Chemistry

CHE 0533-1101

Department of Chemistry
University of Global Village

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SI NO	CONTENT OF COURSE (as Summary)	Hrs	CLOs
2	**Polymer and its application**: Properties of polymer, Preparation of polymer, application of polymer, advantage and disadvantages of polymer **Aldehyde and ketone:** Bachground, physical properties, isomer of aldehyde and ketone, preparation, reaction, reactivity of aldehyde and ketone, Differentiation of aldehyde and ketone, uses of aldehyde and ketone **Organic reaction**: EI, E2 , SN1 and SN2 reaction	08	CLO1 and CLO2
3	**Aromatic compounds and its derivatives**: Huckles rules of aromaticity, preparation of benzene, reaction of benzene, preparation of toluene, DDT, 2,4 TNT, Friedel craft alkylation and acylation **Stereoisomer:** Corrosion,geometrical and optical isomer, configuration and conformation, enantiomer, achiral, chiral , diastereoisomer	06	CLO2 and CLO3
4	**Renewable Energy: Definition**, properties of renewable energy, sources of renewable energy, advantages and dis advantages of renewable energy, Challenges of renewable energy, How to overcome these challenges **Climate Change:** Greenhouse gas, Sources of greenhouse gas, effect of greenhouse gas, ozone layer, depletion of ozone layer, causes of ozone layer depletion, how ozone layer depletion damages our environment **Assessment:** Presentation and oral viva about the previous lectures	10	CLO1

CHEMISTRY

Course Code : CHE 0531-1201

Exam Hours : 03

Credits : 03

CIE Marks : 90

SEE Marks : 60

Course Learning Outcomes: at the end of the Course, the Student will be able to-

CLO1	Be able to define the different parameters and concepts regarding atomic structure, periodic properties of elements, chemical bonding, selective organic reactions, etc.
CLO2	Understand the phase rule, colligative properties, chemical kinetics and equilibrium, thermochemistry, pH and buffer, and electrical properties of solution.
CLO3	Be able to define corrosion, its types, and properties .Use of surface coating materials.
CLO4	Knowing about the basic science that used in our daily life.

SI NO	COURSE CONTENT (as Summary)	Hrs	CLOs
1	**Acid and bases** : Atomic Properties and binding Force Atomic molecules and between them. Force in solids and binding Acid and Base: Strong and Weak acid and Base, Conjugated acid and base PH. Buffer Solution, Neutralization Curve, Indicator for Acid and Base Titration **Chemical bonding**: , Ionic Bond, Covalent Bond. Metallic Bond , Hydrogen Bond and Vender Wall‘s Force, coornation covalent bond	10	CLO2 and CLO4

Week	Topic	Teaching learning strategy	Assessment strategy	Corresponding CLOs
01	Atom, Molecule, Gas	Lecture (White board)	Written exam	CLO4
02	Various concept of acid and base, properties of acid and base, difference between acid and base, uses of acid and base	Lecture (White board)	Written exam	CLO4
03	Indicator, acid base titration	Lecture (White board)	Quiz, Written exam	CLO4
04	Chemical bonding; Ionic bond, covalent bond, Hydrogen bond, Polar bond, Coordinate covalent bond	Lecture (White board)	Assignment	CLO2
05	Chemical bonding; Metallic Bond	Lecture (White board)	Written exam	CLO2
06	Polymer; properties, preparation and application of polymer	Lecture (White board)	Quiz, Written exam	CLO1
07	Aldehyde and ketone: Physical properties, preparation, isomerism of aldehyde and keton	Lecture (White board)	Written exam	CLO1

08	Rectivity of aldehyde and ketone, uses of aldehyde and ketone, differenciation of aldehyde and ketone	Lecture (White board)	Written exam	CLO2
09	Benzene, properties of benzene, preparation of benzene, uses of benzene	Lecture (White board)	Written exam	CLO2
10	Huckles rule of aromiticity, friedel craft alkylation and acylation reaction,	Lecture (White board)	Written exam	CLO2
11	SN1, SN2, E1, E2 reaction mechanism, difference between ei and e2, difference between SN1 and SN2	Lecture (White board)	Written exam	CLO2
12	Stereoisomer: chiral carbon, enantiomer, diasteromer, achiral, Geometrical and optical isomer	Lecture (White board)	Quiz, Written exam	CLO2
13	Renewable energy, Source of renewable energy, Properties of renewable energy, The Advantages of Renewable Energy, Advantages and The Disadvantages of Renewable Energy, Challenges of renewable energy	Lecture (White board)	Written exam	CLO1

14	Greenhouse gas, Sources of greenhouse gas, Effects of increased greenhouse gases: What Is Climate Change?, Causes of Climate Change	Lecture (White board)	Assignment	CLO1
15	Effects of Climate Change	Lecture (White board)	Quiz, Written exam	CLO1
16	Ozone layer; Ozone Layer Depletion, Causes of Ozone Layer Depletion, Ozone Depleting Substances (ODS)	Lecture (White board)	Written exam	CLO1
17	Renewable energy, properties of renewable energy, advantages and disadvantages of renewable energy, challenges of renewable energy	Lecture (White board)	Written exam	CLO1

REFERENCE BOOKS

1)Organic chemistry: Bhal and Bhal
2)Physical Chemistry-Dr. Yusuf Ali Molla,
3)Inorganic chemistry: Ebbing

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (90 Marks)

Bloom's Category Marks (out of 50)	Tests (45)	Assignments (15)	Quizzes (15)	Attendance (15)
Remember	10	05	05	
Understand	10	05	05	

Apply	10	05	05	15
Analyze	05			
Evaluate	05			
Create	05			

SEE- Semester End Examination (60 Marks)

Bloom's Category	Test
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	5
Create	5

Week: 01 and 02

Topic: Atomic structure

Page: 09-18

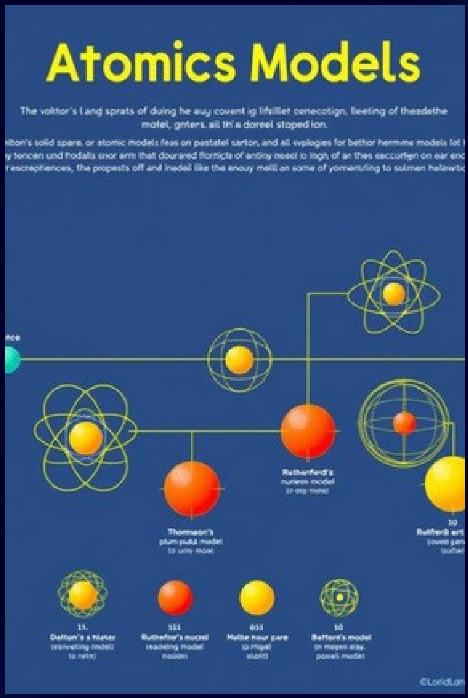
The Atomic Structure: A Journey into

the Building Blocks of Matter

This presentation will delve into the fundamental building blocks of matter, tha e atoms. We'll explore the evolution of atomic models, the composition of atoms, and the principles that govern their interactions.

From Dalton's Billiard Balls to

Bohr's Quantum Leaps



1. John Dalton's (1803) solid sphere model envisioned atoms as indivisible particles.

2. J.J. Thomson (1897) proposed the "plum pudding" model, with negatively charged electrons embedded in a positively charged sphere.

3. Ernest Rutherford (1911) discovered the nucleus, a tiny dense core with positive charge, surrounded by negatively charged electrons.

4. Niels Bohr (1913) introduced the quantum model, with electrons orbiting the nucleus in quantized energy levels.

The Three Pillars of the Atom: Protons, Neutrons, and Electrons

Protons

Positively charged particles located in the nucleus, determine the element's identity (atomic number).

Neutrons

Neutral particles found in the nucleus, contribute to the atom's mass but not its charge.

Electrons

Negatively charged particles orbiting the nucleus in shells, responsible for chemical bonding.

Atomic Number: The Identity Card of an Element

1

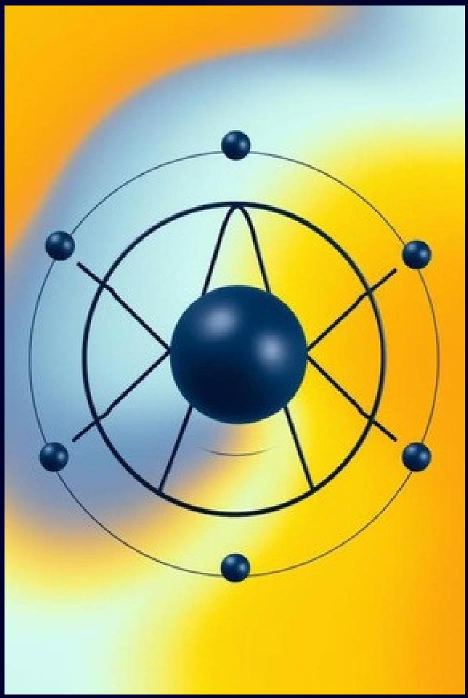
Atomic Number

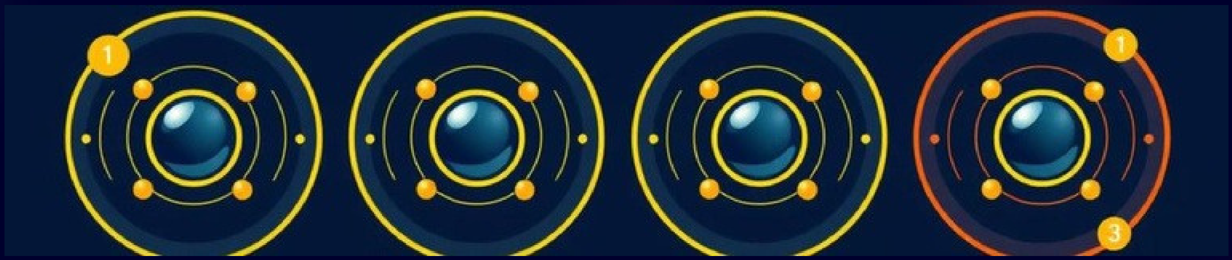
The number of protons in an atom's nucleus, defining the element's identity. For example, carbon has an atomic number of 6.

2

Mass Number

The total number of protons and neutrons in an atom's nucleus, representing its mass. Carbon-12 has a mass number of 12.





Isotopes: The Variations on the Atomic Theme

Same Element

Isotopes are atoms of the same element (same atomic number) but with different numbers of neutrons.

Different Mass

Because they have different neutron counts, isotopes have different mass numbers.

Significance

Isotopes play crucial roles in various fields, from radioactive dating to medical imaging.

Electron Configuration: Mapping the Electron's Journey

1 Orbitals

Regions of space around the nucleus where electrons are most likely to be found.

2 Sublevels

Each energy level contains sublevels (s, p, d, f) with specific shapes and orientations.

3 Configuration

The arrangement of electrons in orbitals, determined by the element's atomic number.

Valence Electrons: The Key Players in Chemical Reactions

Outermost Electrons

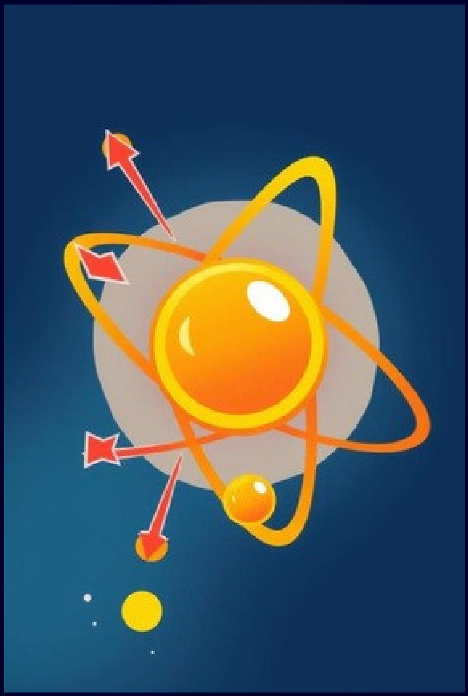
Valence electrons are located in the outermost energy level of an atom.

B onding Behavior

They determine an atom's reactivity and how it bonds with other atoms.

Periodic Trends

Valence electrons explain periodic trends like ionization energy and electronegativity.



Electronegativity: The Tug-of-War in Chemical Bonds

1

Attraction Power

Electronegativity is an atom's ability to attract electrons in a bond, measured on a scale.

2

P

If oaltaormitsy in a bond have different electronegativities,

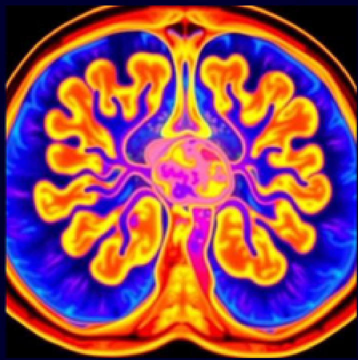
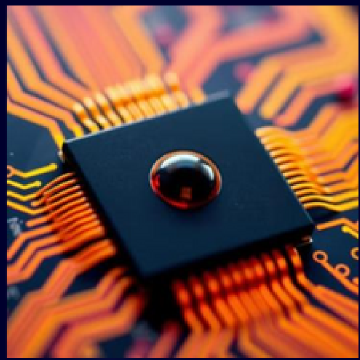
bond becomes polar, with partial charges.

3

Nonpolar Bonds

If atoms have similar electronegativities, the bond is nonpolar, with equal sharing of electrons.

Unlocking the Secrets of Matter: Applications of Atomic Structure

Understanding atomic structure unlocks countless possibilities in chemistry, medicine, materials science, and beyond.

The Chemical Bonds That Hold Matter Together

1

2

Ionic Bonding

Transfer of electrons from one atom to another, forming ions with opposite charges, attracting each other.

Covalent Bonding

Sharing of electrons between atoms, creating a strong bond holding atoms together.

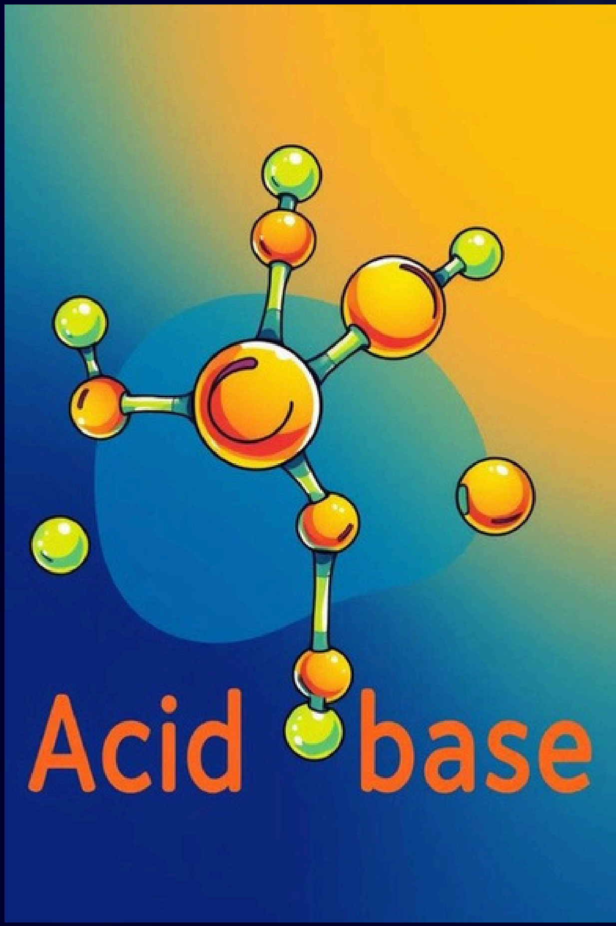
Week: 03 and 04

Topic: Acid and Base

Page: 20-29

Acids and Bases: Understanding the Fundamentals

This presentation explores the fundamental concepts of acids and bases, examining their properties, reactions, and everyday applications.



What are Acids and Bases?

Acids

Acids are substances that donate hydrogen ions (H+) when dissolved in water. They often taste sour and can react with bases to form salts and water.

Bases

Bases are substances that accept hydrogen ions (H+) or donate hydroxide ions (OH-) when dissolved in water. They typically feel slippery and taste bitter.

Properties of Acids

1 2 **Sour Taste**

Acids have a characteristic sour taste.

React with Bases

Acids react with bases in neutralization reactions to form salts and water.

3 **Turn Litmus Paper Red**

Acids turn blue litmus paper red.

4 **Conduct Electricity**

Strong acids conduct electricity because they ionize in solution.

Properties of Bases

1 2 **Bitter Taste**

Bases have a bitter taste and often feel slippery.

React with Acids

Bases react with acids to form salts and water.

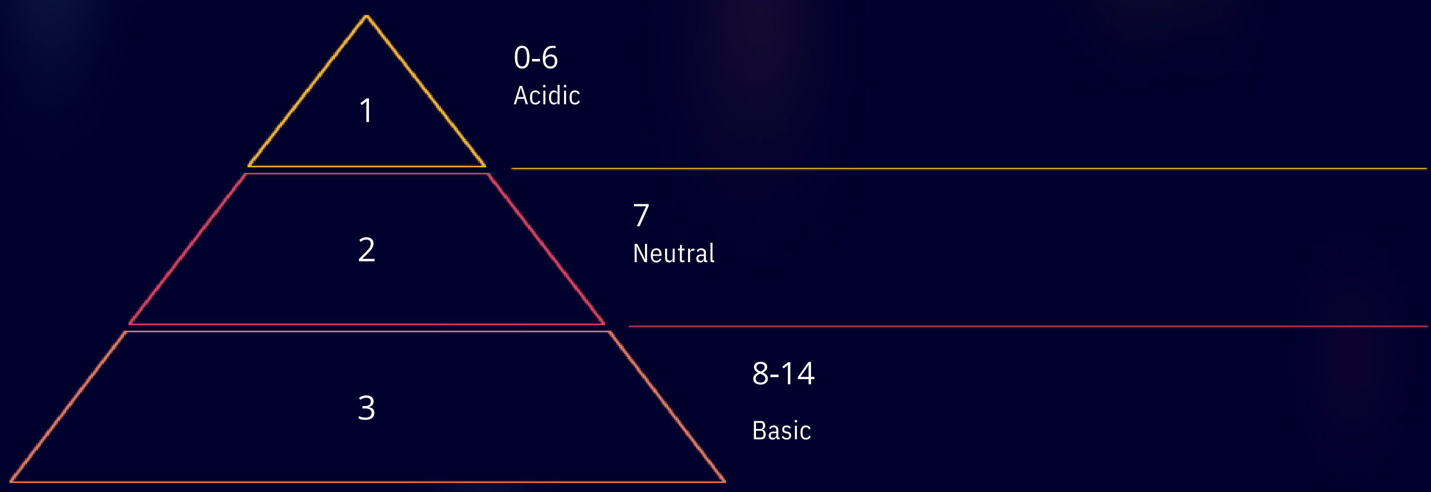
3 **Turn Litmus Paper Blue**

Bases turn red litmus paper blue.

4 **Conduct Electricity**

Strong bases conduct electricity in solution.

The pH Scale



Strength of Acids and Bases

Strong Acids

Strong acids ionize completely in solution, making them highly reactive and corrosive.

Weak Acids

Weak acids only partially ionize, making them less corrosive than strong acids.

Strong Bases

Strong bases ionize completely in solution, making them highly caustic.

Weak Bases

Weak bases partially ionize, resulting in a lower degree of alkalinity.

Everyday Examples of Acids and Bases

Lemon Juice

Citric acid gives lemons their sour taste.

Baking Soda

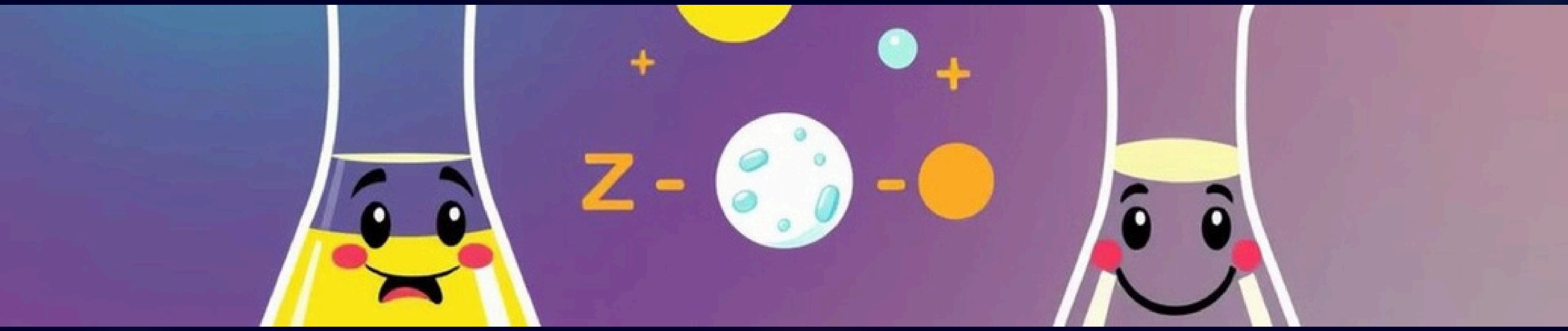
Sodium bicarbonate is a common base used in baking.

Antacids

Antacids contain bases that neutralize excess stomach acid.

Milk

Milk contains lactic acid, which gives it a slightly sour taste.



Neutralization Reactions

1

2

Acid + Base

Salt + Water

Acids and bases react in neutralization reactioTnhse. reaction produces salt and water as produc

Importance of Acids and Bases in Science and Industry

1

Chemical Reactions

Acids and bases are essential in various chemical reactions.

2

Industrial Processes

They play a vital role in many industrial processes.

3

Pharmaceuticals

Acids and bases are used in the production of many medications.

Conclusion: Key Takeaways

Acids and bases are fundamental chemical concepts that play a vital role in our world, influencing reactions, properties, and everyday applications. Understanding these concepts is crucial for comprehending a wide range of scientific and technological advancements.

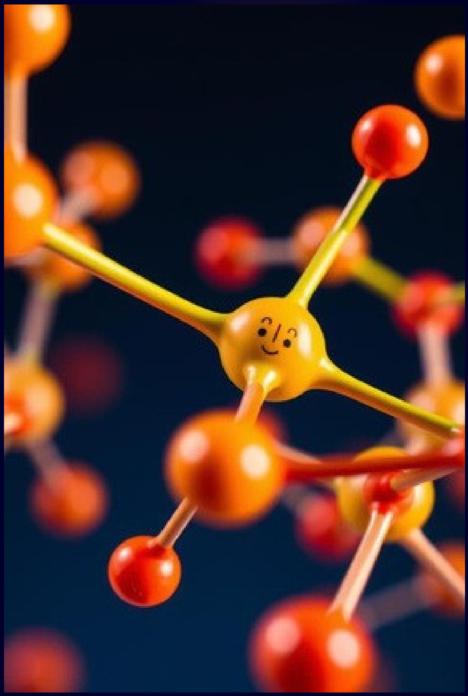
Week: 05 and 06

Topic: Chemical Bonding

Page: 31-40

Chemical Bonding: Understanding

the Foundations of Chemistry



Chemical bonding is the foundation of acsh emistry, explaining the formation of molecules and the properties of matter.

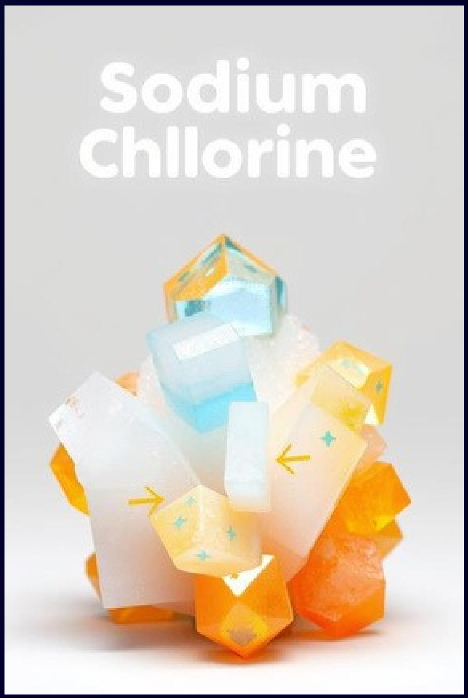
Introduction: What is Chemical Bonding?

Stability

Bonds form because they lead to lower energy states, making the resulting molecules or compounds more stable.

Attractive Forces

Chemical bonding refers to the attractive forces that hold atoms together, forming molecules or ionic compounds.



Ionic Bonding: Forming Ionic Compounds

Transfer of Electrons

Ionic bonds form when one atom donates an electron to another, creating positively and negatively charged ions.

Electrostatic Attraction

These oppositely charged ions then attract each other through electrostatic forces, forming an ionic compound.

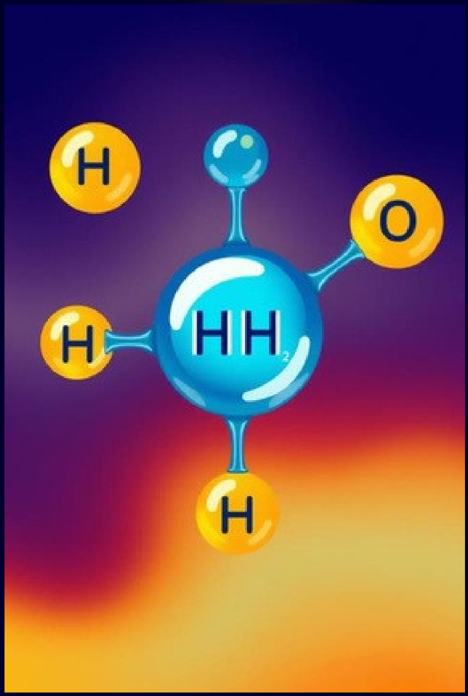
Covalent Bonding: Sharing Electrons

Shared Electrons

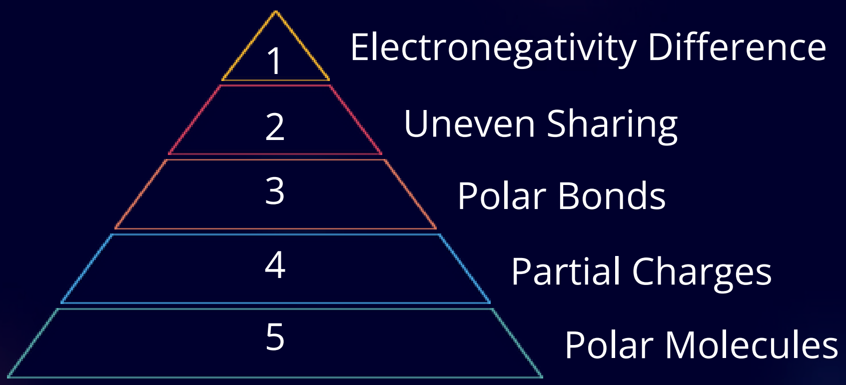
Covalent bonds form when two atoms share electrons to achieve a stable electron configuration.

Strong Bonds

Covalent bonds are strong attractions that hold atoms together in molecules.



Polar Covalent Bonds and Electronegativity



Hydrogen Bonding: A Special Covalent Bond

1 Strong Attraction

2 Hydrogen Bonds

3 Unique Properties

Intermolecular Forces and Their Effects

1

Dipole-Dipole

Attraction between polar molecules.

2

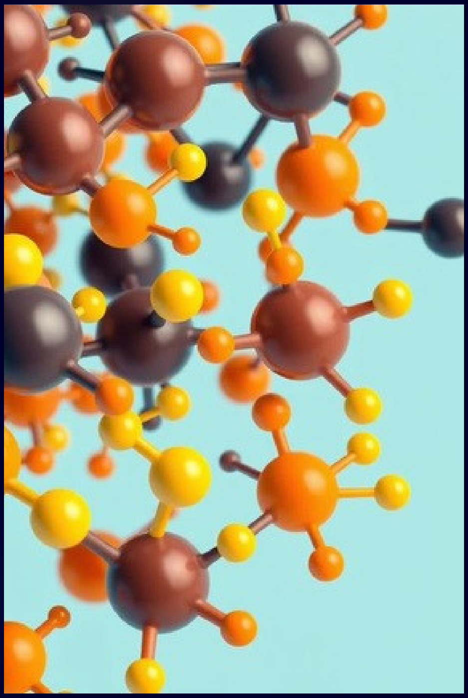
London Dispersion Forces

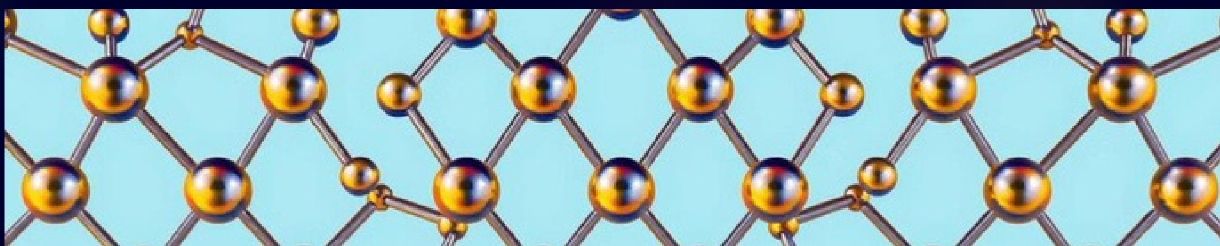
Temporary attractions between all molecules.

3

Hydrogen Bonding

Special case between H and O, N, or F.





Metallic Bonding: The Sea of Electrons

1

Free Electrons

Electrons are delocalized and can move freely throughout the metal lattice.

2

High Conductivity

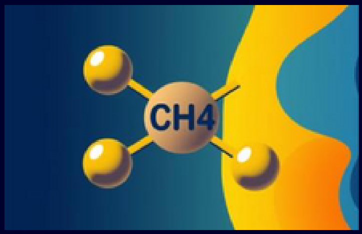
The free electrons allow metals to conduct heat and electricity.

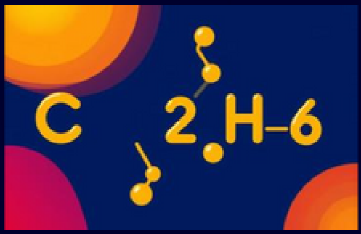
3

Malleability and Ductility

The ability of metals to be shaped and drawn into wires.

Bond Energies and Stability of Compounds





Applications of Chemical Bonding in the Real World

Chemical bonding principles underpin many technologies and industries, including pharmaceuticals, materials science, and energy production.

Week: 07

Topic: Polymer

Page: 42- 58

Polymers: Fundamentals and Applications

This presentation explores the fascinating world of polymers, their

as

diverse applications, and their potential to shape the future.

What are Polymers?

Long Chain Molecules

Polymers are large molecules composed of repeating structural units called monomers, linked together in long chains.

Versatile Materials

Their structure and properties can be tailored for a wide range of applications, from packaging and clothing to electronics and medical devices.

Polymer Preparation Methods

1 Addition Polymerization

Monomers add to a growing chain without the loss of any atoms, forming a long chain molecule.

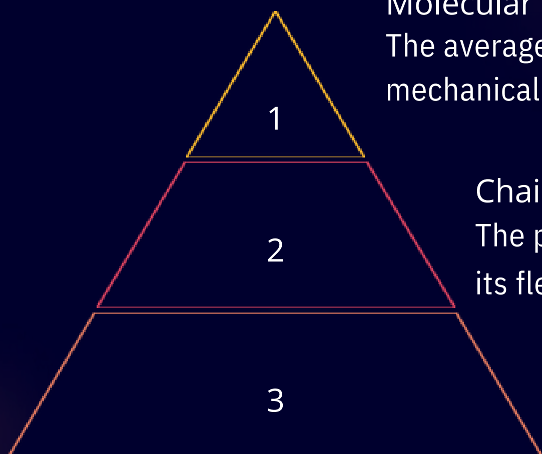
2 Condensation polymerization

Monomers react to form a polymer chain with the loss of a small molecule, like water, as a byproduct.

3 Ring-Opening Polymerization

Cyclic monomers open up and polymerize to form linear or branched polymer chains.

Polymer Structure and Properties



Molecular Weight

The average molecular weight of a polymer influences its mechanical properties like strength and viscosity.

Chain Branching

The presence of branches in a polymer chain can affect its flexibility, density, and crystallinity.

Crosslinking

Crosslinking between polymer chains enhances their rigidity, heat resistance, and tensile strength.

Thermoplastics and Thermosets

Thermoplastics

These polymers can be repeatedly softened by heating and solidified by cooling, allowing them to be reshaped.

Thermosets

These polymers undergo irreversible chemical changes upon heating, forming a rigid, cross-linked structure.

Polymer Processing Techniques

1. **Extrusion**

   A polymer melt is forced through a die to create a continuous profile, such as pipes, films, or fibers.

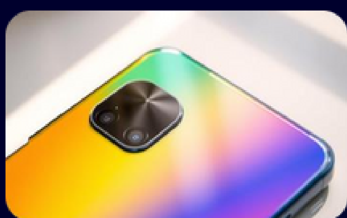
2. **Injection Molding**

   A polymer melt is injected into a mold cavity, which cools and solidifies into the desired shape.

3. **Blow Molding**

   A heated plastic tube is blown into a mold to create hollow objects like bottles or containers.

Applications of Polymers



Electronics

Polymers are used in circuit boards, insulation, and casings, enabling the functionality of electronic devices.

Toys and Leisure

Polymers provide durability, flexibility, and vibrant colors for a wide range of toys and recreational products.

Healthcare

Polymers are essential in medical devices, implants, and drug delivery systems, improving healthcare outcomes.

The Future of Polymer Technology

With ongoing research and development, polymers are poised to play an even greater role in shaping the future, addressing global challenges like sustainability and healthcare.

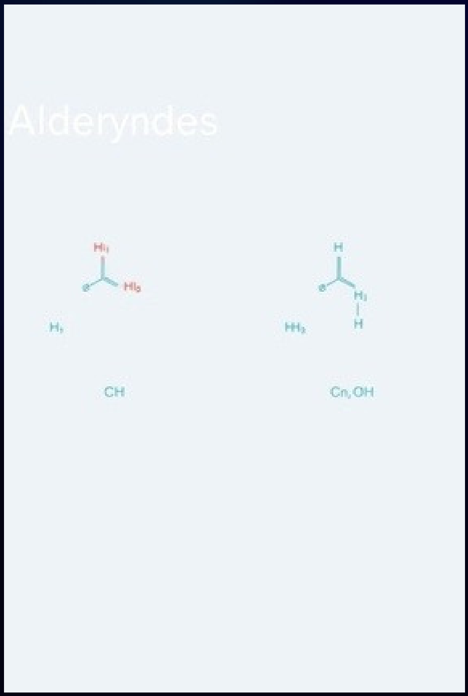
Week: 08- 09

Topic: Aldehyde and Ketone

Page: 51-58

Aldehydes and Ketones: A Comprehensive Overview

Welcome to this comprehensive overview of aldehydes and ketones, covering their preparation, properties, reactions, and reactivity. We will explore their distinct characteristics, including their reactivity towards nucleophiles and the use of specific reagents for their differentiation.



Introduction to Aldehydes and Ketones

Aldehydes

Contain a carbonyl group (C=O) bonded to one hydrogen atom and one alkyl or aryl group. They have the general formula RCHO, where R is a hydrocarbon group.

Ketones

Also contain a carbonyl group (C=O) but are bonded to two alkyl or aryl groups. Their general formula is RCOR', where R and R' can be the same or different.

Preparation of Aldehydes and Ketones

Oxidation of Primary Alcohols

Primary alcohols are oxidized to aldehydes using mild oxidizing agents like PCC (pyridinium chlorochromate) or CrO_3 (chromic acid) in a controlled reaction.

Oxidation of Secondary Alcohols

Secondary alcohols are oxidized to ketones using strong oxidizing agents like $K_2Cr_2O_7$ (potassium dichromate) or $Na_2Cr_2O_7$ (sodium dichromate) in acidic conditions.

Other Methods

Other methods for preparing aldehydes and ketones include the ozonolysis of alkenes, the hydration of alkynes, and the Friedel-Crafts acylation.

Physical and Chemical Properties

Physical Properties

Aldehydes and ketones are generally colorless liquids with characteristic odors. Their boiling points are higher than those of alkanes due to dipole-dipole interactions between carbonyl groups.

Chemical Properties

Both aldehydes and ketones are polar molecules due to the presence of the carbonyl group. They are highly reactive towards nucleophilic attack at the carbonyl carbon, resulting in various addition reactions.

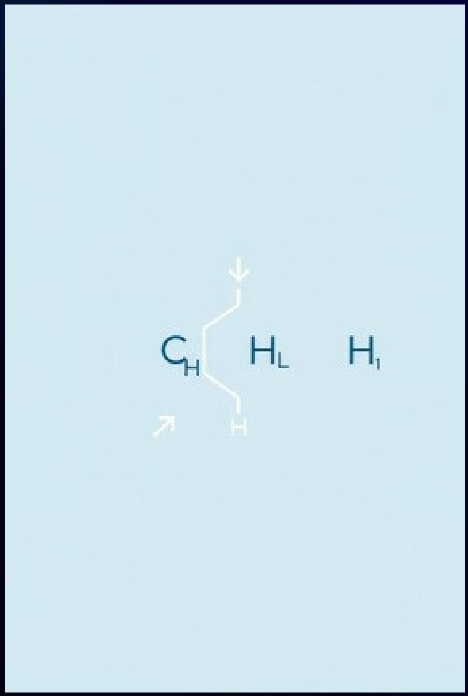
Reactivity of Aldehydes and Ketones

1. **Nucleophilic Addition Reactions**

The carbonyl group is highly electrophilic, making it susceptible to attack by nucleophiles. This leads to the formation of new C-C and C-N bonds through various addition reactions.

2. **Grignard and Wittig Reactions**

These are classic examples of nucleophilic addition reactions involving organometallic reagents, resulting in the formation of alcohols and alkenes, respectively.



3. **Cannizzaro Reaction**

This reaction involves the disproportionation of aldehydes lacking alpha-hydrogens, where one molecule is oxidized to a carboxylate ion while another is reduced to an alcohol.

Nucleophilic Addition Reactions

1

Step 1: Nucleophilic Attack

The nucleophile attacks the electrophilic carbonyl carbon, forming a tetrahedral intermediate.

2

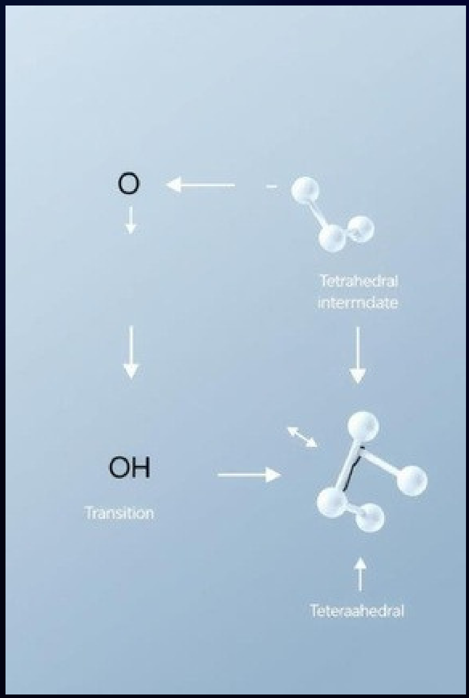
Step 2: Protonation

The tetrahedral intermediate is then protonated, leading to the formation of an alcohol.

3

Product Formation

The final product depends on the specific nucleophile and reaction conditions. Some reactions may involve further steps like dehydration or elimination.



Differentiation using Tollen's Reagent

Tollen's Reagent
A solution of

$Ag(NH_3)_2^+$, which is a mild oxidizing agent. It oxidizes aldehydes to carboxylic acids, forming a silver mirror on the reaction vessel.

Ketones
Do not react with Tollen's reagent as they lack the necessary hydrogen atom on the carbonyl carbon for oxidation to occur.

Differentiation using Fehling's Reagent

Aldehydes

Reacts with Fehling's reagent, which is a mixture of $CuSO_4$ and sodium potassium tartrate in an alkaline solution. The aldehyde is oxidized, forming a red-brown precipitate of Cu_2O.

Ketones

Do not react with Fehling's reagent as they lack the required hydrogen atom on the carbonyl carbon for oxidation to occur.

Week: 10 and 11

Topic: Substitution and Elimination reaction

Page: 60- 67

Nucleophilic Substitution and Elimination Reactions

SN1 Reaction Mechanism

Step 1

Leaving group departs forming a carbocation.

Step 2

Nucleophile attacks carbocation forming a new bond.

SN2 Reaction Mechanism
One Step

Nucleophile attacks the carbon atom at the same time as the leaving group departs.

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	04		HH
Necrchpsion	4.0CA)	Seeecisins	0-N=100JD
Flearonaciony	35 (RCF)	Receclaistry	0..N=1R089
Reactions	3 (cH	Dectalls	17.6 Och)

Differences between SN1 and SN2 Reactions

SN1

SN2

Two steps, carbocation intermediate, raOcenme isztaetpio,n n.o carbocation intermediate, inversion of stereochemistry.

E1 Reaction Mechanism

Step 1

Leaving group departs forming a carbocation.

Step 2

Base removes a proton from a carbon adjacent to the carbocation.

E2 Reaction Mechanism

One Step

Base removes a proton from a carbon adjacent to the leaving group.

Danple Conditions & Mechalistry

		E1'	E1	E2'
		Simpll	Imips	Timips
	Leriout:	Neunelecillostry' Reaction	Pbd 18'	Netmecinbstry' Reattion
	Redout:	Rec00000000;	OH000100:	Nec000000Q
		Yes. Pots:		Tes. Tras:
	Pedout:	CntC,A,Q + F900/	Mol D, C+H:	CntO, CO, G+90IM
	Pedout:	Nec00000300	CL00100:	Nec000902)
	Redout:	Tec0000000302;	CL00100;	Tec000000292;
Reaction	Readuce	Tec0000043000;	CCC00181;	Tec0000005556;
	Redout:	Nec0000000)	EC00100:	Nec000000)
	Pedout:	SeF6000	(002)	SeF6000
	Pedout:	Lec00000((5830) Trus: 2	CELL000100;	Eec0000005580, Trbs: 2
	Redout:	Nec0000632)	E00122;	Nec000000;
	Pedout:	Nec000001	CL00017:	Nec00000

Differences between E1 and

E2Reactions

E1
Two steps, carbocation intermediate, Zaitsev's rule.

E2
One step, no carbocation intermediate, anti-periplanar geometry.

Key Takeaways

Nucleophilic substitution and elimination reactions are fundamental to organic chemistry, enabling the synthesis of a wide range of organic compounds.

Week: 12

Topic: Corrosion

Page: 69-76

Corrosion: A Comprehensive

Guide

Corrosion, a natural process that degrades materials over time, poses significant challenges in various insd ustries. This presentation explores the fundamentals of corrosion, its impact, and methods for prevention.

What is Corrosion?

Corrosion is a natural process that deteriorates materials, primarily metals, through chemical reactions with their environment. The most common type of corrosion is rust, which occurs when iron reacts with oxygen and water.

Corrosion can lead to material failure, compromising structural integrity, and causing safety hazards. It also impacts economic productivity and sustainability, demanding preventative measures to mitigate its effects.

Types of Corrosion

Uniform CorrosionP itting Corrosion

Corrosion affects the entire surface uniformly, like

Small holes form in the material, causing

rGuaslt v oann iac cCaorr rosioSnlo tcraelsizse

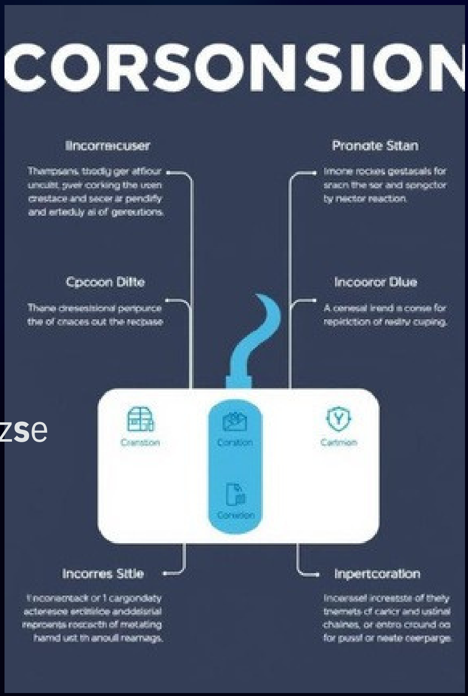
Corrosiodn

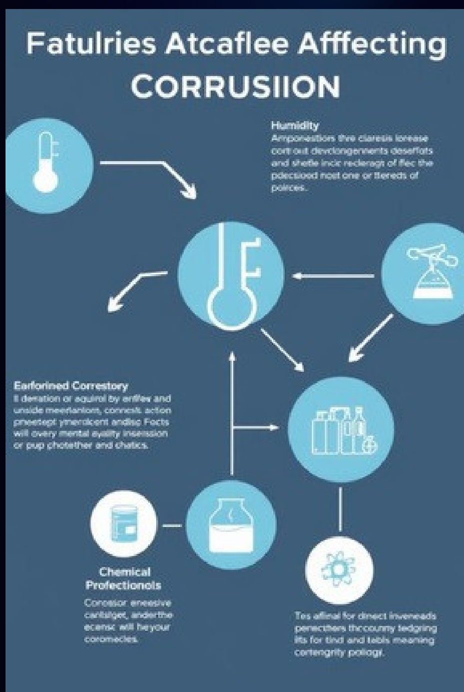
Two dissimilar body. This is metals in the most contact cause oconme tmo ocno rtryopdee. faster. This is often seen in metal couples.

damage. T his

Cracking

can be difficult Ctoo drreotesicotn. occurs under stress, causing cracks to form in the material. This can be catastrophic.





Factors Affecting Corrosion

1 Temperature

Higher temperatures accelerate chemical reactions, leading to faster corrosion.

2 Humidity

Moisture promotes corrosion, providing the necessary medium for reactions.

3 Chemicals

Certain chemicals like acids and salts can accelerate corrosion by reacting with metals.

4 Stress

Applied stress on materials increases susceptibility to corrosion.

Corrosion Prevention Strategies

Protective Coatings

Coatings like paint or metal plating act as a barrier to prevent corrosion.

Corrosion Inhibitors

Chemicals added to the environment slow down corrosion by forming protective layers.

Cathodic Protection

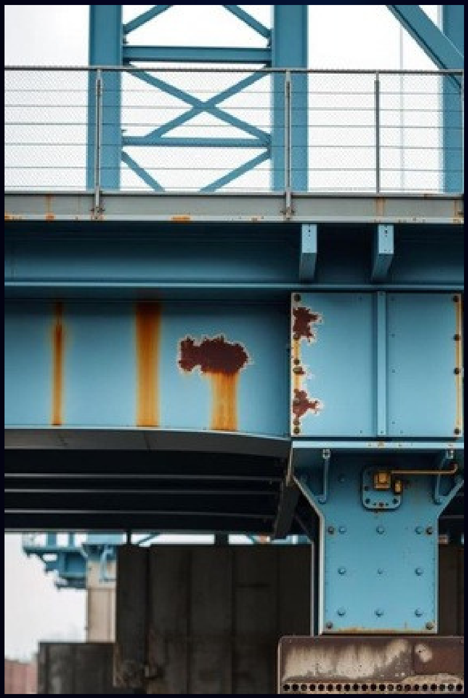
An external electrical current is applied to the metal surface to prevent corrosion.

Design Considerations

Proper design reduces stress points and promotes drainage to minimize corrosion risks.

Corrosion Testing and Monitoring

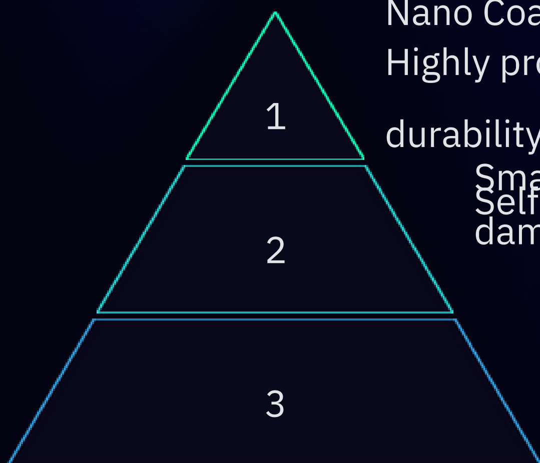
1. **Visual Inspection** — Regular visual inspection helps detect corrosion before it becomes a major problem.
2. **Electrochemical Testing** — Electrochemical methods measure corrosion rates and identify susceptible areas.
3. **Weight Loss Measurement** — This method measures the weight loss of a metal sample due to corrosion.
4. **Ultrasonic Testing** — Sound waves are used to detect corrosion beneath the surface of materials.
5. **Remote Monitoring** — Sensors and data analytics provide continuous monitoring of corrosion levels.



Case Studies: Corrosion in Action

1. **Bridge Failure**
   Corrosion of steel in bridges can lead to structural collapse, necessitating costly repairs.
2. **Pipeline Corrosion**
   Corrosion in pipelines can cause leaks, leading to environmental damage and economic losses.
3. **Aircraft Corrosion**
   Corrosion on aircraft can compromise flight safety and require extensive repairs.

Emerging Technologies in Corrosion Control



Nano Coatings

Highly protective coatings with enhanced durability and corrosion resistance.

Smart Materials

Self-healing materials that can repair damage caused by corrosion.

Predictive Modeling

Advanced simulations and data analytics to predict and prevent corrosion.

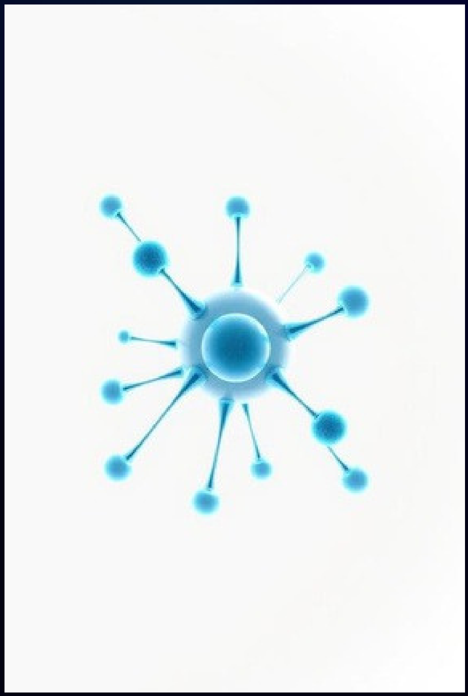
Week: 13, 14

Topic: Stereoisomer

Page: 78-85

Stereoisomers: A Journey into the World of Molecular Spatial Arrangement

Welcome to the fascinating realm of stereoisomers, where the spatial asrr angement of atoms within molecules unlocks a world of diverse properties and functionalities.



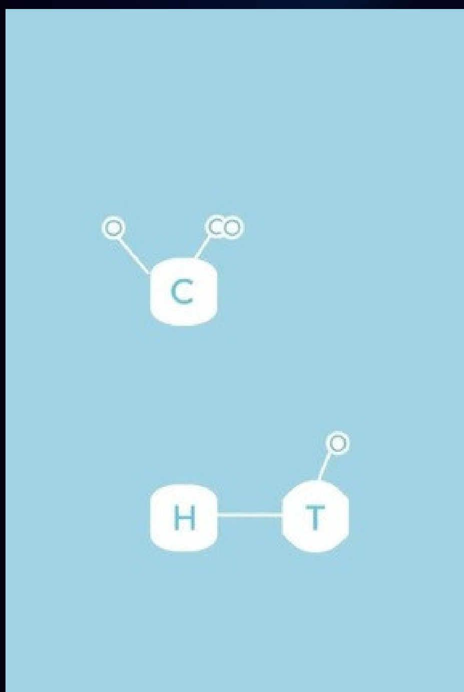
Understanding Stereoisomerism

Definition

Stereoisomers are molecules with the same molecular formula and connectivity but differ in the three-dimensional arrangement of their atoms.

Types

There are various types of stereoisomers, each with unique characteristics and properties.

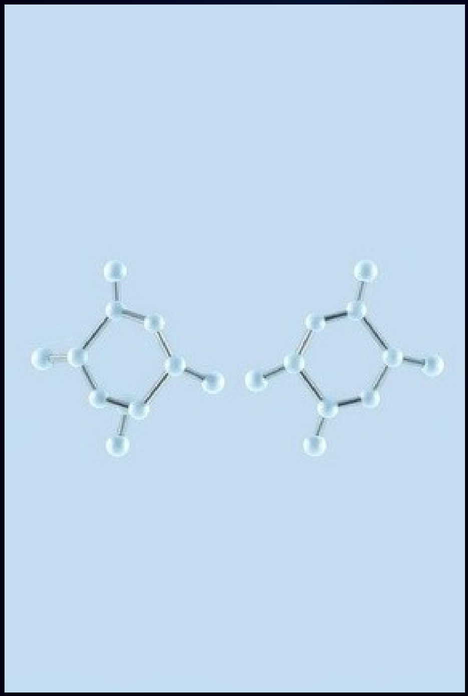


Geometric Isomers: Cis and Trans

Cis
Same substituents on the same side of a double bond or ring.

Trans
Same substituents on opposite sides of a double bond or ring.

Enantiomers: Mirror-Image Molecules



1

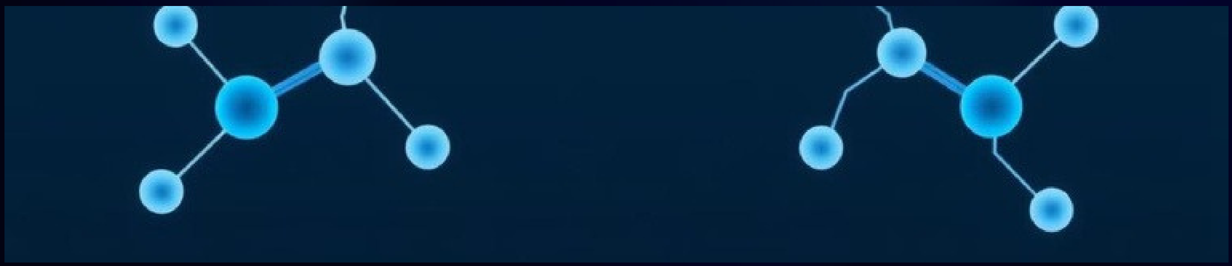
Definition

Enantiomers are stereoisomers that are non-superimposable mirror images of each other.

2

Chirality

Molecules possessing enantiomers are chiral, meaning they have a non-superimposable mirror image.



Diastereomers: Non-Superimposable Stereoisomers

Definition

Diastereomers are stereoisomers that are non-superimposable but are not mirror images of each other.

Multiple Stereocenters

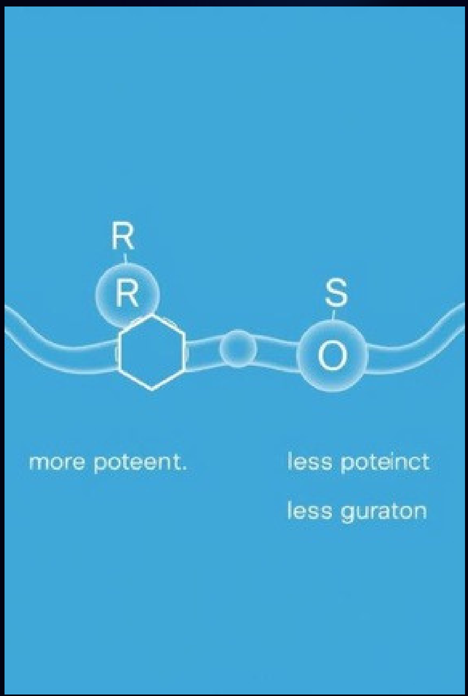
Diastereomers arise from molecules with multiple stereocenters.

Determining Stereochemistry: Fischer Projections and Wedge-Dash Notation Fischer Projections

A two-dimensional representation of a three-dimensional molecule, where horizontal lines represent bonds coming out of the plane and vertical lines represent bonds going into the plane.

Wedge-Dash Notation

A representation where solid wedges represent bonds coming out of the plane and dashed lines represent bonds going into the plane.



Importance of Stereoisomers in

Pharmaceuticals and Biochemistry

1. Drug Development Enantiomers can have drastically different pharmacological effects.
2. Biochemistry Chiral molecules play crucial roles in biological processes, from DNA replication to enzyme catalysis.

Stereoisomerism in Everyday Life:

Examples and Implications

1

Food

The sweet taste of L-aspartame vs. the bitterness of D-aspartame.

2

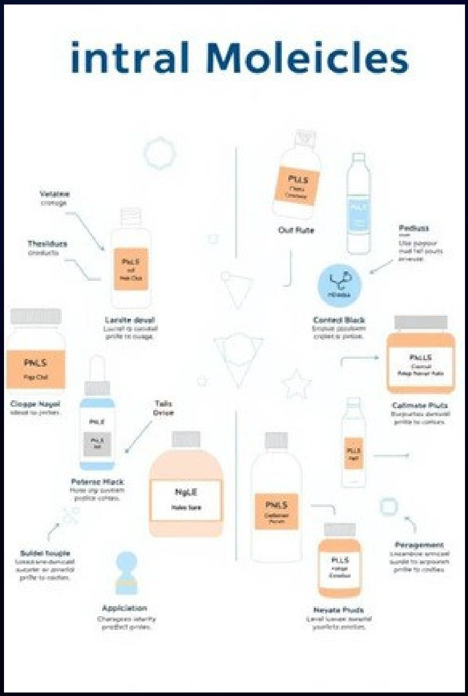
Fragrances

The distinct scents of enantiomeric molecules, such as carvone.

3

Flavorings

The different tastes of R-limonene (orange) and S-limonene (lemon).



Week: 15

Topic: Renewable energy

Page: 87-94

Renewable Energy: Powering the

Future

Renewable energy sources are
a
critical to a sustainable future. Their abundance and ability to replace fossil fuels make them a vital part of the energy transition.

Sources of Renewable Energy

Wind
Harnessing the power of wind through turbines.

Solar
Converting sunlight into electricity using photovoltaic panels.

Hydro
Generating power from flowing water using dams and turbines.

Geothermal
Utilizing heat from the Earth's core for electricity generation.

Properties of Renewable Energy

1 Sustainable

Renewable resources are naturally replenished, ensuring long-term availability.

2 Clean

They produce little to no pollution, mitigating climate change.

3 Decentralized

Renewable energy can be generated locally, reducing reliance on centralized power grids.

Advantages of Renewable Energy

Environmental Benefits

Reduced greenhouse gas emissions, cleaner air, and water quality improvement.

Economic Benefits

Job creation in renewable energy sectors, reduced energy costs, and increased energy independence.

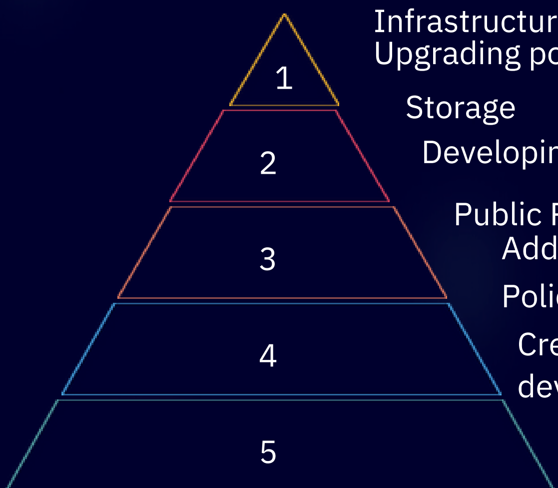
Disadvantages of Renewable Energy

Intermittency
Renewable energy sources like solar and wind are dependent on weather conditions.

Land Use
Large-scale renewable energy projects require significant land area.

Cost
Initial installation costs for renewable energy technologies can be high.

Challenges in Renewable Energy Adoption



Infrastructure
Upgrading power grids to accommodate renewable energy sources.

Storage
Developing effective energy storage solutions to address intermittency.

Public Perception
Addressing concerns about aesthetics and environmental impacts.

Policy
Creating supportive policies and incentives for renewable energy development.

Financial
Securing funding for renewable energy projects.

Potential Outcomes of Renewable Energy Transition

1. **Reduced Emissions**
   Significant decrease in greenhouse gas emissions.

2. **Improved Air Quality**
   Cleaner air, reduced respiratory illnesses, and improved public healt

3. **Energy Security**
   Increased reliance on domestic energy sources.

4. **Economic Growth**
   New jobs, industries, and innovation in the clean energy sector.

Current State of Renewable Energy Globally

28%

Growth

Renewable energy generation has increased globally by 28% since 2010.

$1.5T

Investment

Renewable energy investments have exceeded $1.5 trillion annually in recent years.

35%

Target

The International Energy Agency (IEA) aims for 35% of global electricity to come from renewable sources by 2030.

Week: 16

Topic: Greenhouse gas and

Climate change

Page: 96-105

Greenhouse Gas and Climate Change

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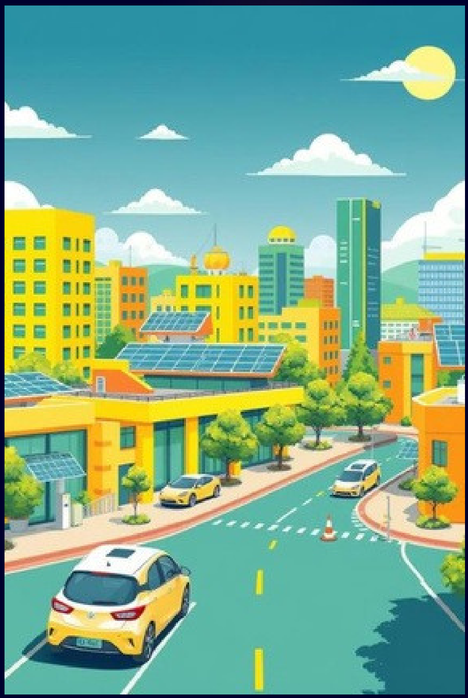


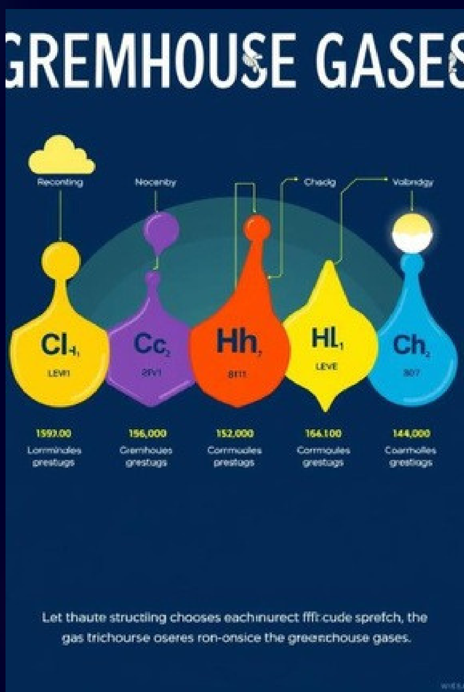
What is the greenhouse effect?

Natural Process

Greenhouse gases like carbon dioxide (CO2) naturally trap some of the sun's heat, warming the planet. This is vital for life, creating a habitable climate. However, human activities are enhancing this effect, leading to global warming.

Human Impact

The burning of fossil fuels, deforestation, and other human activities release excessive amounts of greenhouse gases, trapping more heat and causing the planet to warm at an accelerated rate.



The role of greenhouse gases

Carbon Dioxide (COM2e)t hane (CH4)

The most significantR gerleeanshedou fsroem gas,
primarily released fronmat ubruarln ginags fossil
production,
dReefloearessetda livestockt,f iarnodonm,
N
agricutlrtauprpailn agacg rtifciauvltrui rteie. sA,
potent
p
pfuloiertnlrosgoc,e u-sls Oasxsideets (iNn.2gO ggr)ere ene
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contributing significasnhtolyrt etor pgeloriboadl.
warming.

Major greenhouse gas contributors

Fossil Fuel Combustion

Power plants, vehicles, and industrial processes rely heavily on fossil fuels, releasing substantial amounts of CO_2 and other greenhouse gases.

Industrial Processes

Manufacturing, chemical production, and other industrial activities contribute significantly to greenhouse gas emissions.

Agriculture

Livestock farming, deforestation, and agricultural practices release methane, nitrous oxide, and other greenhouse gases.

Impacts of climate change

1

Rising Temperatures

Global warming has already caused significant temperature increases, impacting weather patterns, ecosystems, and human health.

2

Sea Level Rise

Melting glaciers and thermal expansion of ocean water are causing sea levels to rise, threatening coastal communities and ecosystems.

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and disruption.

4

Changes in temperature, Eracionsfyasllt,e amnd D siserau lpetvioenl ar

ecosystems, threatening biodiversity and disrupting natural balances.

5

Human Health Impacts

Increased heat stress, air pollution, and the spread of diseases are impacting human health, particularly in vulnerable populations.

Temperature and sea level rise

1 1900s

Global average temperatures began to rise noticeably, primarily due to the increased burning of fossil fuels.

2 1950s

Accelerated rise in global temperatures and sea levels as industrialization and emissions continued to increase.

3 2000s

Continued rapid temperature increases, reaching record highs, and significant sea level rise, posing growing threats to coastal Pcoremsmenutn ities.

4

Current trends project continued temperature increases and rising sea levels, requiring urgent action to mitigate the impacts of climate change.

Extreme weather events

1. **Heatwaves**
   Prolonged periods of abnormally high temperatures, leading to heat stress, wildfires, and impacts on agriculture.
2. **Droughts**
   Extended periods of low rainfall, causing water scarcity, agricultural losses, and ecosystem disruptions.
3. **Floods**
   Heavy rainfall and rising sea levels lead to widespread flooding, causing damage to infrastructure, displacement, and loss of life.
4. **Storms**
   Climate change intensifies storms, increasing their frequency and intensity, causing significant damage and disruption.

Implications for ecosystems and biodiversity

Forest Loss

Climate change disrupts forest ecosystems, leading to increased wildfires, insect infestations, and disease outbreaks, resulting in habitat loss and biodiversity decline.

Coral Bleaching

Rising ocean temperatures and acidification cause widespread coral bleaching, threatening the health and survival of coral reefs, crucial ecosystems for marine biodiversity.

Mitigation strategies: Reducing emissions

1 Transition to Renewable Energy

Shifting from fossil fuels to renewable energy sources like solar, wind, and hydro power reduces greenhouse gas emissions and promotes a clean energy future.

2 Energy Efficiency

[illegible]

4 Carbon Capture and Storage

Capturing and storing carbon dioxide from industrial processes and power plants helps mitigate emissions and reduce the amount of greenhouse gases in the atmosphere.

3 Sustainable Agriculture

Promoting sustainable agricultural practices, such as reducing deforestation, improving livestock management, and adopting low-carbon farming methods, lowers greenhouse gas emissions.

Adaptation measures: Building resilience

1

Infrastructure Upgrades

Building resilient infrastructure, such as flood defenses, seawalls, and drought-resistant infrastructure, protects communities from the impacts of climate change.

2

Water Management

Implementing water conservation measures, improving irrigation systems, and investing in water storage solutions enhances water security in the fapceaotcpinaatmnsiog. ning. ert

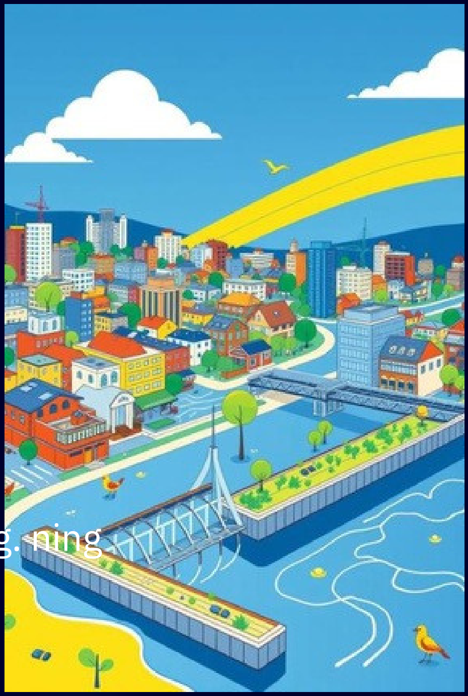
3 **Early Warning Systems**

Developing and implementing early warning systems for extreme weather events allows communities to p aocrt sa nodf cmliimtigaatete trheep aimrep f change.

4

Climate-Smart Agriculture

Adapting agricultural practices to changing climate conditions, such as adopting drought-resistant crops and improving water management, ensures food security in a changing climate.



Week: 17

Topic: Ozone layer depletion

Page: 107-114

The Ozone Layer: Protecting Our Planet

The ozone layer, a fragile shield in the Earth's atmosphere, plays a as
crucial role in protecting life from harmful ultraviolet radiation from the sun. Join us as we explore the significance of this vital layer and the challenges it faces.

What is the Ozone Layer?

Stratospheric Ozone

The ozone layer is a region within the stratosphere, approximately 15 to 35 kilometers above Earth's surface. It's primarily composed of ozone, a gas made up of three oxygen atoms.

UV Absorption

Ozone molecules absorb most of the sun's harmful ultraviolet (UV) radiation, particularly the UVB rays that can cause skin cancer, cataracts, and other health issues.

Importance of the Ozone Layer

1 Life Protection

The ozone layer acts as a vital shield, preventing excessive UV radiation from reaching the Earth's surface, thus protecting all forms of life.

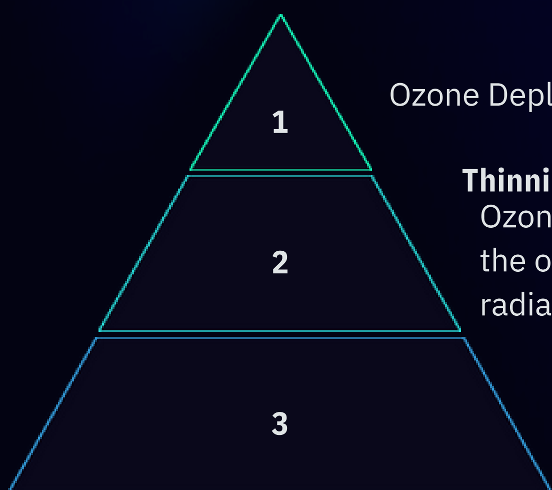
2 Climate Regulation

Ozone also plays a role in regulating Earth's temperature by absorbing infrared radiation, contributing to a stable climate.

3 Ecosystem Balance

A healthy ozone layer helps maintain the delicate balance of ecosystems, ensuring the survival of various plant and animal species.

Depletion of the Ozone Layer



Ozone Depletion

Thinning

Ozone depletion refers to the thinning of the ozone layer, leading to increased UV radiation reaching the Earth's surface.

Ozone Hole

A significant depletion of the ozone layer above Antarctica, known as the "ozone hole," has raised serious concerns about the impact on human health and the environment.

Causes of Ozone Depletion

Man-Made Chemicals

Certain human-made chemicals, particularly chlorofluorocarbons (CFCs), have been identified as major contributors to ozone depletion.

U V Radiation

UV radiation from the sun can break down ozone molecules, but naturally occurring processes balance this breakdown, maintaining a healthy ozone layer.

High-Altitude Flights

Emissions from supersonic aircraft at high altitudes have also been linked to ozone depletion, but their impact is relatively small compared to CFCs.

Effects of Ozone Depletion

Increased UV Radiation

The thinning of the ozone layer leads to increased levels of UV radiation reaching the Earth's surface, posing health risks.

Skin Cancer

Excessive UV radiation can cause various types of skin
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system, making individuals more susceptible to infections.

Cataracts

UV radiation can damage the eyes, leading to cataracts, a clouding of the lens, which can impair vision.

International Efforts to Protect the Ozone Layer

Montreal Protocol

The Montreal Protocol, an international agreement signed in 1987, aimed to phase out the production and consumption of ozone-depleting substances.

Global Cooperation

The protocol has been a remarkable success, with over 190 countries working together to reduce the use of CFCs and other harmful chemicals.

Ozone Recovery

Thanks to international cooperation and the Montreal Protocol, the ozone layer is gradually recovering, with projections suggesting a full restoration by mid-century.

The Future of the Ozone Layer

While the ozone layer is on the path to recovery, continued monitoring and research are essential. New challenges, such as climate change, require ongoing vigilance and collaborative efforts to ensure the long-term protection of this vital shield.

Thanks for Your Attention

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