitution reactions (SN1 & SN2)	2		CO5
40.	Discuss the Addition reactions and Elimination reactions (E1 & E2 Mechanism)	2		CO5
41.	Classify the Oxidation, reduction, cyclization and ring opening reactions	2		CO6
42.	Explain the optical activity, absolute configuration and Conformational analysis	1		CO5
43.	Discuss the Isomerism in transition metal complex and Representation of 3 dimensional structures with	Assignment		CO6

	examples			
44.	Distinguish the Structural isomers and Stereoisomers with examples	2		CO5
45.	Explain the Configurations, symmetry, and chirality	1		CO5
46.	Discuss the Enantiomers and diastereomers with examples	2		CO6
47.	Represent the Synthesis of commonly used drug molecules with Examples.	1	1	CO6

Chemistry Laboratory (Contact Hours – 20)

1.	Determine the hardness (Ca^{2+}) of water using EDTA – Complexometric method Analyse the amount of calcium present in given water sample using titration method.	2	CO2
2.	Estimate the amount of chloride content in a water sample. Analyse the amount of chloride present in given water sample using Argentometric method.	2	CO2
3.	Determine the strength of an acid using pH meter Determine strength of HCl using standard NaOH by measuring the pH changes.	2	CO4
4.	Determine the strength of an acid by conductometry. Determine strength of HCl acid using standard NaOH by measuring conductometry method.	2	CO4
5.	Determine the strength of a mixture of acetic and hydrochloric acid by conductometry. Find out the strength of a mixture of acid by measuring conductometry method.	2	CO4
6.	Determine the ferrous ion using potassium dichromate by potentiometric titration. Find out the ferrous ion present in the given solution by potentiometric titration.	2	CO2
7.	Determine the molecular weight of a polymer by viscosity average method Analyse the molecular weight of given polymer solution	2	CO4
8.	Determine adsorption of oxalic/acetic acid from aqueous solution by activated carbon Find out the adsorption of acids in aqueous solution by activated carbon	2	CO4
9.	Determine the rate constant of acid hydrolysis of an ester. Find out the rate constant acid hydrolysis of an ester.	2	CO4
10.	Determine the amount of sodium carbonate, sodium hydroxide in a mixture by titration. Find out the mixture of bases in titration method	2	CO4

Part C- Assessment and Evaluation

Assessment Pattern Theory

There are four Continuous Learning Assessments (CLAs) for theory course Engineering Chemistry.

CLA 1 for 30 marks with unit 1 (full unit) and unit 2 (first half of the unit 2).

CLA 2 for 30 marks with unit 3 (full unit) and unit 2 (second half of the unit 2).

CLA 3 for 30 marks with unit 4 (full unit) and unit 5 (full unit).

CLA 4 for 10 marks (Assignments).

CO WEIGHTAGE

CO's	**WEIGHTAGE**	
	THEORY	**LAB**
CO1	20%	-
CO2	16%	30%
CO3	20%	-
CO4	16%	70%
CO5	12%	-
CO6	16%	-

Engineering Chemistry/ U20CYBJ01

CO's	**Tests (Mark)**			
	CLA 1	**CLA 2**	**CLA 3**	**CLA 4 Assignments (marks)**
CO1	16 marks			4 marks
CO2	8 marks	12 marks		
CO3		18 marks		2 marks
CO4			14 marks	
CO5			10 marks	
CO6	6 marks		6 marks	4 marks
Total	30 marks	30 marks	30 marks	10 marks

Assessment Pattern for LAB

There are four Continuous Learning Assessments (CLAs) for the lab course Engineering Chemistry.

CLA 1 for 30 marks with experiments 1 to 3.

CLA 2 for 30 marks with experiments 4 to 6.

CLA 3 for 30 marks with experiments 7 to 10.

CLA 4 for 10 marks (observation & viva-voce).

Engineering Chemistry Laboratory/ U20CYBJ01

CO's	Tests (Marks)			
	CLA 1	CLA 2	CLA 3	Observations & Viva Voce CLA 4
CO2	20 marks	10 marks		5 marks
CO4	10 marks	20 marks	30 marks	5 marks
Total	30 marks	30 marks	30 marks	10 marks

Final Examination – Weightage 50%

THEORY

CO's	100 MARKS
CO1	20 marks
CO2	12 marks
CO3	20 marks
CO4	18 marks
CO5	14 marks
CO6	16 marks

LAB

CO's	100 MARKS	
	EXPERIMENTS	RECORD & VIVAVOICE
CO2 &CO4	70 marks	30 marks
Total	70 marks	30 marks

Part D-Learning Resources

6. Text Books

1. Concise Inorganic chemistry: 5th Edition by J.D. Lee, Wiley, 2008.
2. William Kemp, Organic Chemistry, 3rd Edition. Mac Millan, 2009.
3. Introduction to Chemical Engineering Thermodynamics, J.M. Smith, H.C. Ness, M. Abbott, B Bhatt, 2009.
4. Morrison R.T and Boyd R.N., Organic Chemistry, 6th Edition, New York, 1976.

7. Reference Books

1. Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, By James E. Huheey, Medhi 1983.
2. Peter Atkins, Julio de Paula, and James keeler Atkins Physical Chemistry, 11th Edition, 2017.
3. Chemistry Laboratory – I & II, Dr. A. P. Srikanth, R. Komalavalli, Shreem Bhuvaneswari publications , Ch-44, 2009

8. Other Resources (Online Resources or others)

i) https://nptel.ac.in/courses/122/101/122101001/ Atomic Structure, Structural Chemistry

ii) https://nptel.ac.in/courses/122/101/122101001/ Titrations : Acid-Base, Redox and Complexometric

LECTURE NOTES (FOR ALL UNITS)

ENGINEERING CHEMISTRY SYLLABUS

UNIT I - ATOMIC AND MOLECULAR STRUCTURE

Structure of Atom – Introduction- Schrodinger equation - Derivation – Particle in a box solution – Plots of these functions to explore their spatial variations - Forms of the hydrogen atom wave functions. Orbitals and Quantum Numbers.

Atomic orbital – Equation for molecular orbitals – Energy level diagrams of diatomic molecular orbital. Molecular orbitals of diatomic molecules- Homonuclear – Heteronuclear diatomic molecules.

Introduction – Explanation – π-molecular orbitals of butadiene- Applications for conjugated molecules . Aromaticity – π-molecular orbitals benzene.

Crystal field theory – Introduction – Explanation – Energy level diagrams for transition metal ions – Magnetic properties of transition compounds.

SCHRÖDINGER WAVE EQUATION

Heisenberg & Louis de Broglie dual behaviour of electron, an Austrian physicist Erwin Schrödinger developed his legendary equation by making the use of wave-particle duality and classical wave equation. Schrödinger wave equation is a mathematical expression describing the energy and position of the electron in space and time, taking into account wave nature of the electron inside an atom.

$$\hat{H}\psi = E\psi \qquad \hat{H} = -\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)+V$$

$$\left[\frac{-h^2}{8\pi^2 m}\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)+V\right]\psi = E\psi$$

$$\frac{-h^2}{8\pi^2 m}\left(\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}\right)+V\psi = E\psi$$

$$\frac{-h^2}{8\pi^2 m}\left(\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}\right)+V\psi - E\psi = 0$$

$$\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi^2 m}{h^2}(E-V)\psi = 0$$

Schrödinger shared the Nobel Prize for Physics with P.A.M. Dirac in 1933

SCHRÖDINGER WAVE EQUATION: PARTICLE IN BOX

$\psi = A\sin kx + B\cos kx$. where A and B are constants. When $x = 0$, $\sin kx = 0$ & $\cos kx = 1$; hence, $\psi = B$ when $x = 0$. However, the boundary condition stated that $\psi = 0$ when $x = 0$, and this is only true if $B = 0$.

Rewriting the above equation: $\psi = A\sin kx$; $\psi = 0$.

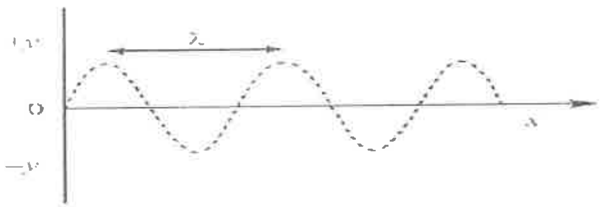
Since the probability, ψ^2, that the particle will be at points between $x = 0$ and $x = a$; a cannot be zero. The particle must be somewhere inside the box, the last equation is only valid if: $Ka = n\pi$; where $n = 1, 2, 3 \ldots$; n cannot be zero as this would make the probability, ψ^2, zero meaning that the particle would no longer be in the box. Combining the last two equations gives:

$$\psi = A\sin\frac{n\pi x}{a} \qquad k^2 = \frac{8\pi^2 mE}{h^2} \qquad E = \frac{k^2h^2}{8\pi^2 m} = \frac{n^2h^2}{8ma^2}$$

where $n = 1, 2, 3 \ldots$; n is the quantum number determining the energy of a particle of mass m confined within an one dimensional box of width a. So, the limitations placed on the value of ψ have led to quantized energy levels, the spacing of which is determined by m and a.

SCHRÖDINGER WAVE EQUATION: ONE DIMENTIONAL BOX

The Schrödinger wave equation may be represented in several forms, in order to understand the concept involved, consider a wave traveling in a string along the *x*-axis with velocity *v* and it examines its application to the motion of a particle in a one-dimensional box gives the form of the Schrödinger wave equation that is appropriate for motion in the x direction:



The wave motion in a string.

$$\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0$$

where m = mass, E = total energy and
V = potential energy of the particle.

Now let us rewrite the Schrödinger equation for the specific case of the particle in the one-dimensional box where V = 0

$$\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0 \quad \frac{d^2\psi}{dx^2} = -\frac{8\pi^2 mE}{h^2}\psi \quad \frac{d^2\psi}{dx^2} = -k^2\psi \text{ where } k^2 = \frac{8\pi^2 mE}{h^2}$$

MOLECULAR ORBITAL THEORY

Molecular orbital (MO) theory was developed by F. Hund and R.S. Mulliken in 1932. The salient features of this theory are :

(i) The electrons in a molecule are present in the various molecular orbitals as the electrons of atoms are present in the various atomic orbitals.

(ii) The atomic orbitals of comparable energies and proper symmetry combine to form molecular orbitals.

(iii) Electron in an atomic orbital is influenced by one nucleus, in a molecular orbital it is influenced by two or more nuclei depending upon the number of atoms in the molecule. Thus, an atomic orbital is monocentric while a molecular orbital is polycentric.

(iv) The number of molecular orbital formed is equal to the number of combining atomic orbitals. When two atomic orbitals combine, two molecular orbitals are formed. One is known as bonding molecular orbital while the other is called antibonding molecular orbital.

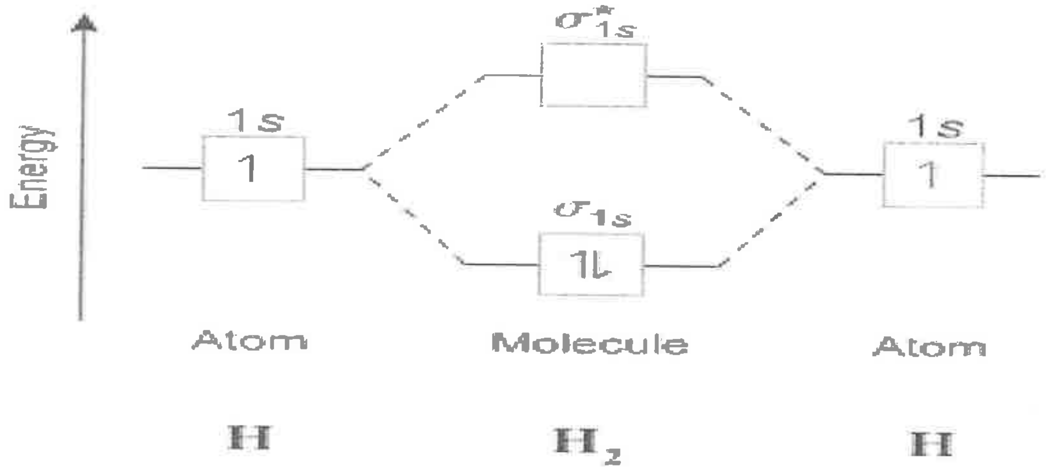
(v) The bonding molecular orbital has lower energy and greater stability than the corresponding antibonding molecular orbital.

(vi) The electron probability distribution around a nucleus in an atom is given by an atomic orbital, the electron probability distribution around a group of nuclei in a molecule is given by a molecular orbital.

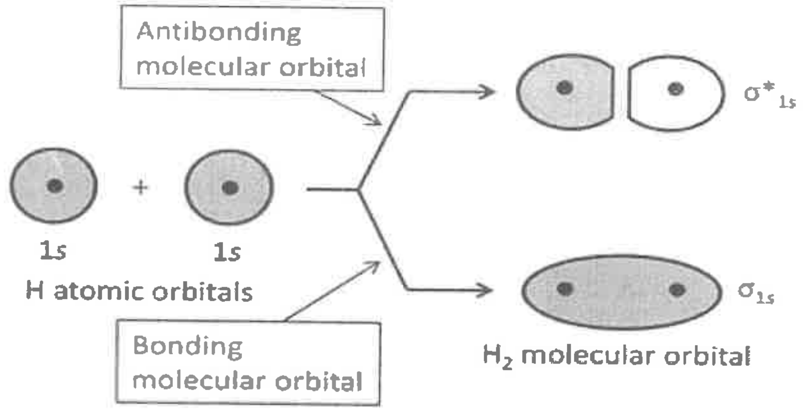
(vii) The molecular orbitals are filled like atomic orbitals in accordance with the *aufbau* principle obeying the Pauli's exclusion principle and the Hund's rule.

Bonding in some Homonuclear di-atomic molecules

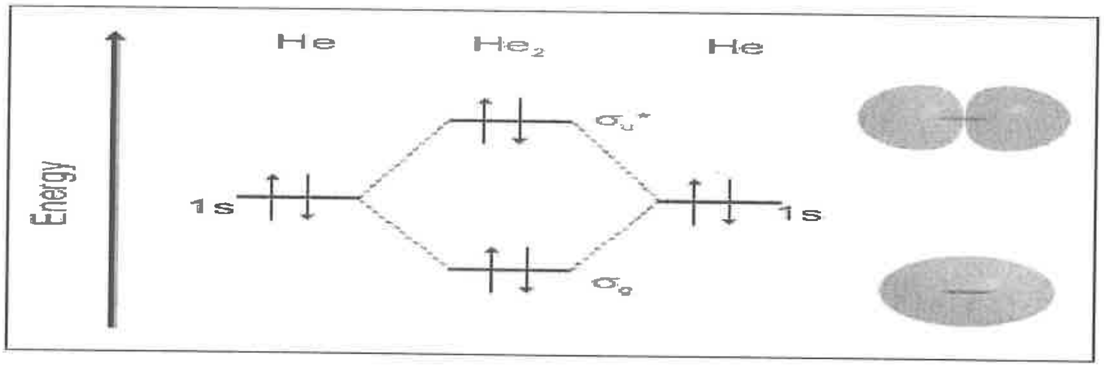
Molecular Orbital Diagram (H_2)



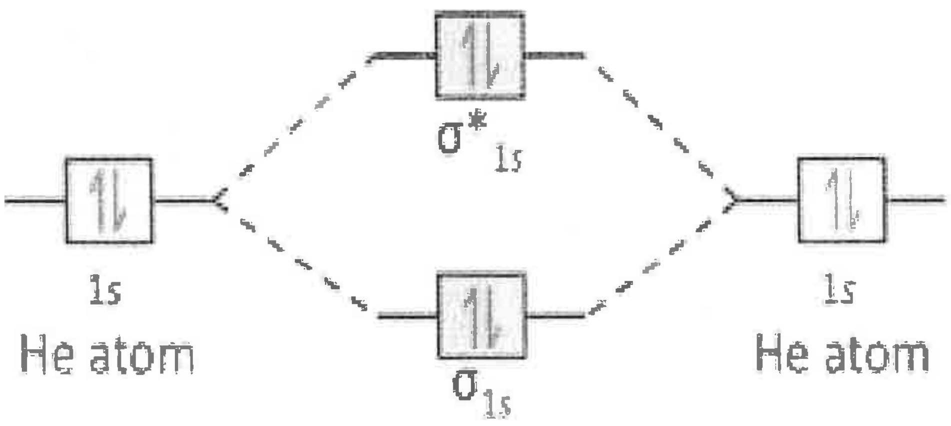
- ✓ Electronic configuration of H atom $1s^1$
- ✓ Electronic configuration of H_2 molecule $1s^2$
- ✓ *Bond Order* $= \frac{Nb-Na}{2} = \frac{2-0}{2} = 1$
- ✓ Molecule has no unpaired electron hence it is diamagnetic



Diatomic molecules: The bonding in He_2



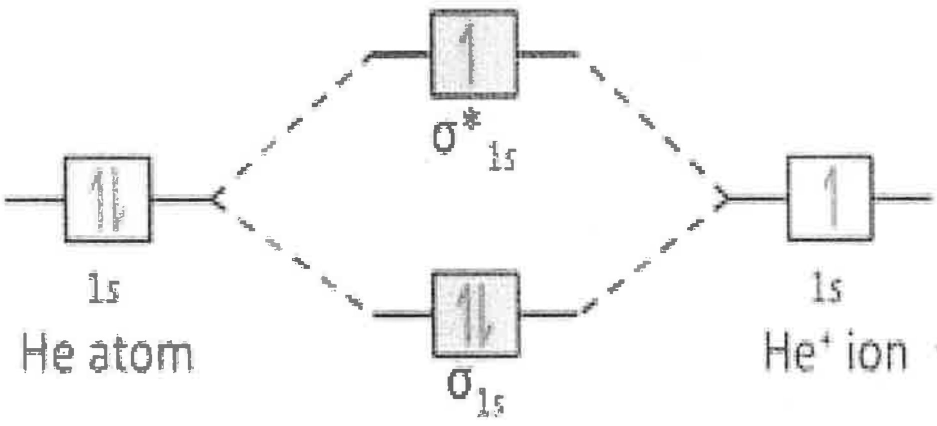
He_2 molecule



Unstable molecule

Bond Order = ½(2 - 2) = 0

He_2^+ molecule

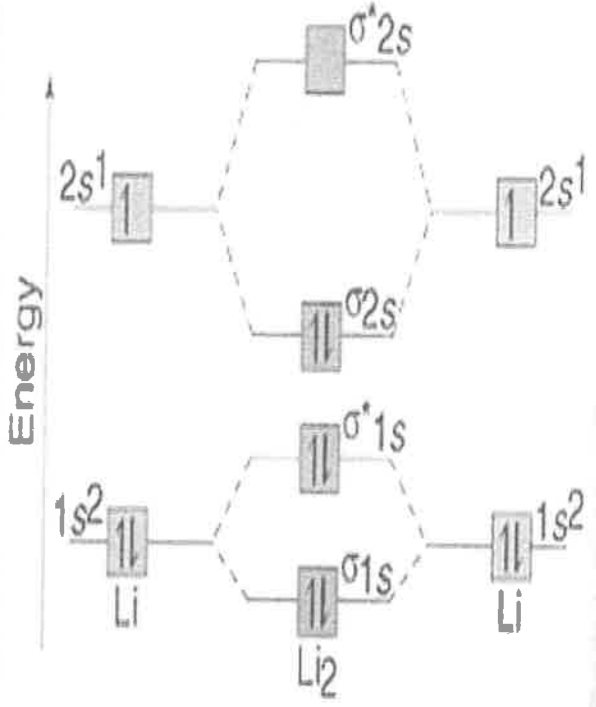


Stable molecule

Bond Order = ½(2 - 1) = ½

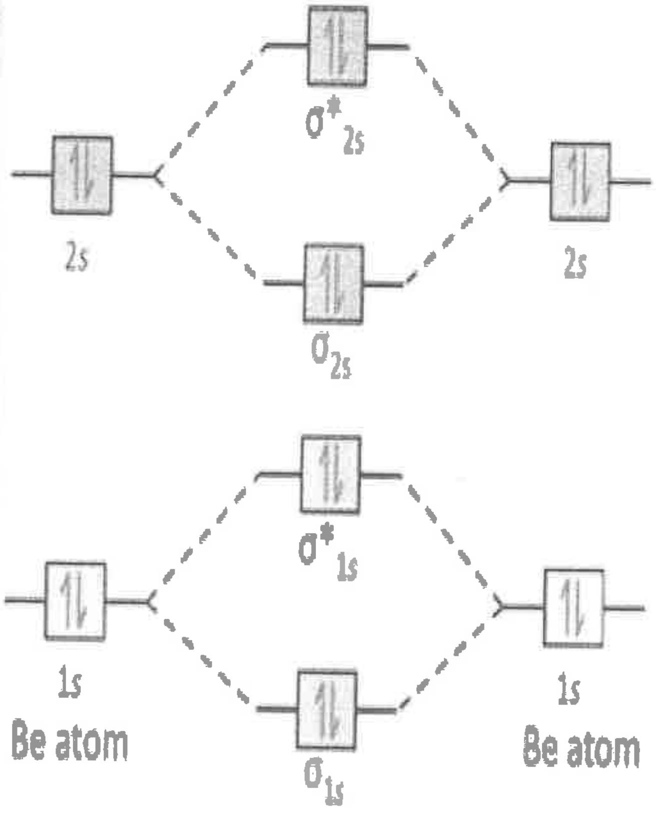
Molecular Orbital theory is powerful because it allows us to predict whether molecules should exist or not and it gives us a clear picture of the of the electronic structure of any hypothetical molecule that we can imagine.

MO Diagram of Li_2 molecule



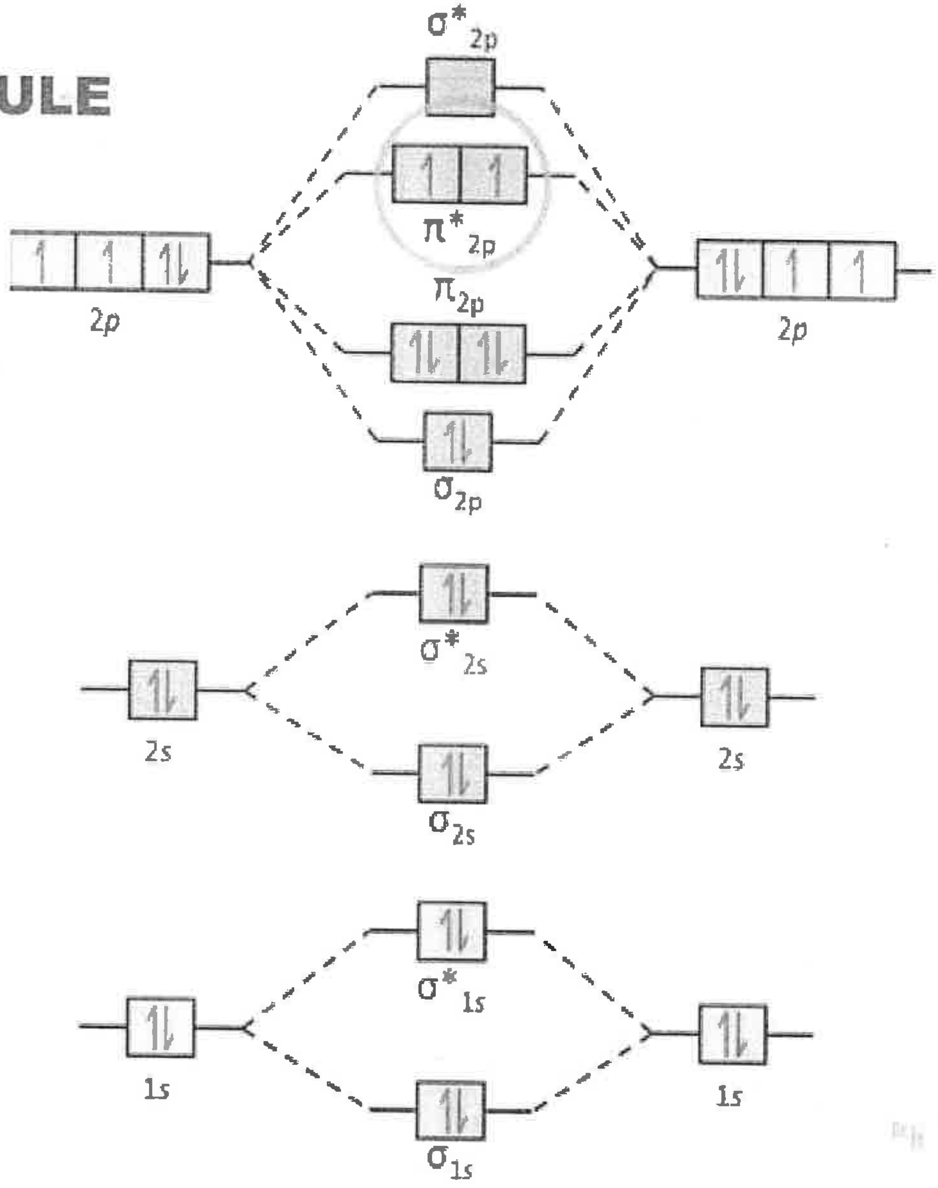
- ✓ Electronic configuration of Li atom $1s^2\ 2s^1$
- ✓ Electronic configuration of Li_2 molecule $\sigma 1s^2 \sigma^* 1s^2\ \sigma 2s^2$
- ✓ *Bond Order* $= \frac{Nb-Na}{2} = \frac{4-2}{2} = 1$
- ✓ Molecule has no unpaired electron hence it is diamagnetic

Be_2 molecule



Unstable molecule

MO DIAGRAM OF O_2 MOLECULE

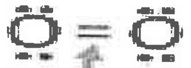


- ✓ Electronic configuration of O atom $1s^2\,2s^2\,2p^4$
- ✓ Electronic configuration of O_2 molecule $\sigma1s^2\ \sigma^*1s^2\ \sigma2s^2\ \sigma^*2s^2$ $\sigma2pz^2$ $\pi2px^2$ $\pi2py^2$ π^*2px^1 π^*2py^1
- ✓ Molecule has two unpaired electron hence it is paramagnetic

Oxygen Atom Electron Configuration:

$_8O:\ 1s^2 2s^2 2p^4$

Lewis Structure:



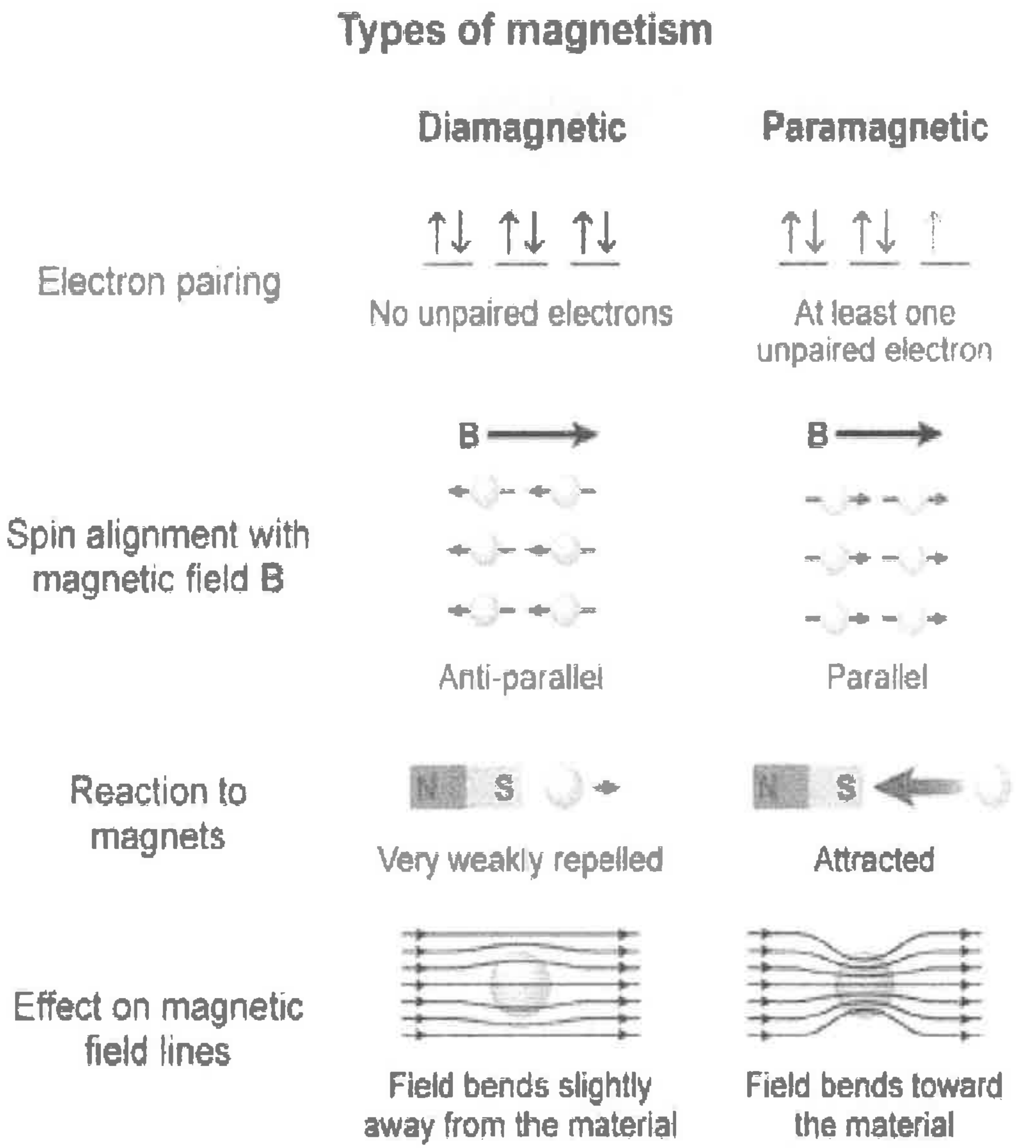
Bond Order = ½(8 − 4) = 2

Magnetic Property:

Paramagnetic

Paramagnetism and Diamagnetism

- Atoms with unpaired ↑ electrons are called ***paramagnetic***.
  - Paramagnetic atoms are attracted to a magnet.
- Atoms with paired ↑↓ electrons are called ***diamagnetic***.
  - Diamagnetic atoms are repelled by a magnet.



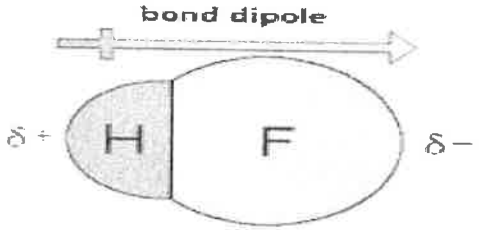
Types of magnetism

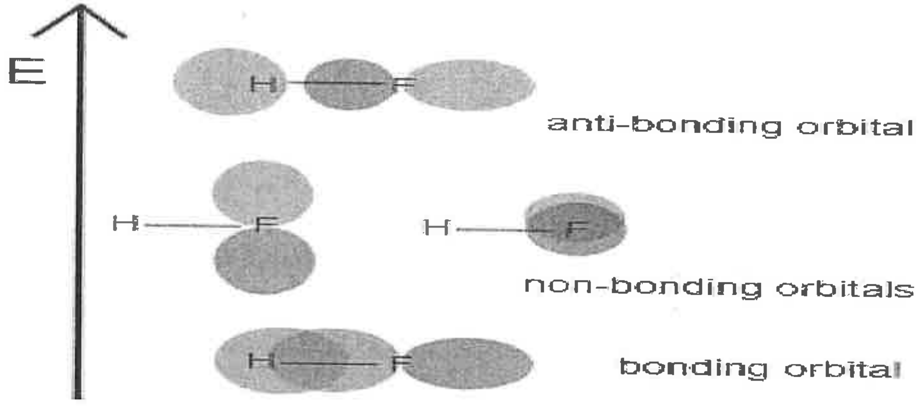
	Diamagnetic	**Paramagnetic**
Electron pairing	↑↓ ↑↓ ↑↓ No unpaired electrons	↑↓ ↑↓ ↑ At least one unpaired electron
Spin alignment with magnetic field **B**	B → Anti-parallel	B → Parallel
Reaction to magnets	N S Very weakly repelled	N S Attracted
Effect on magnetic field lines	Field bends slightly away from the material	Field bends toward the material

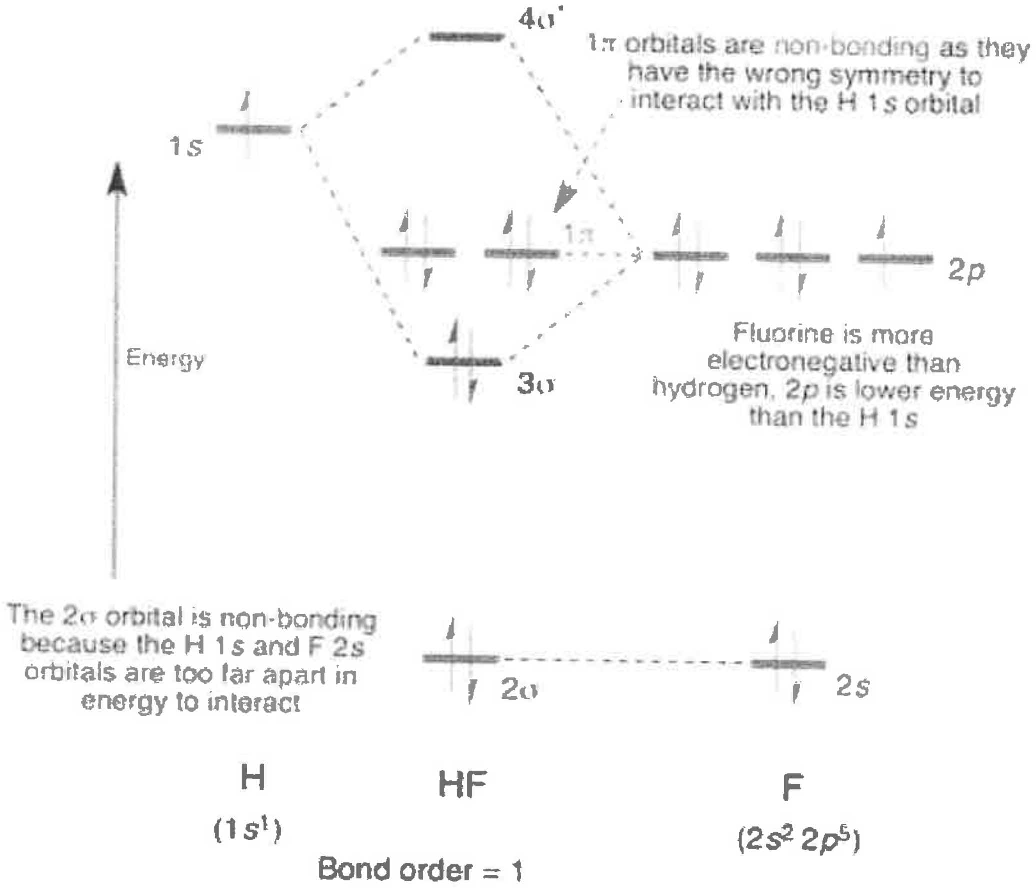
MO BONDING IN HETERONUCLEAR DIATOMIC MOLECULES

Let's Start Slowly: HF

- Valence electrons
  - H – $1s^1$
  - F – $1s^2\ 2s^2\ 2p^5$
- Focus on the valence interactions
- Accommodate for differences in electronegativity
- Allow mixing between symmetry-allowed states







1π orbitals are non-bonding as they have the wrong symmetry to interact with the H 1*s* orbital

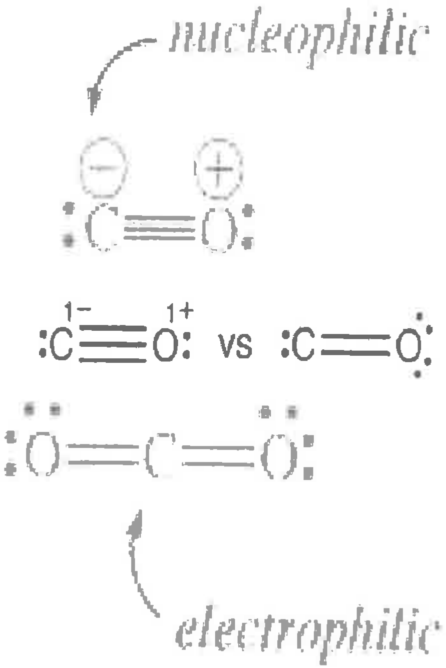
Fluorine is more electronegative than hydrogen, 2*p* is lower energy than the H 1*s*

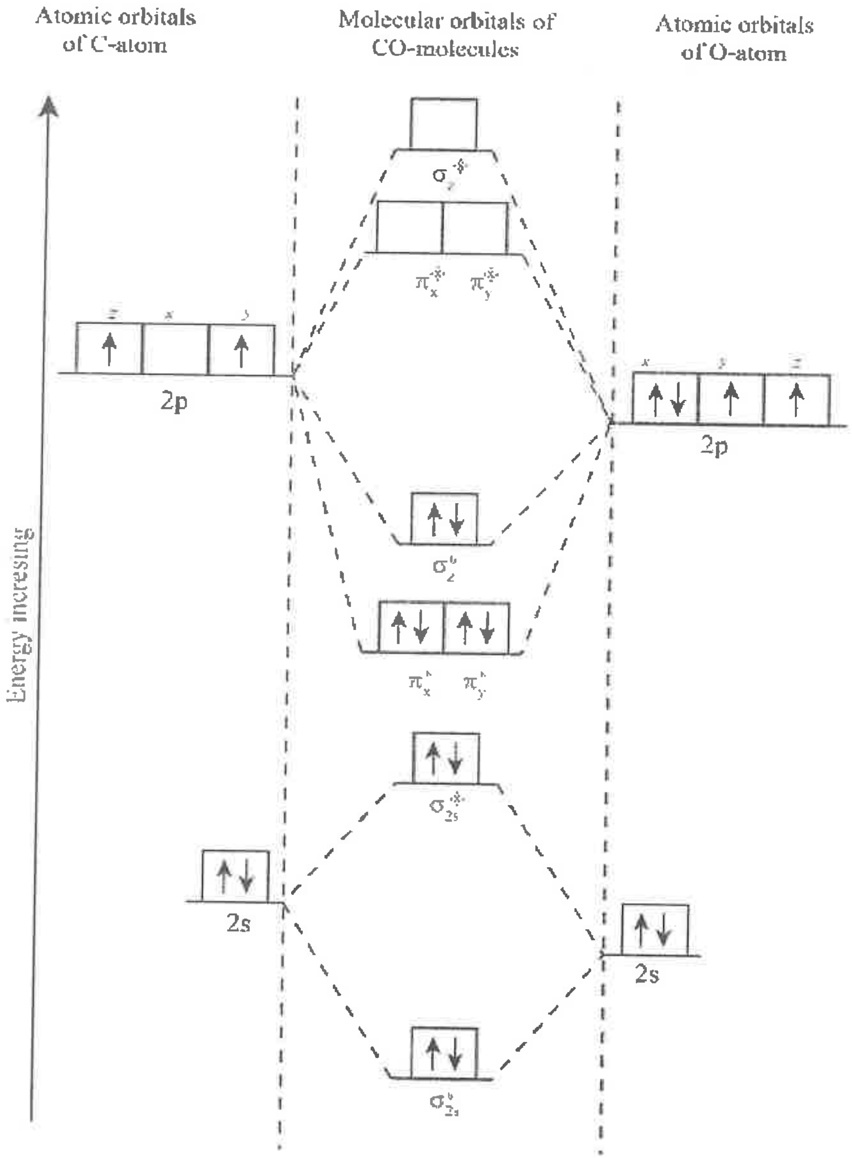
The 2σ orbital is non-bonding because the H 1*s* and F 2*s* orbitals are too far apart in energy to interact

Bond order = 1

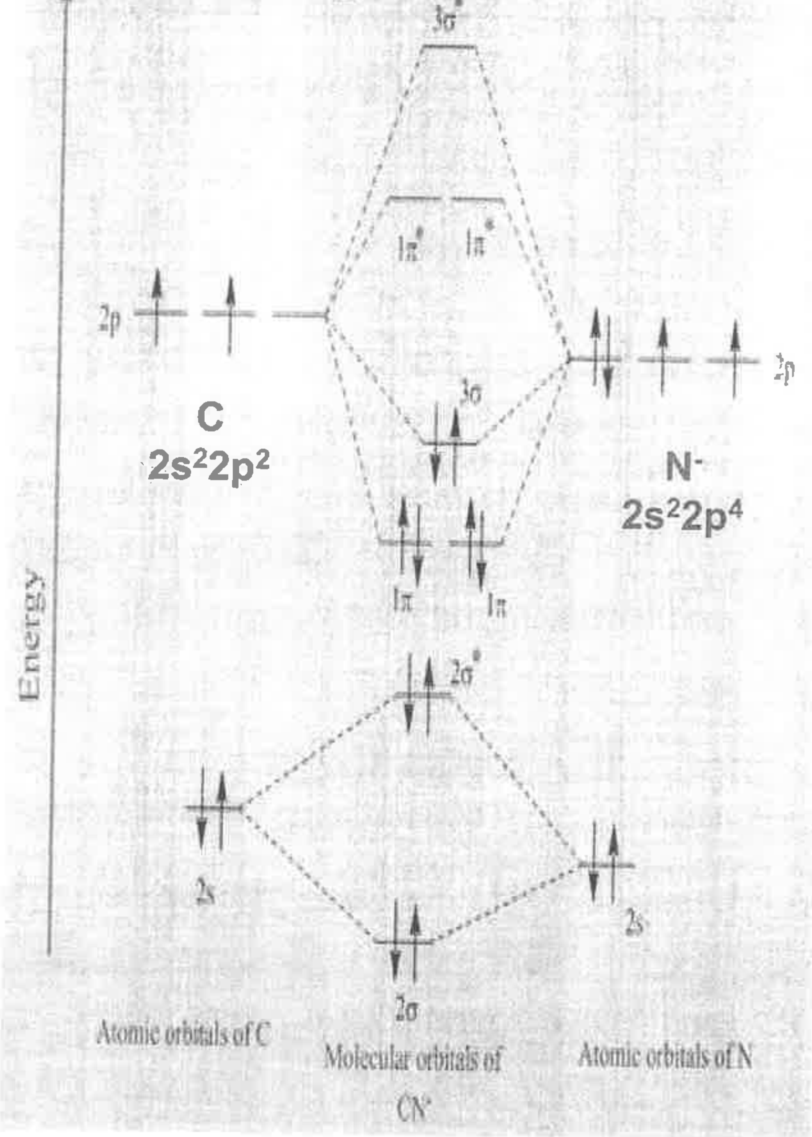
HOMO = highest occupied molecular orbital.
LUMO = lowest unoccupied molecular orbital.
NBMO = Non-bonding molecular orbital.

MO DIAGRAM OF CO

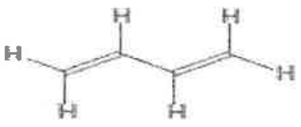




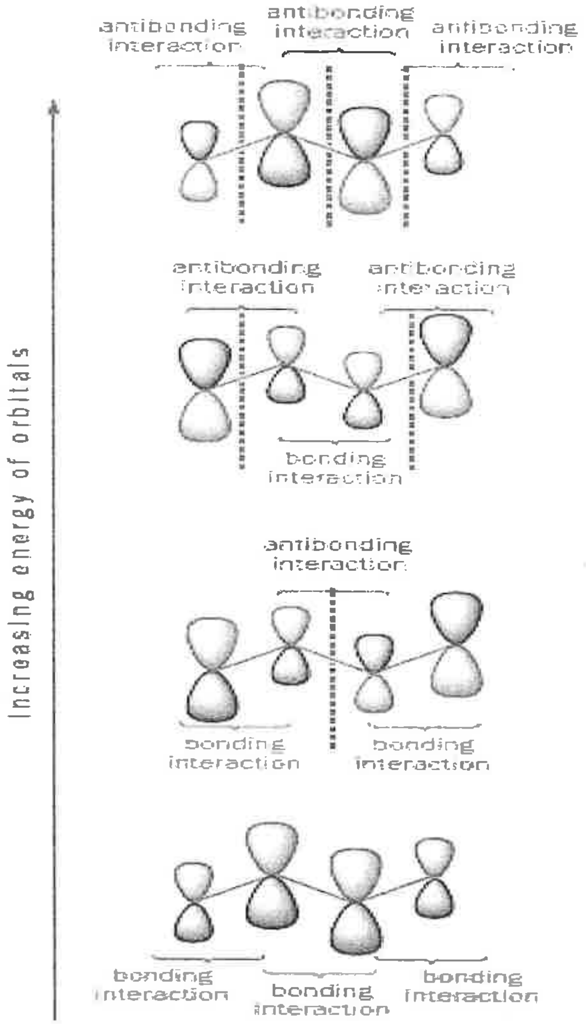
MO diagram of CN-



MO DIAGRAM OF 1,3-BUTADIENE



butadiene



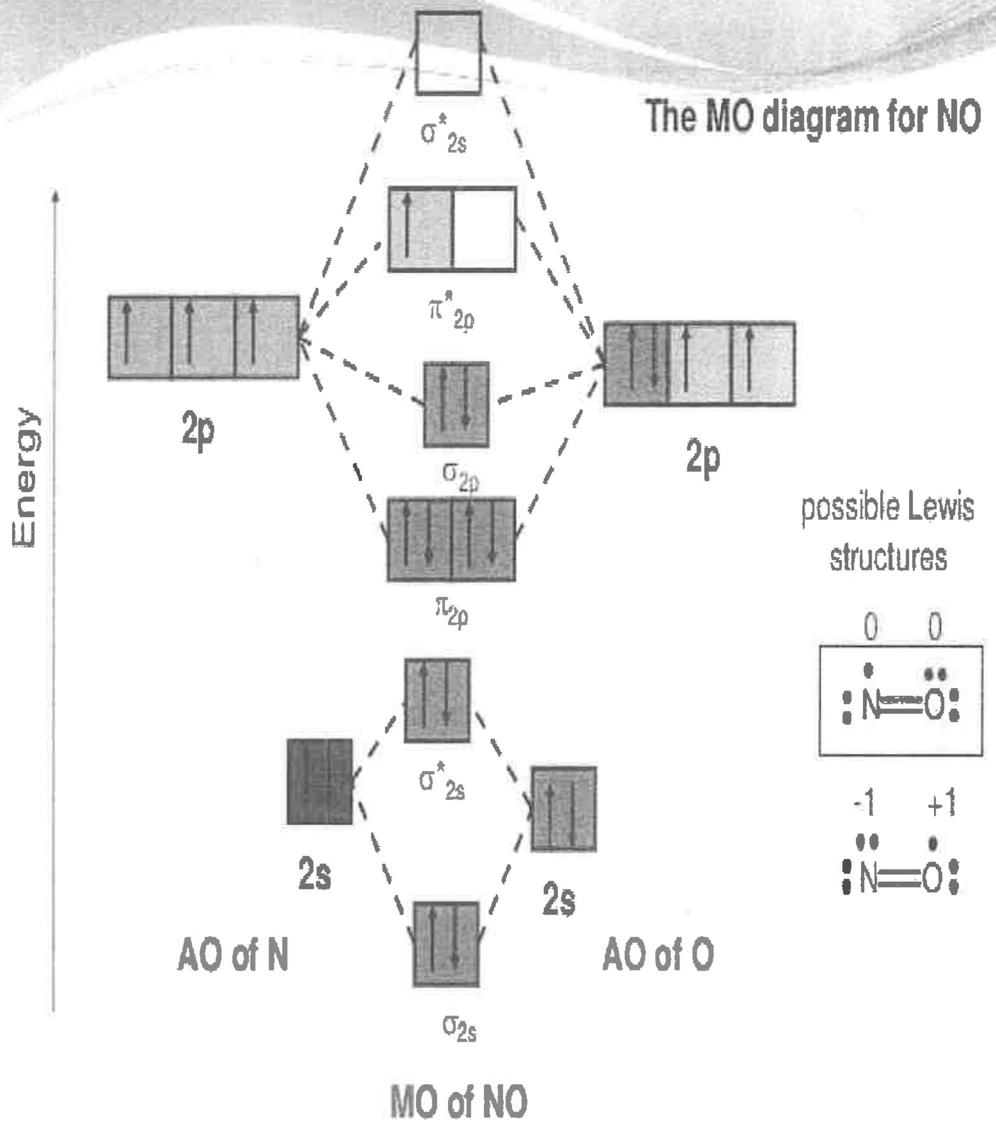
ψ_4 - 3 nodal planes
0 bonding interactions
3 antibonding interactions
overall - antibonding orbital

ψ_3 - 2 nodal planes
1 bonding interaction
2 antibonding interactions
overall - antibonding orbital

ψ_2 - 1 nodal plane
2 bonding interactions
1 antibonding interaction
overall - bonding orbital

ψ_1 - 0 nodal planes
3 bonding interactions
0 antibonding interactions
overall - bonding orbital

The MO diagram for NO



$N = 1s^2 2s^2 2p^3$

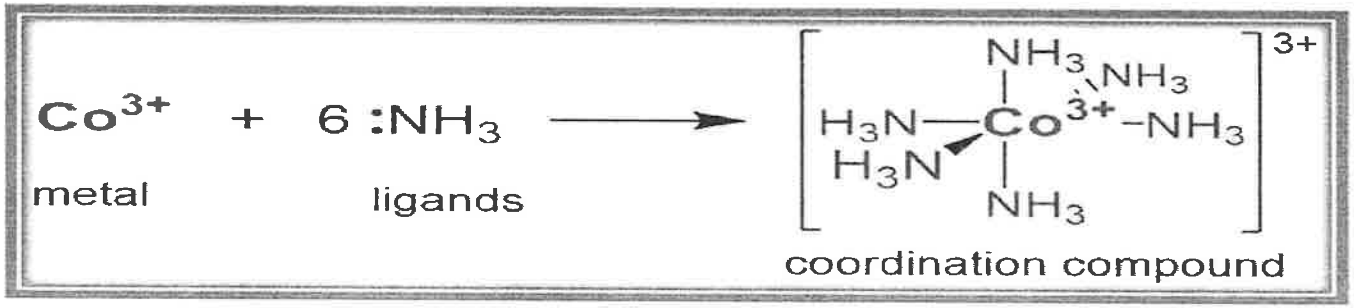
$O = 1s^2 2s^2 2p^4$

Bond Order=2.5

Bond Length=1.15A^0

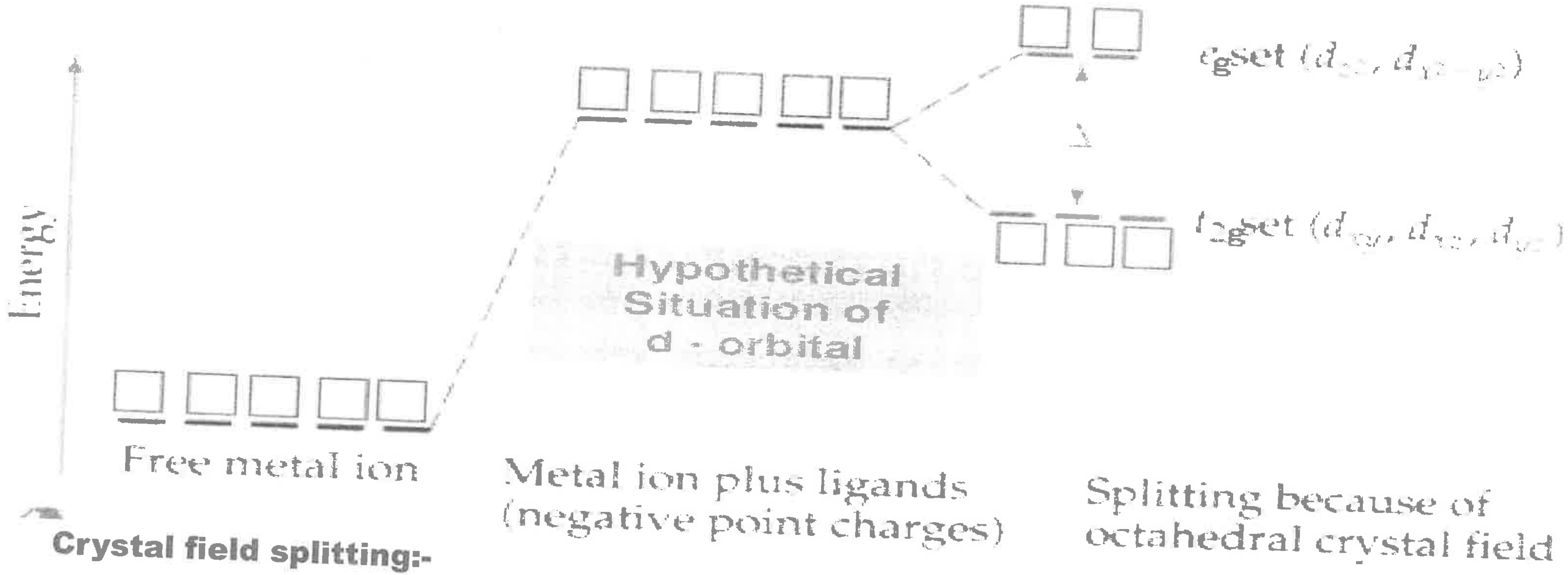
- ✓ Molecule has one unpaired electron hence it is paramagnetic

ASSUMPTIONS



- The transition metal ions are placed in the centre and it is surrounded by ligand with lone pair of electrons.
- The ligand are either negative (e.g. Cl-, CN-) or neutral molecule (e.g. H_2O, NH_3) are considered as point charge. If ligand is neutral, then negative end of dipole (lone pair) is directed towards metal ion.
- There is no interaction between metal orbitals and ligand orbitals.
- The attraction between metal ion and ligand is purely electrostatic i.e. 100% ionic band.
- The degeneracy of d-orbital of free metal ion is removed by ligand when complex is formed.
- This theory has been used to describe various spectroscopies of transition metal coordination complexes, in particular optical spectra (colours).
- CFT successfully accounts for some magnetic properties, colours, hydration enthalpies, and spinel structures of transition metal complexes.
- CFT was subsequently combined with molecular orbital theory to form the more realistic and complex ligand field theory (LFT), which delivers insight into the process of chemical bonding in transition metal complexes.

DEGENERACY OF ORBITALS

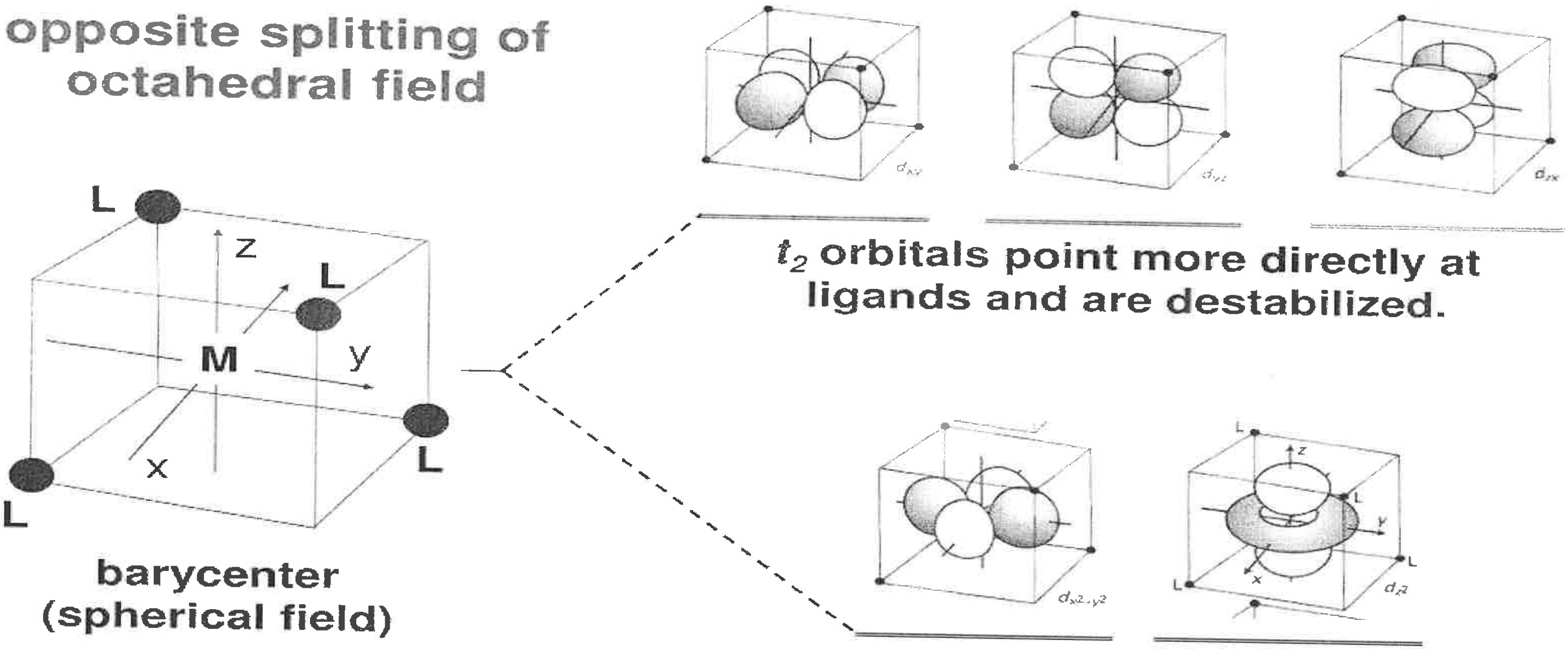


Crystal field splitting:-

The degeneracy of d-orbital is splits by ligand field or the energy of d-orbital becomes differentiated in presence of ligand. This effect is known as crystal field splitting. The gain in bonding energy achieved in this way is called crystal field stabilization energy (C.F.S.E.). **D and q are called Differential of quanta**

Tetrahedral Crystal Field Splitting

opposite splitting of octahedral field



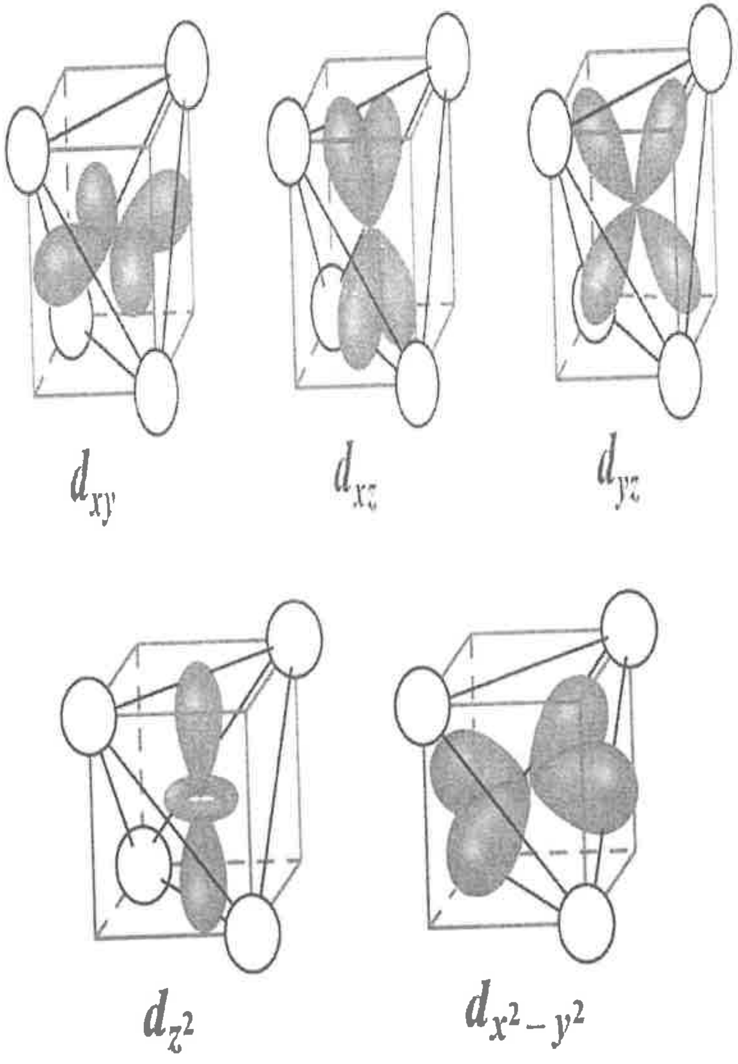
barycenter
(spherical field)

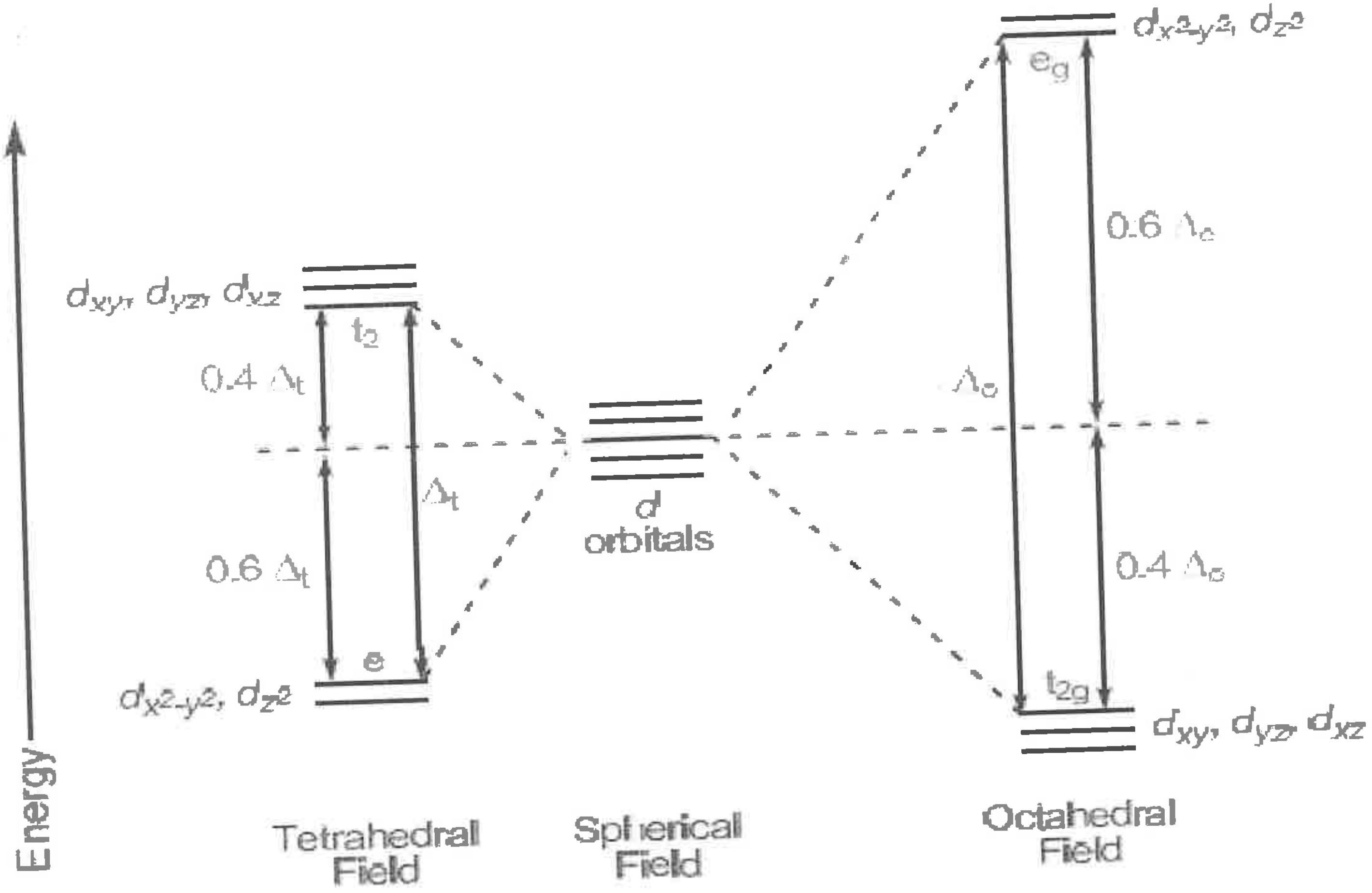
t_2 orbitals point more directly at ligands and are destabilized.

e orbitals point less directly at ligands and are stabilized.

$\Delta_t < \Delta_o$ because only 4 ligands and d orbitals point between ligands

Octahedral Vs Tetrahedral

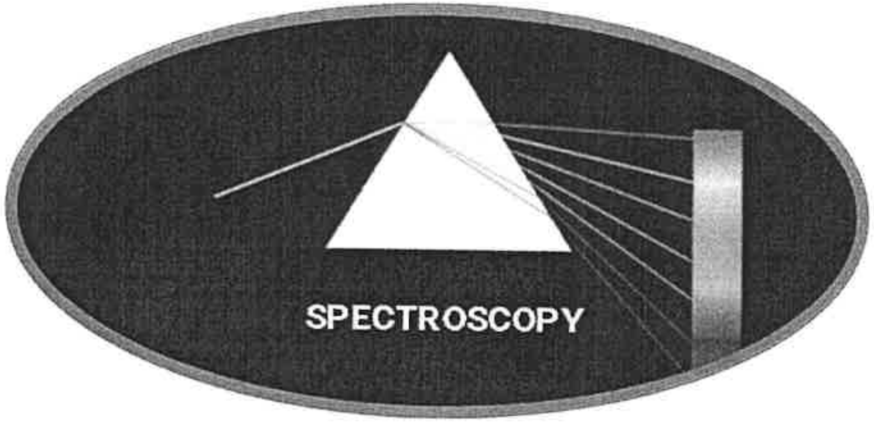


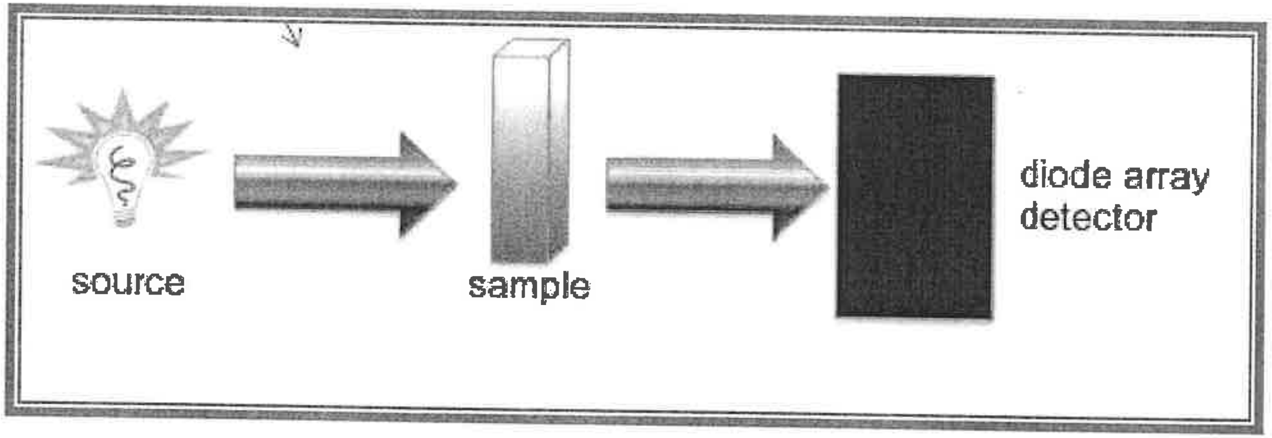


UNIT II

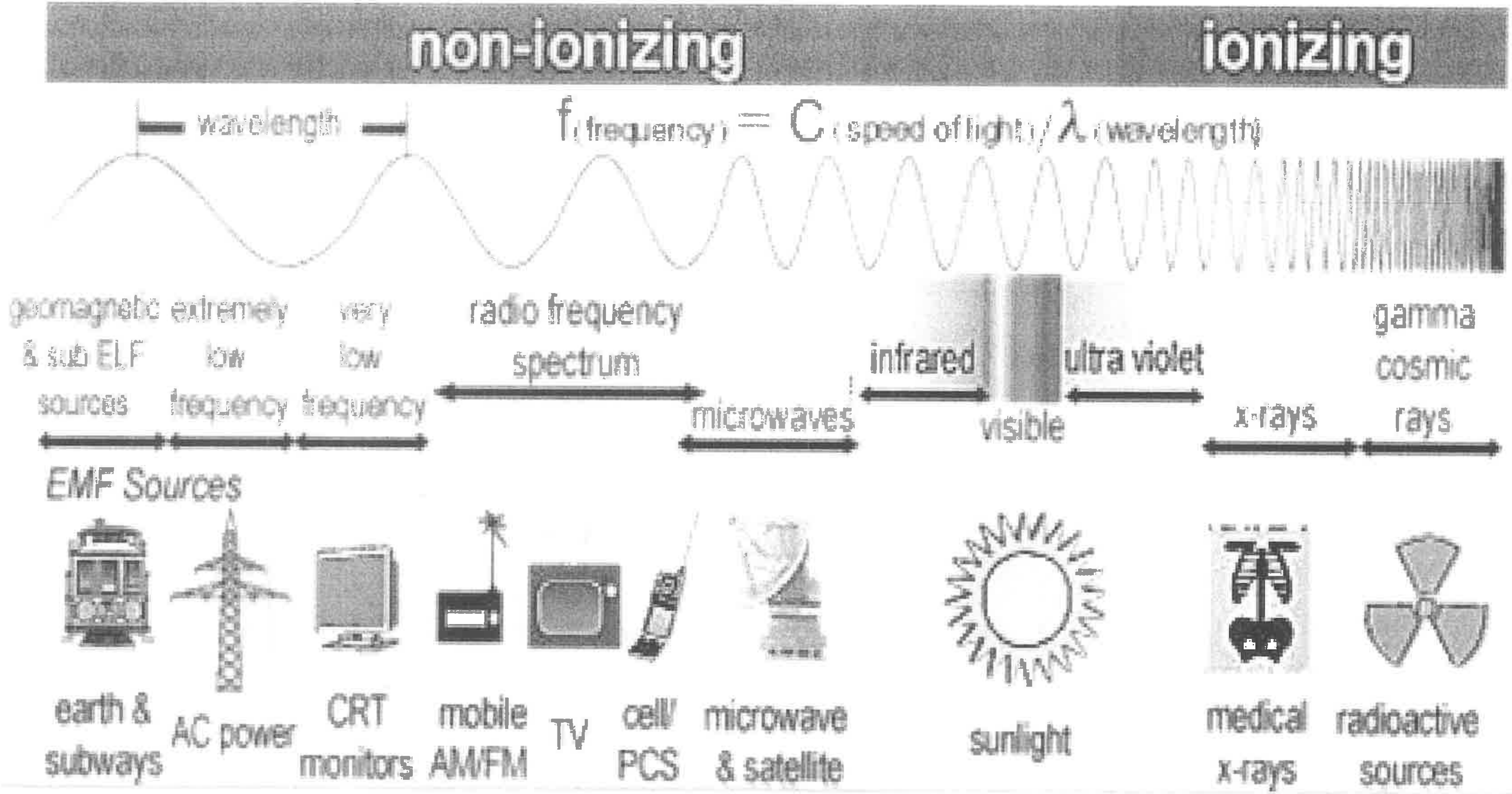
FUNDAMENTALS AND APPLICATIONS OF SPECTROSCOPY

- Spectroscopy – General introduction and Explanation;
- Types of Spectroscopy – Basic concepts and Principles of Electronic spectroscopy, Rotational spectroscopy and Vibrational spectroscopy.
- Applications of rotational and vibrational spectroscopy of diatomic molecules – Selection rules.
- Nuclear magnetic resonance spectroscopy – Introduction, principle, Instrumentation and applications.





INTERACTION OF EMR WITH MOLECULE



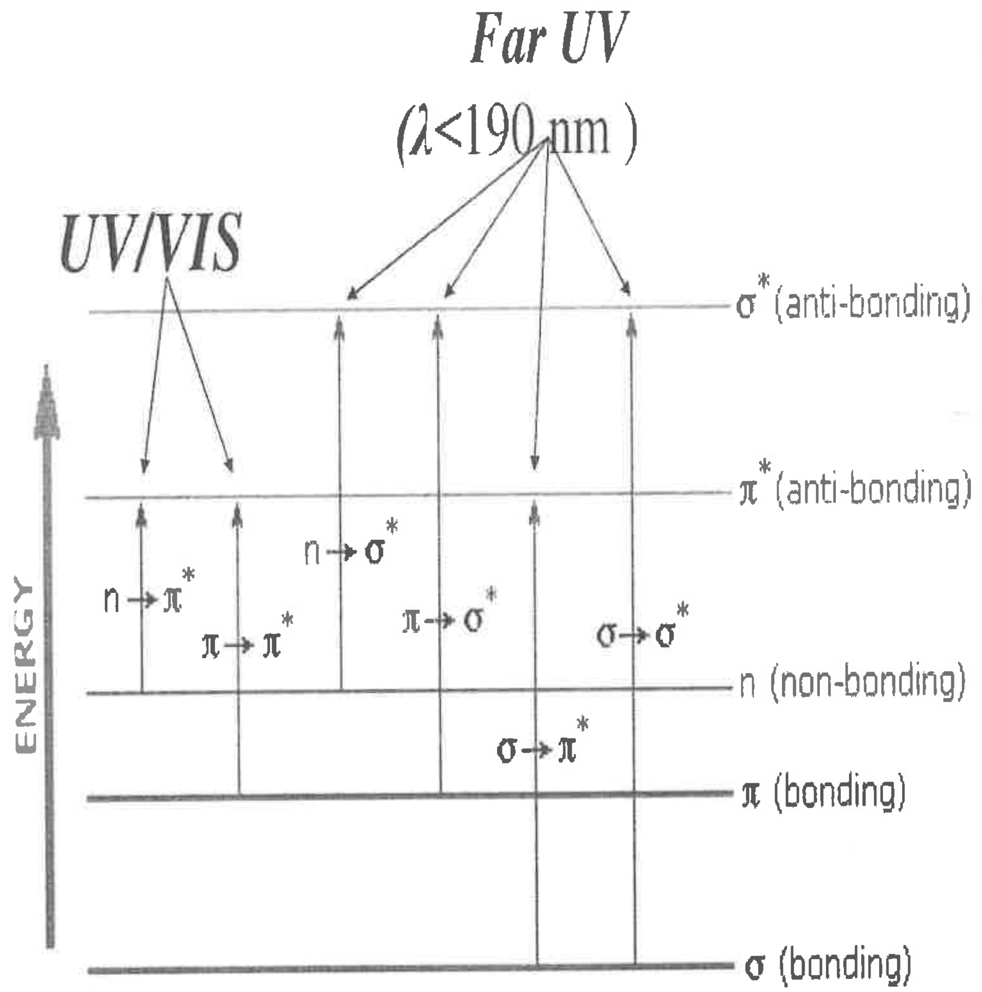
PRINCIPLES OF UV ABSORPTION SPECTROSCOPY

- The UV radiation region extends from 10 nm to 400 nm.
- Near UV Region: 200 nm to 400 nm.
- Far UV Region: below 200 nm to 10 nm.
- Far UV spectroscopy is studied under vacuum condition.
- The visible radiation region extends from 400 nm to 800 nm.
- In UV spectroscopy, the sample is irradiated with the broad spectrum of the UV radiation.
- If a particular electronic transition matches with the energy of a certain band of UV, it will be absorbed and the remaining UV light passes through the sample and is observed.
- From this residual radiation a spectrum is obtained with “gaps” at these discrete energies – this is called an *absorption spectrum.*

THE POSSIBLE TYPE OF ELECTRONIC TRANSITIONS

In UV-Vis spectroscopy the elections undergo transitions involving σ, π and n elections. There are six type of transitions are possible. They are

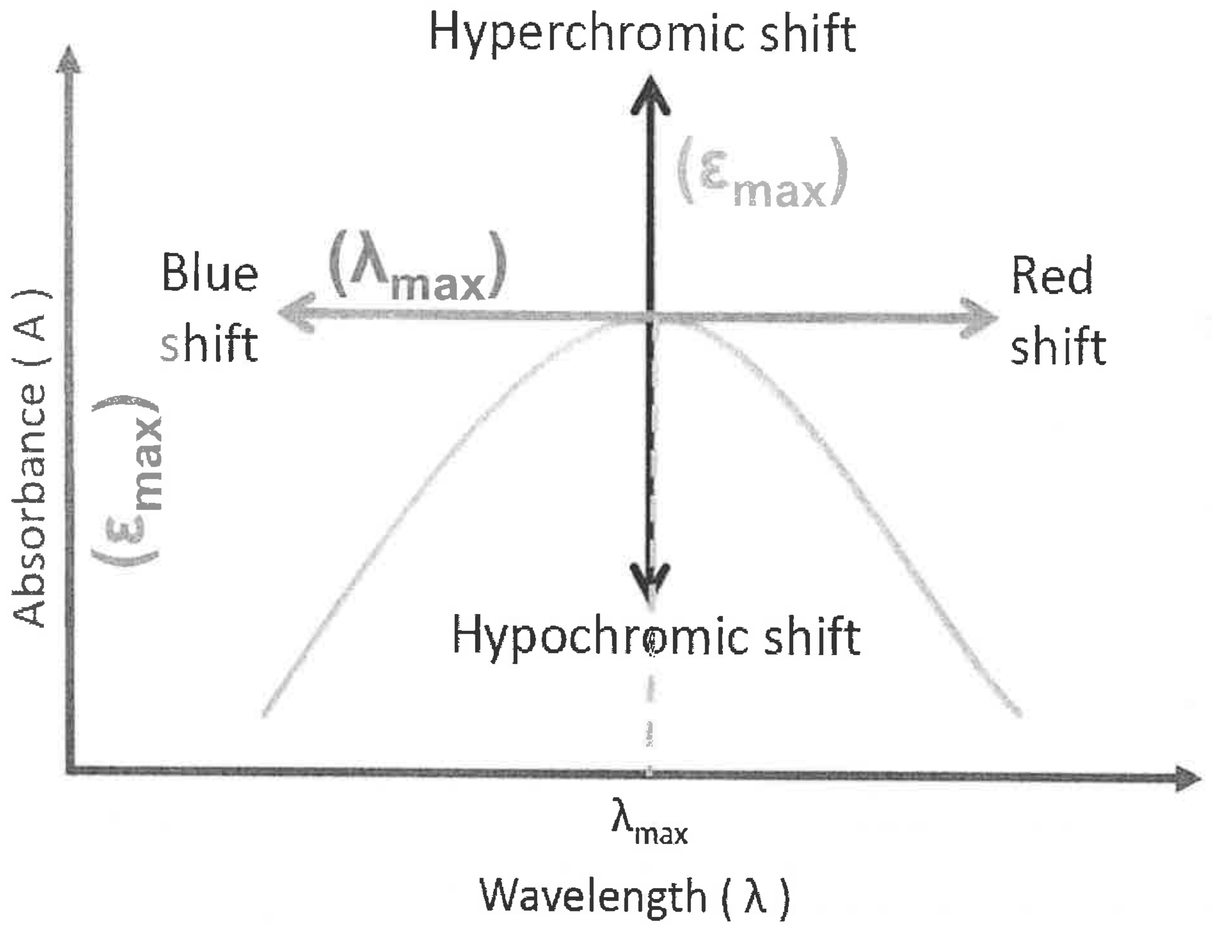
1. **$\sigma \rightarrow \sigma^*$ transition,** In alkanes & single bond compounds like H_2, Li_2, CH_4.
2. **n $\rightarrow \sigma^*$ transition,** In oxygen, Nitrogen, Sulfur, halogen containing single bond compounds.
3. **$\pi \rightarrow \pi^*$ transition,** In alkenes, alkynes, carbonyl like unsaturated compounds, B_2, C_2, CO, CN.
4. **n $\rightarrow \pi^*$ transition,** Carbonyls, Nitriles like oxygen, Nitrogen, Sulfur containing double bond (unsaturated) compounds.
5. **$\sigma \rightarrow \pi^*$ transition,** Carbonyls
6. **$\pi \rightarrow \sigma^*$ transition,**



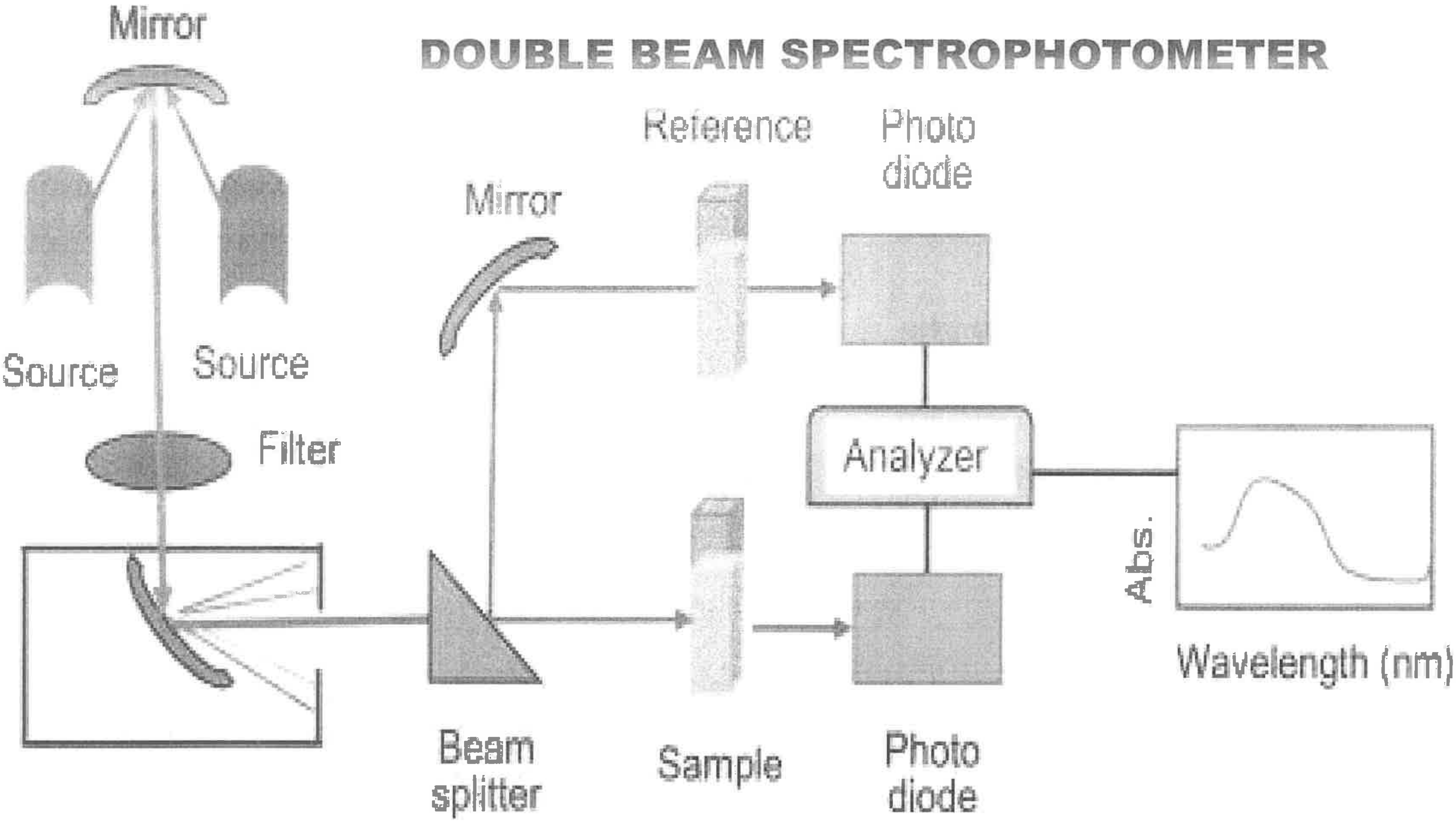
ABSORPTION & INTENSITY SHIFTS

1. **Bathochromic Shift (Red Shift):** When absorption maxima (λ_{max}) of a compound shifts to longer wavelength, it is known as bathochromic shift or red shift.
2. **Hypsochromic Shift (Blue Shift):** When absorption maxima (λ_{max}) of a compound shifts to shorter wavelength, it is known as hypsochromic shift or blue shift.
3. **Hyperchromic Effect:** When absorption intensity (ε_{max}) of a compound is increased, it is known as hyperchromic shift.
4. **Hypochromic Effect:** When absorption intensity (ε_{max}) of a compound is decreased, it is known as hypochromic shift.

Shifts and Effects



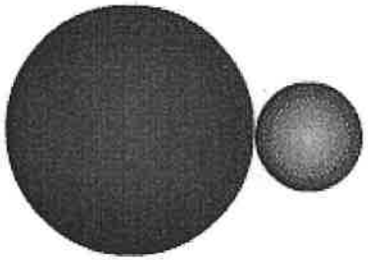
DOUBLE BEAM SPECTROPHOTOMETER



INTRODUCTION

The IR Spectroscopic Process

1. The quantum mechanical energy levels observed in IR spectroscopy are those of *molecular vibration*
2. We perceive this vibration as heat
3. When we say a *covalent bond* between two atoms is of a certain length, we are citing an average because the bond behaves as if it were a vibrating spring connecting the two atoms
4. For a simple diatomic molecule, this model is easy to visualize:



Vibration of a Diatomic Molecule
Approximates an Oscillating Spring

5. There are two types of bond vibration:

Stretch – Vibration or oscillation along the line of the bond

symmetric

asymmetric

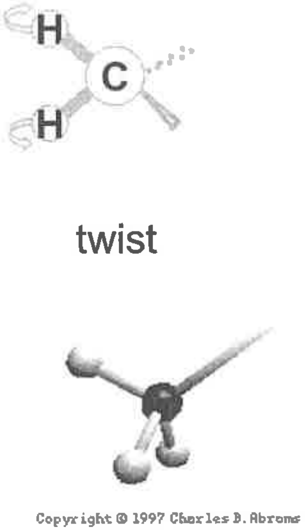
Bend – Vibration or oscillation not along the line of the bond

in plane

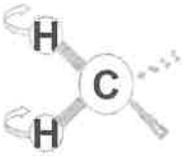
out of plane

scissor

rock



twist

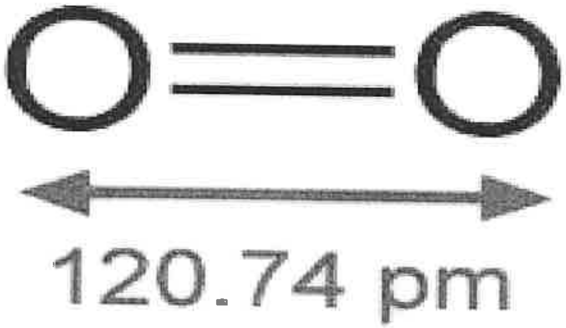


wag

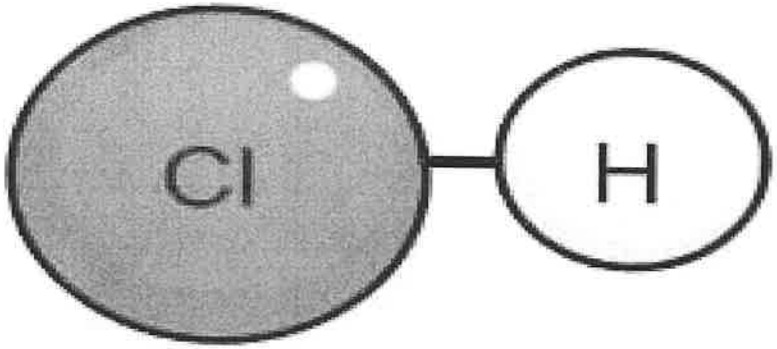
Condition for molecules to be IR active :

- The change in vibrational movements should produce a net dipole moment.

- Homonuclear atoms containing molecules are IR inactive.



- Heteronuclear atoms are IR active if their vibrations result in net dipole moment.



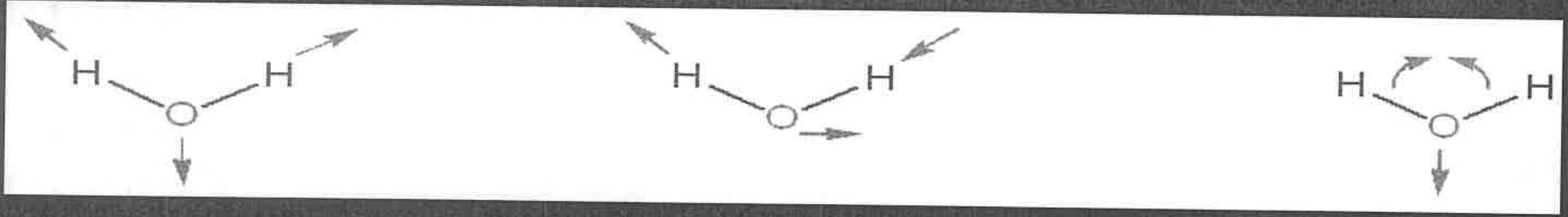
Fundamental Vibrations (Absorption Frequencies)

A molecule has as many as degrees of freedom as the total degree of freedom of its individual atoms.

- Each atom has 3 degree of freedom (x,y,z)
- A molecule of n atoms therefore has 3n degrees of freedom.
- Non linear molecules (e.g. H_2O)

Vibrational degrees of freedom or Fundamental Vibrations

= 3n - 6 3 x 3-6= 3 vibrations



Symmetrical Stretching (υ_s OH) 3652 cm^{-1}

Asymmetrical Stretching (υ_{as} OH) 3756 cm^{-1}

Scissoring (δ_s HOH) 1596 cm^{-1}

Source of NMR

The source of energy in NMR is radio waves which have long wavelengths having more than 10^7nm, and thus low energy and frequency.

When low-energy radio waves interact with a molecule, they can change the nuclear spins of some elements, including ^1H and ^{13}C.

Mass number	Atomic number	Spin number I		Examples
Odd	Odd or even	$\frac{1}{2}$	Half-integer	^{1}H, ^{13}C, ^{15}N, ^{19}F, ^{31}P
		$\frac{3}{2}$		^{11}B, ^{35}Cl, ^{37}Cl, ^{79}Br, ^{81}Br
		$\frac{5}{2}$		^{127}I, ^{17}O
Even	Even	0 (no spin)		^{12}C, ^{16}O, ^{32}S, ^{34}S
Even	Odd	1	Integer	^{14}N, ^{2}H (or D)
		3		^{10}B

SOLVENTS USED IN NMR

The following solvents are normally used in which hydrogen replaced by deuterium.

CCl_4 - carbon tetrachloride

CS_2 - carbon disulfide

$CDCl_3$ - Deuteriochloroform

C_6D_6 - Hexa deuteriobenzene

D_2O - Deuterium oxide

Chemical shift

A **chemical shift** is defined as the difference in parts per million (ppm) between the resonance frequency of the observed proton and tetramethylsilane (TMS) hydrogens.

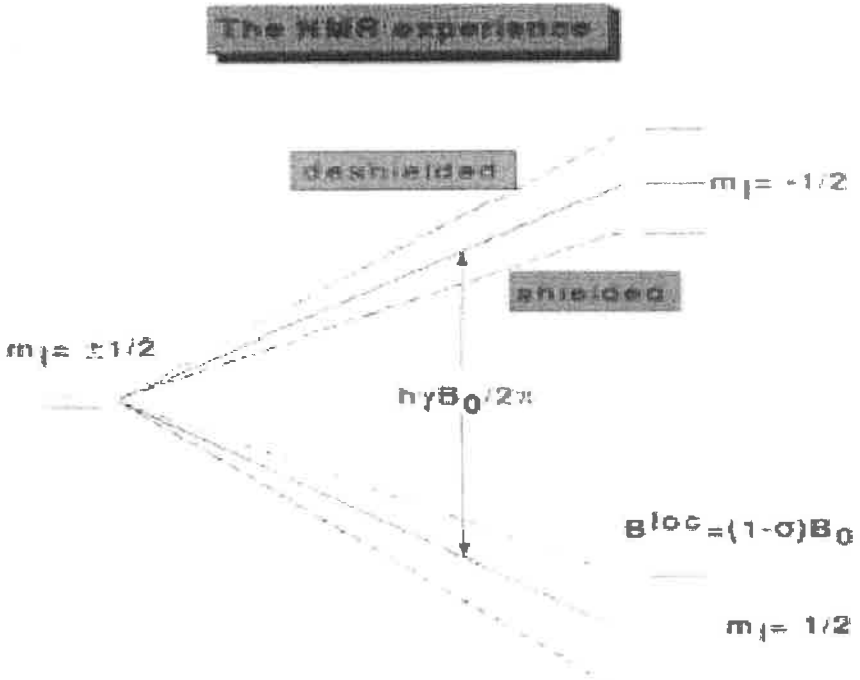
TMS is the most common reference compound in NMR, it is set at $\delta = 0$ ppm

$$\text{Chemical shift, } \delta = \frac{\text{frequency of signal} - \text{frequency of reference}}{\text{spectrometer frequency}} \times 10^{6}$$

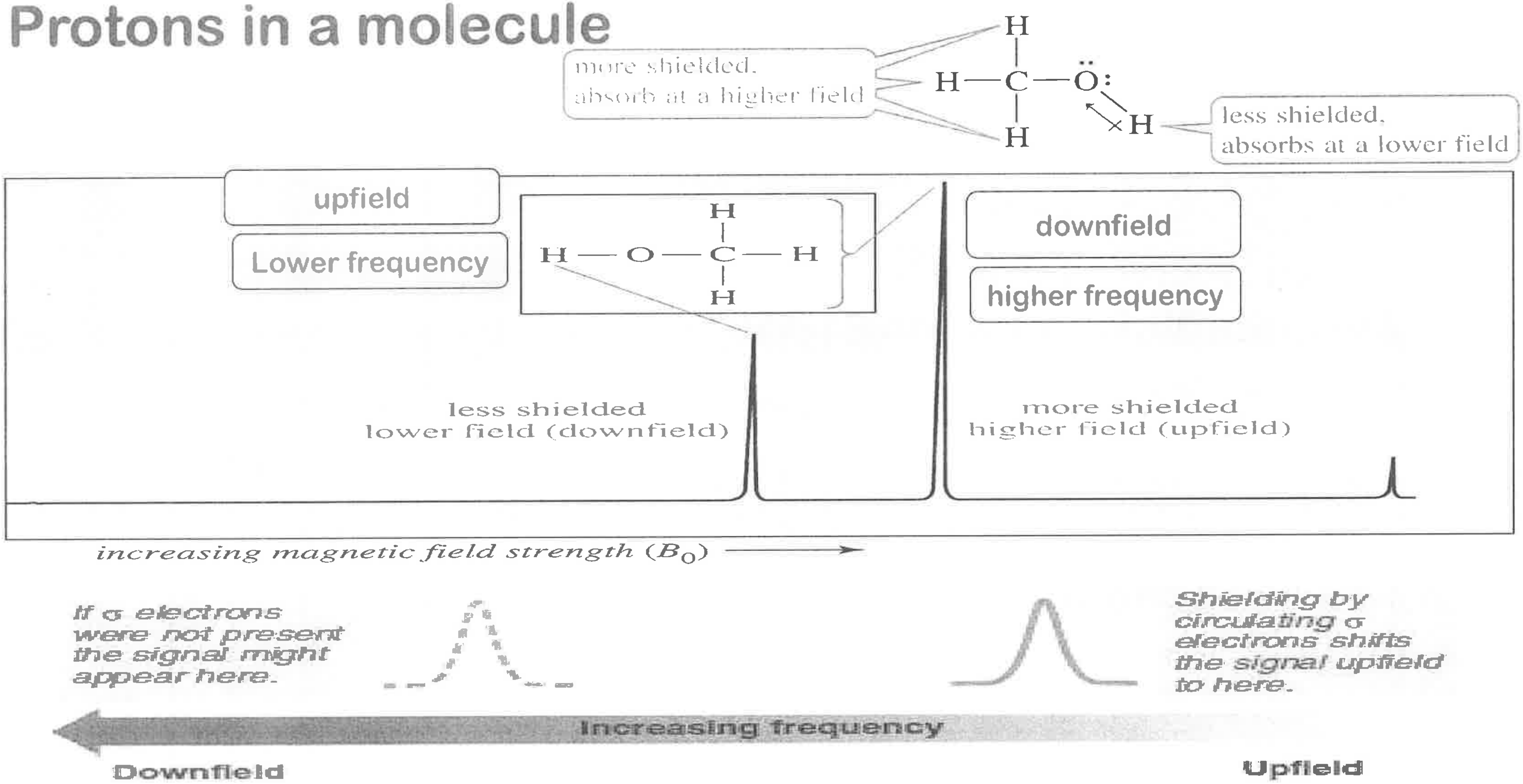
Shielding and Deshielding

A nucleus is said to be **shielded** when electrons around the nucleus circulates in a magnetic field and create a secondary induced magnetic field which opposes the applied field .

Trends in chemical shift are explained based on the degree of shielding or deshielding , e.g. of deshielding effect



Protons in a molecule



more shielded, absorb at a higher field

less shielded, absorbs at a lower field

upfield

Lower frequency

downfield

higher frequency

less shielded
lower field (downfield)

more shielded
higher field (upfield)

increasing magnetic field strength (B_0) →

If σ electrons were not present the signal might appear here.

Shielding by circulating σ electrons shifts the signal upfield to here.

Increasing frequency

Downfield

Upfield

A shielded proton will absorb *at lower frequency (upfield)*

UNIT III - SURFACE CHARACTERIZATION AND IONIZATION ENERGY

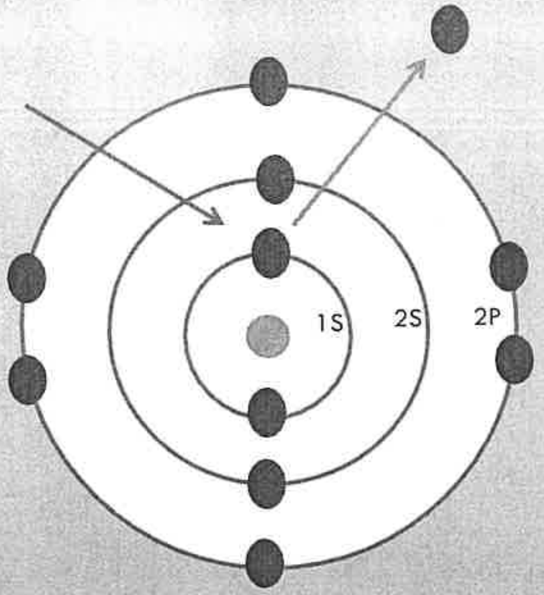
XPS (X-ray Photoelectron Spectroscopy) – Introduction – Explanation – Diffraction and Scattering of solids – Explanation – Ionic, dipolar interaction – Vander waals interaction – Equation of state of real gases – critical phenomena – Effective nuclear charge, penetration of orbitals – Variations of s, p, d and f orbital energies of atoms in the periodic table – Electronic configurations, atomic and ionic sizes – Ionization energies, electron affinity and electronegativity – Polarizability, oxidation states – Coordination numbers and geometries.

Principle

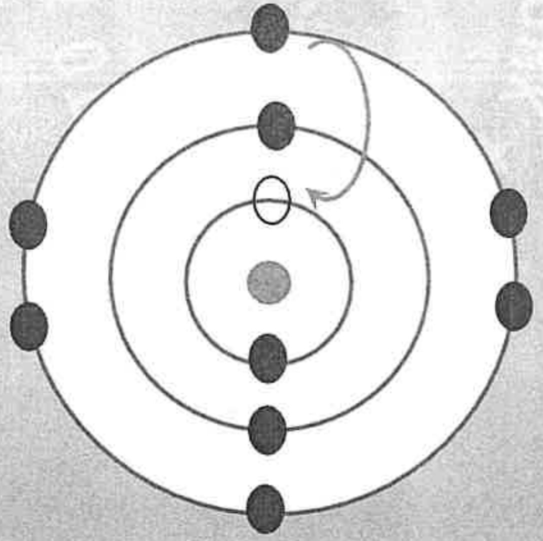
- The working principle of XPS is ejection of electron from the surface of sample in UHV condition when it is expose to the soft x-rays.
- Elements present in sample can be identified on the basis of kinetic energies and binding energies of their photoelectrons.
- Intensities of photoelectron provide information about concentration of element in a sample.
- The electrons emitted from atoms near the sample surface (10- 100 Angstroms) can escape the sample surface. This depth is about twenty atomic layers

Photoelectric **Effect**

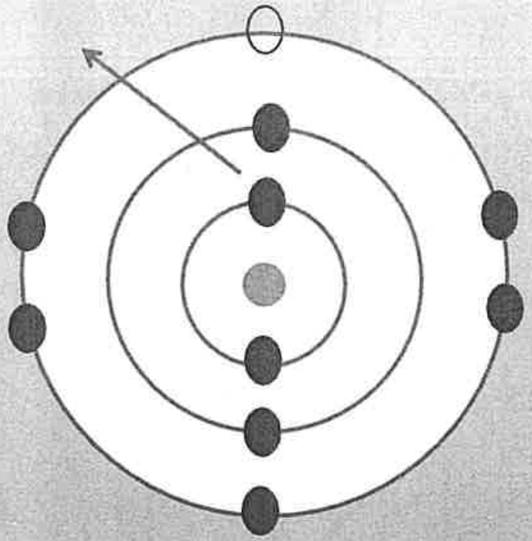
- When an X-ray (with energy hv) ejects out an electron (by energy B.E).
- The ejected electron is called photoelectron and this effect is called photoelectric effect.
- The atom will release energy by the emission of an Auger Electron



Photoemission



Relaxation



Auger Electron Emission

XRD (X-ray Diffraction analysis)

X-RAY PROPERTIES

- X ray, invisible, highly penetrating electromagnetic radiation of much shorter wavelength (higher frequency) than visible light.
- The wavelength range for X rays is from about 10^{-8}m to about 10^{-11} m, the corresponding frequency range is from about 3×10^{16} Hz to about 3×10^{19}Hz.

X-RAY ENERGY

- Electromagnetic radiation described as having packets of energy or photons.
- The energy of the photon is related to its frequency by the following formula:

$$E = h\nu$$

$$\nu = \frac{c}{\lambda}$$

$$E = h\frac{c}{\lambda}$$

Bragg's law

- Bragg's law was used to explain the interference pattern of X-rays scattered by crystals, diffraction has been developed to study the structure of all states of matter with anybeam.
- Bragg carried out a series of experiments, the result of which he published the Bragg equation

$$n\,\lambda = 2\,d\,\sin\theta$$

where,

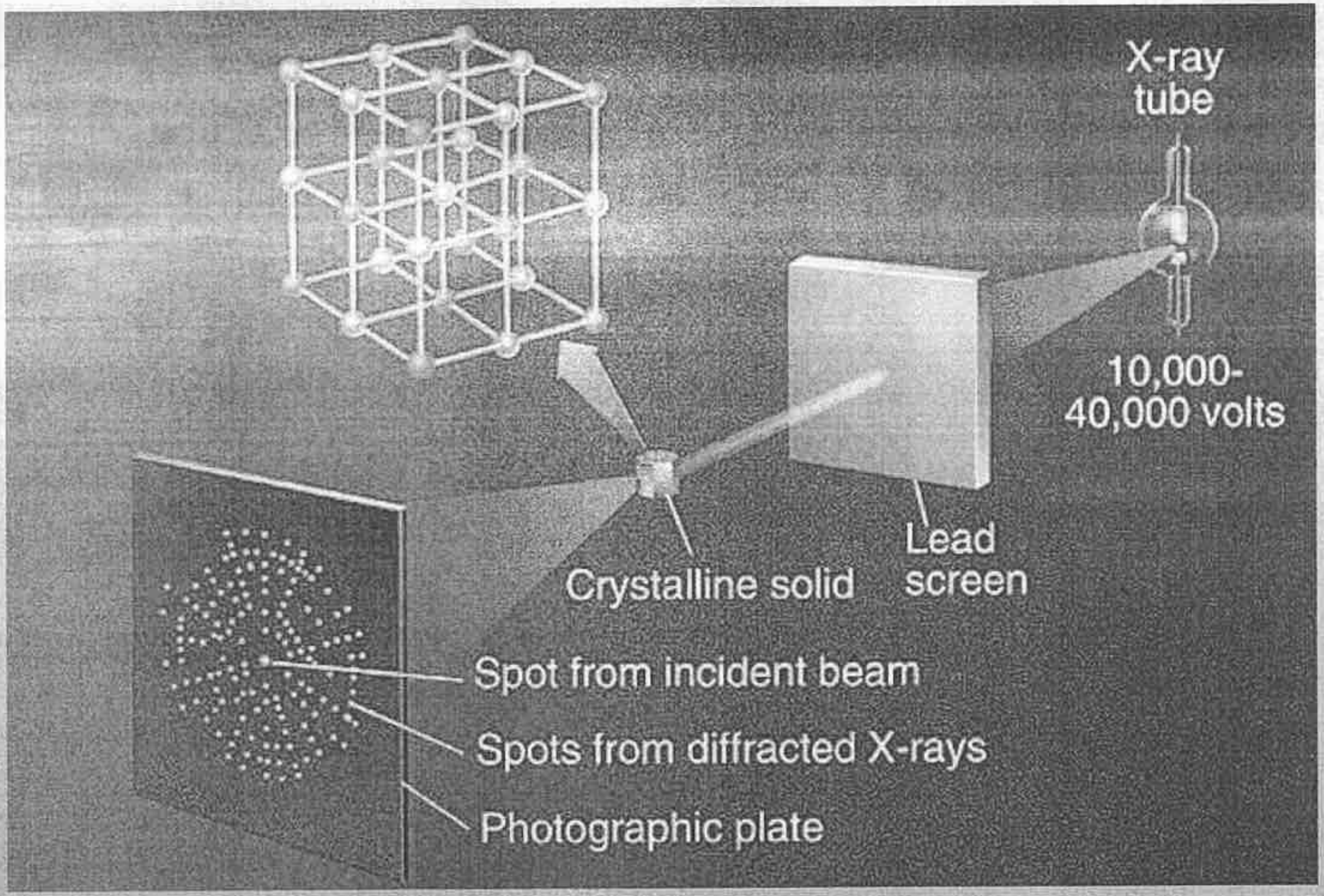
assume $n = 1$ for the first order reflection

λ = wavelength

θ = X-ray incidence angle

d = distance between atomic layer

Instrumentation of XRD



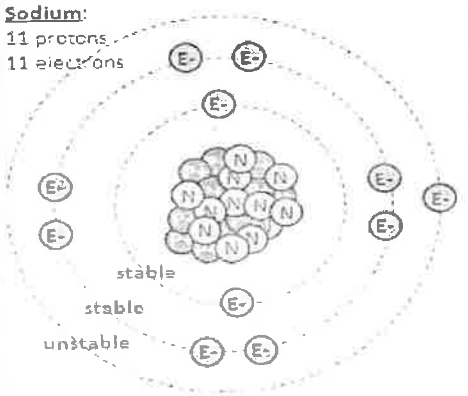
IONIC INTERACTION

11
Na
23

Atomic number:
Amount of protons

Amount of electrons

Atomic Mass
P + N = 23
11 + ? = 23

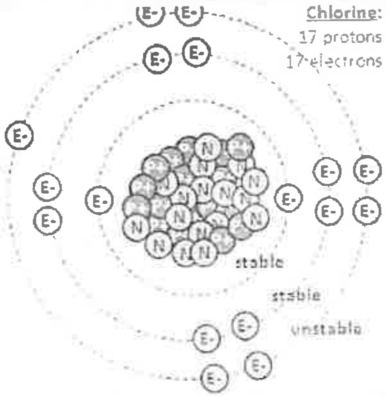


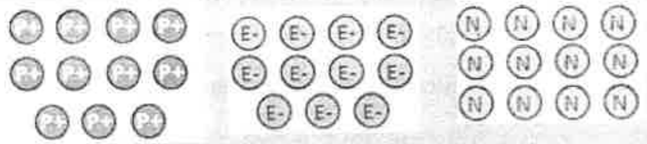
17
Cl
35

Atomic number:
Amount of protons

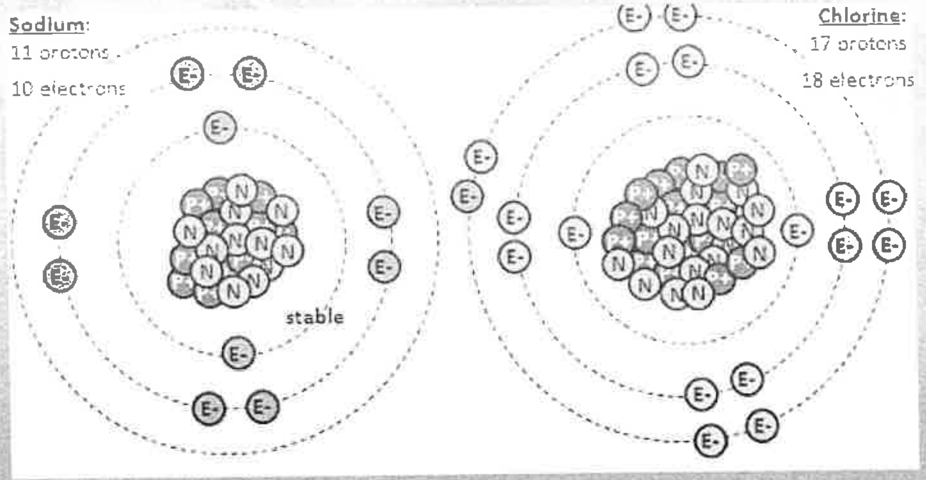
Amount of electrons

Atomic Mass
17 P + ? N = 35



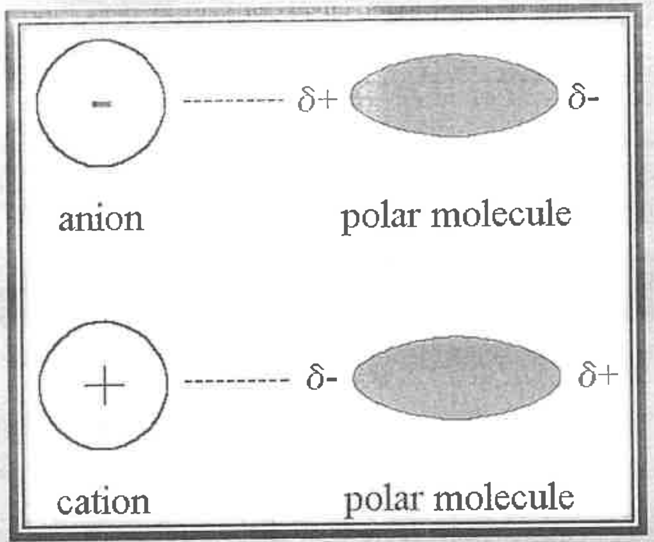


B1



Ion-dipole interactions

- An ion-dipole force is an attractive force that results from the electrostatic attraction between an ion and a neutral molecule that has a dipole. Most commonly found in solutions.
- A positive ion (cation) attracts the partially negative end of a neutral **polar molecule.**
- A negative ion (anion) attracts the partially positive end of a neutral polar molecule



- **Ion-dipole forces** are generated between polar water molecules and a sodium **ion.**
- These **intermolecular ion-dipole forces** are much weaker than covalent or **ionic** bonds.

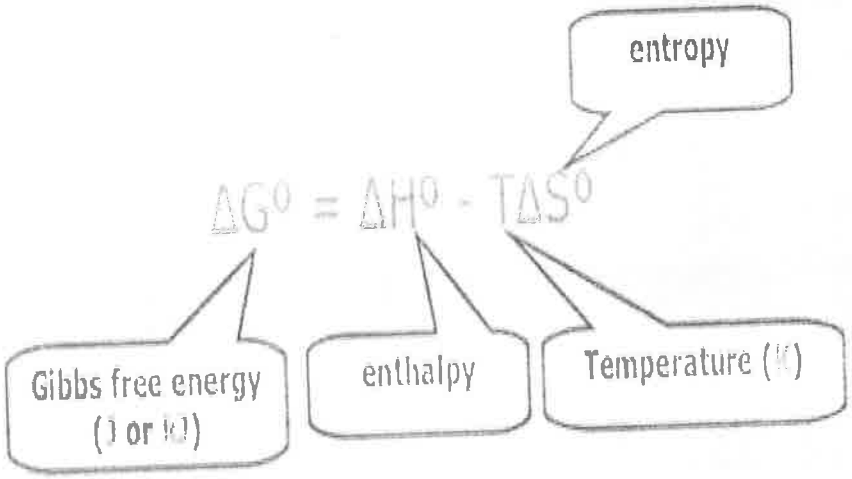
UNIT IV – THERMODYNAMICS AND CORROSION

- Thermodynamic functions: energy, entropy and free energy
- Estimations of entropy and free energies
- Free energy and emf. Cell potentials, the Nernst equation and applications
- Hard soft acids and bases
- Acid base, oxidation reduction and solubility equilibria
- Water chemistry
- Corrosion and its control

THERMODYNAMICS VARIATION OF ΔG IN RELATION WITH Δ H & Δ S

ENTROPY AND GIBBS FREE ENERGY

How are entropy and enthalpy related?



$$\Delta G^0 = \Delta H^0 - T\Delta S^0$$

Gibbs free energy is the energy that is available to do useful work.

A reaction will spontaneously occur if ΔG<0 (exergonic reaction)

A reaction will NOT spontaneously occur if ΔG>0 (endergonic reaction)

[illegible]	[illegible]	[illegible]
Exothermic ($\Delta H < 0$)	Increase ($\Delta S > 0$)	Yes, $\Delta G < 0$
Exothermic ($\Delta H < 0$)	Decrease ($\Delta S < 0$)	Only at low temps, if $\lvert T\Delta S\rvert < \lvert\Delta H\rvert$
Endothermic ($\Delta H > 0$)	Increase ($\Delta S > 0$)	Only at high temps, if $\lvert T\Delta S\rvert > \lvert\Delta H\rvert$
Endothermic ($\Delta H > 0$)	Decrease ($\Delta S < 0$)	No, $\Delta G > 0$

Nernst Equation

Consider the following redox reaction

$$M^{n^+} + ne^- \leftrightarrow M$$

Reduction reaction $M^{n^+} + ne^- \rightarrow M$

For such a redox reversible reaction, the free energy change (ΔG) and its equilibrium constant (K) are inter related as $\Delta G = - RTln\, K + RTln \frac{[Product]}{[Reactant]}$

$$\Delta G = \Delta G^o + RTln \frac{[Product]}{[Reactant]}$$

……………………(1) is know as ***Van't Hoff isotherm***

Where $\Delta Go = Standard\ free\ energy\ chance$

The above equation (1) The decrease in free energy (ΔG) in the above reaction will provide electrical energy. In the cell, if the reaction involves transfer of "n" number of electrons, then "F" Faraday of electricity will flow. If E is the EMF of the cell, then the total electrical energy (nFE) produced in the cell

$$-\Delta G = nFE \text{ (or)}$$

$$-\Delta Go = nFE^{o} \text{ .... (2)}$$

Where $-\Delta G = decrease\ in\ free\ energy\ change$

$-\Delta Go = decrease\ in\ Standard\ free\ energy\ change$

Comparing equation 1 and 2, it becomes

$$\Delta G = \Delta Go + RTln\frac{[Product]}{[Reactant]} \text{ ....(1)}$$

$$-nEF = -nFE^{o} + RTln\frac{[M]}{[Mn^{+}]} \text{ .... (3)}$$

Dividing the above equation (3) by $-nF$

$$\frac{-\cancel{n}FE}{-\cancel{n}F} = \frac{-\cancel{n}FEo}{-\cancel{n}F} + \frac{RT}{-nF}ln\frac{[M]}{[Mn^{+}]}$$

$$E = Eo -$$

$$\frac{RT}{nF}ln\frac{[M]}{[Mn^{+}]}$$

Therefore the activity of solid metal[M] = 1

$$E = Eo - \frac{RT}{nF} ln \frac{[M]}{[Mn^{+}]}$$

$$E = Eo - \frac{RT}{nF} ln \frac{[1]}{[Mn^{+}]}$$

$$E = Eo + \frac{RT}{nF} ln\, [Mn^{+}]$$

$$E = Eo + \frac{2.303RT}{nF} log\, [Mn^{+}]$$

When

$R = 8.314$ J/K/mole

$F = 96500\ coulombs$

$T = 298\ K\ (25^{o}C)$

$$E_{red} = Eored + \frac{2.303 \times 8.314 \times 298}{n \times 96500} log\, [Mn^{+}]$$

For Reduction potential

$$\boxed{E_{red} = Eored + \frac{0.0591}{n} log\, [Mn^{+}]}$$

Acids & Bases

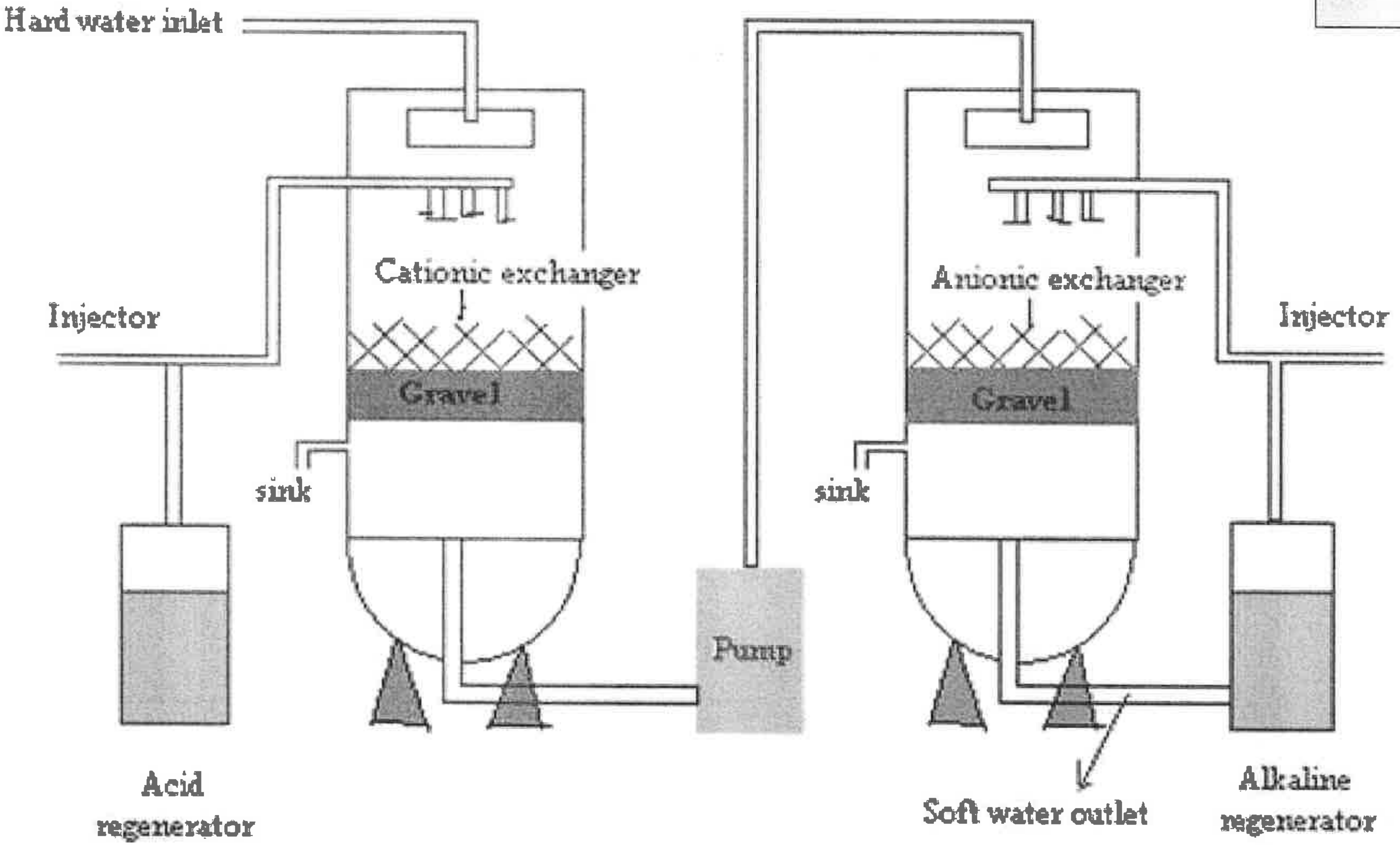
Acids:

- acids are sour tasting
- **Arrhenius acid:** Any substance that, when dissolved in water, increases the concentration of hydronium ion (H_3O^+)
- **Bronsted-Lowry acid:** A proton donor
- **Lewis acid:** An electron acceptor

Bases:

- bases are bitter tasting and slippery
- **Arrhenius base:** Any substance that, when dissolved in water, increases the concentration of hydroxide ion (OH^-)
- **Bronsted-Lowery base:** A proton acceptor
- **Lewis acid:** An electron donor

SO – 2



Demineralization process

- **Ca^{2+}, Mg^{2+}, Fe^{2+} or Mn^{2+} ions** → exchanged by H^+ / OH^-

  Temporarily stored in the pores of the resin

External Conditioning

Done by **Ion-exchange process (or) Demineralization**

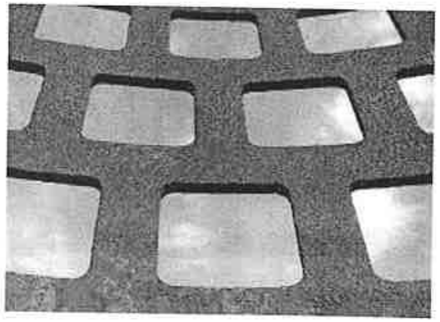
- **Ion-Exchange process:**

The soft water obtained by **zeolite process does not contain** harness producing **Ca^{2+} and Mg^{2+} ions, but it may contain** other **ions like Na^+, K^+, SO_4^{2-}, Cl^-** etc.

Ion exchange resins are ***insoluble, cross-linked, long chain organic polymers*** with a ***microporous structure*** which can absorb cations and anions. The **functional groups (-COOH, -SO_3H)attached to the chains** are responsible **for the ion exchanging properties.**

1. OXIDATION CORROSION

- Direct attack of oxygen at low or high temperature on metal surfaces in the absence of moisture.
- Alkali metals –(Na, Li, K etc..) and alkaline metals(Mg, Ca, Sn etc..) are rapidly oxidised at low temperature.
- At high temperature, almost all metals (except Ag, Au and Pt) are oxidized.



1. OXIDATION CORROSION

- Direct attack of oxygen at low or high temperature on metal surfaces in the absence of moisture.
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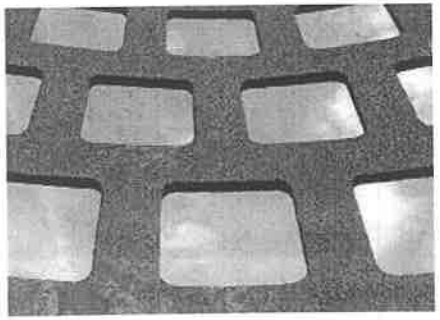


Mechanism:

(i) Oxidation takes place at the surface of the metal forming metal ions(M^{2+})

$$M \rightarrow M^{2+} + 2e^-$$

(ii) Oxygen is converted to oxide ion (O^{2-}) due to the transfer of electrons from metal.

$$1/2\ O_2 + 2e^- \rightarrow O^{2-}$$

(iii) oxide ion reacts with the metal ions to form metal oxide film.

$$M + 1/2\ O_2 \rightarrow M^{2+} + O^{2-}{}_{\text{(Metal –oxide film)}}$$

The Nature of the Oxide formed plays an important part in oxidation corrosion process.

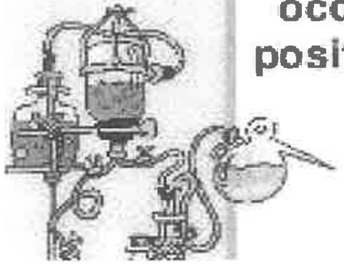
Metal + Oxygen → Metal oxide (corrosion product)

1. OXIDATION CORROSION

- Direct attack of oxygen at low or high temperature on metal surfaces in the absence of moisture.
- Alkali metals –(Na, Li, K etc..) and alkaline metals(Mg, Ca, Sn etc..) are rapidly oxidised at low temperature.
- At high temperature, almost all metals (except Ag, Au and Pt) are oxidized.

UNIT V - ORGANIC REACTION AND MECHANISMS & SYNTHESIS OF COMMON DRUGS

- Introduction to type of reactions involving substitution-Addition-Elimination.
- Oxidation and reduction reactions.
- Cyclization and ring opening reactions.
- Optical activity, Absolute configurations-Conformational analysis.
- Isomerism in transition metal complex & representation of 3 dimensional structures.
- Structural isomers and stereoisomers – Configurations and symmetry and chirality – Enantiomers, diastereomers.
- Introduction-Synthesis of commonly used drug molecules-Examples.



STRUCTURAL ISOMERISM

Same molecular formula but different structural formulae

- **CHAIN ISOMERISM**

- **POSITION ISOMERISM**

- **FUNCTIONAL GROUP ISOMERISM**

STEREOISOMERISM

Same molecular formula but atoms occupy different positions in space.

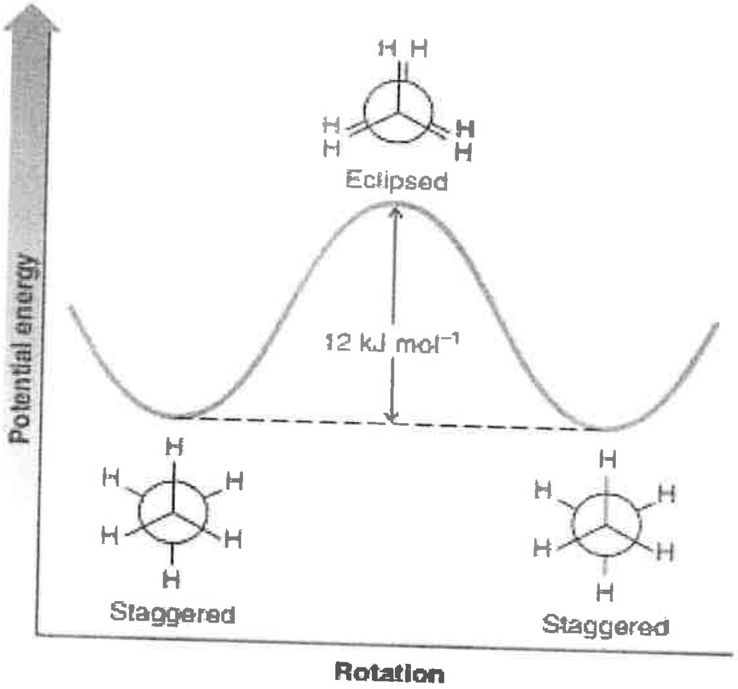
- **GEOMETRICAL ISOMERISM**

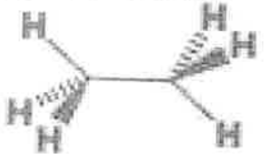
Occurs due to the restricted rotation of C=C double bonds... two forms... CIS and TRANS

- **OPTICAL ISOMERISM**

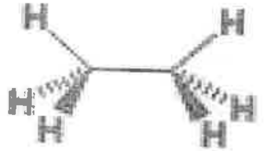
Occurs when molecules have a chiral centre. Get two non-superimposable mirror images.

CONFORMATIONAL ANALYSIS





the staggered conformation of ethane



the eclipsed conformation of ethane

Conformers like these cannot be isolated except at extremely low temperatures.

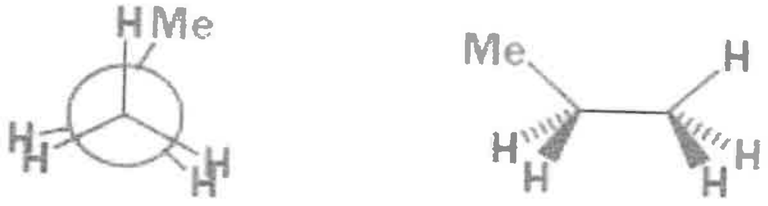
A "Price List" For Some Steric Interactions

H–H eclipsing interaction: **1.0 kcal/mol**

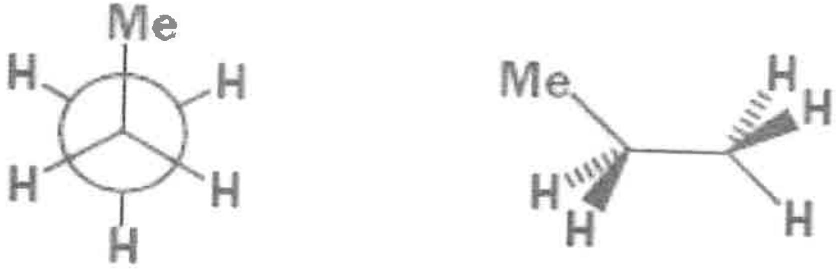
CH_3–H eclipsing interaction: **1.4 kcal/mol**

CH_3–CH_3 eclipsing interaction: **3.0 kcal/mol**

Can use these values to estimate the "costs" of various conformations!



the eclipsed conformation of propane

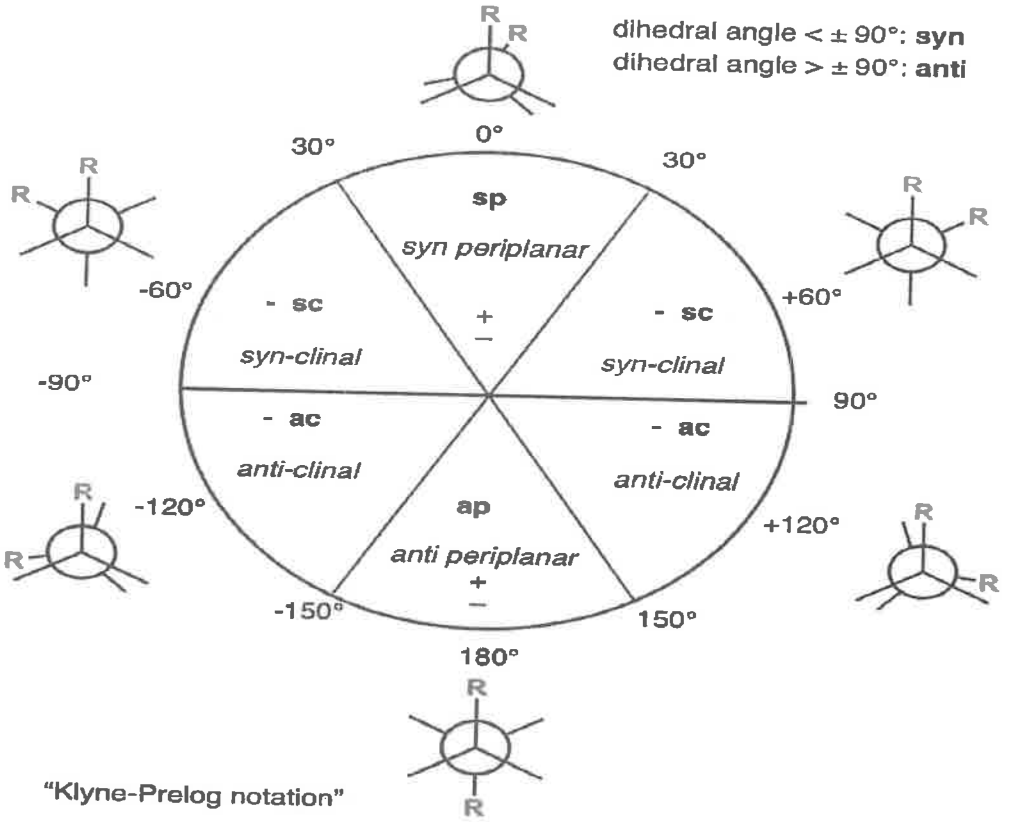


the staggered conformation of propane

CONFORMATIONAL ANALYSIS OF BUTANE

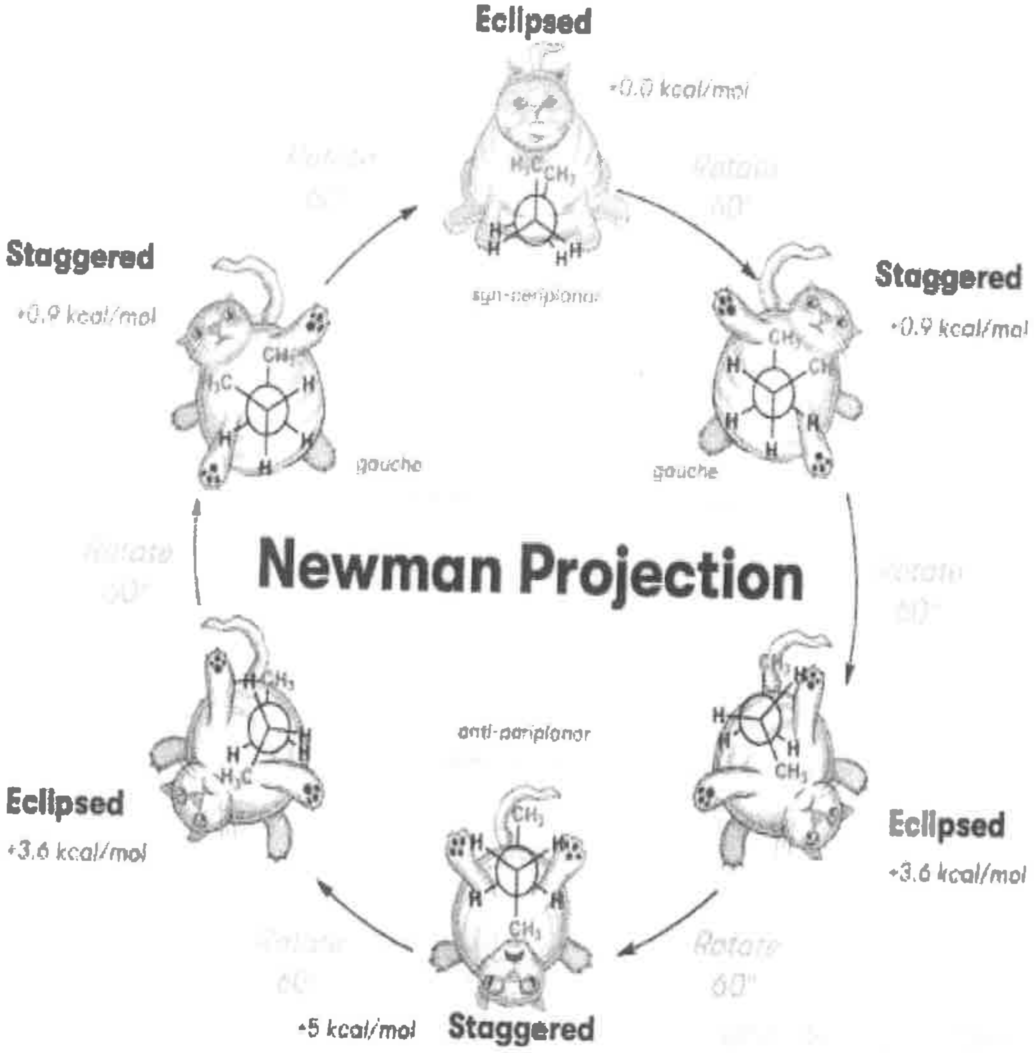
syn vs anti, periplanar vs clinal

dihedral angle < ± 90°: **syn**
dihedral angle > ± 90°: **anti**



"Klyne-Prelog notation"

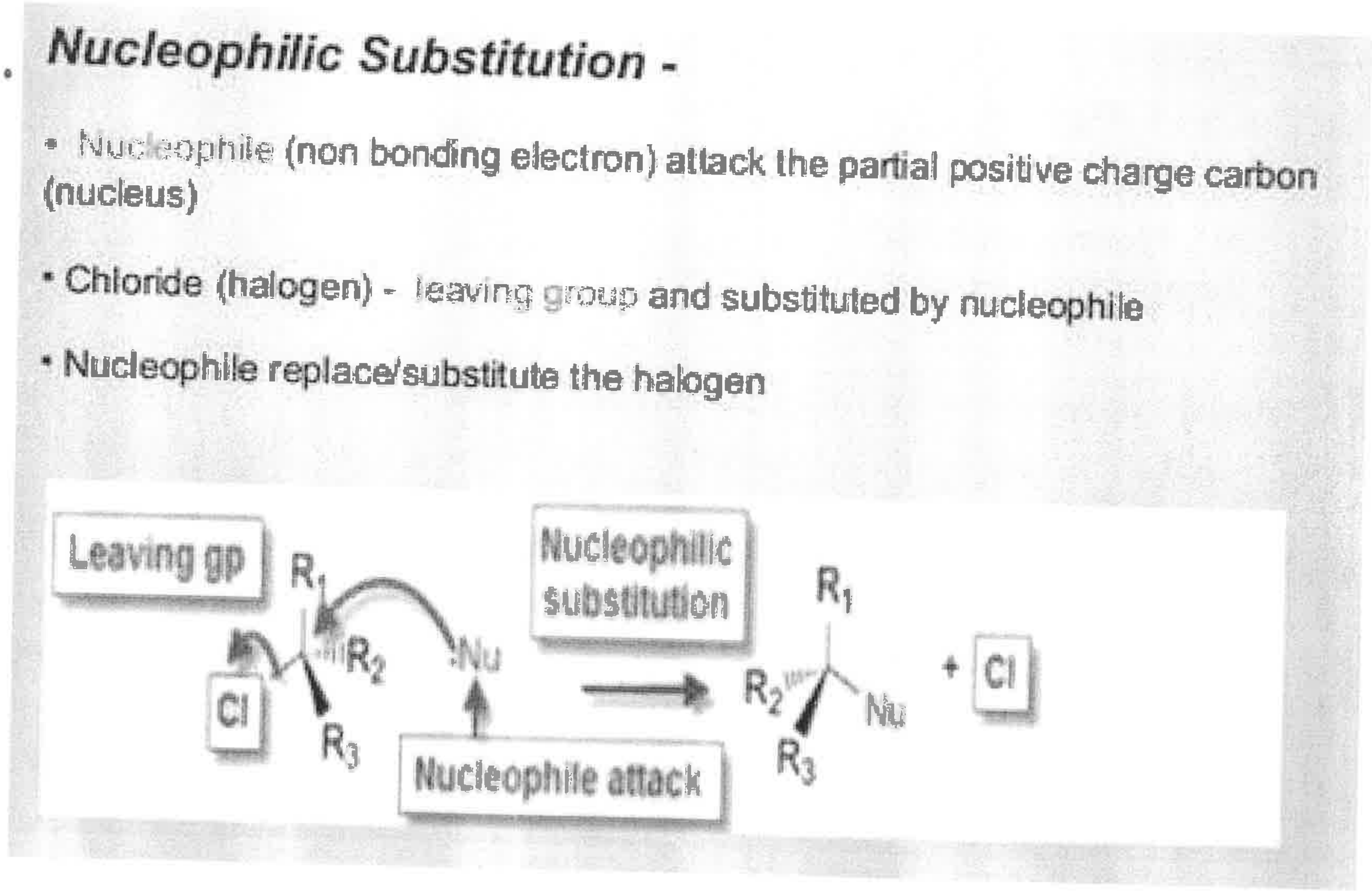
Dihedral angle	Designation	Dihedral angle	Designation
0 ± 30°	± syn periplanar	180 ± 30°	± anti periplanar
+60° ± 30°	+ syn-clinal	-120° ± 30°	- anti-clinal
120 ± 30°	+ anti-clinal	-60 ± 30°	- syn-clinal



NUCLEOPHILC SUBSTITUTION REACTION

Content……

- SN1 Reaction
- SN2 Reaction



***Nucleophilic Substitution* -**

- Nucleophile (non bonding electron) attack the partial positive charge carbon (nucleus)
- Chloride (halogen) - leaving group and substituted by nucleophile
- Nucleophile replace/substitute the halogen

Nucleophilic Substitution

S_N1

S: Substitution
N: Nucleophilic
1: unimolecular

S_N2

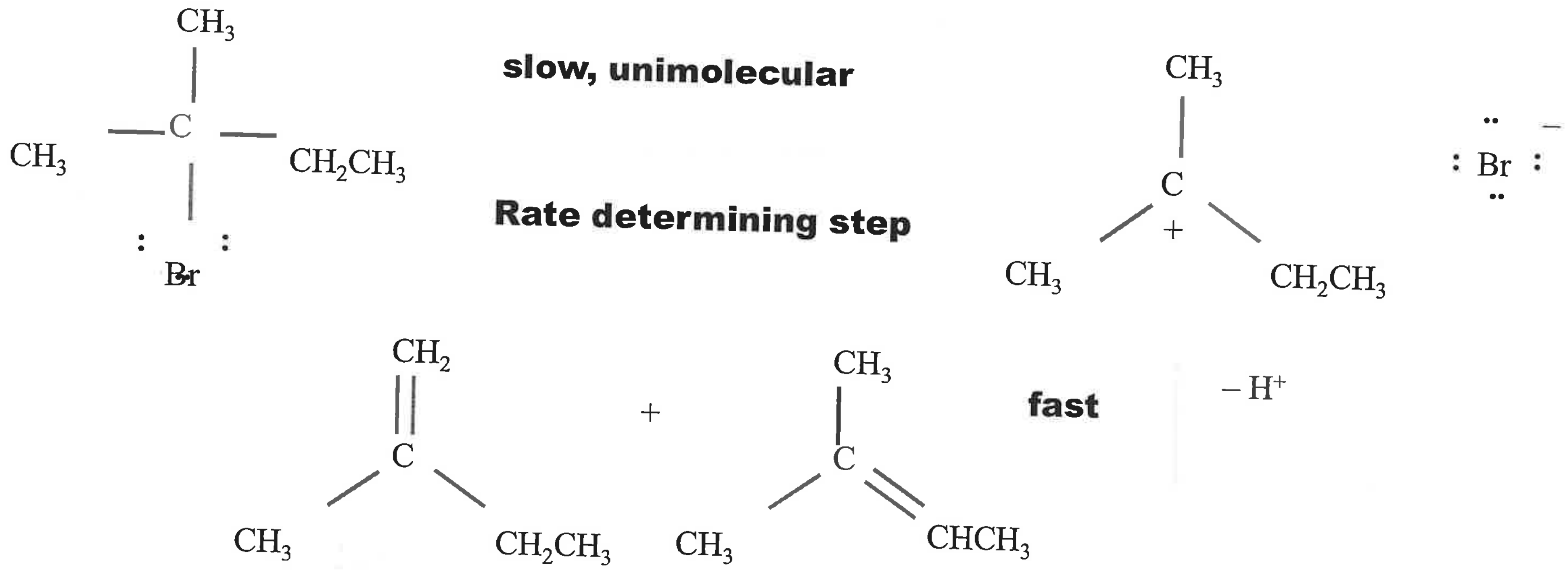
S: Substitution
N: Nucleophilic
2: Bimolecular

leaving group goes first and nucleophile comes later

nucleophile attacks and leaving group goes simultaneously

The E_1 Mechanism

- ❖ Alkyl halides can undergo elimination in absence of base.
- ❖ Carbocation is intermediate
- ❖ Rate-determining step is unimolecular ionization of alkyl halide



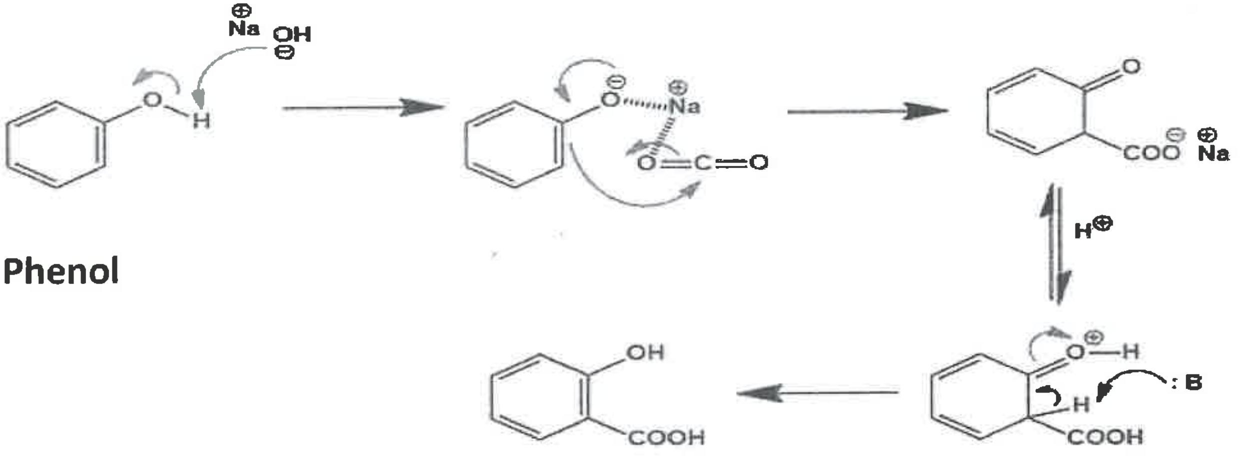
slow, unimolecular

Rate determining step

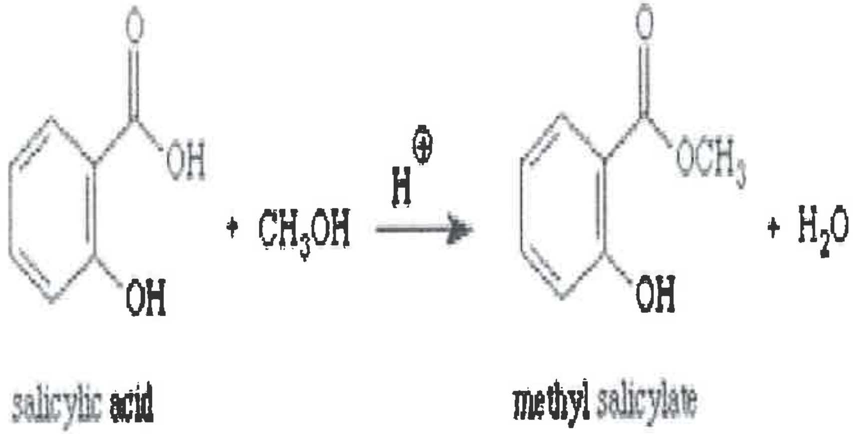
fast

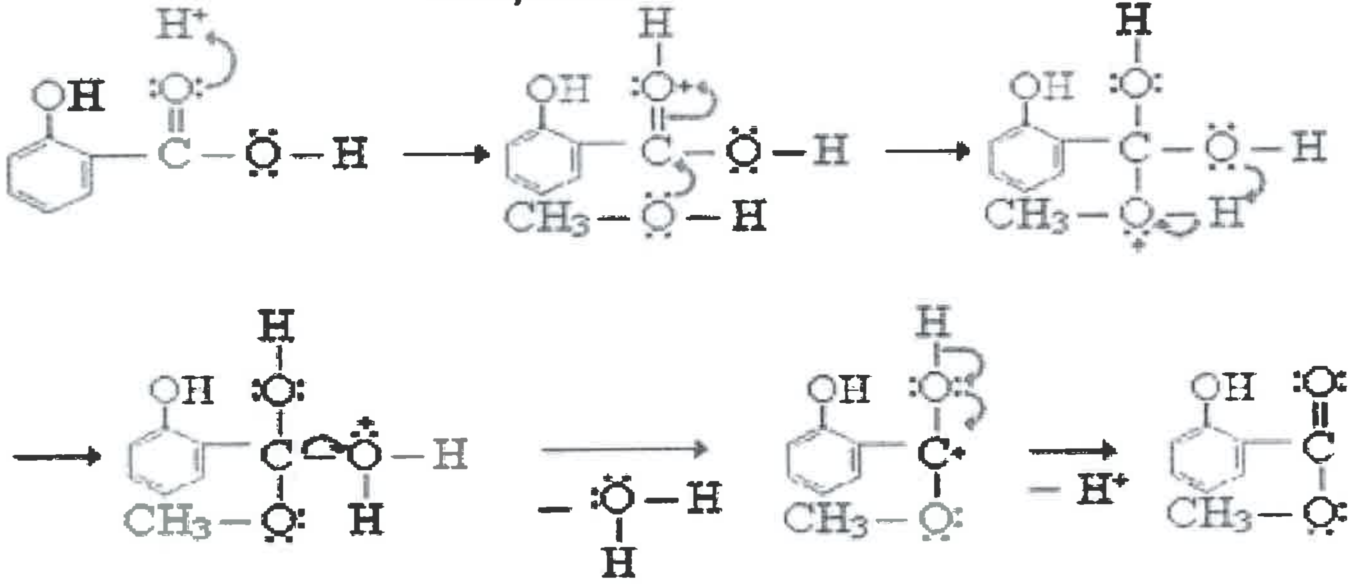
$- H^+$

SYNTHESIS OF SALICYLIC ACID & METHYL SALICYLATE



Salicylic acid





CLA I - QUESTION PAPER & ANSWER KEY

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -I
U20CYBJ01 – ENGINEERING CHEMISTRY
ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **MARKS: 30 Marks**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	**Part – A Answer all the Questions (5 x 2 = 10)**	Weightage	CO	Blooms level
1	Define chromophore.	2	CO6	2
2	Define Spectroscopy.	2	CO2	2
3	What is the selection rule for IR?	2	CO2	3
4	Why homo diatomic molecules are IR inactive?	2	CO2	3
5	What are the regions of UV spectroscopy?	2	CO2	3
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Analyze the MO diagram of 1, 3- Butadiene and predict their HOMO & LUMO orbital. **OR** b) Analyze the Crystal field splitting energy of d^5 to d^{10} electronic configuration in week field tetrahedral complexes.	4	CO1	3
7	a) Examine the possible shifts in UV spectroscopy? **OR** b) Examine any four possible transitions state in UV spectroscopy	4	CO6	3
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a) Analyze the molecular orbital diagram of following molecules and predict their magnetic properties? 1. O_2 2. NO **OR** b) Draw and give details about the crystal field theory for octahedral geometry with an example.	12	CO1	4

CO	WEIGHTAGE
CO1	16
CO2	8
CO3	
CO4	-
CO5	-
CO6	6
TOTAL	**30**

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -I
U20CYBJ01 – ENGINEERING CHEMISTRY

ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **DATE: 26/04/2023** **MARKS: 30 Marks**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	**Part – A Answer all the Questions (5 x 2 = 10)**	Weightage	CO	Blooms level
1	What is the selection rule for UV visible spectroscopy?	2	CO6	2
2	Define spectrum.	2	CO2	2
3	What are the regions of IR spectroscopy?	2	CO2	2
4	Explain the selection rule in IR linear and non-linear molecules.	2	CO2	3
5	Mention the Ionizing & Non-ionizing rays in spectroscopy.	2	CO2	3
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Sketch the MO diagram of benzene and analyze the HOMO & LUMO orbital. **OR** a) Explain the crystal field splitting pattern of $[Fe(CN)_6]^{4-}$ & $[Fe(H_2O)_6]^{2+}$ complexes.	4	CO1	3
7	a) Examine the term chromophore and Auxochrome with suitable example? **OR** b) Examine any four possible effects state in UV spectroscopy?	4	CO6	3
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a) Analyze the molecular orbital diagram of following molecules and predict their magnetic properties? 1. F_2 2. CN **OR** b) Draw and give details about the crystal field theory for tetrahedral geometry with an example.	12	CO1	4

CO	WEIGHTAGE
CO1	16
CO2	8
CO3	
CO4	-
CO5	-
CO6	6
TOTAL	**30**

CONTINUOUS LEARNING ASSESSMENT –I

U20CYBJ01-ENGINEERING CHEMISTRY ACADEMIC YEAR/SEM: 2022-2023/ Term 1

SET-A

Part – A Answer all the Questions (5 x 2 = 10)

1. **Define chromophore.**

   Ans. The part of a molecule responsible for imparting colour, are called as chromospheres, i.e., the functional groups, C=N etc.

2. **Define Spectroscopy.**

   Ans: It is a technique that uses the interaction of energy with a sample to perform an analysis.

3. **What is the selection rule for IR?**

   Ans: The selection rule says, that vibrations are only IR active (or allowed), if the molecular dipole moment changes during the vibration.

4. **Why homo diatomic molecules are IR inactive?**

   Ans: HCl, CO and NO are IR active. While H_2, O_2, Cl_2 are IR inactive.

5. **What are the regions of UV spectroscopy?**

   Ans:
   - The UV radiation region extends from 10 nm to 400 nm.
   - Near UV Region: 200 nm to 400 nm.
   - Far UV Region: below 200 nm to 10 nm.

PART-B Answer all the Questions (2 x 4 = 8)

6. a). Analyze the MO diagram of 1, 3- Butadiene and predict their HOMO & LUMO orbital.

   b). Analyze the Crystal field splitting energy of d^5 to d^{10} electronic configuration in week field tetrahedral complexes.

PART-C Answer all the Questions (1 x 12 = 12)

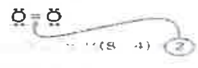
8. a). Analyze the molecular orbital diagram of following molecules and predict their magnetic properties?

   1. O_2
   2. NO

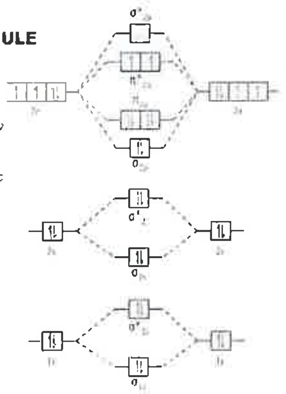
MO DIAGRAM OF O_2 MOLECULE

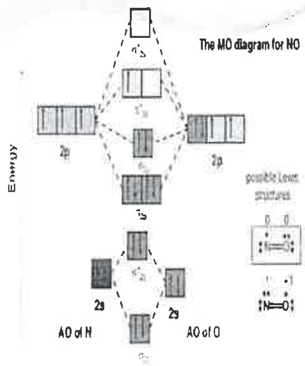
- ✓ Electronic configuration of O atom $1s^2 2s^2 2p^4$
- ✓ Electronic configuration of O_2 molecule $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2$ $\sigma 2pz^2$ $\pi 2px^2$ $\pi 2py^2$ $\pi^* 2px^1$ $\pi^* 2py^1$
- ✓ Molecule has two unpaired electron hence it is paramagnetic

$_8O$: $1s^2 2s^2 2p^4$



Paramagnetic





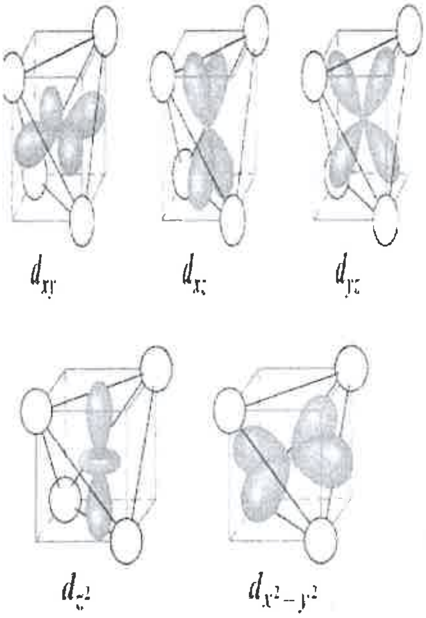
N=$1s^2 2s^2 2p^3$
O=$1s^2 2s^2 2p^4$

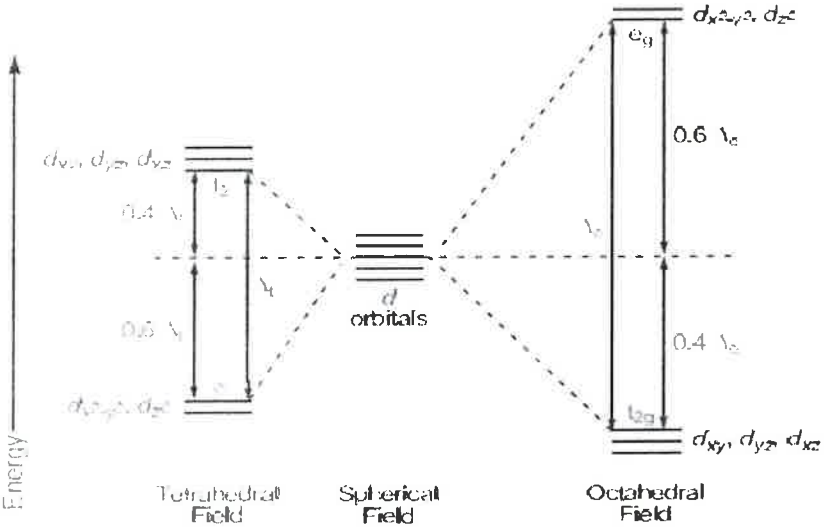
Bond Order=2.5
Bond Length=1.15A^0

- ✓ Molecule has one unpaired electron hence it is paramagnetic

b) Draw and give details about the crystal field theory for octahedral geometry with an example.

Octahedral Vs Tetrahedral





CLA I – SAMPLE ANSWER SHEETS

CLA II - QUESTION PAPER & ANSWER KEY

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -II
U20CYBJ01 – ENGINEERING CHEMISTRY
ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **MARKS: 30 Marks** **SET - A** **DATE:**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	**Part – A Answer all the Questions (5 x 2 = 10)**	Weightage	CO	Blooms level
1	Why TMS is used as a standard in NMR?	2	CO2	2
2	Mention the NMR active and inactive nuclei. $_6C^{12}$, $_6C^{13}$, $_7N^{14}$, $_7N^{15}$, $_8O^{16}$, $_8O^{17}$	2	CO2	2
3	Define upfield and downfield.	2	CO2	2
4	Write the NMR splitting pattern for $CH_3COCH_2CH_3$	2	CO2	2
5	Is it possible to detect all elements in XPS? Give reason.	2	CO3	2
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Examine the chemical shift in 1H NMR of following molecules and arrange them in increasing order of chemical shift. i) CH_3F, CH_3Br, CH_3I, CH_3Cl ii) CH_3OH, CH_3Br, $(CH_3)_4Si$ **OR** b) Explain the UV instrumentation method with the help of a neat block diagram.	4	CO2	3
7	a) Derive the Bragg's equation for XRD with pictorial representation analyze how it used to find out the crystal lattice? **OR** b) Explain about polarization and how the trend various in periodic table.	4	CO3	4
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a) Explain the energy level of orbital arrangement using Pauli, Hund's and Aufbaf rule. **OR** a. Explain the following terms and write their periodic trends i. Atomic radii ii. Ionization Energy iii. Electronegativity	12	CO3	4

CO	WEIGHTAGE
CO1	-
CO2	12
CO3	18
CO4	-
CO5	-
CO6	-
TOTAL	**30**

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -II
U20CYBJ01 – ENGINEERING CHEMISTRY
ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **MARKS: 30 Marks** **SET - B** **DATE:**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	**Part – A Answer all the Questions (5 x 2 = 10)**	Weightage	CO	Blooms level
1	Define Chemical shift.	2	CO2	2
2	Mention the NMR active and inactive nuclei. $_1H^1$, $_1D^2$, $_8O^{16}$, $_9F^{19}$, $_8O^{16}$, $_{15}P^{31}$	2	CO2	2
3	Define shielding and deshielding of protons.	2	CO2	2
4	Write the NMR splitting pattern for CH_3 CH_2COOH	2	CO2	2
5	Define binding energy?	2	CO3	2
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Examine the chemical shift in 1H NMR of following molecules and arrange them in increasing order of chemical shift. i) CH_3Cl, $CHCl_3$, CH_2Cl_2, CH_4 ii) CH_3F, CH_3I, $(CH_3)_4Si$ **OR** b) Explain the IR instrumentation method with the help of a neat block diagram.	4	CO2	3
7	a) Analyze the applications of XRD and how it used in annealing of metal alloys? **OR** b) Explain the principle of XPS and how binding energy helps to find out the XPS spectra?	4	CO3	4
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a. Find out oxidation number $K_3[Fe(CN)_6]$, $Ni[CO_4]$, $KClO_4$, $[Cu(NH_3)_6]Br_2$, $[Fe(H_2O)_6]Cl_2$, K_2CrO_4 **OR** a. Explain the following terms and their periodic trends i) Atomic Radii ii) Ionic Radii iii) Electron affinity	12	CO3	4

CO	WEIGHTAGE
CO1	-
CO2	12
CO3	18
CO4	-
CO5	-
CO6	-
TOTAL	**30**

CONTINUOUS LEARNING ASSESSMENT -II

U20CYBJ01-ENGINEERING CHEMISTRY ACADEMIC YEAR/SEM: 2022-2023/ Term 1

SET-A

Part – A **Answer all the Questions (5 x 2 = 10)**

1. Why TMS is used as a standard in NMR?

Ans: Tetramethylsilane became the established internal reference compound for ^1H NMR because it has a strong, sharp resonance line from its 12 protons.

2. Mention the NMR active and inactive nuclei.

Ans: NMR active, ${}_6C^{13}$, ${}_7N^{15}$, ${}_80^{17}$ and Inactive ${}_6C^{12}$, ${}_7N^{14}$, ${}_80^{16}$

3 Define upfield and downfield.

Ans: Nuclei that absorb on upfield side are strongly shielded, whereas nuclei that absorb on the downfield side are weakly shielded

4. Write the NMR splitting pattern for CH3COCH2CH3

Ans: CH_3 Singlet, CH_2 quartet, CH_3 triplet

5. Is it possible to detect all elements in XPS? Give reason.

Ans: XPS has become the most widely used for identified on sample surfaces from the binding energies of photoelectrons emitted during X-ray excitation.

PART-B **Answer all the Questions (2 x 4 = 8)**

6. a) Examine the chemical shift in 1H NMR of following molecules and arrange them in increasing order of chemical shift.

i) CHF, CH3Br, CH3I, CHCI

ii) CH2OH, CH3Br, (CH1)4Si

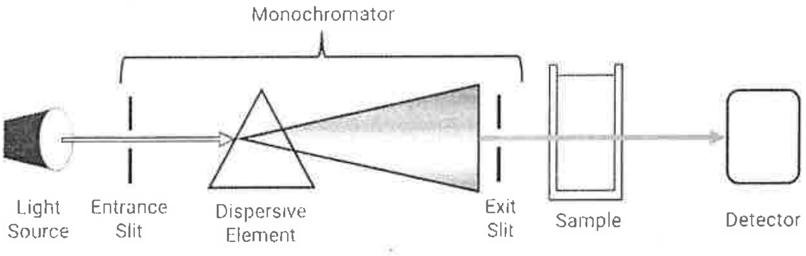
Ans: CH_3I, CH_3Br, CH_3Cl, CHF,

$(CH1)_4Si$, CH_3Br, CH_2OH

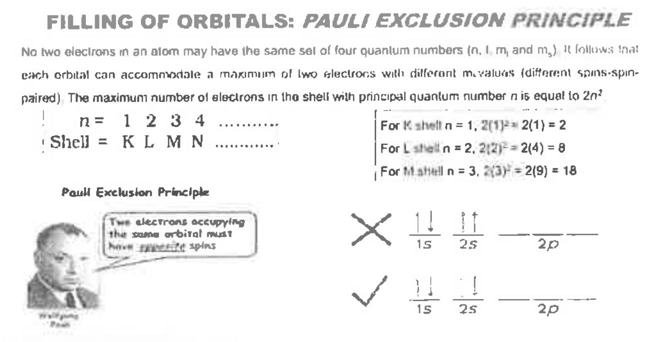
OR

b) Explain the UV instrumentation method with the help of a neat block diagram.

Ans:



Ans:

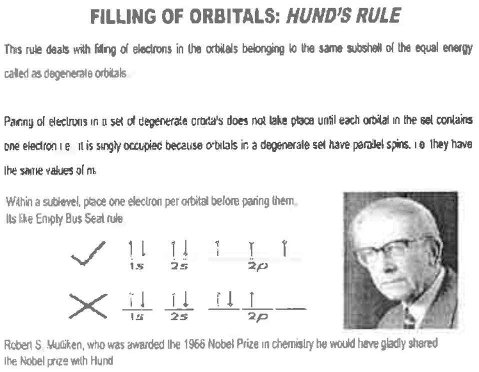


FILLING OF ORBITALS: *PAULI EXCLUSION PRINCIPLE*

No two electrons in an atom may have the same set of four quantum numbers (n, l, m_l and m_s). It follows that each orbital can accommodate a maximum of two electrons with different m_s values (different spins-spin-paired). The maximum number of electrons in the shell with principal quantum number n is equal to $2n^2$

n = 1 2 3 4 ....
Shell = K L M N ....

For K shell n = 1, $2(1)^2 = 2(1) = 2$
For L shell n = 2, $2(2)^2 = 2(4) = 8$
For M shell n = 3, $2(3)^2 = 2(9) = 18$



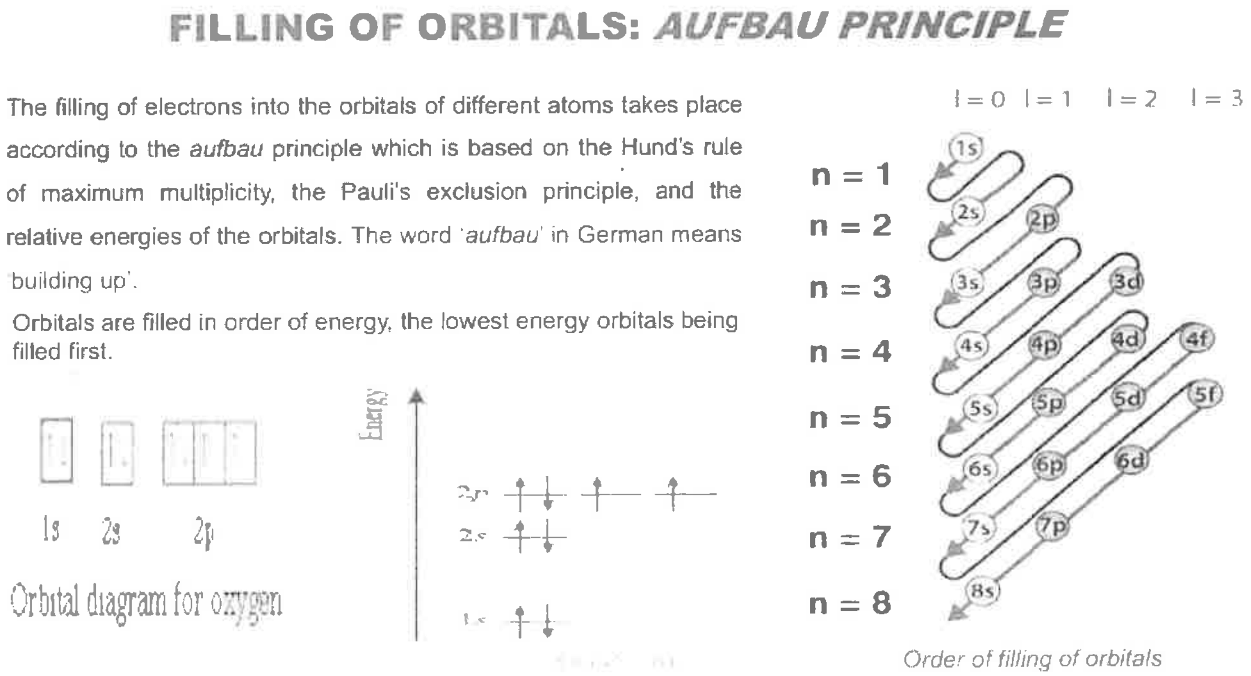
FILLING OF ORBITALS: *HUND'S RULE*

This rule deals with filling of electrons in the orbitals belonging to the same subshell of the equal energy called as degenerate orbitals.

Pairing of electrons in a set of degenerate orbital's does not take place until each orbital in the set contains one electron i.e. it is singly occupied because orbitals in a degenerate set have parallel spins, i.e. they have the same values of m_s

Within a sublevel, place one electron per orbital before paring them.
Its like Empty Bus Seat rule

Robert S. Mulliken, who was awarded the 1966 Nobel Prize in chemistry he would have gladly shared the Nobel prize with Hund



FILLING OF ORBITALS: *AUFBAU PRINCIPLE*

The filling of electrons into the orbitals of different atoms takes place according to the *aufbau* principle which is based on the Hund's rule of maximum multiplicity, the Pauli's exclusion principle, and the relative energies of the orbitals. The word '*aufbau*' in German means 'building up'.

Orbitals are filled in order of energy, the lowest energy orbitals being filled first.

Orbital diagram for oxygen

Order of filling of orbitals

OR

b. Explain the following terms and write their periodic trends

i. Atomic radii

ii. Ionization Energy

iii. Electronegativity

Ans:

Ionisation Energy

The ionisation energy is the energy required to remove one mole of electrons from one mole of atoms in the gaseous state.

The first ionisation energy of magnesium:

$$\mathrm{Mg\,(g)} \longrightarrow \mathrm{Mg^{+}\,(g)} \quad + \quad \mathrm{e^{-}} \qquad 744\ \mathrm{kJmol^{-1}}$$

Ionization Energy

$\mathrm{Al}(g) \rightarrow \mathrm{Al^{+}}(g) + e^{-}$ $\quad I_1 = 580$ kJ/mol

$\mathrm{Al^{+}}(g) \rightarrow \mathrm{Al^{2+}}(g) + e^{-}$ $\quad I_2 = 1815$ kJ/mol

$\mathrm{Al^{2+}}(g) \rightarrow \mathrm{Al^{3+}}(g) + e^{-}$ $\quad I_3 = 2740$ kJ/mol

$\mathrm{Al^{3+}}(g) \rightarrow \mathrm{Al^{4+}}(g) + e^{-}$ $\quad I_4 = 11{,}600$ kJ/mol

Al: $1s^2 2s^2 2p^6 3s^2 3p^1$

CONTINUOUS LEARNING ASSESSMENT -II

U20CYBJ01-ENGINEERING CHEMISTRY ACADEMIC YEAR/SEM: 2022-2023/ Term 1

SET-A

Part – B **Answer all the Questions (5 x 2 = 10)**

1. Define Chemical shift.

Ans:

A chemical shift is defined as the difference in parts per millions (ppm) between the resonance frequency of the observed proton and tetramethylsilane (TMS) 12 hydrogens. TMS is the most common reference compound in NMR, it is set at delta = 0 ppm.

$$\text{Chemical shift, } \delta = \frac{\text{frequency of signal} - \text{frequency of reference}}{\text{spectrometer frequency}} \times 10^{6}$$

2. Mention the NMR active and inactive nuclei.

${}_1H^{1'}$ ${}_1D^{2}$, ${}_80^{16}$, ${}_9F^{19}$, ${}_80^{16}$, ${}_{15}P^{31}$

Ans: NMR active ${}_1H^{1'}$ ${}_1D^{2}$, ${}_9F^{19}$, ${}_{15}P^{31}$ and Inactive ${}_80^{16}$, ${}_80^{16}$

3. Define shielding and deshielding of protons.

Ans:

Shielding of proton: High electron density is high around the nucleus shielding the nucleus from the external magnetic field and the signal are upfield in the NMR spectrum.

Deshielding: Low electron density falls around the nucleus, deshields nucleus and the signal are downfield in the NMR

spectrum.

4. Write the NMR splitting pattern for CH3 CH2COOH

Ans:

CH3-triplet, CH2- quartet, COOH-singlet

5. Define binding energy?

Ans:

Binding energy is especially applicable to subatomic particles in atomic nuclei, to electrons bound to nuclei in atoms, and to atoms and ions bound together in crystals.

PART-B **Answer all the Questions (2 x 4 = 8)**

6. a) Examine the chemical shift in 1H NMR of following molecules and arrange them in increasing order of chemical shift.

Ans:

Principle

The working principle of XPS is ejection of electron from the surface of sample in UHV condition when it is expose to the soft x-rays.

Elements present in sample can be identified on the basis of kinetic energies and binding energies of their photoelectrons.

Intensities of photoelectron provide information about concentration of element in a sample.

The electrons emitted from atoms near the sample surface (10-100 Angstroms) can escape the sample surface. This depth is about twenty atomic layers.

$$\boxed{KE = h\nu - BE - \emptyset}$$

KE → Kinetic Energy (measure in the XPS spectrometer)

hv → photon energy from the X-Ray source (controlled)

Ø → spectrometer work function. It is a few eV, it gets more complicated because the materials in the instrument will affect it. Found by calibration.

BE → is the unknown variable

PART-C Answer all the Questions (1 x 12 = 12)

8. a. Find out oxidation number

K3[Fe(CN)6], Ni[CO4], KCIO4, [Cu(NH3)6]Br2, [Fe(H2O)6]Cl2, K2CrCO4

Ans:

Solution:

$K_3[Fe(CN)_6]$

Oxidation number of potassium $(K) = +1$

Oxidation number of cyanide ion $(CN) = -1$

Let oxidation number of Fe be x.

As we know that sum of oxidation state of ll the atoms in a compound is equal to the overall charge on that compound.

$\therefore 3(+1) + x + 6(-1) = 0$

$\Rightarrow 2 + x - 6 = 0$

$\Rightarrow x = 6 - 3$

$\Rightarrow x = +3$

Hence the oxidation state of Fe in $K_3[Fe(CN)_6]$ is $+3$.

COVALENT RADIUS

Definition : half the length from one nuclei to another atom's nuclei bonded covalently

METALLIC RADIUS

Definition : half of the distance between the two adjacent metal atoms in the metallic lattice

VANDER WAALS RADIUS

Definition : half the distance between two neighbouring atoms which are not chemically bonded in solid state. Appear also touching. less attractive force

Ionisation Energy

The ionisation energy is the energy required to remove one mole of electrons from one mole of atoms in the gaseous state.

The first ionisation energy of magnesium:

$Mg\ (g) \longrightarrow Mg^{+}\ (g) + e$ 744 kJmol⁻¹

Ionization Energy

$Al(g) \rightarrow Al^{+}(g) + e^{-}$ $I_1 = 580$ kJ/mol

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$Al^{2+}(g) \rightarrow Al^{3+}(g) + e^{-}$ $I_3 = 2740$ kJ/mol

$Al^{3+}(g) \rightarrow Al^{4+}(g) + e^{-}$ $I_4 = 11{,}600$ kJ/mol

Al: $1s^{2}2s^{2}2p^{6}3s^{2}3p^{1}$

Electronegativity

- ability of atom to attract electrons in bond
- noble gases tend not to form bonds, so don't have electronegativity values
- Unit = Pauling
- Fluorine: most electronegative element = 4.0 Paulings

ELECTRONEGATIVITY

Nonpolar Covalent Bond	Polar Covalent Bond	Ionic Bond
Electrons are shared equally	Electrons are shared unequally	Electrons are transferred

CLA III - QUESTION PAPER & CLA III - KEY

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -III
U20CYBJ01 – ENGINEERING CHEMISTRY
ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **MARKS: 30 Marks** **SET - A** **DATE: 01:07:2023**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	Part – A Answer all the Questions (5 x 2 = 10)	Weightage	CO	Blooms level
1	Define corrosion.	2	CO4	2
2	Define substitution reaction.	2	CO5	2
3	Write any four reducing agents.	2	CO5	2
4	Draw the staggered form of butane.	2	CO5	2
5	Alloying of metals is preferable. Give reason.	2	CO6	2
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Draw the constitutional isomers of butanol or a) Discuss the ring opening reaction with an example.	4	CO5	2
7	a) Draw the cis trans isomer and write the IUPAC name for the molecule $ClCH=CHCl$ and $CH_3C_2H_5C=CCH_3C_2H_5$ **or** b) Derive Nernst equation for reduction reaction and write the Nernst equation for the reaction $Fe^{2+}+2e^{-} \rightarrow Fe$	4	CO6	3
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a) Mention and elaborate the appropriate methods that has to be followed to treat the municipal water. **OR** b) Explain in detail how corrosion occurs in presence of oxygen and hydrogen in dry environment.	12	CO4	3

CO	WEIGHTAGE
CO1	-
CO2	-
CO3	-
CO4	14
CO5	10
CO6	6
TOTAL	**30**

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
Department of Chemistry

CONTINUOUS LEARNING ASSESSMENT -III
U20CYBJ01 – ENGINEERING CHEMISTRY
ACADEMIC YEAR/SEM : 2022-2023/ Term 1

TIME : 1 hour 30 mins **MARKS: 30 Marks** **SET - A** **DATE:01:07:2023**

INSTRUCTIONS: Answer all the Questions (COMMON TO ALL BRANCHES)

Q. No	**Part – A Answer all the Questions (5 x 2 = 10)**	Weightage	CO	Blooms level
1	Define Diene and Dienophile with example.	2	CO4	2
2	What is meant by addition reaction?	2	CO5	2
3	Define chiral molecule.	2	CO5	2
4	Write any four oxidising agents.	2	CO5	2
5	What is HSAB?	2	CO6	2
	PART-B Answer all the Questions (2 x 4 = 8)			
6	a) Draw the different stereochemical forms of tartaric acid. **or** b) Write the constitutional isomers of pentane.	4	CO5	2
7	a) Explain in detail about enantiomer and diasteromer taking place in organic molecule with suitable example. **or** b) Derive Nernst equation for oxidation reaction and write the Nernst equation for the reaction $Fe \rightarrow Fe^{2+} + 2e^{-}$	4	CO6	3
	PART-C Answer all the Questions (1 x 12 = 12)			
8	a) Explain the approriate methods that could be used to control the corrosion by modifying the metal. **or** b) Sketch the ion-exchanger method and explain how it is used for removing cations and anions present in water.	12	CO4	3

CO	**WEIGHTAGE**
CO1	-
CO2	-
CO3	-
CO4	14
CO5	10
CO6	6
TOTAL	**30**

CONTINUOUS LEARNING ASSESSMENT TEST – III
U20CYBJ01 - ENGINEERING CHEMISTRY
ANSWER KEY FOR SET – A

DATE : 01.07.2023 & FN
ACADEMIC YEAR : 2022-2023 / I

PART – A

1. CORROSION

The destruction of a metal or alloy by chemical or electrochemical reaction with its environment is known as corrosion.Eg.Rusting of iron.

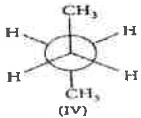
2. SUBSTITUTION REACTION

The substitution reaction is defined as a reaction in which the functional group of one chemical compound is substituted by another group

3. FOUR REDUCING AGENTS

$LiAlH_4$, $NaBH_4$, H_2/Pt, Na/liquid NH_3

4. STAGGERED FORM OF BUTANE



(IV)
Anti (staggered)

5. ALLOYING OF METALS IS PREFERABLE

Alloying of metals is preferable in order to protect the metal from corrosion.

PART – B

6.(a) CONSTITUTIONAL ISOMERS OF BUTANOL

There are four constitutional forms of butanol.


n-butanol


tert-butanol

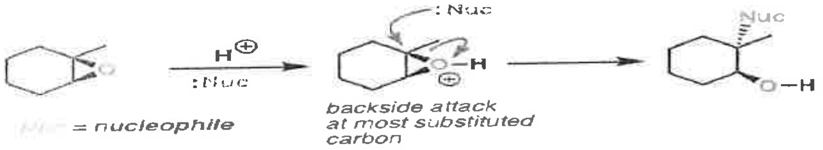

sec-butanol


isobutanol

6.(b) RING OPENING REACTION

Opening of epoxides under acidic conditions occurs in two key steps

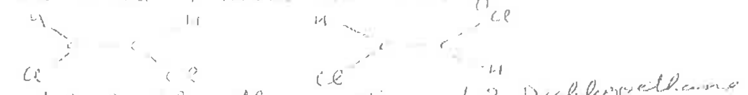
- First, the epoxide is protonated
- Second, the nucleophile attacks at the most substituted position



- The result is that the two groups (nucleophile and OH) are oriented *trans* to one another

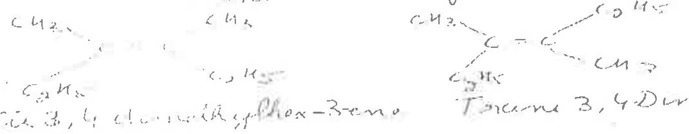
7.(a) Cis – trans isomer

Cis and trans isomers of CHCl = CHCl are



Cis 1,2 Dichloroethene Trans 1,2 Dichloroethene

Cis and Trans isomers of $C_2H_5-CCH_3 = CCH_3C_2H_5$ are



Cis 3,4 dimethylhex-3-ene Trans 3,4 Dimethylhex-3-ene

7.(b) Nernst equation

$$M^{n+} + ne^- \rightleftharpoons M$$

For this equilibrium, the free energy change (ΔG) and standard free energy change (ΔG°) are related by van't Hoff isotherm:

$$\Delta G = \Delta G^\circ + RT\ln\frac{[Product]}{[Reactant]} \text{-------------(1)}$$

$$-\Delta G = nFE \quad \text{Or} \quad -\Delta G^\circ = nFE^\circ \quad \text{Substituting this in equation (1)}$$

$$-nFE = -nFE^0 + RT\ln\frac{[Product]}{[Reactant]}$$

$$E = E^0 - \frac{RT}{nF}\ln\frac{[M]}{[M^{n+}]}$$

CONTINUOUS LEARNING ASSESSMENT TEST – III
U20CYBJ01 - ENGINEERING CHEMISTRY
ANSWER KEY FOR SET – B

DATE : 01.07.2023 & FN **ACADEMIC YEAR : 2022-2023 / I**

PART – A

1. DIENE AND DIENOPHILE

A diene is an organic compound particularly a hydrocarbon, containing two double bonds Eg. 1,3-butadiene. Dienophile is a compound which readily reacts with a diene; in general an alkene in the diels-alder reaction Eg. Ethene

2. ADDITION REACTION

An addition reaction is an organic reaction in which two or more molecules combine to generate a bigger one (the adduct).

3. CHIRAL MOLECULE

Molecules that are non-superimposable mirror images of each other are said to be chiral.

4. FOUR OXIDISING AGENTS

CrO_3, H_2O_2, MnO_2,$KMnO_4$, $Na_2Cr_2O_7$

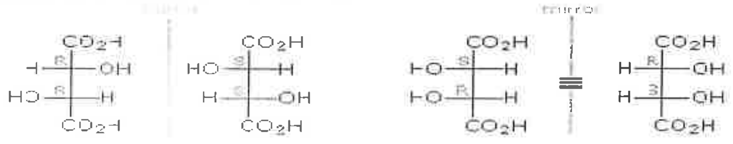
5. HSAB

HSAB means Hard Acid Soft Base Theory.This theory works on the principle that soft acid reacts with the soft base while hard acid reacts with the hard base.

PART – B

6.(a) STEROCHEMICAL FORMS OF TARTARIC ACID

There are 3 forms of tartaric acid

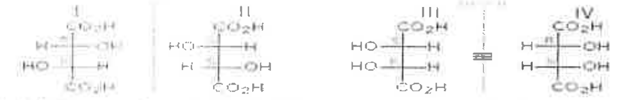


(−)-tartaric acid (-)-tartaric acid *meso*-tartaric acid

6.(b) CONSTITUTIONAL ISOMERS OF PENTANE

pentane **2-methylbutane (isopentane)** **2,2-dimethylpropane (neopentane)**

7.(a) ENANTIOMER AND DIASTEROMER



(+)-tartaric acid (-)-tartaric acid *meso*-tartaric acid

I & II ; III & IV are called Enantiomers

I & III; II & III ; I & IV; II & IV are called Diasteromers

7.(b) Nernst equation

$$M^{n+} + ne \rightleftharpoons M$$

For this equilibrium, the free energy change (ΔG) and standard free energy change (ΔG°) are related by van't Hoff isotherm:

$$\Delta G = \Delta G^\circ + RT \ln\frac{[Product]}{[Reactant]} \text{---------------}(1)$$

$-\Delta G = nFE$ Or $-\Delta G^\circ = nFE^\circ$ Substituting this in equation (1)

$$-nFE = -nFE^0 + RT\ln\frac{[Product]}{[Reactant]}$$

$$E = E^0 - \frac{RT}{nF}\ln\frac{[M]}{[M^{n+}]}$$

since [M]=1 $\therefore E = E^0 + \frac{RT}{nF}\ln[M^{n+}]$ Or $E = E^0 + 2.303\frac{RT}{nF}\log[M^{n+}]$

When T = 298K; R = 8.314 $JK^{-1}mol^{-1}$; F = 96500 coulomb, the equation becomes,

$$E = E^0 + \frac{0.0591}{n}\log[M^{n+}]$$

CLA III - SAMPLE ANSWER SHEETS

ASSIGNMENT QUESTIONS

SAMPLE ASSIGNMENTS

Assignment -1

Name :- B. Vijay mohan reddy

Reg. No :- U22EC071

Section :- F1

Topic :- (a) CFT diagram for tetrahedral and Square planar complex

(b) Application of XRD.

Crystal field splitting in tetrahedral complexes or splitting of d orbital in tetrahedral com-plexes.

* In a tetrahedral complex. the metal ion is at the center of the regular tetrahedron and ligands are at the Four alternate corners of the tetrahedran.

* In Free metal ions. all the five d-orbitals have the same energy they are degenerate (State-1) As the ligands approch the central metal ion repolsion. will take place b/w metal electron and the negative electric field of ligands. This repolsion will raise the energy of the orbital.

* Because of different properties the five d-orbitals will be repelled to different Extents there foe their Enegies no longer of orbitals called e and t_2 the orbitals include $d_{x^2y^2}$ and d_{z_2} orbitals while "t"

* The angle between the e orbatal the ecntral metal and the ligands is 540.44 which is half metal and the ligands is 540. The angle between the t_2 orbital. the Central metal and the ligands is 350 -16.

* The difference in energy between the two sets of d-orbitals is denoted by 10 Δq or Δt and is called crystal field splitting energy is tetrahedral complenes.

* It is Found that Δ the t value is alway less than is Δ_0

Tetrahedral complenes - High spin Complenes:-

most of the tetrahedral comples are high-spin complers.

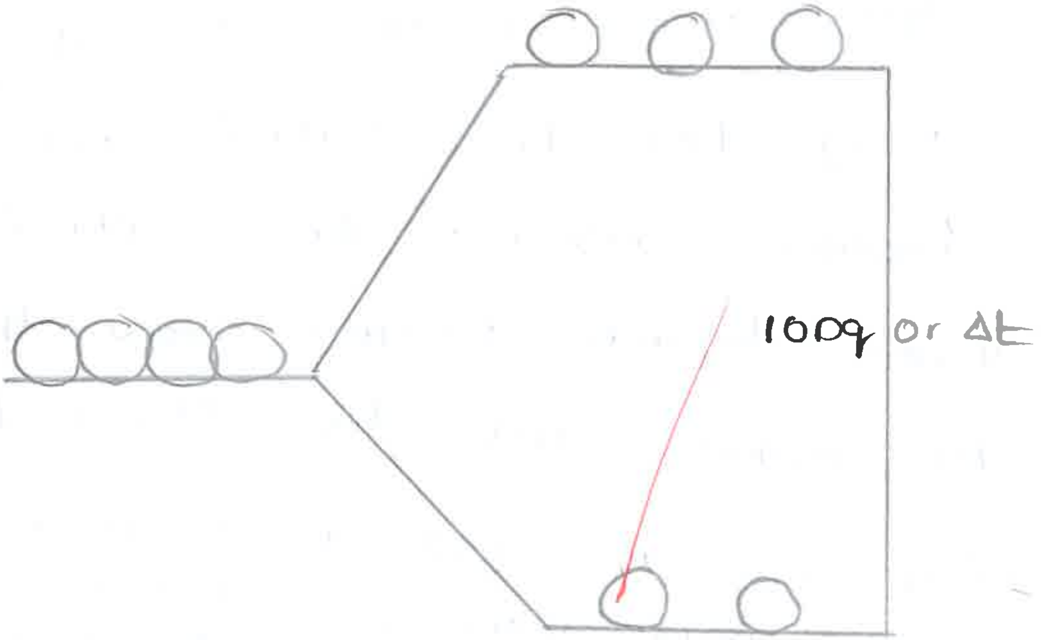
In tetrahedral complens, the fire degenerate metal d-orbital split into two

Crystal Field Spitting in Square planer complexes.

* In an octahedral complex all ligands are at an equal distance from the central metal If two trans ligands lying along z-axis are slightly moved away from the central metal then the distance between the central metal and terms ligands becomes more that between the metal and the other ligands on xy plane this will result in a tetragonally
ligands lying alone z-axis are slightly
distroted of octal hedral structwe.

* In the tetra structwe the metal d-orbitals with z component dz_2 dxz, dyz will experience less repulsions and the other two d-orbital $dx_2 - y_2$, d_{xy} will experence more repulsion from the ligands that they do in an octahedral Environment. there fore under the influence of

orbital split into two energy levels. the the upper t_2 and the lower e level the energy gap between e and t_2 is denoted by Δt.

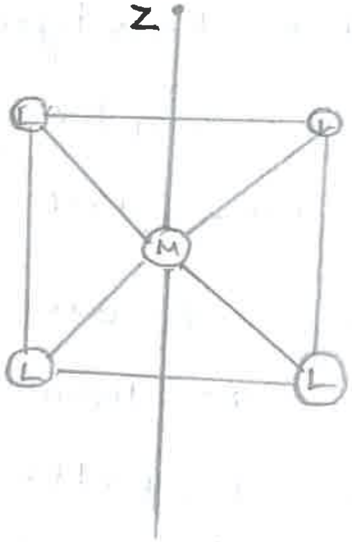


Δt value is much small compared to Δ_o ie, $\Delta t = \frac{4}{9}\Delta_o$

Sin Δt is much smaller compared to Δ_o and Δt < pairing energy (P). the electron prefers t_2 orbitalals rathers that Paring up in e orbital in tetrahedral complexes. Hence most of the tetrahedral complexs are high spin complexs.

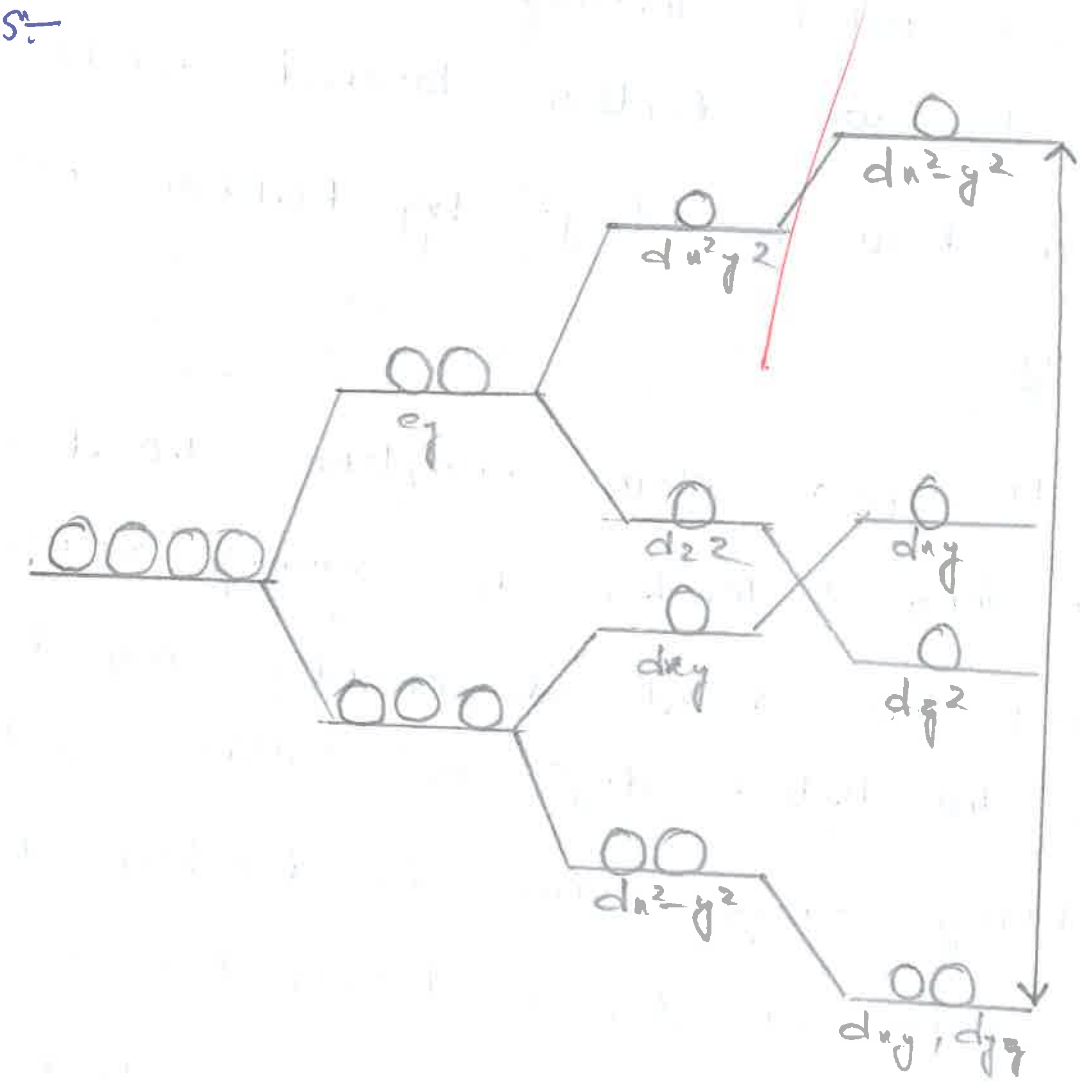
* A square planer complex can be derived from the tetragonal structure by removing completely the two trans ligands along z-axis in a square planar complex. there are only 4-ligands on the xy-plane the loss of two ligands on the z-axis allows the remaining 4 ligands to move closer to the central metal ion destablising the dx^2y^2 and dxy orbital. Hence the d-orbital of central metal involving z componets ie, dz^2 dxz, dyz are further lowered while the other two ie, dx^2-y^2, dxy further raised in Energy.

In square plane complexes the d-orbitals split into 4 levels. the energy different between the lowest degenerate dxz, dyz pair. and the highest dx^2y^2 is called crystal field splitting energy and is denoted by Δsp the value of Δsp is lager that Δo It has been found that Δsp is about 1.3 times Δo.



Crystal Field splitting in square planer complex

-S:-



Cement :-

the performance charaacteristics of cement are directly related to its phase composition For example ASTM type allo cement devolops high larger strength and is characterized by having a ASTM type IV cement is known as to have a low a much lower mass fraction of alite.

Power of Generation:-

Residual stresses created during the manufacturing process can lead to stress corrosion craking, distortion failure cracking permature pat failure and instance of over design. the nondestructive nature of the x-ray diffraction (XRD) technique has made of the generation components a useful tool for process optimation, design improvement, and failure analysis.

Applications of XRD [x- ray Diffraction]:-

Additive manufacturing:-

3d printing is increasing being used as an alternative method of matoring component. In paticular replacement parts that were manufactored via traditional methods such as casting are new being made using additive manfactoring processes. while a printer can prodecer the same residual stress distribution in the pats

Aerospace:-

Residual stresses play a key role in the life of aerospace structure proto provides both measurement services and x-ray diffraction residual stress measurement instruments enabling our customers to obtain residual stress various aerospace components.

Auto motive:-

X ray diffraction has become the industry standard for residual stress characterization.

ASSIGNMENT - 1 & 2.

Name :- D. Karthik kumar Reddy

Reg no :- U22EC105

Section :- F1

Ad. No :- 8118

Department :- ECE

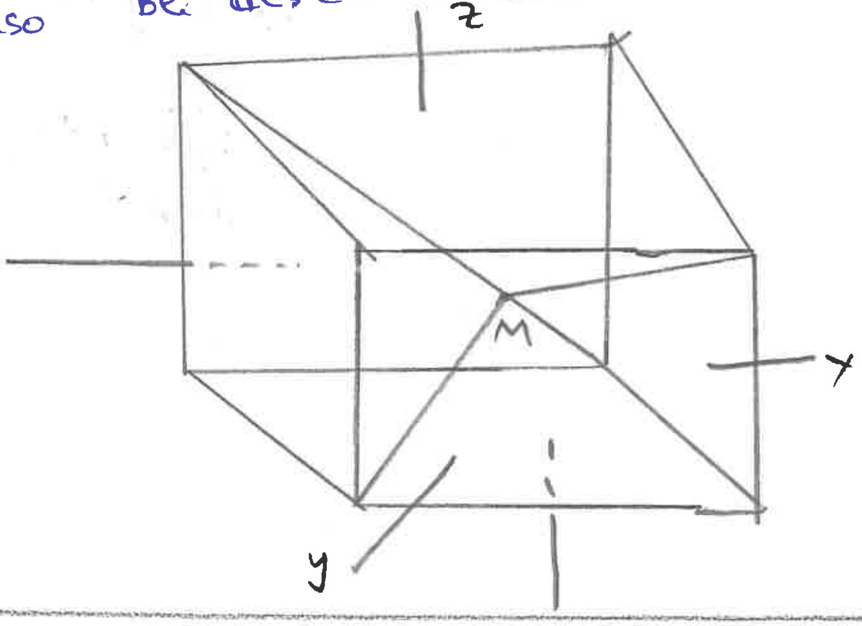
a) crystal field splitting in Tetrahedral field.

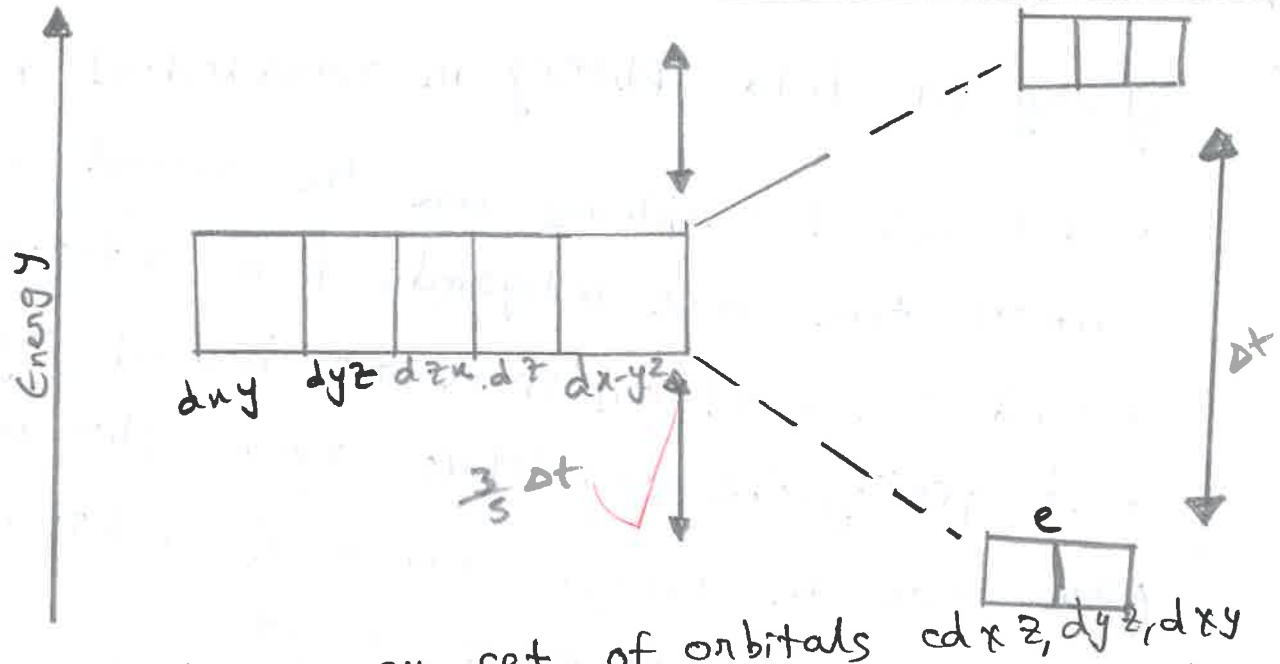
* Tetrahedral complexes are the second most common type : here 4 ligands form a tetrahedron around the metal ion. in a tetrahedral crystal field splitting, the d- orbitals again split into 2 groups, with an energy difference of tet groups, with an energy difference of tet.

* The lower energy orbitals will be dz^2, dx^2, dy^2 and the higher energy orbitals will be dxy, dxz and dyz - opposite to the octahedral case.

* furthermore, since the ligand electrons in tetrahedral symmetry are not oriented directly towards the d-orbitals, the energy splitting will be lower than in the octahedral Case.

* square planar and other complex geometries can also be described by CfT.

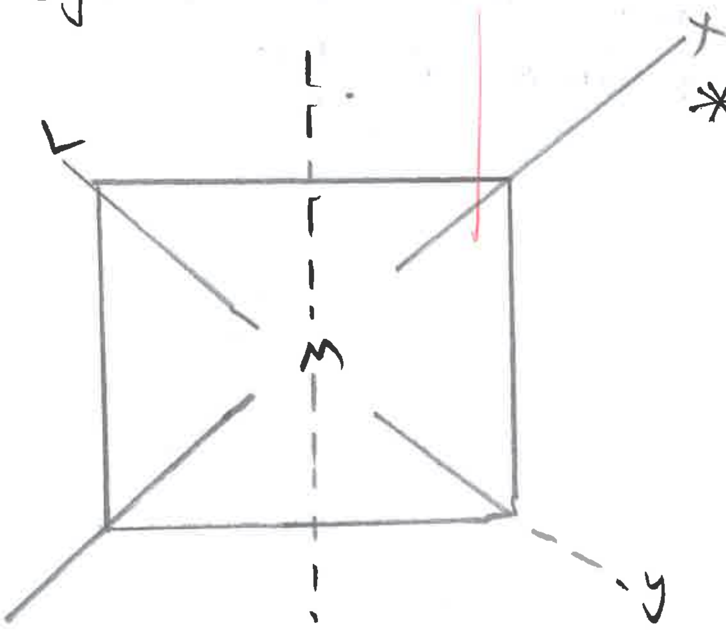




The higher energy set of orbitals (dxz, dyz, dxy is labelled as t_2 and the lower energy get (dz² and dx²-y²) is labelled as.

* The Crystal field splitting in the tetrahedral field is intrinisically smaller than in the octahedral field. For most purpose the relationship may be represented as $\Delta t = \frac{4}{9} \Delta o$

Crystal field splitting of square planar.



* degenerate orbital

$\left.\begin{matrix} dxy \\ dyz \\ dzx \end{matrix}\right\} t_{2g}$ $\left.\begin{matrix} dx^2-y \\ dz^2 \end{matrix}\right\} e_g$

* square planar Complex is a 2D structure.

* In entire Complex are orbital dx^2-y^2 has strong repulsion force and then dxy experience less repulsion force than dx^2-y^2 because it lies in between the axis.

* Then the orbital dz^2 experiences more repulsion and present at the xy plane and less repulsion is experienced by dyz, dxz orbitals.

* So due to this d-orbitals undergo splitting it is called as crystal field splitting.

* d-orbitals are called degenerate orbitals because all the orbitals of d has same energy level.

* square planar complex is similar to the octahedral complex so it that crystal field splitting in octahedral was done and after octahedral splitting it undergoes square plannar splitting.

* clearly Δsp (square planar > Δo (octahedral), > Δt (tetrahedral)

* Δsp has alarge spilting so it has low spin complex.

* Example for square plannar complex are

$\{Ni(CN)_4)^{2-}$, $[Pd(Cl_4)]^{2-}$

b) Applications of XRD :-

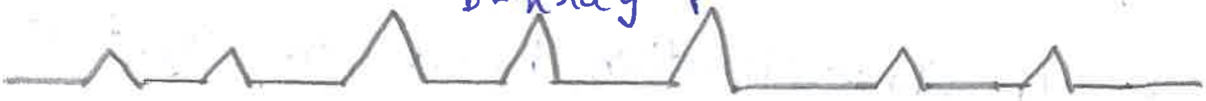
1. structure of crystals.

a

a - xray pattern of salt Nacl

b

b-xray pattern of salt Nacl



c

c -xray pattern of salt and Nacl

d

d-xray pattern of Power mixed Crystal of Nacl and kcl.

2). paymer characterization.

* Determine degree of crystanility.

* Non -crystalline portion scatters x-ray beam to give a continuous back ground (amorphous materials)

* crystalline portion causes difraction lines that are not continuous crystalline materials).

3) state of anneal in metals.

* RD is used to test the metals without removing the part from it position and without weakening.

4) particle size determination.

Spot counting method

$v = V \cdot S\theta \cos\theta / 2n$

v = volume of individual crystallite.

V = total volume irradiated.

n = no. of spots in difracting.

$S\theta$ = divergence of x-ray beam.

5). Miscellaneous Application.

- * Self classification based on crystalinity.
- * Analysis of industrial dusts.
- * Assessment of weathering and degradation of minerals and polymer.
- * Study of corrosion products.
- * Examination of tooth enamel and dentine.
- * Examination of bone state and tissue state.
- * Structure of DNA & RNA.

Assignment - 2

(A). **Isomerism in transition metal complex:-**

It is a phenomenon where different compounds with same chemical formula but distinct structural elements or arrangements exist. this is due to the ability of transition metals to form coordination compounds with various ligands, resulting in different bonding arrangements and Geometeries.

There are two main types of isomeris observed transition metal complexes :- structural isomerism and stereoisomerism.

1. **structural isomerism:-**

a) Ionisation isomerism: occurs when an ion or ligand is exchanged between the coordination sphere and the surrounding solvent.

Ex:- $[Co(NH_3)_5Cl]Cl_2$ can exist as $[Co(NH_3)_5Cl]^{2+}$ and $[Co(NH_3)_5)^{3+}Cl_2^-$

b) Coordination Isomerism:- Arises when the ligonary in a complex interchange their position between ions. the central metal atom/ion and the counter ions.

Ex:- for instance $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are Coordination isomers

2. streoisomerism:-

a) Geometric Isomerism (cis-Irons Isomerism):.

This occurs in octahedral Complexes with two different ligands arronged in adjacent positions. If the two similar ligands are either cis or trons to each other, Geometric isomerism is observed.

Ex:. $[Co(NH_3)_4Cl_2]$ can exist as cis and trans isomers.

b) optical isomerism:- type of isomerism occurs when a Complex lacks a plane of symmetry, resulting in non-superimposable mirror image structures.

Ex:. $[Co(en)_3]^{3+}$, where en represents ethylene diamine. It's important to note that not all the transition metals exhibit isomerism and the present of isomerism depends on the ligands, coordination number and geometry of the complex. Isomerism in transition metal Complex has significant implications in their properties, reactivity and biological activity.

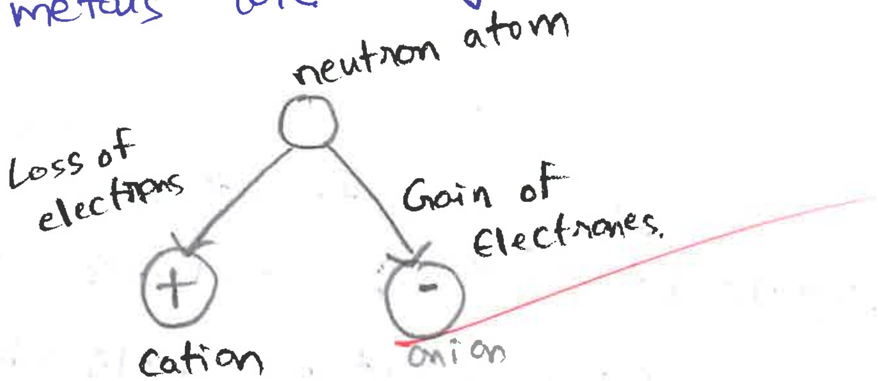
(B) Ionic Interaction:- A rise from electrostatic attraction between two groups of opposite charge these bonds are formed between positively Charged and negatively charged group.

* They are also referred to as ionic bonds and are the forces that hold together ionic compounds like charges repel each other and opposite charge attract.

* Ionic bond is a specific type of chemical bond formed b/w a metal and a non-metal.

* Metals are alkali and alkali earth metals.

* Non metals are halogen.



Ex:- Nacl

Ionic Interaction in Sodium Chloride.

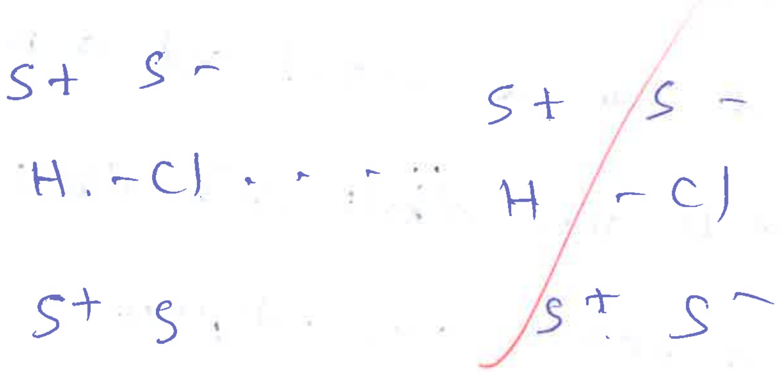
Dipole :- A Polarized molecule having partically positive and negative pole.

Share one pair of electron.

Fluorine is more Electro negative.

Dipole - Dipole interaction :- Forms when two dipolar molecules interact with each other through space when this occurs, the partically negative portion of one of the polar molecules is attracte to the partially positive portion of second polar molecule.

Ex :-



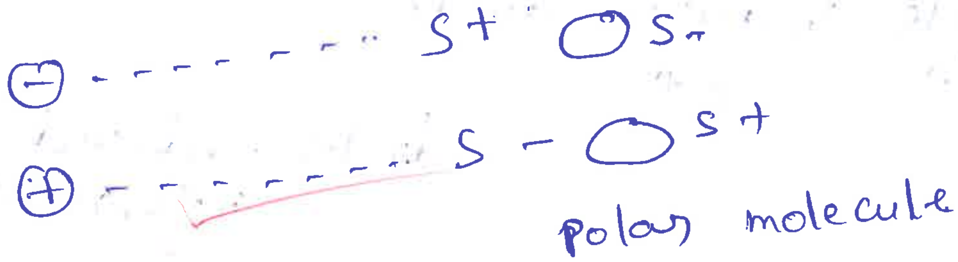
attraction.

Van der waals interaction :- Includes attraction and repulsion between atoms, molecules and Surfaces as well as other interactional of inter molecular forces they differ from Covalent and ionic bonding in that they are Caused by Correlations in the fluctuating polarization of of near by particles.

Ion - dipole interaction:- Is an attractive force that results from the electrostatic attraction between an ion and a metal of as a dipole.
a neutral molecule that has

* A positive ion attracts the partically negative end of a neutral polar molecule.

* A negative ions attracts the partically positive end of a neutral polar molecule.



* Ion dipole forces are generated between polar water molecules and a sodium ion.

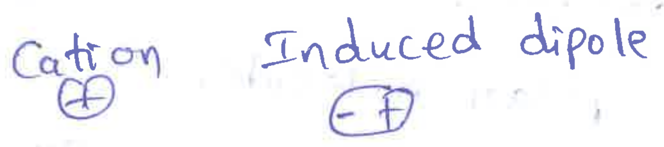
* These inter molecullar ion - dipole forces are much weaker than Covalent or ionic bonds.

Dispersion forces or london forces:-

* These forces that a rise as a result ~~as~~ of temporary dipole induced in atoms or molecules.

* A temporary dipole to a tempory dipole to form in another non-polar molecule.

* Dispersion is the only inter molecular attraction that occur between non-polar molecules.



ion-induced dipole interaction.

dipole-induced dipole interaction.

END SEMESTER QUESTION PAPER

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH
Declared as Deemed to be University under section 3 of UGC act 1956
173, Agaram Main Road, Selaiyur, Chennai – 600 073,Tamil Nadu
End Semester Examinations - Nov / Dec -2022
Regulation - 2020

Reg No.								

Programme(s)	Batch	Term	Course Code(s)	Course Title
B.Tech - Common to all branches	2022	I	U20CYBJ01	Engineering Chemistry

Time: Three Hours

Max Marks: 100

Date: 03.03.2023 / FN

Part A – (10 x 2 = 20 Marks)
(Answer All Questions)

Q.No	Question	BL	CO
1	Define bond order.	U	CO1
2	What is meant by crystal field theory?	U	CO1
3	State the selection rule for electronic spectroscopy.	U	CO2
4	Why TMS is used as a standard in NMR?	U	CO2
5	Electro negativity decreases down the group. Give reason.	U	CO3
6	What is coordination number & geometry? Give example.	U	CO3
7	Define Spontaneous process.	U	CO4
8	Define electrochemical corrosion.	U	CO4
9	What is meant by addition reaction?	U	CO5
10	Draw the staggered form of butane.	U	CO5

Part B – (5 x 4 = 20 Marks)
(Answer All Questions)

Q.No	Question	BL	CO
11	Derive Schrodinger wave equation in a one dimensional box when the velocity of the wave (v).	AN	CO1
12	Explain in detail how electronic spectroscopy can be used for predicted and applied for a organic molecule?	AP	CO6
13	Derive the Bragg's equation for XRD with pictorial representation and analyze how it used to find out the crystal lattice?	AN	CO3
14	Explain how corrosion is controlled by sacrificial anode and impressed current cathode protection?	AP	CO4
15	Write the constitutional isomers of pentane.	U	CO5

Part C– (5 x 12 = 60 Marks)
(Answer either (a) or (b) of each questions)

Q.No	Question	BL	CO
16(a)	Discuss the various factors affecting the crystal field stabilization energy depending on the metal and environment with an illustration.	AN	CO1
	OR		
16(b)	Sketch and explain about the crystal field splitting for tetrahedral geometry. Explain the hybridization taking place with an example.	AN	CO1
17(a)	Explain the different types of vibration modes in IR spectroscopy. Discuss about the fundamental vibration bands taking place in a nonlinear molecule with an example.	AP	CO2
	OR		
17(b)	Explain in detail how the vibrational band occurs in IR instrumentation with the help of a block diagram?	AP	CO6
18(a)	Explain about how binding energy and kinetic energy is measured for different electronic orbitals with the help of XPS?	AN	CO3
	OR		
18(b)	Explain the following terms and how it varies with the periodic trends	AN	CO3

19(a)	Derive Nernst equation for reduction potential. Write its applications and apply the Nernst equation for the equation $Cu^{2+}_{(aq)} + 2e^{-} \rightarrow Cu_{(s)}$.	AP	CO6
	OR		
19(b)	Explain the different methods that could be used to control the corrosion by modifying the metal.	AP	CO4
20(a)	Explain S_N2 Reaction mechanism with suitable examples.	U	CO5
	OR		
20(b)	Discuss in detail the synthetic mechanism of Paracetamol. Mention its uses.	AP	CO6

END SEMESTER ANSWER KEY

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

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173, Agaram Main Road, Selaiyur, Chennai – 600 073,Tamil Nadu

End Semester Examinations - May / June-2023

Regulation – 2020

Reg. No.

Programme(s)	Batch	Term	Course Code(s)	Course Title
B. Tech – I Year (Common to all branches)	2020, 2021& 2022	II	U20CYBJ01	Engineering Chemistry

Time: Three Hours
Max Marks: 100

Date: 31.07.2023 / FN

1 Define bond order.

Ans: bond order = number of bonding electrons - number of antibonding electrons/2

2 What is crystal field stabilization energy?

Ans: the energy of the electron configuration in the ligand field minus the energy of the electronic configuration in the isotropic field.

3 What is Beer-Lamberts law?

Beer Lamberts Law:

Ans: $A = \varepsilon b c$

4 Why TMS is used as a standard in NMR?

Ans: Tetramethylsilane became the established internal reference compound for ^1H NMR because it has a strong, sharp resonance line from its 12 protons.

5 Write Bragg's equation for XRD spectroscopy.

Ans: $n\lambda = 2d \sin\Theta$

6 Define Ionization energy.

Ans: The amount of energy required to remove an electron from an isolated atom or molecule.

7 Write Nernst equation for reduction reaction.

Ans: $E = E^0 + \frac{0.0591}{2}\log[Fe2+]$

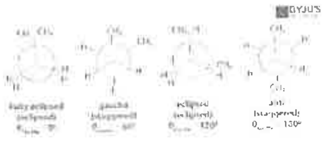
8 Define electrochemical corrosion.

Ans: The destruction of a metal or alloy by chemical or electrochemical reaction with its environment is known as corrosion.Eg.Rusting of iron.

9 What is meant by addition reaction?

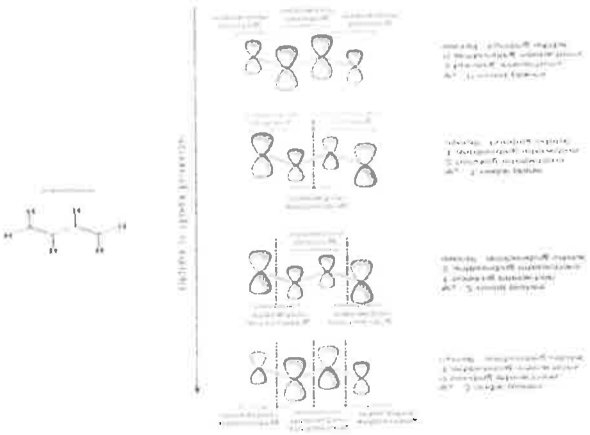
Ans: An addition reaction is an organic reaction in which two or more molecules combine to generate a bigger one (the adduct).

10 Draw the staggered form of butane.

Ans: 

Part B (5x4=20 Marks)

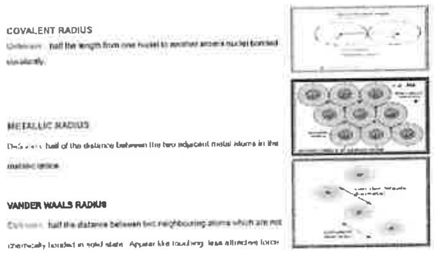
11 Sketch the MO diagram of 1,3-Butadiene and analyze the HOMO & LUMO orbital.

Ans: 

12 How to detect the functional groups, symmetry and study the progress of chemical reaction using IR spectroscopy?

Ans: Here, we take the IR spectrum of Formaldehyde for an example. Formaldehyde has a C=O. functional group and C-H bond

13 Examine the term atomic radii & how it varies with the period and group of the periodic table.

Ans: 

COVALENT RADIUS

Definition : half the length from one nuclei to another atom's nuclei bonded covalently.

METALLIC RADIUS

Definition : half of the distance between the two adjacent metal atoms in the metallic lattice.

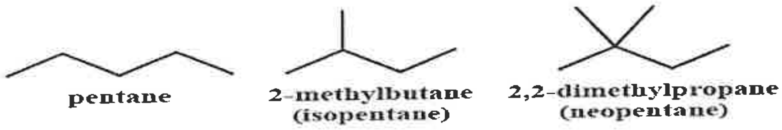
VANDER WAALS RADIUS

Definition : half the distance between two neighbouring atoms which are not chemically bonded in solid state. Appear like touching, less attractive force

14 Explain how corrosion is controlled by sacrificial anode and impressed current cathode protection?

Ans: The main difference between the two methods is that the impressed current cathodic protection uses an external power source with inert anodes while the sacrificial anodes cathodic protection uses the naturally occurring electrochemical potential difference between different metallic elements to provide protection.

15 Write the constitutional isomers of pentane.

Ans: 

Part C-(5 x 12-60 Marks)

16(a) Depict and elucidate the molecular orbital diagrams for N2 and O2 molecules. Calculate its bond order.

MO DIAGRAM OF O_2 MOLECULE

- ✓ Electronic configuration of O atom $1s^2 2s^2 2p^4$
- ✓ Electronic configuration of O_2 molecule $\sigma1s^2\ \sigma^*1s^2\ \sigma2s^2\ \sigma^*2s^2\ \sigma2pz^2\ \pi2px^2\ \pi2py^2\ \pi^*2px^1\ \pi^*2py^1$
- ✓ Molecule has two unpaired electron hence it is paramagnetic

Oxygen Atom Electronic configuration

$_8O$: $1s^2 2s^2 2p^4$

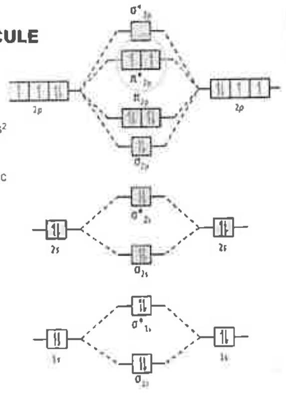
Lewis Structure

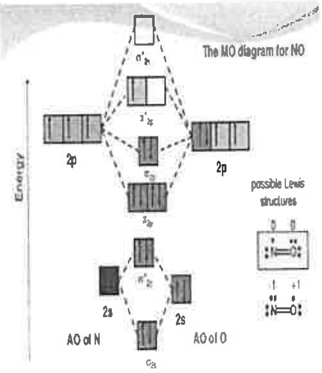
Ö=Ö

Bond Order = ½(8 − 4) = ②

Magnetic Property

Paramagnetic





$N = 1s^2 2s^2 2p^3$
$O = 1s^2 2s^2 2p^4$

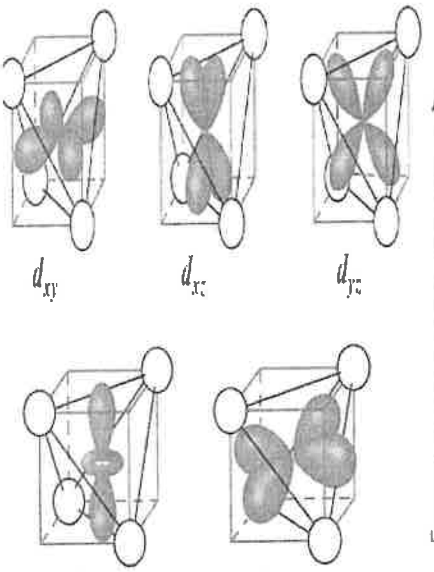
Bond Order=2.5
Bond Length=1.15A⁰

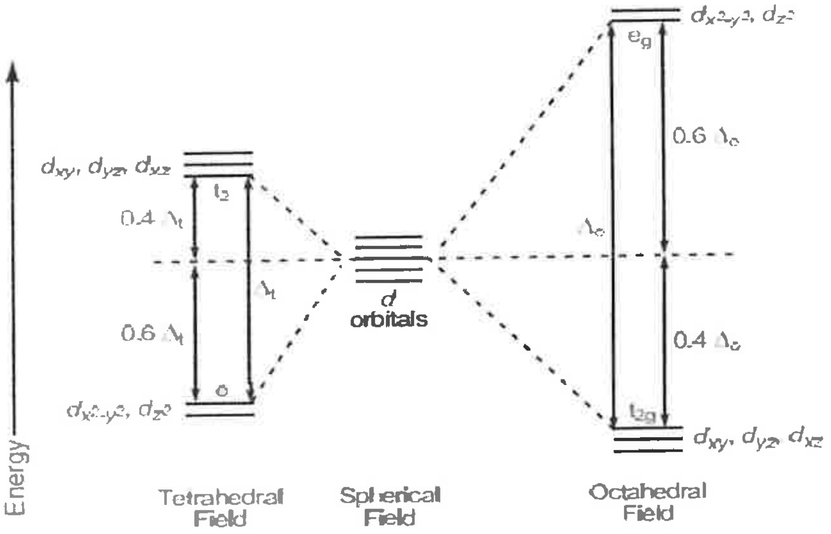
✓ Molecule has one unpaired electron hence it is paramagnetic

OR

16(b) Draw and give details about the crystal field splitting for octahedral geometry with an example.

Octahedral Vs Tetrahedral





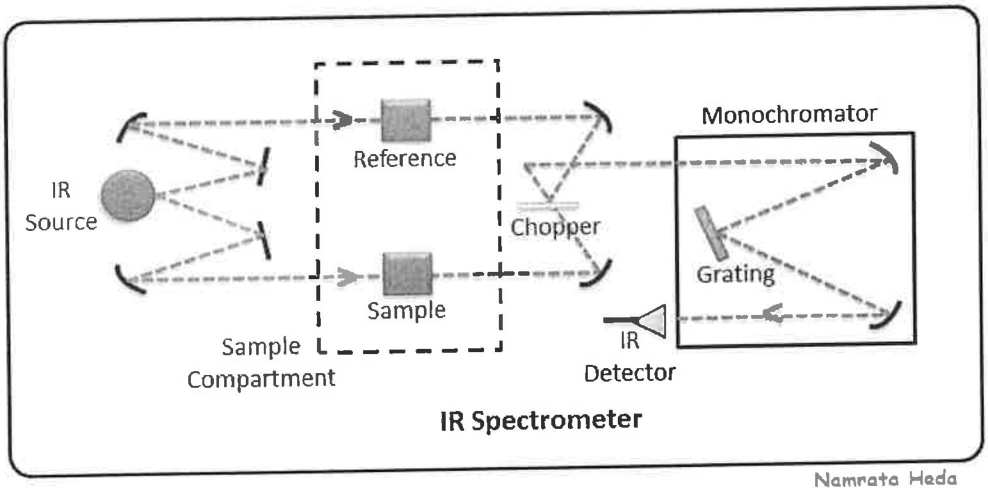
17(a) Explain the term chemical shift. How electronegativity is affecting chemical shift values of following compounds in NMR spectroscopy?

CH3CI, CH3I, (CH3)4 Si, CHBr3, CH2Br2, CH3F, CH3OH, CH3Br, CH2C12, CH4

Ans: CH3OH, CH3F, CH3Cl, CH2C12, CHC13, CH3I, CH4, (CH3)4Si

OR

17(b) Explain in detail how the vibrational band occurs in IR instrumentation with the help of a block diagram.



Namrata Heda

18(a) Find out the oxidation number for the following molecule

K3[Fe(CN)6], Ni[CO4], CaCl2, [Fe(NH3)6]Br2, [Cu(H2O)6]Cl2, K2CrO4

Ans: +3, 0, +2, +2, +3, +6

OR

18(b) Explain about how binding energy and kinetic energy is measured for different electronic orbitals with the help of XPS.

$$\boxed{KE=hv-BE-\emptyset}$$

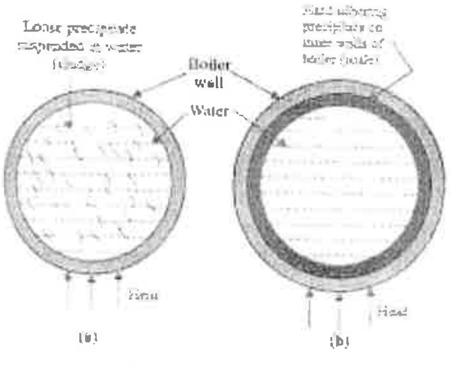
KE → Kinetic Energy (measure in the XPS spectrometer)

hv → photon energy from the X-Ray source (controlled)

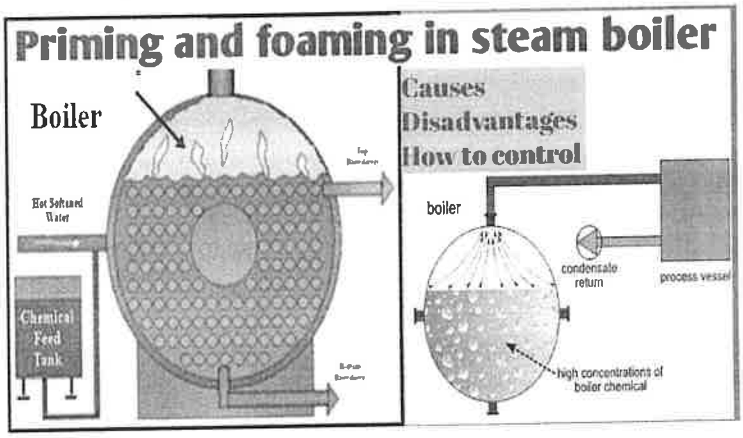
Ø → spectrometer work function. It is a few eV, it gets more complicated because the materials in the instrument will affect it. Found by calibration.

BE → is the unknown variable

19(a) Explicate the boiler troubles taking place due to scale, sludge, priming, foaming and caustic embrittlement in detail and how it can be prevented and removed.



(a) Sludge in boiler (b) Scale in boiler



OR

19(b) Explain the different methods that could be used to control the corrosion by modifying the metal.

The rate of corrosion can be controlled by modifying the metal.

1) Selection of the metal 2) Using metal alloys

3) Using pure metals4) Proper designing

5) Cathodic protection methods:

(a) Sacrificial anodic protection

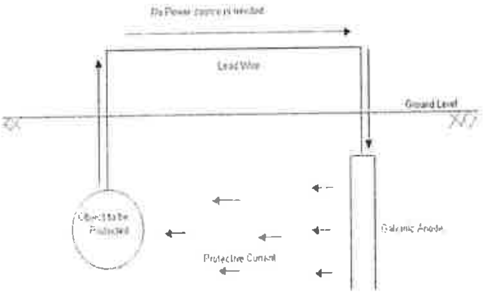
The metal to be protected is made cathode. It is connected with more active metal. Corrosion will concentrate only on the active metal. Thus original metal is protected. Hence this process is known as sacrificial anodic protection method.

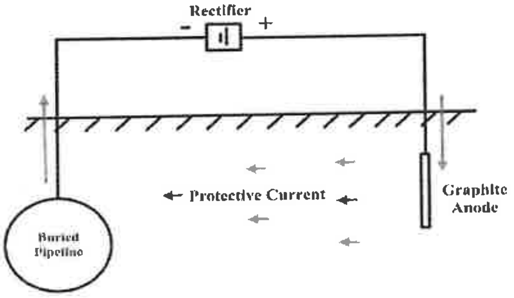
Eg.Sacrificial anodes - Zn, Mg, Al.

b. Impressed current cathodicprotection :

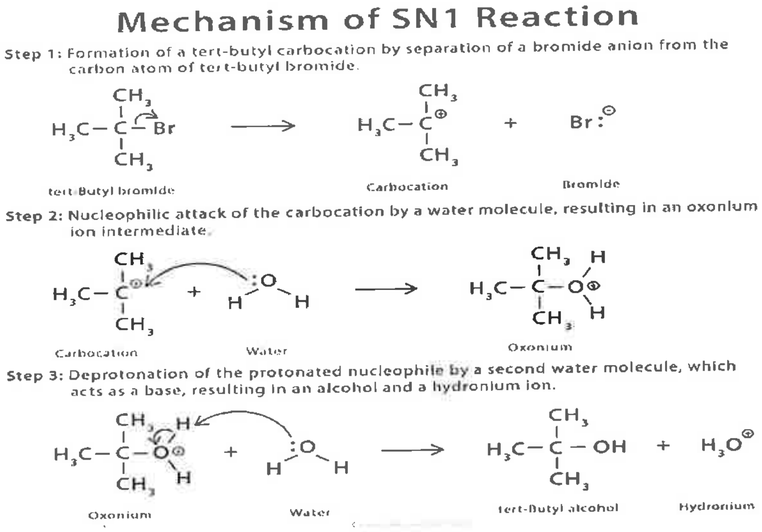
The corroding metal is converted from anode to cathode. This is done by applying a current in opposite direction of corrosion current.

Method: Negative terminal of the battery is connected to the metal. Positive terminal of the battery is connected to an inert anode. Inert anode used are graphite, platinised Titanium. The anode is buried in a "back fill" to provide electrical contact.





20(a) Explain SN1 Reaction mechanism with suitable examples.


Mechanism of SN1 Reaction

Step 1: Formation of a tert-butyl carbocation by separation of a bromide anion from the carbon atom of tert-butyl bromide.

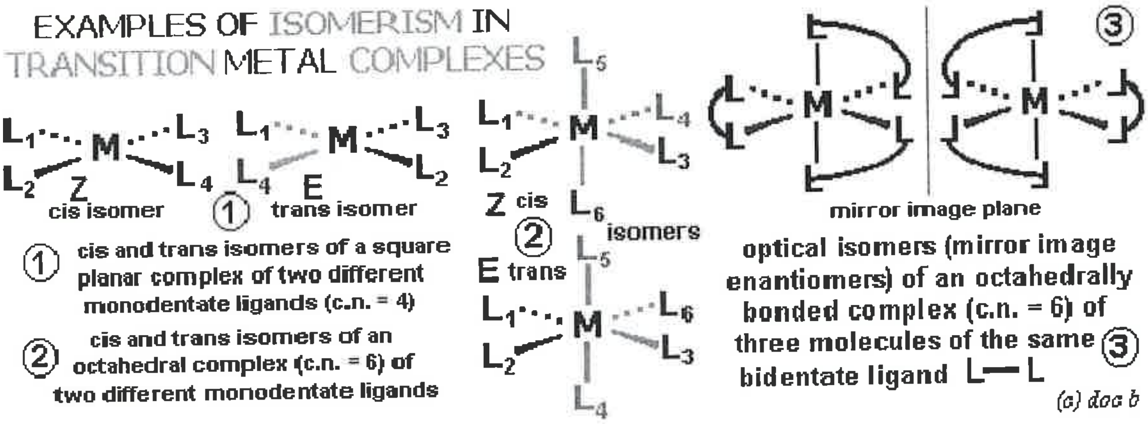
Step 2: Nucleophilic attack of the carbocation by a water molecule, resulting in an oxonium ion intermediate.

Step 3: Deprotonation of the protonated nucleophile by a second water molecule, which acts as a base, resulting in an alcohol and a hydronium ion.

Ans:

OR

20(b) Explain the isomerism taking place in transition metal compounds.



EXAMPLES OF ISOMERISM IN TRANSITION METAL COMPLEXES

① cis and trans isomers of a square planar complex of two different monodentate ligands (c.n. = 4)

② cis and trans isomers of an octahedral complex (c.n. = 6) of two different monodentate ligands

optical isomers (mirror image enantiomers) of an octahedrally bonded complex (c.n. = 6) of three molecules of the same bidentate ligand L—L ③

(c) doc b

TEXT BOOK AND REFERENCE BOOK

Text Book

1. Concise Inorganic chemistry: 5th Edition by J.D. Lee, Wiley, 2008.
2. William Kemp, Organic Chemistry, 3rd Edition. Mac Millan, 2009.
3. Introduction to Chemical Engineering Thermodynamics, J.M. Smith, H.C. Ness, M. Abbott, B Bhatt, 2009.
4. Morrison R.T and Boyd R.N., Organic Chemistry, 6th Edition, New York, 1976.

Reference Book

1. Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, By James E. Huheey, Medhi 1983.
2. Peter Atkins, Julio de Paula, and James keeler Atkins Physical Chemistry, 11th Edition, 2017.
3. Chemistry Laboratory – I & II, Dr. A. P. Srikanth, R. Komalavalli, Shreem Bhuvaneswari publications , Ch-44, 2009

Other Resources (Online Resources or others)

i) https://nptel.ac.in/courses/122/101/122101001/ **Atomic Structure, Structural Chemistry**

ii) https://nptel.ac.in/courses/122/101/122101001/ **Titrations : Acid-Base, Redox and Complexometric**

QUESTION BANK

BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CHEMISTRY

QUESTION BANK

Department	:	**Chemistry**
Program Name / Code	:	**B TECH**
Course Name / Code	:	**Engineering Chemistry / U20CYBJ01**

Q. No.	Question	Weight age	CO	Bloom's Level
	UNIT I			
	PART - A			
1	What is meant by Aromaticity?	2	1	2
2	Define Pauli's exclusion principle.	2	1	2
3	Define Huckel's rule with suitable example.	2	1	2
4	Define bond order.	2	1	2
5	Predict the reason why He_2 molecule does not exist?	2	1	2
6	Calculate the bond order for N_2 molecule.	2	1	2
7	What is spectrochemical series?	2	1	2
8	What is meant by crystal field theory?	2	1	2
9	What is crystal field stabilization energy?	2	1	2
10	Define paramagnetic and diamagnetic property.	2	1	2
	PART – B			
1	Draw the energy level diagram of C_2 molecule and analyze the bond order, magnetic property.	4	1	4
2	Sketch the MO diagram of 1,3-Butadiene and analyze the HOMO & LUMO orbital.	4	1	4
3	Derive Schrodinger wave equation in a one dimensional box when the velocity of the wave (v).	4	1	4
4	Elucidate the MO diagram of benzene and analyze the HOMO & LUMO orbital.	4	1	4
5	Draw the energy diagram of d^6 system for the compound $[Fe(H_2O)_6]^{2+}$ & $[Fe(NH_3)_6]^{2+}$	4	1	4
6	Analyze the bond order and magnetic property for the molecule B_2 with the help of energy level diagram	4	1	4
7	Analyze the Crystal field splitting energy of d^5 to d^{10} electronic configuration in strong field tetrahedral complexes.	4	1	4
8	Sketch the energy level diagram of HF molecule and calculate its bond order.	4	1	4
9	Sketch the MO diagram of benzene and analyze the HOMO & LUMO orbital.	4	1	4
10	Analyze the Crystal field splitting energy of d^5 to d^{10} electronic configuration in week field tetrahedral complexes.	4	1	4
	PART – C			
1	Depict and elucidate the molecular orbital diagrams for N_2 and O_2 molecules. Calculate its bond order.	12	1	4

2	Represent the MO diagram for the following molecules with a neat sketch and calculate the bond order. (i) F_2, (ii) CN^-	12	1	4
3	Illustrate the MO diagram of NO and CO molecules and also determine the magnetic moment.	12	1	4
4	Elucidate the Schrodinger wave equation of 3 dimensional, one dimensional and particle in a box system.	12	1	4
5	Discuss the various factors affecting the crystal field stabilization energy depending on the metal and environment with an illustration.	12	1	4
6	Draw and give details about the crystal field splitting for octahedral geometry with an example.	12	1	4
7	Sketch and explain about the crystal field splitting for tetrahedral geometry. Explain the hybridization taking place with an example.	12	1	4

Q. No.	Question	Weight age	CO	Bloom's Level
	Unit-II			
	PART –A			
1	What is meant by molecular spectroscopy?	2	2	2
2	Define auxochrome.	2	6	2
3	Define chromophore and its type.	2	6	2
4	What is Beer-lamberts law?	2	6	2
5	State the selection rule for electronic spectroscopy.	2	2	2
6	Why homo diatomic molecules are IR inactive?	2	2	2
7	Write regions of IR spectroscopy. Which region we use in IR spectroscopy?	2	2	2
8	Why TMS is used as a standard in NMR?	2	2	2
9	Write the NMR splitting pattern for CH_3 CH_2COOH.	2	2	2
10	Define shielding and deshielding of protons.	2	2	2
	PART –B			
1	Illustrate and enlighten the vibrational mode of a linear molecule with an example.	4	2	3
2	How to detect the functional groups, symmetry and study the progress of chemical reaction using IR spectroscopy?	4	2	3
3	Explain in detail how electronic spectroscopy can be used for predicted and applied for a organic molecule.	4	6	3
4	Find out the Spin (I) value for the following nuclei and mention which one is NMR active or inactive nuclei. ${}_1H^1$, ${}_1D^2$, ${}_6C^{12}$, ${}_6C^{13}$, ${}_7N^{14}$, ${}_7N^{15}$, ${}_8O^{16}$, ${}_9F^{18}$,${}_9F^{19}$, ${}_8O^{17}$, ${}_{15}P^{31}$	4	2	3
5	Explain about chemical shift in Nuclear Magnetic Resonance spectroscopy and how the δ value varies with the upfield and	4	2	3

	downfield.			
6	Describe and derive the equation of Beer's Lambert's law with its limitations. How it is used for analyzing the unknown concentration of the solution?	4	6	3
7	Explain the possible absorption shits in UV spectroscopy with suitable example in detail.	4	6	3
8	Predict the splitting pattern of following molecules i) CH_3CH_2COOH ii) $CH_3CH_2COCH_3$ iii) $CH_3CH_2OCH_2CH_3$ iv) $CH_3CH_2CH_2\ CH_2Br$	4	2	3
9	Examine the chemical shift in ^1H NMR of following molecules and arrange them in increasing order of chemical shift. (a) CH_3Cl, $CHCl_3$, CH_2Cl_2, CH_4 (b) CH_3F, CH_3I, $(CH_3)_4Si$, CH_3Cl	4	2	3
10	Sketch the different vibrational modes of IR spectroscopy? Give its selection rule.	4	2	3
	PART – C			
1	Expalin the term chemical shift. How electronegativity is affecting chemical shift values of following compounds in NMR spectroscopy? CH_3Cl, CH_3I, $(CH_3)_4$ Si, $CHBr_3$, CH_2Br_2, CH_3F, CH_3OH, CH_3Br, CH_2Cl_2, CH_4	12	2	3
2	Explain the UV instrumentation methods and differentiate the single beam and double beam method.	12	6	3
3	Explain the different types of vibration modes in IR spectroscopy. Discuss about the fundamental vibration bands taking place in a non linear molecule with an example.	12	2	3
4	Explain the fundamental vibration bands for linear (CO_2) and non-linear (H_2O) molecules.	12	2	3
5	Explain in detail how the vibrational band occurs in IR instrumentation with the help of a block diagram.	12	6	3
6	Draw and explain the possible electronic transitions in UV spectroscopy with suitable example in detail.	12	6	3
7	Explain how shielding effect and deshielding effect takes place in NMR spectroscopy.	12	2	3

Q. No.	**Question**	**Weightage**	**CO**	**Bloom's Level**
	UNIT-III			
	PART –A			
1	What is the basic principle of XPS?	2	3	2
2	Is it possible to detect all elements in XPS? Give reason.	2	3	2

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QUESTION BANK

3	Define kinetic energy?	2	3	2
4	What is meant by path difference?	2	3	2
5	Write Bragg's equation for XRD spectroscopy.	2	3	2
6	Write any two applications of XRD methods.	2	3	2
7	Define ionic Radii?	2	3	2
8	Electro negativity decreases down the group. Give reason?	2	3	2
9	Define Ionization energy.	2	3	2
10	What is coordination number & geometry? Give example.	2	3	2
PART –B				
1	Derive the Bragg's equation for XRD with pictorial representation and analyze how it used to find out the crystal lattice.	4	3	4
2	Elucidate the binding energy taking place in various electronic shells.	4	3	4
3	Examine the term atomic radii & how it varies with the period and group of the periodic table.	4	3	4
4	Analyze the applications of XRD and how it used in analyzing the crystal structure.	4	3	4
5	Describe about the elemental shift & chemical shift taking place in X-ray Photoelectron Spectroscopy.	4	3	4
6	How does absorption and emission Spectroscopy takes place when it is passed into a organic molecule.	4	3	4
7	Find out the geometry and hybridization of the following compound $[Cu(CN)_4]^{2-}$,$[NiBr_4]^{2-}$	4	3	4
8	Calculate the oxidation number for the following molecule $KClO_3$, $[Fe(H_2O)_4]^{2+}$, $[Cu(Br)_4]^{2-}$,$[NiBr_4]^{2-}$	4	3	4
9	How ionic radii and ionization energy varies with the group and period in the Mendeleev's periodic table?	4	3	4
10	Explain how binding energy changes for Li and Na atom in XPS spectroscopy?	4	3	4
PART – C				
1	Explain the following terms and how it varies with the periodic trends i. Ionisation energy ii. Electronegativity iii. Ionic radii	12	3	4
2	Sketch the energy level of orbital arrangement using (n+l) rule, Pauli, Hund's and Aufbaf rule.	12	3	4
3	Explain how X-ray Photoelectron Spectroscopy is used with the x ray source inside a hemispherical analyser.	12	3	4

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QUESTION BANK

4	Find out the oxidation number for the following molecule $K_3[Fe(CN)_6]$, $Ni[CO_4]$, $CaCl_2$, $[Fe(NH_3)_6]Br_2$, $[Cu(H_2O)_6]Cl_2$, K_2CrO_4	12	3	4
5	Find out the geometry of the following compounds $[Cu(NH_3)_4]^+$, $[Ni(CN)_4]^{2-}$, $Ni(CO)_4$, $[NiCl_4]^{2-}$, $[Cu(H_2O)_4]^{2+}$, $[Cu(NH_3)_4]^{2+}$.	12	3	4
6	Explain about how binding energy and kinetic energy is measured for different electronic orbitals with the help of XPS.	12	3	4
7	Explain the following terms and how it varies with the periodic trends i. Atomic Radii ii. Polarization iii. Electron affinity	12	3	4

Q. No.	Question	Weight age	CO	Bloom's Level
	UNIT-IV			
	PART –A			
1	Define isolated system.	2	4	2
2	What is HSAB Principle?	2	4	2
3	Define Spontaneous process.	2	4	2
4	Alloying of metals is preferable. Give reason.	2	4	2
5	Write Nernst equation for reduction reaction.	2	6	2
6	Write any two Nernst equation applications.	2	6	2
7	What is meant by Caustic embrittlement?	2	4	2
8	Define Native metal with example.	2	4	2
9	Define electrochemical corrosion.	2	4	2
10	Write different type of wet corrosion.	2	4	2
	PART –B			
1	Write different types of system in thermodynamics with suitable example.	4	4	3
2	Derive Nernst equation for the oxidation reaction $M \rightarrow M^{n+} + 2e^-$			
3	Explain about the galvanic corrosion taking place in Zn-Fe and Cu-Fe couple with suitable example.	4	4	3
4	How scale and sludge affects boiler and what can be done to remove it?	4	4	3
5	Enumerate the characteristics or requirements that is required for a potable water.	4	4	3
6	Explain how corrosion is controlled by sacrificial anode and impressed current cathode protection.	4	4	3
7	Examine the Hard and soft acid base (HSAB) concept for acids and bases.	4	4	3

8	Examine the differential aeration corrosion taking place in a metal with example.	4	4	3
9	How reverse osmosis process is carried out using a semi permeable membrane.	4	4	3
10	Explain in detail how hydrogen evolution takes place in wet condition.	4	6	3
	PART – C			
1	Explicate the boiler troubles taking place due to scale, sludge, priming, foaming and caustic embrittlement in detail and how it can be prevented and removed.	12	4	3
2	Derive Nernst equation for reduction potential. Write its applicationsand apply the Nernst equation for the equation $Cu^{2+}_{(aq)}+2e^{-}\rightarrow Cu_{(s)}$.	12	6	3
3	Mention and elaborate the preventive methods that have to be followed to treat the municipal water.	12	4	3
4	Sketch the ion-exchanger method and explain how it is used for removing cations and anions present in water.	12	4	3
5	Examine the carbonate, calgon and phosphate conditioning method for water treatment.	12	4	3
6	Explain the different methods that could be used to control the corrosion by modifying the metal.	12	4	3
7	Explain in detail how corrosion occurs in presence of oxygen and hydrogen in dry environment.	12	6	3

Q. No.	**Question**	**Weight age**	**CO**	**Bloom's Level**
	UNIT-V			
	PART –A			
1	Define substitution reaction.	2	5	2
2	What is meant by addition reaction?	2	5	2
3	Compare addition and substitution reaction.	2	5	2
4	Define Diene and Dienophile with example.	2	6	2
5	Define the term racemic mixture.	2	6	2
6	Define Cis-Trans isomers with example.	2	6	2
7	Write any four reducing agents.	2	5	2
8	Differentiate chiral and achiral molecule with example.	2	5	2
9	Draw the staggered form of butane.	2	5	2
10	Define drug. Give two examples.	2	6	2
	PART – B			
1	Write the different oxidation reaction mechanism with suitable examples.	4	6	3
2	Draw the constitutional isomers of butanol	4	5	2

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QUESTION BANK

3	Explain in detail about enantiomer and diasteromer taking place in organic molecule with suitable example.	4	6	3
4	Write the constitutional isomers of pentane.	4	5	2
5	Draw the synthesis and mechanism of methyl salicylate and illustrate the use of it in the field of medicine.	4	6	3
6	Discuss the ring opening reaction with an example.	4	5	2
7	How reduction reaction takes place in presence of $LiAlH_4$ as a reducing agent.	4	6	3
8	Draw the cis trans isomer and write the IUPAC name for the molecule $ClCH=CHCl$ and $CH_3C_2H_5C=CCH_3C_2H_5$	4	6	3
9	Draw the different stereochemical forms of tartaric acid.	4	5	2
10	Explain about types of structural and stereo isomerism with an example.	4	5	2
PART – C				
1	Explain S_N1 Reaction mechanism with suitable examples.	12	5	2
2	Explain E^1 and E^2 Reaction mechanism with suitable examples.	12	5	2
3	Explain S_N2 Reaction mechanism with suitable examples.	12	5	2
4	Explain Diels-Alder reaction and its mechanism in detail. Write down some examples of diene and dienophiles.	12	6	3
5	Discuss in detail the synthetic mechanism of Paracetamol. Mention its uses.	12	6	3
6	Explain the isomerism taking place in transition metal compounds.	12	6	3
7	Draw the conformational analysis of Butane and Cyclohexane.	12	5	2

STUDENT PERFORMANCE RECORD
&
STUDENT ATTENDANCE RECORD

ECE TERM I STUDENT PERFORMANCE

S.No.	Reg No.	Student Name	CLA 1 (30	CLA 2 (30	CLA 3 (30	CLA 4 (10
1	U22EC001	ADARI BALA KRISHNA KARTHIK	18	20	20	10
2	U22EC002	R ADARSH YADAV	20	18	12	10
3	U22EC003	AJAY KRISHNA T U	15	14	20	10
4	U22EC004	G AJAY KUMAR REDDY	0	20	18	10
5	U22EC005	AKASH TULLURI	0	20	10	10
6	U22EC006	AKKALA HIMAKARA VENKATESH	15	20	20	10
7	U22EC007	AKKI NAGA PAVAN KUMAR REDDY	22	20	14	10
8	U22EC008	ALLAM VINAY	13	10	16	10
9	U22EC009	ALLAM YASWANTH	0	20	10	10
10	U22EC010	ALLU NAVEEN	20	14	3	10
11	U22EC011	AMBATI CHANDAN REDDY	14	20	18	10
12	U22EC012	AMBATI NAVEEN REDDY	15	20	10	10
13	U22EC013	AMBATI SHIVA REDDY	20	18	20	10
14	U22EC014	AMRITA .	25	28	28	10
15	U22EC015	AMUDALAPALLI LOKESH	21	18	26	10
16	U22EC016	ANAKALA NANDA KUMAR	24	20	18	10
17	U22EC017	ANCHA GANESH	28	28	28	10
18	U22EC018	ANCHELA VAISHNAVI	24	26	20	10
19	U22EC019	ANCHULA ASHOK	15	12	20	10
20	U22EC020	ANDRA CHARAN	18	14	14	10
21	U22EC021	ANDRA MADHUSUDHAN NAIDU	15	16	14	10
22	U22EC022	ANGADI ANWAR	24	18	26	10
23	U22EC023	APPADI KAVYA	26	28	28	10
24	U22EC025	ARELLY ABHIRAM	15	12	18	10
25	U22EC026	ARVAPALLI VARUN KUMAR	18	24	18	10
26	U22EC027	ASAM MANOHAR REDDY	15	14	22	10
27	U22EC028	ASHALA LOKESH	26	20	14	10
28	U22EC029	K ASHOK	28	26	18	10
29	U22EC030	ATHURU TEJA REDDY	15	22	20	10
30	U22EC031	AVISINENI UDAY KIRAN	15	14	16	10
31	U22EC032	AVULA HARSHAVARDHAN REDDY	15	24	24	10
32	U22EC033	AVULAPATI KUSHWANTH RAM	18	16	8	10
33	U22EC034	AYODHYPURAM VENKATRAMI RE	18	26	22	10
34	U22EC035	BACHU SAI SHIVA	17	16	20	10
35	U22EC036	BADDIPALLI BHASKAR REDDY	15	16	18	10
36	U22EC037	BADE HEMA PANDU RANGA RAO	15	14	20	10
37	U22EC038	BAILAPUDI YESWANTH	17	16	20	10
38	U22EC039	BALAGONDA INDU	28	28	28	10
39	U22EC040	BALAM NARESH	20	20	14	10
40	U22EC041	BALTHA SAI TEJA	27	20	14	10
41	U22EC042	BALU RAVI KRISHNA REDDY	15	16	6	10
42	U22EC044	BANDARI SANDEEP	25	12	14	10
43	U22EC045	BANDARU ARAVIND KUMAR	20	16	20	10

44	U22EC046	BANDARU CHARAN KISHORE	25	20	20	10
45	U22EC047	BANDARU UMA MAHESH	15	18	22	10
46	U22EC048	BANDI VINOD	15	8	14	10
47	U22EC049	BAREDDY VENKATESWARA REDDY	22	18	20	10
48	U22EC050	BATHALA VENKATA SUJAN KARTH	12	18	12	10
49	U22EC051	BATHINA CHARAN KUMAR REDDY	22	22	22	10
50	U22EC052	BATTEPATI ANKAIAH	15	12	18	10
51	U22EC053	BAVIRISETTI RAJESH	14	20	20	10
52	U22EC054	BAYYAVARAPU VISHNU VARDHAN	14	12	14	10
53	U22EC055	BESTA MAHENDRA	15	20	14	10
54	U22EC056	BESTHA PAVAN KUMAR	16	12	14	10
55	U22EC057	BHURAGALA RAMESH	24	26	26	10
56	U22EC058	BIJIVEMULA VENKATA SUBBA RED	18	16	20	10
57	U22EC059	BITRA JAYASIMHA	24	14	AB	10
58	U22EC084	CHINDAM SASHIVARUN	23	AB	15	10
59	U22EC102	DEGA SRINU	15	18	18	10
60	U22EC132	GANNAMANI MANOHAR KRISHNA	30	30	30	10
61	U22EC133	GANTA MANIKANTA	15	24	20	10
62	U22EC134	GILAKA PEDDANNA	24	26	26	10
63	U22EC135	GOLAKOTI RAVINDRA SAI KRISHNA	27	26	26	10
64	U22EC136	GOLLA DHANASHEKAR	24	30	30	10
65	U22EC137	GOLLA PAVAN KUMAR	15	20	22	10
66	U22EC138	GOLLAPALLI SATHISH KUMAR	15	22	22	10
67	U22EC139	GORANTALA ROHAN	15	28	28	10
68	U22EC141	GOSU VINAY	15	20	14	10
69	U22EC142	GOTTAPU JAGADEESH	18	26	26	10
70	U22EC143	GUDA REDDY ESWAR REDDY	6	26	26	10
71	U22EC144	GUDDETI SASIKANTH	12	20	24	10
72	U22EC145	GUDE KISHORE BABU	15	16	16	10
73	U22EC146	GUDIVADA HEMANTH	15	20	20	10
74	U22EC147	GUDURI ABHISHEK REDDY	21	30	30	10
75	U22EC148	GUGGILLA VENKATA PRASAD	15	30	30	10
76	U22EC149	GULLA PRASANTH KUMAR	9	24	24	10
77	U22EC150	GUMPULA MAHITA PRITAM	24	26	26	10
78	U22EC151	GUNDRA DHANUNJAY	15	24	24	10
79	U22EC152	GUNNAM ANIL KUMAR	30	30	30	10
80	U22EC153	GUNTURU SANDHYAVALLI	15	28	28	10
81	U22EC154	GURIJEPALLI VINOD KUMAR	30	30	30	10
82	U22EC155	GURRALA MAHESH BABU	0	26	26	10
83	U22EC156	GURRAM NAGA NIHITHA	15	18	18	10
84	U22EC157	GUTAM VENKATESH	15	18	18	10
85	U22EC158	GUTTALASANDU TEJASWINI	18	28	28	10
86	U22EC159	GUTTUR GANESH	15	24	24	10
87	U22EC160	HARI KRISHNAN E	15	20	12	10
88	U22EC161	HARINI G	24	26	26	10
89	U22EC162	INJA SAMARASIMHA REDDY	15	20	16	10
90	U22EC164	JASTHI RAMYASAI	9	22	22	10
91	U22EC165	JILLELLA SISINDAR REDDY	9	20	20	10

92	U22EC166	JUJJURU YADAGIRI	15	28	28	10
93	U22EC167	JUTUR MANASA HARSHINI	18	24	26	10
94	U22EC168	KAKANABOINA VIJAYAMUKTHANA	15	18	18	10
95	U22EC169	KOCHERLA SRI HARSHA	18	22	22	10
96	U22EC170	KADIYALA KARTHIK	24	30	30	10
97	U22EC171	KADIYAM PRAKASH RAJ	15	20	22	10
98	U22EC172	KALA SAI KIRAN	15	20	22	10
99	U22EC173	KALAL ABHILASH KUMAR GOUD	21	20	20	10
100	U22EC174	KALINGIRI SURENDRA BABU	12	20	20	10
101	U22EC175	KALLAKURI ABHISHEK	**6**	**20**	**20**	10
102	U22EC176	KAMASANI NITHISH	0	20	20	10
103	U22EC177	KAMMARI RAJESH ACHARI	15	18	18	10
104	U22EC178	KANCHARLA VENKATA SUKUMAR	15	26	26	10
105	U22EC179	KANCHETTI GANESH	9	22	24	10
106	U22EC180	KANKANALA ANVESH	15	22	20	10
107	U22EC181	KANNEKANTI SURENDRA VENKATA	15	24	20	10
108	U22EC182	KANTINENI ANIL KUMAR	27	28	28	10
109	U22EC183	KANUMALLAPURI MOHAN	15	20	22	10
110	U22EC184	KAPUGORLLA SRIKANTH	15	22	20	10
111	U22EC185	KARNA LAHARI	12	22	22	10
112	U22EC186	KARNAKANTI LOHITH	12	20	24	10
113	U22EC187	KARNATI ASHOK REDDY	15	18	18	2
114	U22EC188	KARPURAPU SAHITH BABU	18	28	28	10
115	U22EC189	KARRA JAYA PRAKASH	21	24	24	10
116	U22EC190	M KARTHIK	12	16	16	10
117	U22EC192	KATHI AKHIL REDDY	30	30	30	10
118	U22EC193	KATPADI ISHAQ	27	28	28	10
119	U22EC194	KEKKIRENI PAVAN.	15	20	20	10
120	U22EC195	KETHAM BALAJI	15	22	20	10
121	U22EC196	KETHIREDDY KEDARNATH REDDY	21	28	28	10
122	U22EC197	KODUMURTHY GOVARDHAN	27	28	30	10
123	U22EC198	KODURI TARUN	15	20	18	10
124	U22EC199	KOLA VENKATA SAI KRISHNA	15	22	16	10
125	U22EC200	KOLAGANI NAGARAJU	15	22	24	10
126	U22EC201	KOLLEBOYINA SRINIVASULU	21	26	26	10
127	U22EC202	KOLLUMALLA SURYA GANESH	15	24	22	10
128	U22EC203	KOMARNENI ROHIT	15	26	24	10
129	U22EC204	KOMMU DURGA DILEEP	15	20	20	10
130	U22EC205	KONA SHARON PRISE SUJEEV	30	20	20	10
131	U22EC276	MOLAKALAPALLI POOJITHA	15	22	22	10
132	U22EC277	MOLAKAPALLI JAGADEESH CHOWI	24	24	22	10
133	U22EC278	MOLLA NASIRULLA	9	24	22	10
134	U22EC279	MOPIDEVI KARTHIK VARMA	15	20	20	10
135	U22EC280	MUDADLA VASU NAIDU	18	22	20	10
136	U22EC281	MUKKAMALLA MANIKANTESWARA	18	22	20	10
137	U22EC282	MULAMREDDY BALA NAGI REDDY	15	22	20	10
138	U22EC283	MUMMASANI DINESH KUMAR RED	15	30	30	10
139	U22EC284	MUNDRU ARUN	12	20	20	10

140	U22EC285	MUTRA DHANANJAYA REDDY	9	22	20	10
141	U22EC286	MUTTHUMULA VENKATA SAI	9	20	20	10
142	U22EC287	MUTYALA MADHU	18	22	22	10
143	U22EC288	MYLARI RAVI SANKAR	15	22	22	10
144	U22EC289	NAAGAD YOUNES KHAN	15	**24**	24	10
145	U22EC290	NADENDLA SATISH KUMAR	15	22	22	10
146	U22EC291	NADENDLA VENKATA SADIK	15	10	10	10
147	U22EC292	NADIMPALLI HARDHIK VARMA	21	26	26	10
148	U22EC293	NAGALAKUNTA VENGAL REDDY	27	30	30	10
149	U22EC294	NAGAVELLI NIKHIL TEJA	15	20	20	10
150	U22EC295	NAGISETTY RAMA KRISHNA	18	20	20	10
151	U22EC296	NAKKALA VENUGOPAL	21	26	26	10
152	U22EC297	NALAM HEMA DURGA VENKAT VIV	21	20	20	10
153	U22EC298	NALAM MURAARI	15	24	24	10
154	U22EC299	NALAMOTHU MANOJ KUMAR	15	18	20	10
155	U22EC300	NALLA SATHISH	30	30	30	10
156	U22EC301	NALLA SURESH	24	22	22	10
157	U22EC302	NALLABOTHULA GOWTHAM KUMA	12	20	22	10
158	U22EC303	NALLABOTHULA BHARGAV SAI	9	20	20	10
159	U22EC304	NANDAM VIVEK JOSHI	12	22	22	10
160	U22EC305	NANDAVARAPU DILEEP	27	18	20	10
161	U22EC306	K V NARENDRA	15	20	20	10
162	U22EC307	NARMALA PHANI KUMAR	18	26	26	10
163	U22EC308	NARNAPATI VEERANJANEYULU	24	28	28	10
164	U22EC309	NARREDDY LAHARI	18	26	24	10
165	U22EC310	NARSIPURAM CHIRU	27	28	28	10
166	U22EC311	NAWIN S	15	AB	AB	10
167	U22EC312	NEMALLAPUDI JASWANTH	15	18	18	10
168	U22EC313	NETHAGANI SREEJA	18	20	20	10
169	U22EC314	NIDADAVOLU NAGA TEJASWINI DE	21	28	28	10
170	U22EC315	NIGIDALA VAMSI VARMA	18	24	22	10
171	U22EC316	NITHISH M	9	12	12	10
172	U22EC317	NIVEDHA D	27	28	26	10
173	U22EC318	PADAMALA MAHESH	9	16	16	10
174	U22EC319	PADMANABHAN S	18	18	18	10
175	U22EC320	PAILA REVATHI	12	**18**	18	10
176	U22EC321	PAKANATI BHARATH KUMAR REDI	9	18	18	10
177	U22EC322	PAKANATI SADA SIVA REDDY	6	18	18	10
178	U22EC323	PALEM HEMANTH SAI	6	16	16	10
179	U22EC325	PALLE POLI REDDY	12	10	12	10
180	U22EC326	PALLE PRAMOD REDDY	6	20	20	10
181	U22EC327	PALLEM YASWANTH KUMAR REDD	30	30	30	10
182	U22EC328	PALLERLA ROHITH KUMAR REDDY	15	28	28	10
183	U22EC329	PALVARI VAMSHI KRISHNA	9	22	22	10
184	U22EC330	PANDARABOINA MAHESH	18	22	22	10
185	U22EC331	PAREPALLI SAI GANESH	21	22	20	10
186	U22EC332	PASUPULETI DAMODHAR NAIDU	15	16	16	10
187	U22EC333	PATAN KHAJA VALI	30	26	24	10

188	U22EC334	PATCHAVA LAKSHMI NARASIMHA	30	30	30	10
189	U22EC335	PATHI GNANENDRA NAIDU	30	30	30	10
190	U22EC336	PEDAMALLI PRASANTH REDDY	24	28	28	10
191	U22EC337	PEDDAKOTLA CHANDU PRAKASH R	24	24	24	10
192	U22EC338	PEDDAMAR BHAGYA SRAVANTHI	21	26	24	10
193	U22EC339	PEDDAPUDI JAGADEESWAR REDDY	15	20	18	10
194	U22EC340	PEMMASANI V L N ADITYA CHANDI	21	**24**	24	10
195	U22EC341	PERAM SIVA MALLESWAR REDDY	15	10	10	10
196	U22EC342	PERUBOINA PURNA SAI NAVEEN	15	20	20	10
197	U22EC343	PERUGU SATHISH	21	26	26	10
198	U22EC344	PILLA VENKATA RAMCHARAN	21	28	28	10
199	U22EC345	PILLIKANDLA HEMANTH	12	22	22	10
200	U22EC346	PINJARI KABULA	12	16	14	10
201	U22EC403	SHARMILA K	27	24	26	10
202	U22EC484	DASOJU HARIKRISHNA	AB	19	15	10

ECE TERM I STUDENT ATTENDANCE PERCENTAGE

S.No.	Reg No.	Student Name	ATTENDANCE %
1	U22EC001	ADARI BALA KRISHNA KARTHIK	71
2	U22EC002	R ADARSH YADAV	62
3	U22EC003	AJAY KRISHNA T U	81
4	U22EC004	G AJAY KUMAR REDDY	68
5	U22EC005	AKASH TULLURI	43
6	U22EC006	AKKALA HIMAKARA VENKATESH	84
7	U22EC007	AKKI NAGA PAVAN KUMAR REDD	81
8	U22EC008	ALLAM VINAY	82
9	U22EC009	ALLAM YASWANTH	71
10	U22EC010	ALLU NAVEEN	77
11	U22EC011	AMBATI CHANDAN REDDY	83
12	U22EC012	AMBATI NAVEEN REDDY	71
13	U22EC013	AMBATI SHIVA REDDY	78
14	U22EC014	AMRITA .	82
15	U22EC015	AMUDALAPALLI LOKESH	86
16	U22EC016	ANAKALA NANDA KUMAR	84
17	U22EC017	ANCHA GANESH	77
18	U22EC018	ANCHELA VAISHNAVI	84
19	U22EC019	ANCHULA ASHOK	82
20	U22EC020	ANDRA CHARAN	65
21	U22EC021	ANDRA MADHUSUDHAN NAIDU	92
22	U22EC022	ANGADI ANWAR	91
23	U22EC023	APPADI KAVYA	86
24	U22EC025	ARELLY ABHIRAM	73
25	U22EC026	ARVAPALLI VARUN KUMAR	84
26	U22EC027	ASAM MANOHAR REDDY	86
27	U22EC028	ASHALA LOKESH	94
28	U22EC029	K ASHOK	81
29	U22EC030	ATHURU TEJA REDDY	81
30	U22EC031	AVISINENI UDAY KIRAN	83
31	U22EC032	AVULA HARSHAVARDHAN REDDY	87
32	U22EC033	AVULAPATI KUSHWANTH RAM	78
33	U22EC034	AYODHYPURAM VENKATRAMI RE	83
34	U22EC035	BACHU SAI SHIVA	78
35	U22EC036	BADDIPALLI BHASKAR REDDY	83
36	U22EC037	BADE HEMA PANDU RANGA RAO	70
37	U22EC038	BAILAPUDI YESWANTH	60
38	U22EC039	BALAGONDA INDU	87
39	U22EC040	BALAM NARESH	82
40	U22EC041	BALTHA SAI TEJA	88
41	U22EC042	BALU RAVI KRISHNA REDDY	84
42	U22EC044	BANDARI SANDEEP	73
43	U22EC045	BANDARU ARAVIND KUMAR	79
44	U22EC046	BANDARU CHARAN KISHORE	84

45	U22EC047	BANDARU UMA MAHESH	81
46	U22EC048	BANDI VINOD	74
47	U22EC049	BAREDDY VENKATESWARA REDDY	86
48	U22EC050	BATHALA VENKATA SUJAN KARTH	86
49	U22EC051	BATHINA CHARAN KUMAR REDDY	88
50	U22EC052	BATTEPATI ANKAIAH	81
51	U22EC053	BAVIRISETTI RAJESH	82
52	U22EC054	BAYYAVARAPU VISHNU VARDHAN	56
53	U22EC055	BESTA MAHENDRA	82
54	U22EC056	BESTHA PAVAN KUMAR	71
55	U22EC057	BHURAGALA RAMESH	92
56	U22EC058	BIJIVEMULA VENKATA SUBBA RED	94
57	U22EC059	BITRA JAYASIMHA	64
58	U22EC084	CHINDAM SASHIVARUN	69
59	U22EC102	DEGA SRINU	100
60	U22EC132	GANNAMANI MANOHAR KRISHNA	96
61	U22EC133	GANTA MANIKANTA	18
62	U22EC134	GILAKA PEDDANNA	99
63	U22EC135	GOLAKOTI RAVINDRA SAI KRISHN	87
64	U22EC136	GOLLA DHANASHEKAR	80
65	U22EC137	GOLLA PAVAN KUMAR	85
66	U22EC138	GOLLAPALLI SATHISH KUMAR	74
67	U22EC139	GORANTALA ROHAN	82
68	U22EC141	GOSU VINAY	80
69	U22EC142	GOTTAPU JAGADEESH	99
70	U22EC143	GUDA REDDY ESWAR REDDY	75
71	U22EC144	GUDDETI SASIKANTH	48
72	U22EC145	GUDE KISHORE BABU	93
73	U22EC146	GUDIVADA HEMANTH	61
74	U22EC147	GUDURI ABHISHEK REDDY	90
75	U22EC148	GUGGILLA VENKATA PRASAD	89
76	U22EC149	GULLA PRASANTH KUMAR	80
77	U22EC150	GUMPULA MAHITA PRITAM	94
78	U22EC151	GUNDRA DHANUNJAY	61
79	U22EC152	GUNNAM ANIL KUMAR	100
80	U22EC153	GUNTURU SANDHYAVALLI	56
81	U22EC154	GURIJEPALLI VINOD KUMAR	100
82	U22EC155	GURRALA MAHESH BABU	92
83	U22EC156	GURRAM NAGA NIHITHA	49
84	U22EC157	GUTAM VENKATESH	85
85	U22EC158	GUTTALASANDU TEJASWINI	100
86	U22EC159	GUTTUR GANESH	73
87	U22EC160	HARI KRISHNAN E	44
88	U22EC161	HARINI G	77
89	U22EC162	INJA SAMARASIMHA REDDY	72
90	U22EC164	JASTHI RAMYASAI	76
91	U22EC165	JILLELLA SISINDAR REDDY	62
92	U22EC166	JUJJURU YADAGIRI	83

93	U22EC167	JUTUR MANASA HARSHINI	94
94	U22EC168	KAKANABOINA VIJAYAMUKTHANA	96
95	U22EC169	KOCHERLA SRI HARSHA	83
96	U22EC170	KADIYALA KARTHIK	83
97	U22EC171	KADIYAM PRAKASH RAJ	79
98	U22EC172	KALA SAI KIRAN	49
99	U22EC173	KALAL ABHILASH KUMAR GOUD	86
100	U22EC174	KALINGIRI SURENDRA BABU	86
101	U22EC175	KALLAKURI ABHISHEK	80
102	U22EC176	KAMASANI NITHISH	90
103	U22EC177	KAMMARI RAJESH ACHARI	77
104	U22EC178	KANCHARLA VENKATA SUKUMAR	51
105	U22EC179	KANCHETTI GANESH	18
106	U22EC180	KANKANALA ANVESH	59
107	U22EC181	KANNEKANTI SURENDRA VENKATA	82
108	U22EC182	KANTINENI ANIL KUMAR	97
109	U22EC183	KANUMALLAPURI MOHAN	92
110	U22EC184	KAPUGORLLA SRIKANTH	92
111	U22EC185	KARNA LAHARI	94
112	U22EC186	KARNAKANTI LOHITH	73
113	U22EC187	KARNATI ASHOK REDDY	73
114	U22EC188	KARPURAPU SAHITH BABU	90
115	U22EC189	KARRA JAYA PRAKASH	92
116	U22EC190	M KARTHIK	89
117	U22EC192	KATHI AKHIL REDDY	94
118	U22EC193	KATPADI ISHAQ	77
119	U22EC194	KEKKIRENI PAVAN.	83
120	U22EC195	KETHAM BALAJI	89
121	U22EC196	KETHIREDDY KEDARNATH REDDY	92
122	U22EC197	KODUMURTHY GOVARDHAN	97
123	U22EC198	KODURI TARUN	89
124	U22EC199	KOLA VENKATA SAI KRISHNA	69
125	U22EC200	KOLAGANI NAGARAJU	24
126	U22EC201	KOLLEBOYINA SRINIVASULU	99
127	U22EC202	KOLLUMALLA SURYA GANESH	63
128	U22EC203	KOMARNENI ROHIT	89
129	U22EC204	KOMMU DURGA DILEEP	66
130	U22EC205	KONA SHARON PRISE SUJEEV	42
131	U22EC276	MOLAKALAPALLI POOJITHA	91
132	U22EC277	MOLAKAPALLI JAGADEESH CHOWI	73
133	U22EC278	MOLLA NASIRULLA	65
134	U22EC279	MOPIDEVI KARTHIK VARMA	74
135	U22EC280	MUDADLA VASU NAIDU	88
136	U22EC281	MUKKAMALLA MANIKANTESWARA	87
137	U22EC282	MULAMREDDY BALA NAGI REDDY	87
138	U22EC283	MUMMASANI DINESH KUMAR RED	91
139	U22EC284	MUNDRU ARUN	85
140	U22EC285	MUTRA DHANANJAYA REDDY	87

141	U22EC286	MUTTHUMULA VENKATA SAI	86
142	U22EC287	MUTYALA MADHU	79
143	U22EC288	MYLARI RAVI SANKAR	78
144	U22EC289	NAAGAD YOUNES KHAN	88
145	U22EC290	NADENDLA SATISH KUMAR	82
146	U22EC291	NADENDLA VENKATA SADIK	80
147	U22EC292	NADIMPALLI HARDHIK VARMA	93
148	U22EC293	NAGALAKUNTA VENGAL REDDY	92
149	U22EC294	NAGAVELLI NIKHIL TEJA	88
150	U22EC295	NAGISETTY RAMA KRISHNA	84
151	U22EC296	NAKKALA VENUGOPAL	88
152	U22EC297	NALAM HEMA DURGA VENKAT VIV	82
153	U22EC298	NALAM MURAARI	74
154	U22EC299	NALAMOTHU MANOJ KUMAR	84
155	U22EC300	NALLA SATHISH	93
156	U22EC301	NALLA SURESH	86
157	U22EC302	NALLABOTHULA GOWTHAM KUMA	86
158	U22EC303	NALLABOTHULA BHARGAV SAI	88
159	U22EC304	NANDAM VIVEK JOSHI	71
160	U22EC305	NANDAVARAPU DILEEP	93
161	U22EC306	K V NARENDRA	59
162	U22EC307	NARMALA PHANI KUMAR	88
163	U22EC308	NARNAPATI VEERANJANEYULU	88
164	U22EC309	NARREDDY LAHARI	87
165	U22EC310	NARSIPURAM CHIRU	89
166	U22EC311	NAWIN S	6
167	U22EC312	NEMALLAPUDI JASWANTH	59
168	U22EC313	NETHAGANI SREEJA	90
169	U22EC314	NIDADAVOLU NAGA TEJASWINI DE	87
170	U22EC315	NIGIDALA VAMSI VARMA	63
171	U22EC316	NITHISH M	86
172	U22EC317	NIVEDHA D	92
173	U22EC318	PADAMALA MAHESH	87
174	U22EC319	PADMANABHAN S	85
175	U22EC320	PAILA REVATHI	88
176	U22EC321	PAKANATI BHARATH KUMAR REDI	79
177	U22EC322	PAKANATI SADA SIVA REDDY	88
178	U22EC323	PALEM HEMANTH SAI	87
179	U22EC325	PALLE POLI REDDY	82
180	U22EC326	PALLE PRAMOD REDDY	84
181	U22EC327	PALLEM YASWANTH KUMAR REDD	93
182	U22EC328	PALLERLA ROHITH KUMAR REDDY	91
183	U22EC329	PALVARI VAMSHI KRISHNA	90
184	U22EC330	PANDARABOINA MAHESH	89
185	U22EC331	PAREPALLI SAI GANESH	81
186	U22EC332	PASUPULETI DAMODHAR NAIDU	80
187	U22EC333	PATAN KHAJA VALI	88
188	U22EC334	PATCHAVA LAKSHMI NARASIMHA	90

189	U22EC335	PATHI GNANENDRA NAIDU	90
190	U22EC336	PEDAMALLI PRASANTH REDDY	92
191	U22EC337	PEDDAKOTLA CHANDU PRAKASH	86
192	U22EC338	PEDDAMAR BHAGYA SRAVANTHI	86
193	U22EC339	PEDDAPUDI JAGADEESWAR REDDY	75
194	U22EC340	PEMMASANI V L N ADITYA CHAND	87
195	U22EC341	PERAM SIVA MALLESWAR REDDY	73
196	U22EC342	PERUBOINA PURNA SAI NAVEEN	82
197	U22EC343	PERUGU SATHISH	86
198	U22EC344	PILLA VENKATA RAMCHARAN	89
199	U22EC345	PILLIKANDLA HEMANTH	88
200	U22EC346	PINJARI KABULA	86
201	U22EC403	SHARMILA K	93
202	U22EC484	DASOJU HARIKRISHNA	30

COURSE END SURVEY

Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)
(Vide Notification No. F9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)

BTECH ELECTRICAL AND ELECTRONICS ENGINEERING
ACADEMIC YEAR 2022-2023 (TERM I) - ENGINEERING CHEMISTRY - U20CYBJ01
STUDENT PERFORMANCE RECORD

Sl No.	Reg. No	Name	CO1	CO2	CO3	CO4	CO5	CO6	Average
1	U22EC018	ANCHELA VAISHNAVI	98	94	95	97	96	97	96
2	U22EC019	ANCHULA ASHOK	98	97	100	94	100	100	98
3	U22EC020	ANDRA CHARAN	100	94	98	100	88	97	96
4	U22EC021	ANDRA MADHUSUDHAN NAID	98	94	98	97	100	100	98
5	U22EC022	ANGADI ANWAR	95	84	100	91	75	97	90
6	U22EC023	APPADI KAVYA	93	94	95	94	92	100	94
7	U22EC025	ARELLY ABHIRAM	95	84	98	100	88	97	94
8	U22EC026	ARVAPALLI VARUN KUMAR	98	94	95	94	83	100	94
9	U22EC027	ASAM MANOHAR REDDY	95	84	100	78	88	100	91
10	U22EC028	ASHALA LOKESH	98	94	95	97	92	100	96
11	U22EC029	K ASHOK	93	100	95	100	88	97	95
12	U22EC030	ATHURU TEJA REDDY	95	84	98	94	88	100	93
13	U22EC031	AVISINENI UDAY KIRAN	98	84	100	91	96	97	94
14	U22EC032	AVULA HARSHAVARDHAN RE	95	94	93	100	83	100	94
15	U22EC033	AVULAPATI KUSHWANTH RAN	93	78	98	88	100	100	93
16	U22EC034	AYODHYPURAM VENKATRAM	95	88	100	97	88	100	94
17	U22EC035	BACHU SAI SHIVA	98	97	93	94	100	100	97
18	U22EC036	BADDIPALLI BHASKAR REDDY	98	88	98	91	83	97	92
19	U22EC037	BADE HEMA PANDU RANGA R	95	88	95	100	100	94	95
20	U22EC038	BAILAPUDI YESWANTH	98	97	98	94	83	94	94
21	U22EC039	BALAGONDA INDU	95	88	98	94	88	100	94
22	U22EC040	BALAM NARESH	93	84	98	94	92	97	93
23	U22EC041	BALTHA SAI TEJA	98	94	95	97	96	100	96
24	U22EC042	BALU RAVI KRISHNA REDDY	95	84	95	100	100	97	95
25	U22EC044	BANDARI SANDEEP	100	100	100	81	92	100	95
26	U22EC045	BANDARU ARAVIND KUMAR	98	78	95	94	88	97	91
27	U22EC046	BANDARU CHARAN KISHORE	93	88	95	100	92	100	94
28	U22EC047	BANDARU UMA MAHESH	93	84	95	97	88	100	93
29	U22EC048	BANDI VINOD	95	94	98	88	79	100	92
30	U22EC049	BAREDDY VENKATESWARA R	0	100	93	97	96	97	80
31	U22EC050	BATHALA VENKATA SUJAN K	95	84	93	97	100	97	94
32	U22EC051	BATHINA CHARAN KUMAR RE	98	94	95	94	92	97	95
33	U22EC052	BATTEPATI ANKAIAH	100	84	100	97	96	100	96
34	U22EC053	BAVIRISETTI RAJESH	95	84	98	100	92	100	95
35	U22EC054	BAYYAVARAPU VISHNU VARI	98	97	93	91	88	100	94
36	U22EC055	BESTA MAHENDRA	95	88	98	97	96	97	95
37	U22EC056	BESTHA PAVAN KUMAR	98	84	98	81	88	97	91
38	U22EC057	BHURAGALA RAMESH	100	94	95	94	96	100	96
39	U22EC058	BIJIVEMULA VENKATA SUBBA	98	84	95	94	83	97	92
40	U22EC059	BITRA JAYASIMHA	95	94	95	97	92	100	95
41	U22EC180	KANKANALA ANVESH	98	91	98	94	96	97	95
42	U22EC181	KANNEKANTI SURENDRA VEN	95	100	95	97	96	100	97
43	U22EC182	KANTINENI ANIL KUMAR	95	91	93	94	100	97	95
44	U22EC183	KANUMALLAPURI MOHAN	100	88	93	94	96	100	95
45	U22EC184	KAPUGORLLA SRIKANTH	95	91	98	97	83	97	93
46	U22EC185	KARNA LAHARI	98	94	98	91	83	100	94
47	U22EC186	KARNAKANTI LOHITH	90	97	98	97	88	97	94
48	U22EC187	KARNATI ASHOK REDDY	100	94	98	100	83	100	96
49	U22EC188	KARPURAPU SAHITH BABU	100	78	98	88	83	100	91
50	U22EC189	KARRA JAYA PRAKASH	98	88	93	97	92	100	94
51	U22EC190	M KARTHIK	100	97	98	94	92	97	96
52	U22EC192	KATHI AKHIL REDDY	98	88	98	81	79	100	90
53	U22EC193	KATPADI ISHAQ	95	91	95	94	96	100	95
54	U22EC194	KEKKIRENI PAVAN.	100	88	98	100	96	100	97

55	U22EC195	KETHAM BALAJI	100	84	100	94	92	100	**95**
56	U22EC196	KETHIREDDY KEDARNATH RE	98	84	95	94	100	100	**95**
57	U22EC197	KODUMURTHY GOVARDHAN	95	94	95	100	75	97	**93**
58	U22EC198	KODURI TARUN	98	81	95	94	88	97	**92**
59	U22EC199	KOLA VENKATA SAI KRISHNA	100	84	98	94	100	97	**95**
60	U22EC200	KOLAGANI NAGARAJU	98	94	100	97	92	100	**97**
61	U22EC201	KOLLEBOYINA SRINIVASULU	98	91	98	75	96	100	**93**
62	U22EC202	KOLLUMALLA SURYA GANESI	93	91	95	94	96	100	**95**
63	U22EC203	KOMARNENI ROHIT	95	94	95	97	96	97	**96**
64	U22EC204	KOMMU DURGA DILEEP	95	94	100	100	88	97	**96**
65	U22EC205	KONA SHARON PRISE SUJEEV	93	88	98	91	88	100	**93**
66	U22EC276	MOLAKALAPALLI POOJITHA	95	91	95	97	83	97	**93**
67	U22EC277	MOLAKAPALLI JAGADEESH CI	98	91	95	100	92	100	**96**
68	U22EC278	MOLLA NASIRULLA	93	97	98	75	96	97	**92**
69	U22EC279	MOPIDEVI KARTHIK VARMA	98	91	95	100	96	100	**96**
70	U22EC280	MUDADLA VASU NAIDU	93	84	93	97	71	97	**89**
71	U22EC281	MUKKAMALLA MANIKANTES	95	88	98	88	100	100	**95**
72	U22EC282	MULAMREDDY BALA NAGI RE	98	91	98	97	100	97	**97**
73	U22EC283	MUMMASANI DINESH KUMAR	95	94	98	81	92	100	**93**
74	U22EC284	MUNDRU ARUN	93	91	95	94	100	97	**95**
75	U22EC285	MUTRA DHANANJAYA REDDY	100	94	98	97	100	100	**98**
76	U22EC286	MUTTHUMULA VENKATA SAI	93	91	100	94	88	100	**94**
77	U22EC287	MUTYALA MADHU	98	78	98	94	96	100	**94**
78	U22EC288	MYLARI RAVI SANKAR	100	94	95	94	96	100	**96**
79	U22EC289	NAAGAD YOUNES KHAN	100	94	98	94	100	97	**97**
80	U22EC290	NADENDLA SATISH KUMAR	100	88	100	97	92	97	**95**
81	U22EC291	NADENDLA VENKATA SADIK	98	91	88	94	100	97	**94**
82	U22EC292	NADIMPALLI HARDHIK VARM	100	81	98	97	92	100	**95**
83	U22EC293	NAGALAKUNTA VENGAL RED	98	88	95	72	92	100	**91**
84	U22EC294	NAGAVELLI NIKHIL TEJA	100	97	98	97	96	100	**98**
85	U22EC295	NAGISETTY RAMA KRISHNA	100	94	98	97	75	97	**93**
86	U22EC296	NAKKALA VENUGOPAL	98	84	93	91	100	97	**94**
87	U22EC297	NALAM HEMA DURGA VENKA	95	91	98	100	96	94	**95**
88	U22EC298	NALAM MURAARI	98	84	93	94	83	97	**91**
89	U22EC299	NALAMOTHU MANOJ KUMAR	95	94	98	72	96	100	**92**
90	U22EC300	NALLA SATHISH	98	94	98	100	83	97	**95**
91	U22EC084	CHINDAM SASHIVARUN	93	100	98	88	96	100	**96**
92	U22EC001	ADARI BALA KRISHNA KARTH	98	88	95	78	96	97	**92**
93	U22EC002	R ADARSH YADAV	95	84	95	88	100	100	**94**
94	U22EC003	AJAY KRISHNA T U	98	94	100	97	100	97	**98**
95	U22EC004	G AJAY KUMAR REDDY	98	100	98	97	92	100	**97**
96	U22EC005	AKASH TULLURI	90	84	93	81	83	97	**88**
97	U22EC006	AKKALA HIMAKARA VENKAT	95	91	98	97	96	100	**96**
98	U22EC007	AKKI NAGA PAVAN KUMAR RI	95	88	100	91	100	100	**96**
99	U22EC008	ALLAM VINAY	93	81	95	91	96	100	**93**
100	U22EC009	ALLAM YASWANTH	98	91	95	100	75	100	**93**
101	U22EC010	ALLU NAVEEN	100	84	95	97	79	97	**92**
102	U22EC011	AMBATI CHANDAN REDDY	98	91	100	100	92	97	**96**
103	U22EC012	AMBATI NAVEEN REDDY	93	88	93	94	96	97	**93**
104	U22EC013	AMBATI SHIVA REDDY	93	91	93	78	92	100	**91**
105	U22EC014	AMRITA .	98	88	95	91	92	100	**94**
106	U22EC015	AMUDALAPALLI LOKESH	95	97	98	78	96	100	**94**
107	U22EC016	ANAKALA NANDA KUMAR	95	91	98	91	79	97	**92**
108	U22EC017	ANCHA GANESH	95	88	98	97	100	97	**96**
109	U22EC102	DEGA SRINU	98	94	98	94	92	100	**96**
110	U22EC132	GANNAMANI MANOHAR KRISI	93	88	100	94	96	97	**94**
111	U22EC133	GANTA MANIKANTA	95	97	88	100	92	100	**95**
112	U22EC134	GILAKA PEDDANNA	93	91	98	94	75	97	**91**
113	U22EC135	GOLAKOTI RAVINDRA SAI KRI	95	88	95	78	88	100	**91**
114	U22EC136	GOLLA DHANASHEKAR	90	91	95	94	83	97	**92**
115	U22EC137	GOLLA PAVAN KUMAR	93	88	100	94	71	100	**91**
116	U22EC138	GOLLAPALLI SATHISH KUMAR	93	91	95	88	100	97	**94**
117	U22EC139	GORANTALA ROHAN	95	94	90	94	75	100	**91**
118	U22EC141	GOSU VINAY	98	94	95	97	75	97	**92**

119	U22EC142	GOTTAPU JAGADEESH	95	91	95	81	96	100	93
120	U22EC143	GUDA REDDY ESWAR REDDY	90	84	100	91	92	100	93
121	U22EC144	GUDDETI SASIKANTH	98	91	90	100	92	100	95
122	U22EC145	GUDE KISHORE BABU	100	84	93	94	100	100	95
123	U22EC146	GUDIVADA HEMANTH	98	97	95	78	100	97	94
124	U22EC147	GUDURI ABHISHEK REDDY	93	91	98	91	92	97	93
125	U22EC148	GUGGILLA VENKATA PRASAD	95	81	98	100	71	97	90
126	U22EC149	GULLA PRASANTH KUMAR	95	84	93	94	75	100	90
127	U22EC150	GUMPULA MAHITA PRITAM	98	94	98	97	92	100	96
128	U22EC151	GUNDRA DHANUNJAY	100	100	100	97	96	100	99
129	U22EC152	GUNNAM ANIL KUMAR	95	81	95	88	75	97	88
130	U22EC153	GUNTURU SANDHYAVALLI	95	91	98	97	100	97	96
131	U22EC154	GURIJEPALLI VINOD KUMAR	95	84	98	88	96	100	93
132	U22EC155	GURRALA MAHESH BABU	98	88	98	97	75	100	92
133	U22EC156	GURRAM NAGA NIHITHA	95	97	93	81	92	100	93
134	U22EC157	GUTAM VENKATESH	98	97	95	94	96	97	96
135	U22EC158	GUTTALASANDU TEJASWINI	95	84	95	91	96	100	93
136	U22EC159	GUTTUR GANESH	100	88	100	94	96	97	96
137	U22EC160	HARI KRISHNAN E	95	88	95	94	100	100	95
138	U22EC161	HARINI G	100	97	98	78	100	97	95
139	U22EC162	INJA SAMARASIMHA REDDY	98	88	95	91	75	100	91
140	U22EC164	JASTHI RAMYASAI	95	78	98	100	79	97	91
141	U22EC165	JILLELLA SISINDAR REDDY	98	97	95	97	96	100	97
142	U22EC166	JUJJURU YADAGIRI	98	84	90	100	75	100	91
143	U22EC167	JUTUR MANASA HARSHINI	100	88	95	75	92	100	92
144	U22EC168	KAKANABOINA VIJAYAMUKT	93	88	95	94	100	100	95
145	U22EC169	KOCHERLA SRI HARSHA	95	94	100	94	100	97	97
146	U22EC170	KADIYALA KARTHIK	98	91	90	91	88	100	93
147	U22EC171	KADIYAM PRAKASH RAJ	98	88	90	100	75	97	91
148	U22EC172	KALA SAI KIRAN	93	88	95	91	83	100	91
149	U22EC173	KALAL ABHILASH KUMAR GO	93	94	93	97	92	100	95
150	U22EC174	KALINGIRI SURENDRA BABU	0	0	0	0	0	0	0
151	U22EC175	KALLAKURI ABHISHEK	98	88	98	97	96	97	95
152	U22EC176	KAMASANI NITHISH	98	91	98	78	100	94	93
153	U22EC177	KAMMARI RAJESH ACHARI	95	91	95	94	96	100	95
154	U22EC178	KANCHARLA VENKATA SUKU	90	94	100	97	83	97	93
155	U22EC179	KANCHETTI GANESH	95	91	90	94	92	100	94
156	U22EC301	NALLA SURESH	100	88	95	100	100	97	97
157	U22EC302	NALLABOTHULA GOWTHAM	100	94	95	94	96	100	96
158	U22EC303	NALLABOTHULA BHARGAV S	98	91	98	94	96	94	95
159	U22EC304	NANDAM VIVEK JOSHI	98	88	90	94	100	100	95
160	U22EC305	NANDAVARAPU DILEEP	98	91	83	97	100	97	94
161	U22EC306	K V NARENDRA	100	100	98	100	92	100	98
162	U22EC307	NARMALA PHANI KUMAR	100	84	98	97	100	97	96
163	U22EC308	NARNAPATI VEERANJANEYUL	95	88	93	97	88	100	93
164	U22EC309	NARREDDY LAHARI	95	94	95	97	88	100	95
165	U22EC310	NARSIPURAM CHIRU	98	81	95	100	71	100	91
166	U22EC311	NAWIN S	95	91	98	100	100	100	97
167	U22EC312	NEMALLAPUDI JASWANTH	95	100	98	81	75	97	91
168	U22EC313	NETHAGANI SREEJA	98	81	98	94	92	97	93
169	U22EC314	NIDADAVOLU NAGA TEJASWI	100	84	98	97	100	97	96
170	U22EC315	NIGIDALA VAMSI VARMA	93	94	100	100	92	100	96
171	U22EC316	NITHISH M	98	91	88	78	96	100	92
172	U22EC317	NIVEDHA D	95	81	100	97	96	100	95
173	U22EC318	PADAMALA MAHESH	98	84	93	94	88	97	92
174	U22EC319	PADMANABHAN S	100	88	98	97	88	97	94
175	U22EC320	PAILA REVATHI	98	84	98	100	96	100	96
176	U22EC321	PAKANATI BHARATH KUMAR	95	94	98	97	96	97	96
177	U22EC322	PAKANATI SADA SIVA REDDY	100	100	95	100	96	100	98
178	U22EC323	PALEM HEMANTH SAI	95	84	98	97	96	97	94
179	U22EC325	PALLE POLI REDDY	95	91	98	100	96	100	96
180	U22EC326	PALLE PRAMOD REDDY	100	88	98	97	71	97	92
181	U22EC327	PALLEM YASWANTH KUMAR	95	91	98	100	100	94	96
182	U22EC328	PALLERLA ROHITH KUMAR R	98	78	100	94	88	97	92

183	U22EC329	PALVARI VAMSHI KRISHNA	95	91	95	97	96	100	**96**
184	U22EC330	PANDARABOINA MAHESH	100	84	100	100	100	97	**97**
185	U22EC331	PAREPALLI SAI GANESH	100	97	98	94	100	100	**98**
186	U22EC332	PASUPULETI DAMODHAR NAI	100	94	98	100	100	100	**99**
187	U22EC333	PATAN KHAJA VALI	100	84	98	94	96	100	**95**
188	U22EC334	PATCHAVA LAKSHMI NARASI	95	81	100	97	88	100	**93**
189	U22EC335	PATHI GNANENDRA NAIDU	98	97	95	100	88	97	**96**
190	U22EC336	PEDAMALLI PRASANTH REDD	100	97	100	81	92	97	**94**
191	U22EC337	PEDDAKOTLA CHANDU PRAK	93	81	98	100	100	97	**95**
192	U22EC338	PEDDAMAR BHAGYA SRAVAN	95	94	100	97	92	100	**96**
193	U22EC339	PEDDAPUDI JAGADEESWAR R	98	97	98	100	96	100	**98**
194	U22EC340	PEMMASANI V L N ADITYA CH	100	97	98	97	71	94	**93**
195	U22EC341	PERAM SIVA MALLESWAR RE	95	88	95	100	92	97	**94**
196	U22EC342	PERUBOINA PURNA SAI NAVE	95	91	98	94	100	100	**96**
197	U22EC343	PERUGU SATHISH	98	97	98	94	96	100	**97**
198	U22EC344	PILLA VENKATA RAMCHARAN	95	88	98	100	88	97	**94**
199	U22EC345	PILLIKANDLA HEMANTH	98	88	98	94	96	100	**95**
200	U22EC346	PINJARI KABULA	95	94	100	97	100	97	**97**
201	U22EC403	SHARMILA K	95	91	95	94	96	100	**95**
202	U22EC484	DASOJU HARIKRISHNA	98	91	98	97	100	97	**97**
			95	**89**	**96**	**93**	**91**	**98**	**94**

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(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)

BTECH ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC YEAR 2022-2023 (TERM I) - ENGINEERING CHEMISTRY - U20CYBJ01

DIRECT ATTAINMNET

CO's	CO1	CO2	CO3	CO4	CO5	CO6
Average Mark	95	89	96	93	91	98
No.of students above average	104	111	112	152	134	110
Total no. of students	202	202	202	202	202	202
% CO attainment	**51**	**55**	**55**	**75**	**66**	**54**

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BTECH ELECTRICAL AND ELECTRONICS ENGINEERING
ACADEMIC YEAR 2022-2023 (TERM I) - ENGINEERING CHEMISTRY - U20CYBJ01
CO INDIRECT ATTAINMNET - SURVEY REPORT

CO	No. of 5's	No. of 4's	No. of 3's	No. of 2's	No. of 1's	CO%
CO1	110	62	15	10	5	**90**
CO2	111	63	11	11	6	**93**
CO3	118	50	17	9	8	**90**
CO4	115	55	13	10	9	**88**
CO5	117	48	19	10	8	**90**
CO6	116	49	16	14	7	**81**

CO ATTAINMENT

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BTECH ELECTRONICS AND ELECTRICAL ENGINEERING
ACADEMIC YEAR 2022-2023 (TERM I) - ENGINEERING CHEMISTRY - U20CYBJ01
CO ATTAINMENT

	MARKS ALLOTTED					MARKS OBTAINED						END SEMESTER EXAM									
CO	AT1	AT2		A1	A2	AT1	AT2		A1	A2	CO ATTAINMENT AVERAGE FROM ASSESSMENT TEST	MARKS ALLOTTED	MARKS OBTAINED	CO ATTAINMENT AVERAGE FROM END SEMESTER EXAM	DIRECT CO ATTAINMENT	INDIRECT CO ATTAINMENT (OBTAINED FROM EXIT SURVEY)	TOTAL CO ATTAINMENT (%)	TARGET [CLASS AVERAGE] (%)	CO ATTAINMENT GAP [TARGET - ATTAINMENT](%)	Actions Proposed to bridge the Gap (Gap >0)	Modification of Target when achieved(Gap <=0)
CO1	16			4		15			4		96	20	19	96	96	90	95	92	-3	Target Attained	Target Increased to 96
CO2	8	12				6.5	11				88	12	11	92	90	93	90	88	-2	Target Attained	Target Increased to 92
CO3	18			2		17			2		95	20	20	98	96	90	95	92	-3	Target Attained	Target Increased to 96
CO4	14					14					96	18	16	89	93	88	92	90	-2	Target Attained	Target Increased to 94
CO5	10					9.5					95	14	12	86	90	90	90	87	-3	Target Attained	Target Increased to 92
CO6	6	6		4		6	5.5		4		97	16	16	97	97	81	94	91	-3	Target Attained	Target Increased to 95

CLA II - SAMPLE ANSWER SHEETS

T. Sree Lakshmi

T. Sree Lakshmi
Register Number :- U21CN248
Section - CSE - L

Bharath Institute of Higher Education & Research
DEAN
Science & Humanities
Chennai - 600 073, Tamil Nadu

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PART - A

1) (d) $1s^2 2s^2 2p^4$

2) (b) ~~(Hund's rule of maximum multiplicity)~~ Heisenberg Uncertanity principle

3) (a) $d_{x^2-y^2}$

4) (b) Fe^{2+}

5) (d) All

6) (c) $CH_2=CH-CH=CH_2$

7) (a) Cosmic rays

8) (b) 400nm to 800nm (c)

6

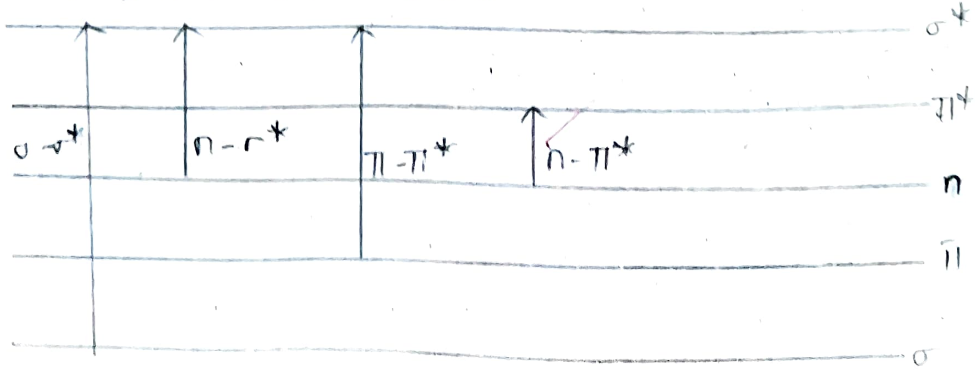
PART - B

9a) Transition states in uv spectroscopy

*Absorption of energy in u-v rigion by the molecules cause the transistion of valence e-ns in the molecules

* $\sigma-\sigma^*$, $n-\sigma^*$, $\pi-\pi^*$, $n-\pi^*$

$\sigma-\sigma^* > n-\sigma^* > \pi-\pi^* > n-\pi^*$



$\sigma-\sigma^*$ transistion :-

It occurs in the compound having all electrons are involved

Ex:- CH_4, C_2H_6 etc are saturated

$n-\sigma^*$ transistion :-

It occurs in saturated compounds having lone pair of electrons

Ex:- $(CH_3)N$

$\pi-\pi^*$ transistion :-

It occurs in any molecules having π electron system

Ex:- Alkenes, Alkyl

$n-\pi^*$ transistion :-

It occurs in unsaturated compounds having lone pair of electrons

Ex:- Aldehydes, Ketones.

10a) Fundamental vibratitions of H_2O and CO_2 in IR Spectroscopy

H_2O :- * H_2O is a bending, non-linear, triatomic molecules

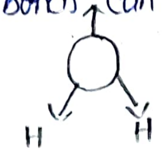
* It has $3n-6 \Rightarrow 3\times3-6 = 9-6 = 3$ (fundamental Vibrations)

↳ No. of atoms

They are
1) Symmetric streching
2) Asymmetric streaching
3) Bending Vibration.

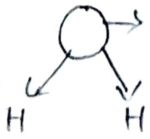
1) Symmetric streaching:-

Both bonds can expand and contrast at the same time



2) Asymmetric streaching:-

One band is expand and another bond undergo contrast



3) Bending Vibration:-

Bond angle changed causes the bending vibratition.

CO_2 :- * CO_2 is linear and triatomic molecule

* It has 3n-5 = 3×3-5 = 9-5 = 4
↳ No. of atoms

They are 1) Symmetric streaching
2) Asymmetric streaching
3) In-plane streaching → Scisscoring → Rocking
4) Out-of plane streaching → Wagging → Twisting

1) Symmetric streaching :- No dipolemoment takes place which (causes the IR inactive, so they) does not produce IR spectrum, so they are IR inactive.

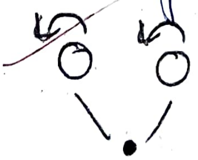
2) Asymmetric streaching :- Dipolemoment takes place which produces IR spectra, so they are IR active

3) In-plane streaching :→ Scissoring
→ Rocking
Dipole momevent takes place and IR active

4) Out-of plane streaching :→ Wagging
Twisting
Dipole moment takes place and IR active

Scissoring

Rocking



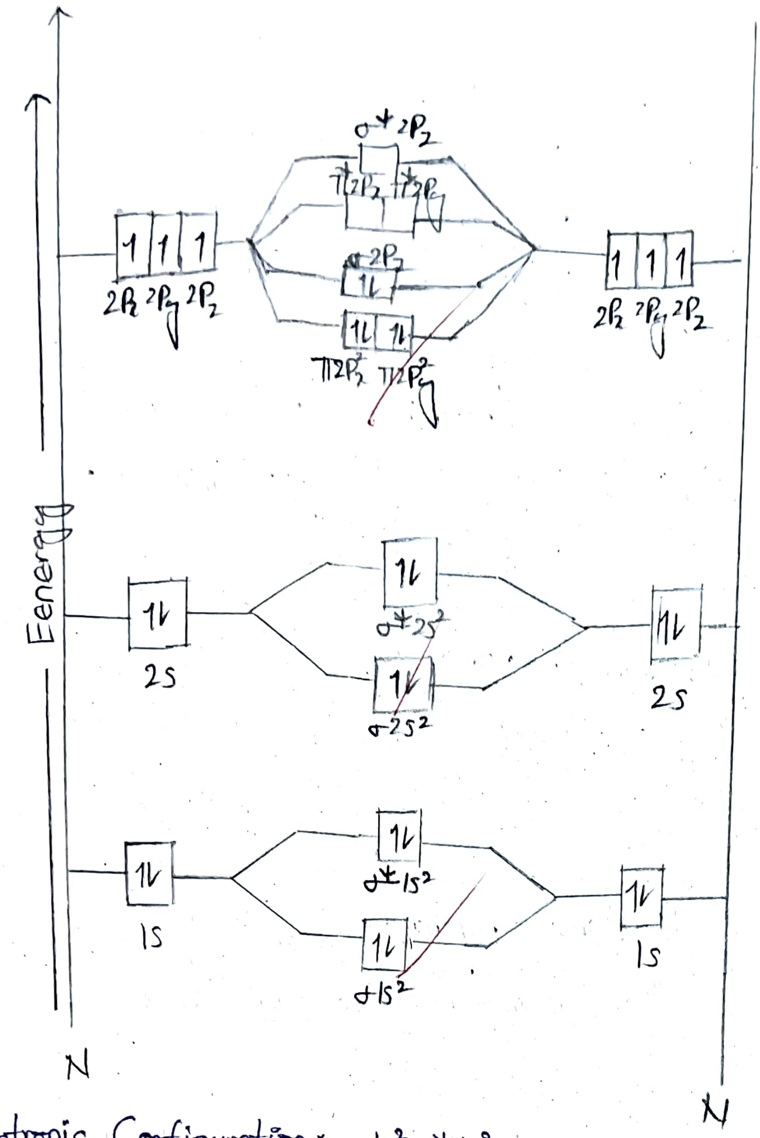
Wagging

Twisting

PART–C

11 a) N_2 :-

Atomic Number = 7 ⇒ $1s^2 2s^2 2p^3$



Electronic Configuration :- $\sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, (\pi 2P_x^2 = \pi 2P_y^2) \sigma 2P$

Bond order :- $\frac{1}{2}(N_b - N_a)$

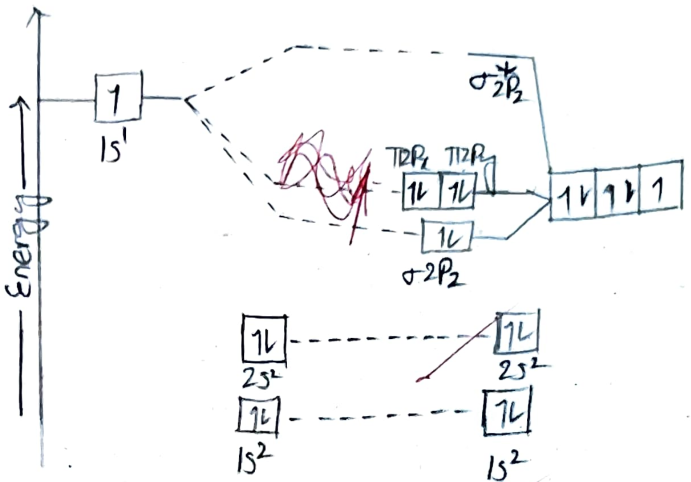
$= \frac{1}{2}(10-4)$

$= \frac{6}{2} = 3$

Magnetic Nature :- It has no lone pair of electrons, So it is a <u>Diamagnetic</u>

T. Sree Lakshmi
Register Number:-
U21CN1248
Section:- CSE-L

HF :- H :- $1s^1$
F :- $1s^2 2s^2 2p^5$



Electronic Configuration :- $1s^2, 2s^2, \sigma\text{-}sP_z (\pi 2P_x = \pi 2P_y)$

Bond order :- $\frac{1}{2}(2-0) = 1$

:- $\frac{2}{2} = 1$

Magnetic Nature :- Since it has no lone pair of electrons it is **Diamagnetic**

Name → Mijanur Rahaman

Roll No → U21CS 490(G)

Subject → Engineering Chemistry

Bharath Institute of Higher Education
DEAN
Science & Humanities
Chennai - 600 073

part - A

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1) [d]

2) [b]

3) [a]

4) [c]

5) [d]

6) [c]

7) [b]

8) [c]

8

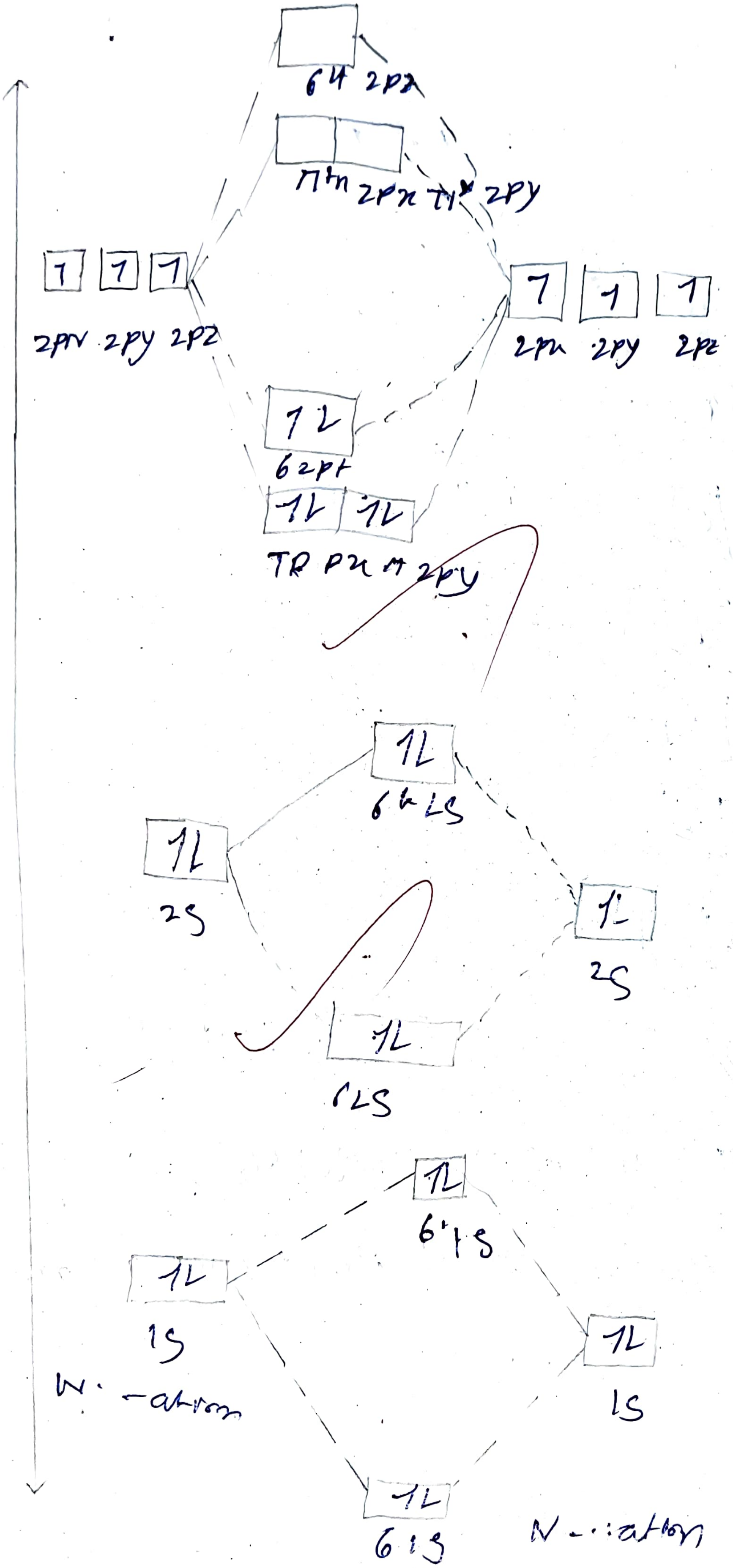
---

9) Th

~~part-B~~ part - C

11) ⓐ NOT of N_2 molcable

elctrone configrytion of N is $1s^2 2s^2 2p3$


6* 2pz
π*n 2px π* 2py
2px 2py 2pz
2px 2py 2pz
6 2pz
π 2px π 2py
6* 2s
2s
2s
6 2s
6* 1s
1s
1s
6 1s
N: -atom
N -: atom

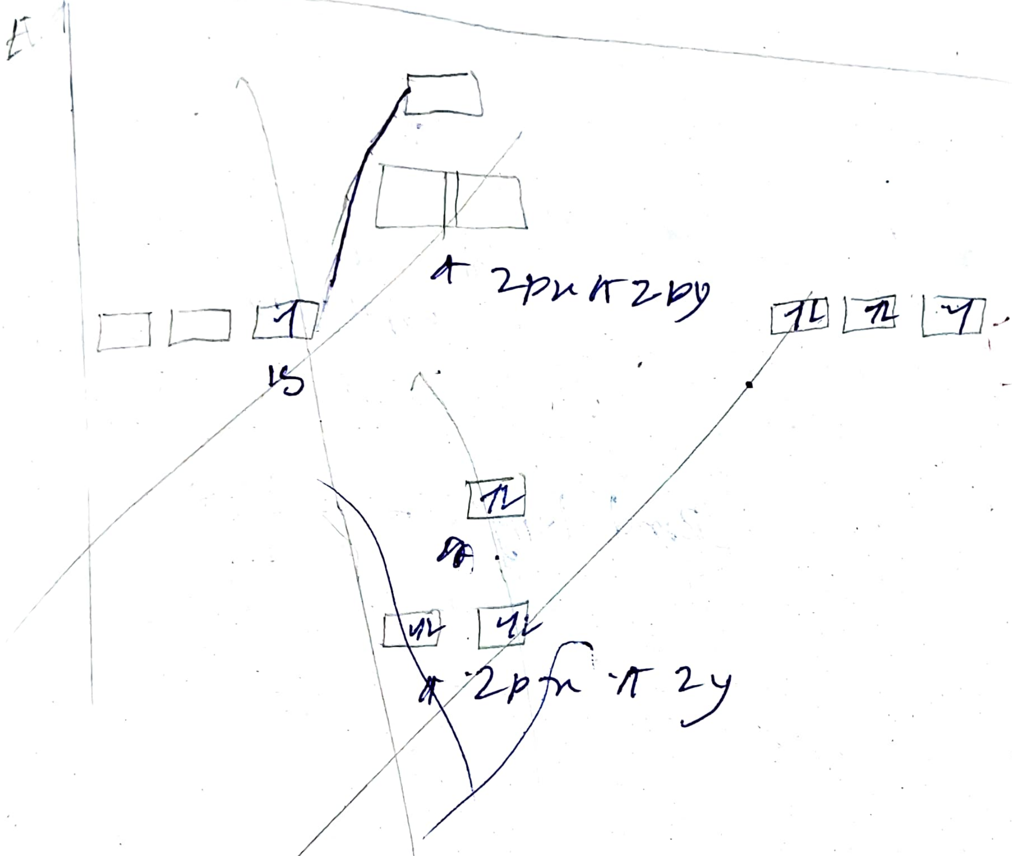
Bond length $= \frac{6}{2} = 3$

$= 3$

I_2 is Diamanatic.

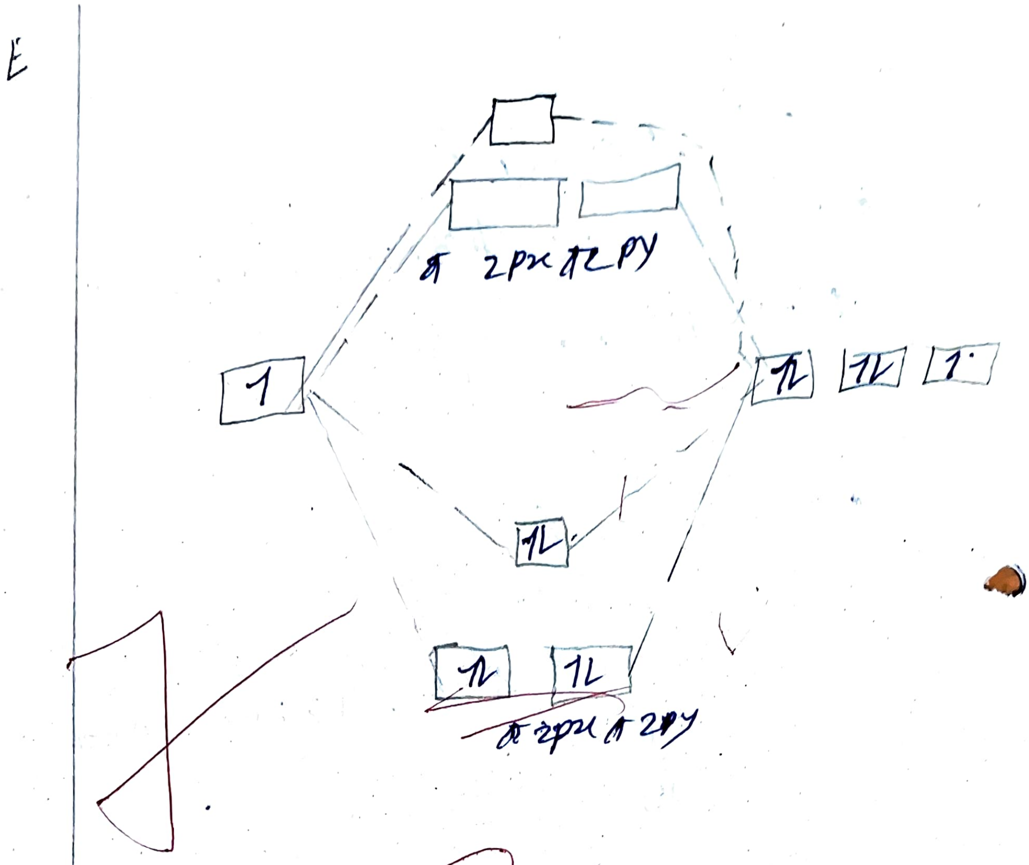
electronic configuration of I_2 is same

F · $1s\ 1s^2\ 2s^2\ 2p^5$.



Bond length $= \frac{2-0}{2}$

$\boxed{= 1}$



Bond ~~length~~ = $\frac{2-0}{2}$

$\boxed{= 1}$

A. Nithin
U21CS009
CSE - A
Sub:- Chemistry

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Part - A

~~30~~

30

1A B

2A D

3A B

4A D

5A D

6A C

7A B

8A D

8

V. Gopal

Part - B

9
9
A

Chemical shift:-

* No of signals and Position plays major role in NMR spectoscopy

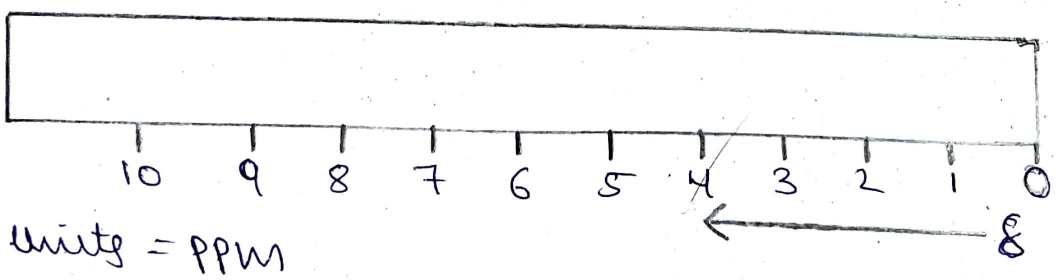
* by knowing the position of proton we can determine the nature of the compound

* diffrent protons have diffrent electronic envoronment.

* due to the variation in the electronic envoronment it absorbs diffrent magnetic field.

chemical shift scale:-

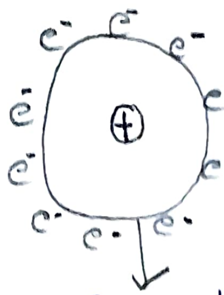
* we use del scale.



* units = PPm

* It goes from right to left.

* when an atom is placed in an external magnetic field a secondry magnetic field is formed by the electrons



* if the scondary magnitic field oposes the eternal magnetic field then it said be shilded atoms. then the ~~atom~~ signal ~~goes~~ shift toup field.

* If the sciondry magnetic field accept the eetrnal magnetic field then the signal shifts to down field.

* the shifting of up field and down field is termed as chemical shift

Increasing order of chemical shift:-

(i) $CH_2Cl < CHCl_2 < CHCl_3$

(ii) $(CH_3)_4Si < CH_3Br < CH_3OH$

10

10 B

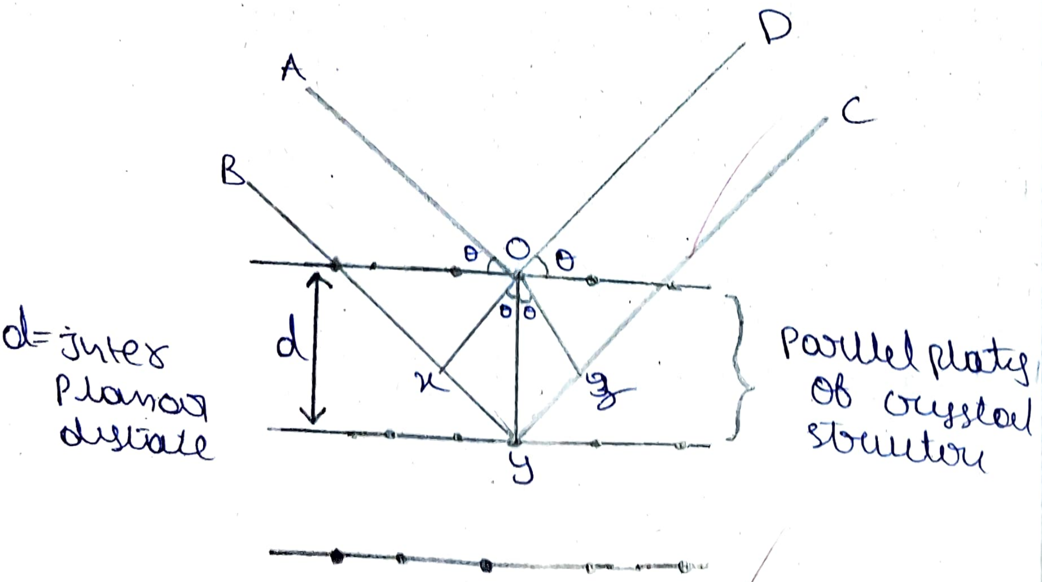
(A)

Bragg's law in XRD spectroscopy:-

* X-ray difraction technique is used for the determinal of structure of any given Crystaline structure

* it Based on the concept of Bragg's law.

* suppose a beam of X-ray fall on the Crystaline structure ~~sum of it rays~~ at glancing angle (θ) sum of the rays will be reflected from the crystal surface outer plate at same angle.



Now the angle ∠xoy = θ

the distance between AO and Bx is equal

$\Rightarrow AO = Bx$

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* Similarly the distance Between DO and CZ is equal

$\Rightarrow DO = CZ$

* Path diffrence is $xy + yz$ — ①

* The path diffrece is equal to integral Multiple of wave length ($n\lambda$) — ②

From ① and ②

$$n\lambda = xy + yz$$

WKT $\sin\theta = L/H$

From Δxoy

$$\sin\theta = \frac{xy}{oy} \Rightarrow xy = oy \sin\theta$$

$$\Rightarrow xy = d\sin\theta \quad — ③ \qquad (\because oy = d)$$

||ly from Δzoy

$$\sin\theta = \frac{yz}{oy} \Rightarrow yz = d\sin\theta \quad — ④$$

from ③ and ④

$$n\lambda = d\sin\theta + d\sin\theta$$

$$\boxed{\therefore n\lambda = 2d\sin\theta}$$

n = order of difraction, λ = wave length

θ = glancing angle.

part-C

11 a

A

* Polarizability:-

→ $\mu_i = \alpha E$

* where α is polarizability of a molecule.

* Polarizabitity is defined as the amount of dipole moment induced per unit strength of field app.

Periodic trends:-

* Across the period

→ The Polarizibility of a molecule is decresed

* down the group:-

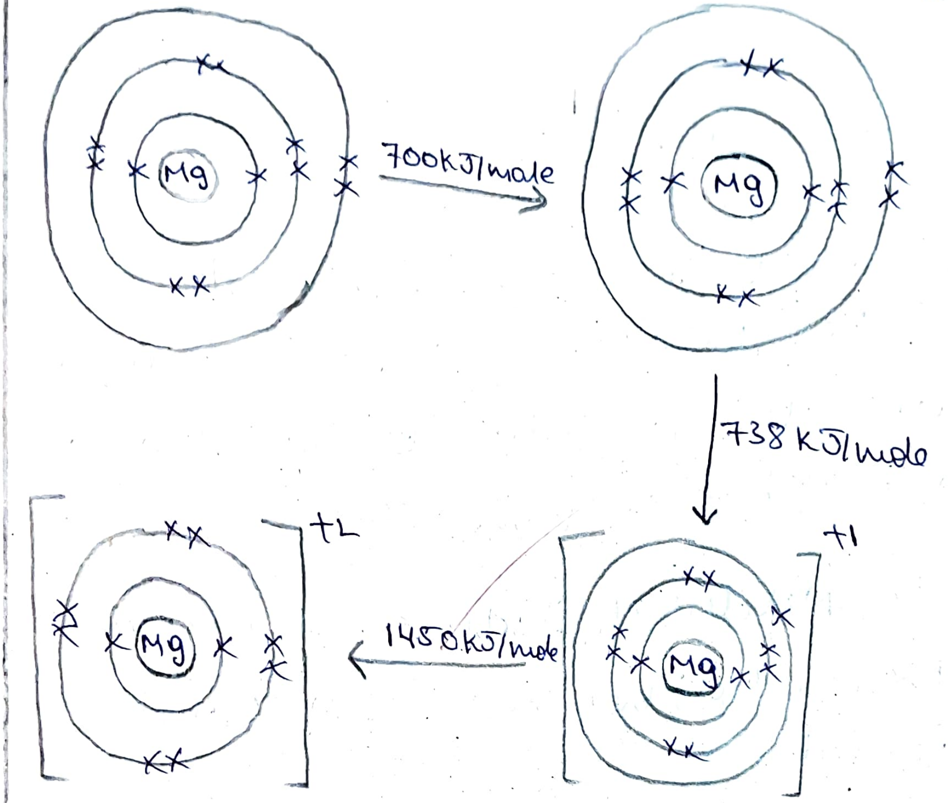
→ The polarizibility of a molecule is increased down the group.

Ionisation Energy:-

* The minimum amount of energy required to remove a valency electron from the atom is termed as the ionisation energy.

eg:- $Mg \longrightarrow Mg^{+1} \longrightarrow Mg^{+2}$

eg:- Mg – 12



Periodic trengs:-

Across the period:-

* Atomic radius decreases
* Ionisation Energy increases.

down the group:-

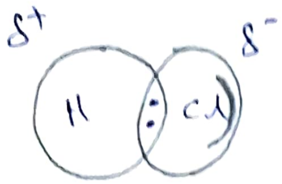
* Atomic radius increases
* Ionisation energy decrease.

Electronegitivity:-

* The tendency of an atom to attract shared pair of electrons towards it self in covalent Bond

eg:

* Hcl



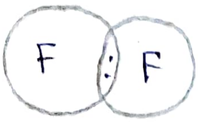
* in the molecule of Hcl. the nucleus of the Hcl chlorine attract highly, which cause the formation electron cloud around the chlorine atom

* the nucleus of Hydrogen weakly attract the nucleus here there is no electron cloud formation

* here polar Bond forms between H and cl due to presence of δ^- and δ^+

eg-2

F = 9



* here the both nucleus attracts the electron with same energy.

* here there is no electron cloud for perticular atom.

* here the cloud forms in between the atoms.

* here forms non polar Bond ~~cov~~ because there is no δ^+ and δ^-

7/2/16

Periodic trends:-

Across the period:-

- Atomic radius decreases.
- Electro Negitivity ∝ Nuclear energy.
- As nuclear energy increases Electro Negitivity increases.

down the group:-

- Atomic radius ~~decreas~~ increases.
- $EN \propto \frac{1}{AR}$
- As Atomic radius increases Electro Negitivity decreases.

10

24/06/22

CLA-2 [Term-2]

T. Anjani
U21CS024
CSE-A

Engineering Chemistry

[U20CYBJ01]

24/6

2/30

11.(a)

1. **Polarizability:**

Polarizalility is defined as how much energy required for an anion to distort or disperse the cation is called polarizability.

- polarizability increase with increase in size of the ~~atom~~ anion.
- polarizability increase with increase in charge of anion.

Periodic Trends:

- Periodic trends of Polarizability are:
- across the period the column increases, when this increases, the cation size also increases.
- down the group decreases, when this decreases the cation size also decreases

2. Ionization Energy:

Ionization energy is the energy required to remove one mole of ion from one mole of atom in the Gaseous state.

Peroidic trends:

- Ionization energy increases across the period. As it increases it will be difficult to remove the electron as the ionization energy ~~will~~ is high.

- Ionization energy decreases down the group. As it decreases it will be easier to remove electrons as the ionization energy ~~it~~ is low.

3. Electronegativity:

Electronegativity of an atom is defined as the energy absorbed or released when electron is added to the atom ~~is~~ ~~calle~~ in gas state is called electro-negativity.

Periodic trends:

- Increases across the period
- Not at all alo

×

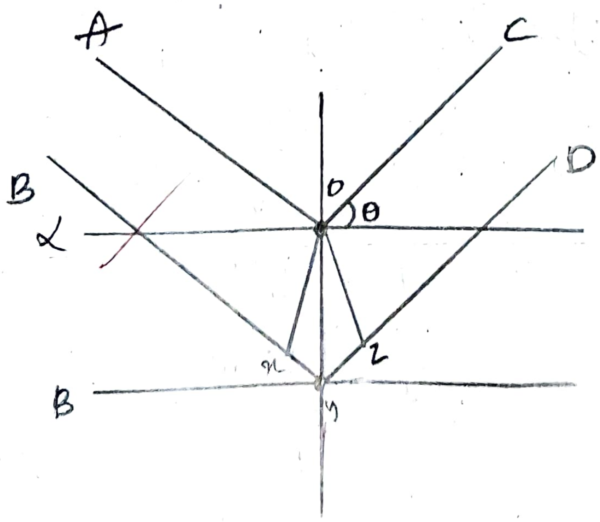
- Across the Period, the electronegativity increases.
- down the group, the electronegativity decreases.

Part-B

10.b **Bragg law of XRD:**

* This is used for the structural construction of the crystalline structure.

* When a beam of light X-rays falls on a upper plate few X-rays are rejected.



Angle of $\angle xoy = \theta$

Similary $\angle yoz = \theta$

distance between the ray AO = Bx

Similarly CO = DZ

Path difference = $xy + yz$ ---①.

Path difference is defined as a integral multiple

$$n\lambda = xy + yz \rightarrow ②$$

now lets the general folm of sinθ

$\Delta xoy \Rightarrow \sin\theta = \frac{L}{H}$

$$\sin\theta = \frac{xy}{oy}$$

$$xy = oy \sin\theta$$

$$xy = d\sin\theta \rightarrow ③$$

from $\Delta yoz \Rightarrow \sin\theta = \frac{L}{H}$

$$\sin\theta = \frac{yz}{oy}$$

$$yz = oy\sin\theta$$

$$yz = d\sin\theta \rightarrow ④$$

24/06/22

CLA-2[Term-2]

Engineering Chemistry

[U20CYBJ01]

T.Anjani

U21CS024

CSE A

①

Sub 3 and 4 in ②

$$n\lambda = d\sin\theta + d\sin\theta$$

$$\boxed{n\lambda = 2d\sin\theta}$$

∴ The above is the equation for Bragg's law in XRD

9.(a)

1. increasing order

$CHCl_3 < CH_2Cl_2 < CH_3Cl$

2. increasing order.

$CH_3Br < CH_3OH < (CH_3)_4Si$

* No.of signals & position of electrons play a key role on NMR.

* As moving the position we can understand the nature of compound.

Part-A

1. [B]

2. [D]

3. [C]

4. [A]

5. [D]

6. [C]

7. [D]

8. [D]

5

CLA-III [SET-A]

U20CYBJ01 - ENGINEERING CHEMISTRY

HOD CHEMISTRY

Name:- Dayam. Sri Harsha

Regd No and Sec:- U21CS169 & "CSE-C'

III PART-C

11 b. Treatment of ~~municipal~~ water for municipal supply:-

Various stages in treatment of water for domestic use.

1. screening
2. Aeration
3. sedimentation
4. coagulation
5. Filtration
6. sterilization or disinfection
7. storage and supply.

V good

Harsha

Municipal water treatment for domestic use:-

Municipal water involved in following purification process of water these:-

Source of water

↓

screening

↓

Aeration

↓

sedimentation

↓

coagulation

↓

Fitration

Diels alder reaction.

↓,

| sterilization (or) disinfection |

1 screening:-

⇒ The process of removing the floating material in water is called screening.

⇒ The floating materials like leaves, wood, pieces are removed by screening.

⇒ the raw water flows through the screening (or) screen, the screen having large number of holes which retain the floating materials and passed. allow to water flow.

2 Aeration:-

⇒ The process of mixed water with air to water which oxygen O_2 and other chemical gases like CO_2, H_2S etc.. are removed and the salts Fe^{+2} and Mn^{+2} are removed which are ~~not~~ dissolved hydroxide salts in water.

⇒ The removing of other gas like CO_2, H_2S etc which are causing bad taste and odour to water.

3. Sedimentation:-

⇒ The process of removing suspended impurities [large particles] in water which are ~~setd~~ allow water to stand for 2-6 hours in a big tank.

The suspended particles are settled down at the bottom and the force of gravity, it can be removed.

⇒ ~~Set~~ Sedementation process removing only 75% (percentage) of suspended impurities.

4. coagulation:-

⇒ Finely divided sand, soil and particles which are not removed by sedimentation.

⇒ The ~~find~~ Finely divided suspended particles can be removed by coagulation.

⇒ In Water, chemical agents are added called coagulants, like alum, [illegible] etc.....

⇒ The alum (or) other coagulants added to Water, ~~the~~ it hydrolises to $Al(OH)_3$.

⇒ The $Al(OH)_3$ reacts with suspended particles and settle down at the bottom.

⇒ By applying the force of gravity, the suspended particles in the bottom (precipitate) get removed.

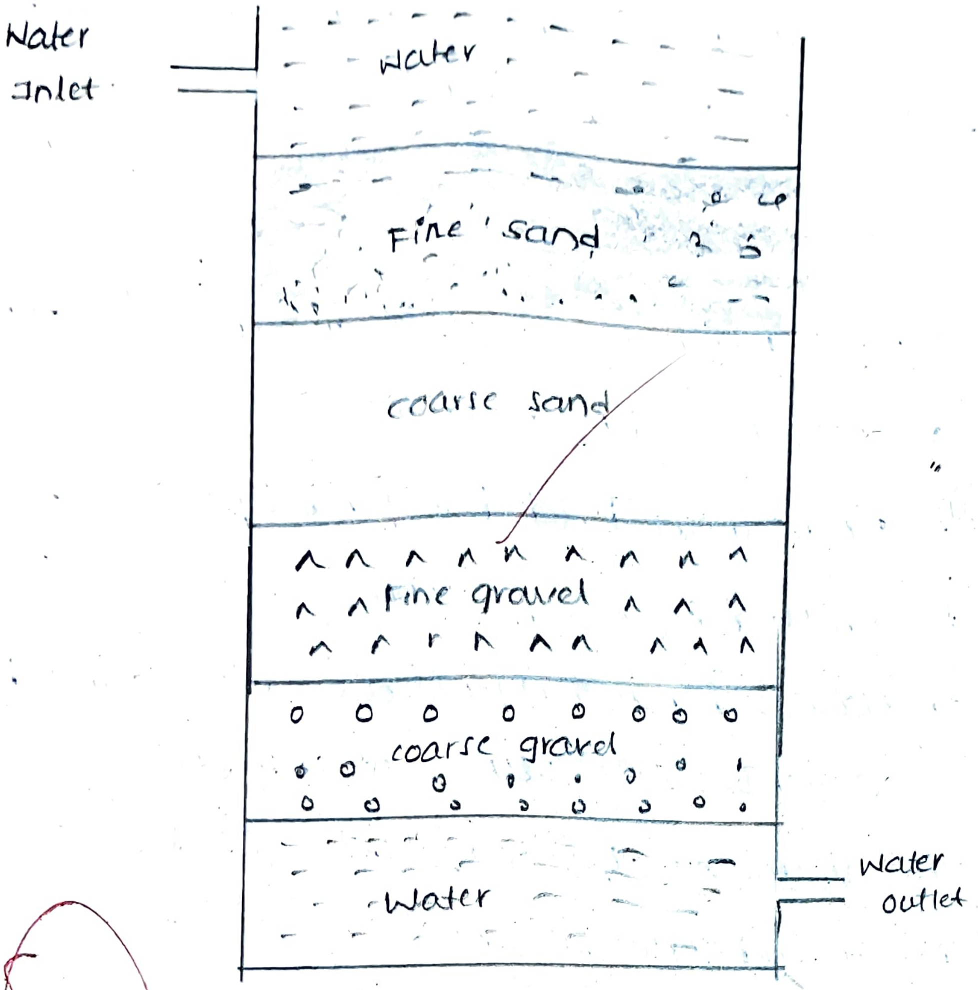
⇒ so, the process of removing Finely divided suspended particles is called coagulation.

5. Filtration:-

⇒ The process of removing mixture of collodial particles and suspended particles in water

Filtration.

⇒ such as fine sand, coarse sand and gravel.



Filtration process.

6. sterilization :-

⇒ The process of killing the patheogens.

⇒ For killing the patheogens in water by adding chemical To the water are called Infectants.

⇒ so, the process of killing patheogen is called sterilization

⇒ sterilization process can be done by

i. chlorination

10 ①

ii. Boiling water

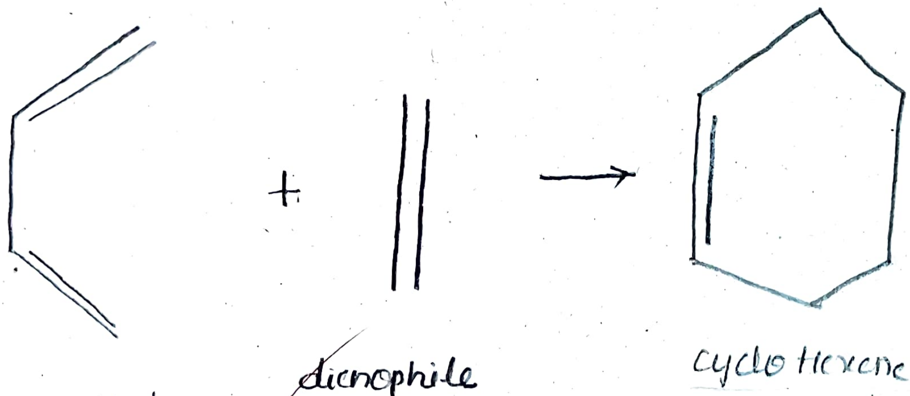
iii. Ozonisation

II. 10 a.

Diel's - Alder reaction :-

Diel's - Alder reaction is the reaction between conjugated diene and a ~~stimulated~~ substituted alkene which is known ~~as~~ (or) termed as dienophile to form a cyclic Hexene system.

- * conjugate Diene
  - → Having alternate double bonds
- * Dienophile
  - → Having love (or) affection with the diene.



conjugated diene

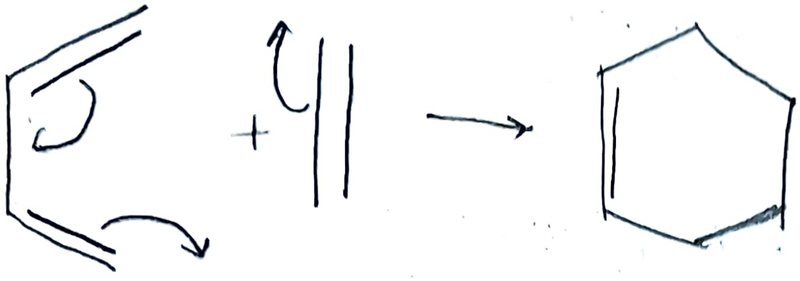
dienophile

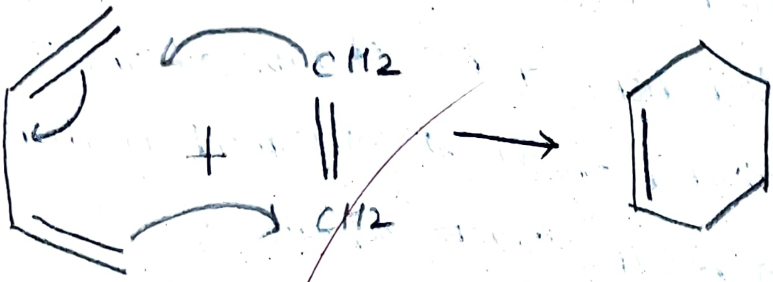
cyclo Hexene

→ the reaction takes place in single step.

→ So, the reaction takes place between conjugated diene and dienophile to form cyclo hexene is Diel's alder reaction.

Mechanism:-



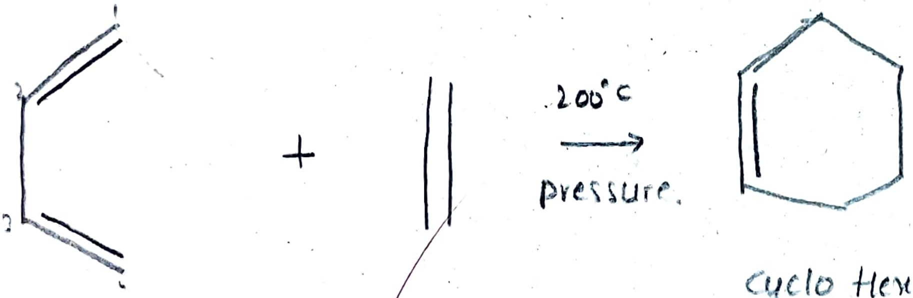


conjugated diene

ethylene

Examples:-

i.

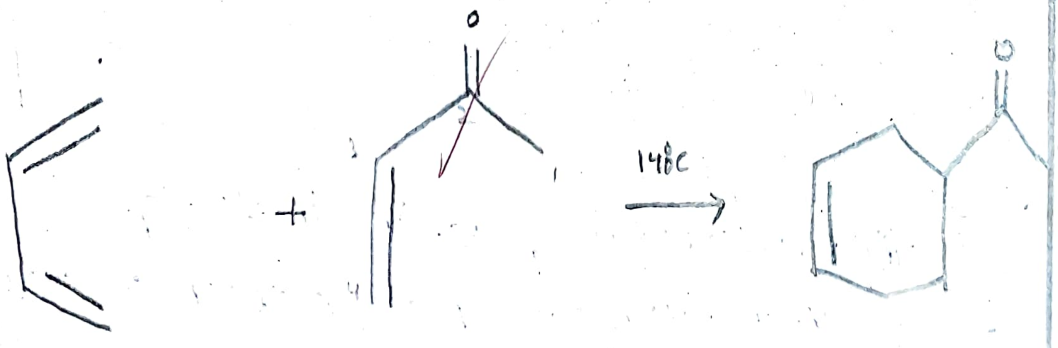


1,3 buta diene

ethylene

cyclo Hexene.

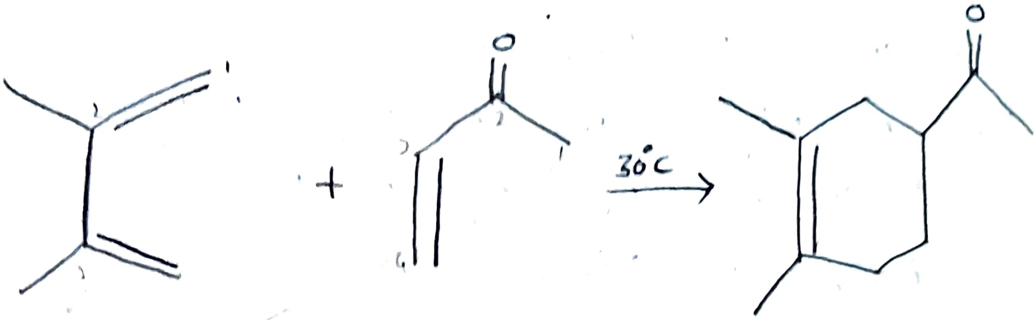
ii.



1,3 buta diene

3- butaen - 2-one

iii.



2,3 dimethyl-
1,3 buta diene

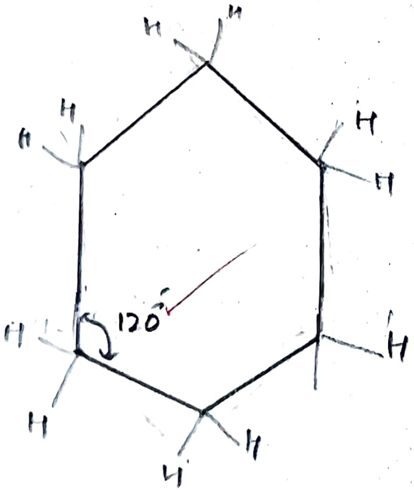
3-buta-en
2-one

II PART-B

9 (b) conformational Analysis of cyclo Hexane:-

⇒ Molecular formula of cyclo Hexane is C_6H_{12}

→ It contains 6 carbon atoms and 12 hydrogen atom arranged in a cyclic structure.



cyclo Hexane.

⇒ For alkane,

→ sp^3 hybridisation

→ Bond angle is 109.5°

→ Tetrahedral in shape.

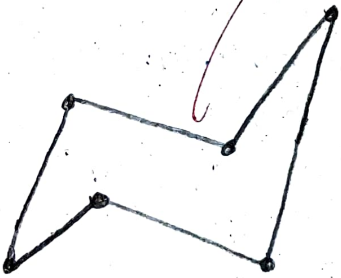
Here, cyclo hexane bond ange is 120°. so, cyclo hexane having angle strain.

⇒ In order to reduce the angle strain of cyclo hexane to angle of tetrahedral of 109.5°. doing conformation.

Types of conformation :-

1. chair conformation
2. Boat conformation
3. Twisted Boat conformation
4. Half-chair conformation.

1. chair conformation :-



chair form

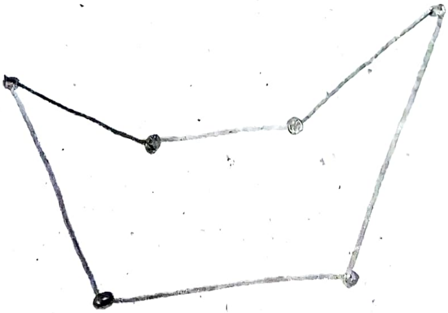
⇒ Low energy
⇒ Highly stable.
⇒ staggered form

2. Boat conformation :-

⇒ High energy

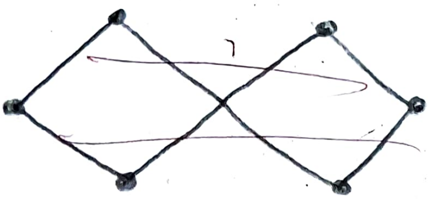
⇒ Less stable

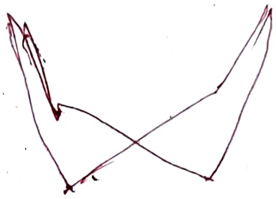
⇒ eclipsed form



Boat

3 Twisted Boat conformation:-

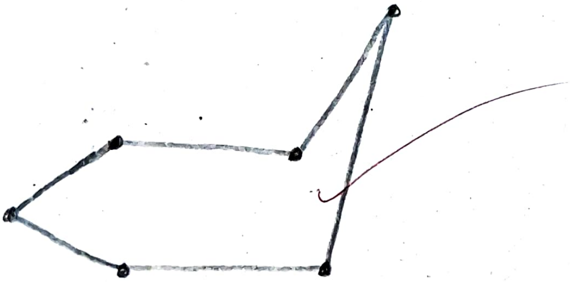




⇒ carbons in different plane.

⇒ so, they having angle strain

4 Half-chair conformation:-



Half chair form

⇒ Less energy   High Energy

⇒ More stable.   Less stable

According to stability order,

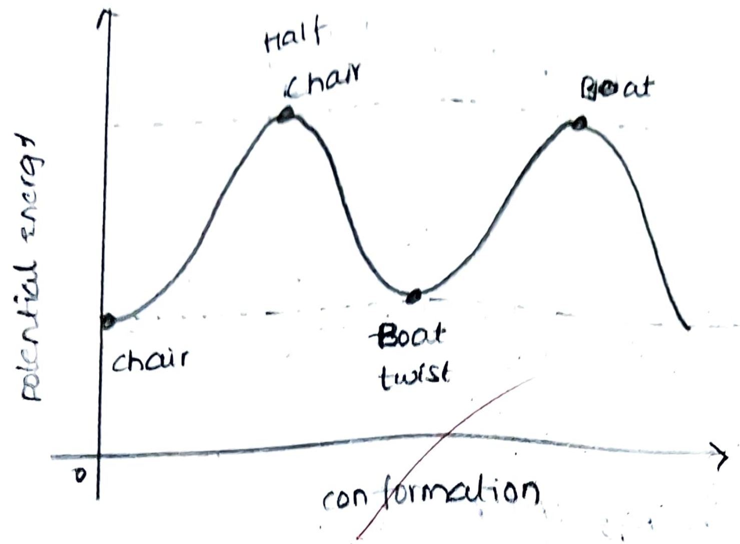
chair > Twisted boat > boat > Half chair

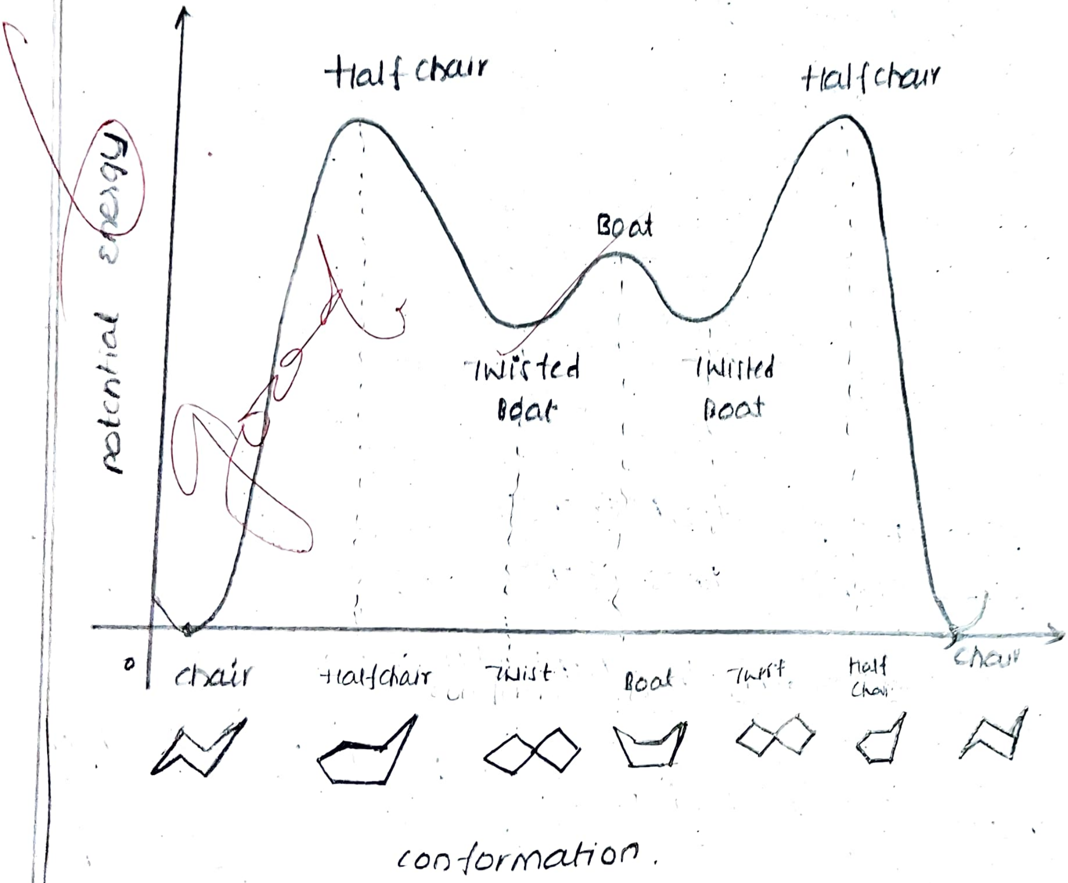
High stable ← Low stable

According to energy:-

chair < twisted boat < boat < Half chair

Energy level diagram :-





PART-A :-

1 [B] Internal Energy.

Isothermal, $dT=0$

Isobaric, $dP=0$

Isochoric, $dV=0$

adiabatic, no loss

cyclic, $dq=0$

2 [D] pressure cooker

open system :- water heater, Tea cup.

Isolated system : thermoflask.

closed system :- pressure cooker, utensil

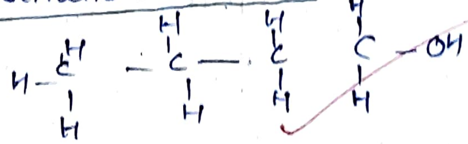
3 [C] Cr^{+6}

~~According~~ to spectrochemical

4 [a]

5 [4] C-4 constitutional isomers

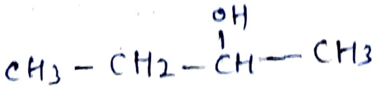
Butanol



$H-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}-OH$

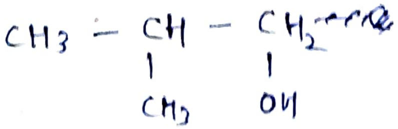
→ C_4
→ H_{10}
→ O_1

Butanol $CH_3-CH_2-CH_2-CH_2-OH$



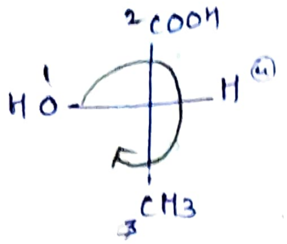
$CH_3-CH_2-\overset{OH}{CH}-CH_3$

$CH_3-\overset{OH}{\underset{CH_3}{C}}-CH_3$



$CH_3-\underset{CH_3}{CH}-\underset{OH}{CH_2}$

6 [b] (S)- isomer



O – High oxidat atomic [illegible]

clock wise – R

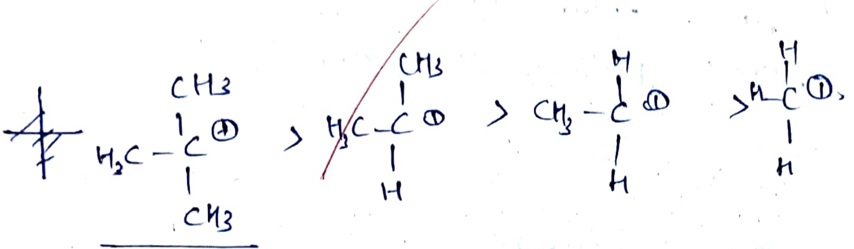
Anticlockwise – S.

clock wise direction – R isomer

but H is in Horizontal plane. It convert into vertical plane by flipping.

∴ so (R) isomer ⟶ (S) isomer

7 [d] Tertiary.



More stable ⇒ 3° > 2° > 1° > methyl carbo cation.

8 [D] PDC

Oxidising agents :-	Weak	Strong
	PCC	H_2SO_4
	PDC	H_2CrO_4

Reducing agents :-

$LiAlH_4$
$NaBH_4$
Pd

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M.Ramanjaneyareddy
CSE-G
Eng. Chemistry

16/20

1+1+1+0+1+1+0+1 => 6

6
9a 2
9b 2
11a 6
16

PART-C

11a) wet corrosion:

=> It is also known electro chemical corrosion. such that it is due to flow of electrons from the anodic and cathodic through the corrosion.

wet corr) electro chemical corrosion

* wet corrosion occurs under the following conditions:

=> when the dissimilar metals occurs by the one part of anodic and another part of the cathode by the aquous solution presence in the corrosion section.

=>

condition for the wet corrosion:

=> The above following conditions to occur wet corrosion. The one part of the anodic through the another part of the ~~ea~~ cathodic.

Cation exchange:

=> The acids are involved in this catholic exch and that is dil. acid.

=> When RH3 compond React with Chloride and sulphide forms acid this process is known as catholic exchange.

Ex:-

1) $RH_2 + CaCl_2 \longrightarrow RCa + 2HCl$

2) $RH_2 + HgSO_4 \longrightarrow RMg + H_2SO_4$

3) $RH + NaCl \longrightarrow RNa + HCl$

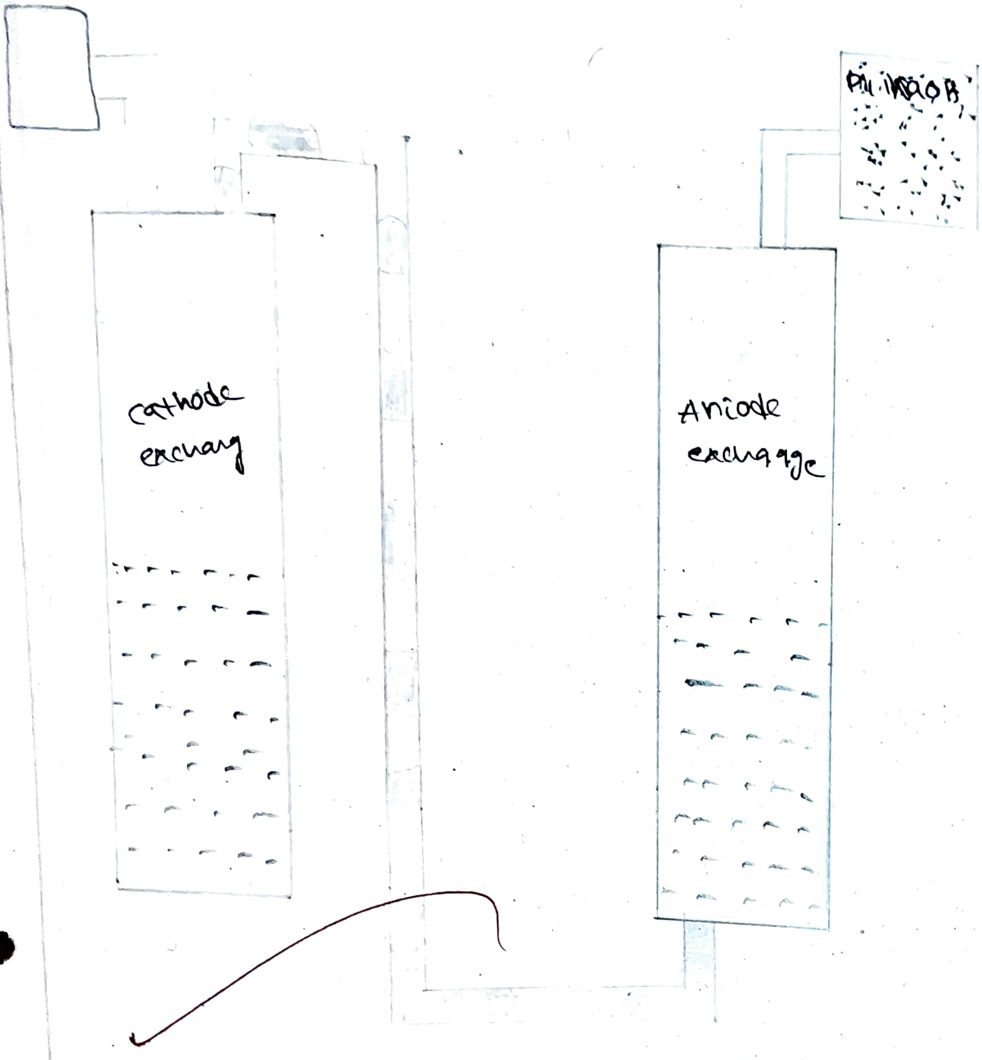
Anion exchange:

Anion are involved in this process

=> In the detertants products are water and Base

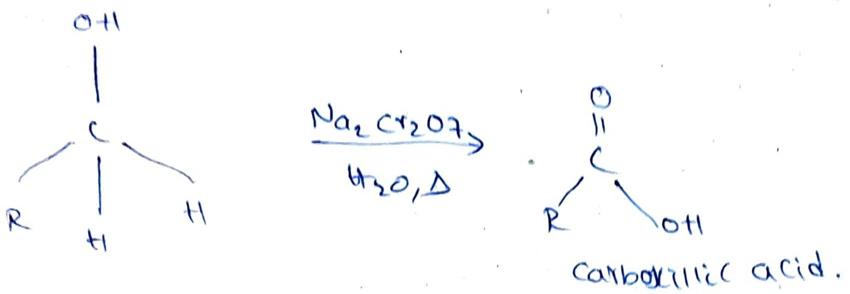
Ex:-

$R(OH)_2 + 2HCl \longrightarrow RCl_2 + 2H_2O$

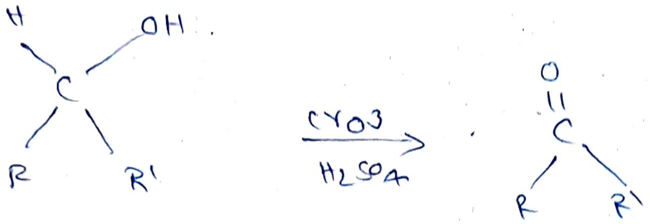

PH INDICATOR
cathode exchang
Aniode exchagge

10b)

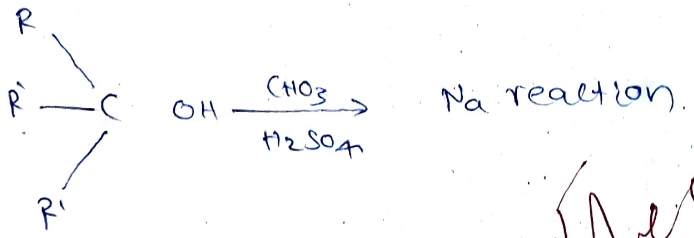
Primary alcohol reaction in the presence of CrO_3



Secondary alcohol reaction in the prescence of CrO_3



Terinary alcohal reaction in the precence of CrO_3.



Check

Presence of CrO_3

421CS471

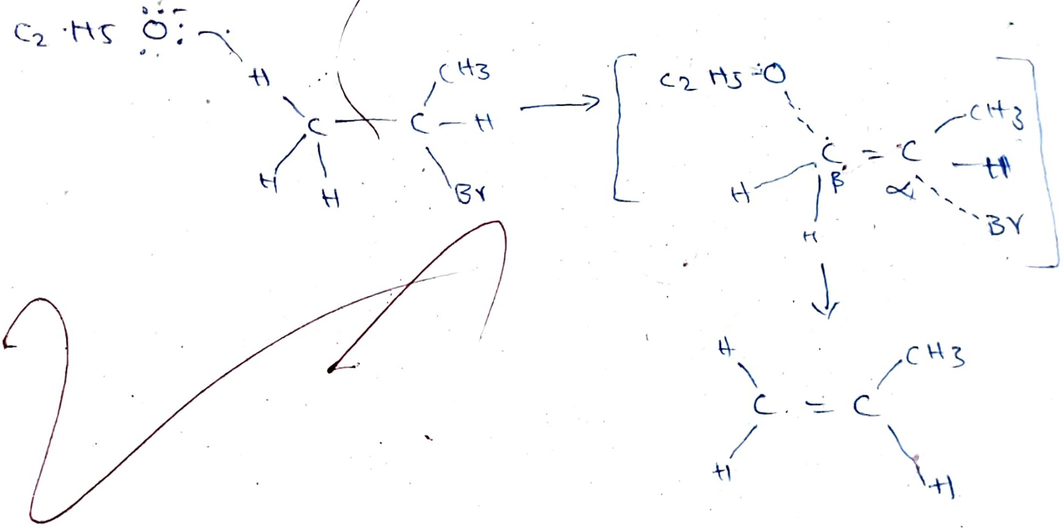
PART-B

a)

E2 Reaction

$C_2 + H_3O^- + CH_2CH\,Br\,CH \rightarrow CH_2 = CHCH_3 + C_2H_3O + Br^-$

E2 mechanism:



$C_2H_6 + \ddot{O}H + Br^-$

PART – A

1) d ⟶ None ✓

2) c ✓

3) b ✓

4) b ✗

5) a ✓

6) b ✓

7) d ✗

8) a ⟶ $NaBH_4$ ✓

6

Bharath

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173, Agaram Main Rd., Selaiyur, Chennai, Tamil Nadu 600073

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