



CHAPTER: CARBON AND ITS COMPOUNDS

INTRODUCTION

◇ Introduction to Carbon

In the previous chapter, we studied many useful compounds.

Now, we will study about:

👉 **Carbon – a very important element**



IMPORTANCE OF CARBON

Carbon is extremely important because:

- Present in **all living organisms**
- Found in:
 - Food
 - Clothes
 - Medicines
 - Fuels (coal, petroleum)

👉 This shows:

Life is carbon-based



CARBON IN NATURE

Even though carbon is very important, its quantity is very small:

- **Earth's crust** → only **0.02% carbon**
- **Atmosphere** → only **0.03% CO₂**

👉 Still, carbon is very useful because of its **unique properties**



CARBON COMPOUNDS

Many everyday things are made of **carbon compounds**:

Examples:

- Food → carbohydrates, proteins
- Clothes → synthetic fibers
- Medicines → organic compounds



TEST FOR CARBON (VERY IMPORTANT)

👉 When a carbon compound is burnt:

- It produces **carbon dioxide (CO₂)**

Test:

- Pass gas through **lime water**
- Lime water turns **milky**

👉 This confirms presence of **carbon**

WHY CARBON IS SPECIAL?

Even though it is present in small quantity:

- Forms a large number of compounds
- Essential for life
- Used in fuels and industries

👉 Therefore:

Carbon is called a versatile element

FINAL UNDERSTANDING

- Carbon is the **base of life**
- Present in almost all useful substances
- Important despite low availability

◇ KEY POINTS

- Carbon = most important element
- Found in all living organisms
- Forms many compounds

◇ RECALL LINK

👉 Previous knowledge:

- Compounds → combination of elements

👉 Now:

- Carbon forms maximum compounds

◇ IMPORTANT DATA

- 0.02% → Earth crust
- 0.03% → Atmosphere

◇ MNEMONIC

👉 **“LIFE = CARBON”**

◇ EXAM TIP

👉 Write:

“Carbon is a versatile element that forms a large number of compounds essential for life.”

◇ REAL-LIFE CONNECTION

- Food → carbon
- Fuel → carbon
- Body → carbon

◇ COMMON MISTAKE

✗ Carbon is abundant

✓ Carbon is limited but highly important

TOPIC: BONDING IN CARBON – COVALENT BOND

◇ 1. Why Carbon Does NOT Form Ionic Bonds?

Carbon (Atomic number = 6)

👉 Electronic configuration:

- K = 2
- L = 4

👉 Valence electrons = 4

! Problem:

To become stable (octet), carbon must:

- Gain 4 electrons → C^{4-} ✗ (unstable, nucleus can't hold 10 electrons)
- Lose 4 electrons → C^{4+} ✗ (too much energy required)

Solution: COVALENT BONDING

👉 Carbon shares electrons instead of gaining/losing

 **Covalent Bond = Sharing of electrons between atoms**

2. HOW COVALENT BOND IS FORMED

Atoms share electrons so that:

- Each atom gets **complete outer shell (octet/duplet)**

EXAMPLES (VERY IMPORTANT)

◇ 1. Hydrogen Molecule (H₂)

- Each H needs 1 electron
- Share 1 pair

👉 Forms:

✓ **Single bond (H–H)**

◇ 2. Oxygen Molecule (O₂)

- Each O needs 2 electrons
- Share 2 pairs

👉 Forms:

✓ **Double bond (O=O)**

◇ 3. Nitrogen Molecule (N₂)

- Each N needs 3 electrons
- Share 3 pairs

👉 Forms:

✓ **Triple bond (N≡N)**

◇ 4. Methane (CH₄)

- Carbon shares 4 electrons with 4 H atoms

👉 Forms:

✓ 4 single bonds

👉 Structure:

Carbon in center + 4 Hydrogen

3. TYPES OF COVALENT BONDS

Type	Sharing	Example
------	---------	---------

Single bond	1 pair	H ₂
Double bond	2 pairs	O ₂
Triple bond	3 pairs	N ₂

⚡ 4. PROPERTIES OF COVALENT COMPOUNDS

👉 Because no ions are formed:

- Low melting point
- Low boiling point
- Poor conductor of electricity

👉 Reason:

- Weak intermolecular forces

💎 5. ALLOTROPES OF CARBON (VERY IMPORTANT)

Same element → different forms

◇ **Diamond**

- Each carbon bonded to 4 atoms
- Strong 3D structure

👉 Properties:

- ✓ Hardest substance
- ✓ Does NOT conduct electricity

◇ **Graphite**

- Each carbon bonded to 3 atoms
- Layered structure

👉 Properties:

- ✓ Soft & slippery
- ✓ Conducts electricity

◇ **Fullerene (C₆₀)**

- Football-like structure
- New form of carbon

FINAL UNDERSTANDING

- Carbon forms **covalent bonds by sharing electrons**
- This explains:
 - Low melting point
 - Poor conductivity
- Different bonding → different structures → different properties

◇ KEY POINTS

- Carbon = 4 valence electrons
- Cannot form ions easily
- Forms covalent bonds

◇ RECALL LINK

👉 Previous:

- Ionic bond = transfer

👉 Now:

- Covalent bond = sharing

◇ MNEMONIC

👉 “SDT”

- S = Single
- D = Double
- T = Triple

◇ IMPORTANT LINE (EXAM)

👉 “Covalent bond is formed by sharing of electron pairs between atoms.”

◇ STRUCTURE TRICK

- $H_2 \rightarrow 1$ bond
- $O_2 \rightarrow 2$ bonds
- $N_2 \rightarrow 3$ bonds

◇ COMMON MISTAKE

✗ Carbon forms ionic bond

✓ Carbon forms covalent bond

◇ HIGH-VALUE QUESTION

👉 Why carbon forms covalent bonds?

✓ Because gaining / losing 4 electrons is not possible

📌 TOPIC: VERSATILE NATURE OF CARBON

◇ Why is Carbon called Versatile?

Carbon forms **millions of compounds**, more than any other element.

👉 Reason:

Unique properties of carbon

⚡ 1. CATENATION (VERY IMPORTANT)

👉 Definition:

Catenation is the ability of carbon to **form bonds with other carbon atoms**

🔄 RESULT OF CATENATION

Carbon forms:

- Long chains
- Branched chains
- Ring structures

👉 Example:

- C–C–C–C (chain)
- Ring (benzene type)

! Why carbon shows maximum catenation?

- Strong **C–C bond**
- Small size → strong attraction

👉 Other elements (like silicon):

- Show less catenation
- Bonds are weaker

⚡ 2. TETRAVALENCY (VERY IMPORTANT)

👉 Carbon valency = 4

👉 So it can:

- Form 4 bonds with:
 - Carbon
 - Hydrogen
 - Oxygen
 - Nitrogen, etc.

RESULT

Carbon forms:

- Variety of compounds
- Different structures
- Different properties

⚡ 3. TYPES OF CARBON COMPOUNDS

◇ Saturated Compounds

- Only **single bonds**
- Example: CH₄

👉 Properties:

✓ Less reactive

◇ Unsaturated Compounds

- Double or triple bonds

👉 Types:

- Double bond → Alkene
- Triple bond → Alkyne

👉 Properties:

✓ More reactive

⚡ 4. STRONG BONDING

Carbon forms:

- Strong covalent bonds

👉 Reason:

- Small atomic size
- Strong attraction for electrons

👉 Result:

✓ Stable compounds

5. ORGANIC COMPOUNDS

👉 Carbon compounds are called:

Organic compounds

◇ Important Fact:

Earlier:

- People thought organic compounds formed only in living beings

👉 But:

- **Friedrich Wöhler** proved this wrong
- He made **urea** in lab

◇ Exceptions (NOT organic):

- CO₂
- CO
- Carbonates
- Bicarbonates
- Carbides

FINAL UNDERSTANDING

Carbon is versatile because of:

1. Catenation
2. Tetravalency
3. Strong bonds

👉 These properties allow formation of:

✓ Millions of compounds

✓ Life-supporting molecules

◇ KEY POINTS

- Carbon forms maximum compounds
- Due to catenation + tetravalency

◇ RECALL LINK

👉 Covalent bond:

- Carbon shares electrons

👉 Now:

- Uses this to form chains

◇ MNEMONIC

👉 “CTVS”

- C = Catenation
- T = Tetravalency
- V = Variety
- S = Stability

◇ EXAM LINE (VERY IMPORTANT)

👉 “Carbon is versatile due to catenation and tetravalency.”

◇ STRUCTURE TYPES

- Chain
- Branched
- Ring

◇ COMMON MISTAKE

✗ Only carbon shows catenation

✓ Others also show but less

◇ HIGH-VALUE QUESTION

👉 Why carbon forms large number of compounds?

✓ Due to strong C–C bonds + tetravalency

TOPIC: SATURATED & UNSATURATED CARBON COMPOUNDS

◇ 1. SATURATED CARBON COMPOUNDS

👉 Definition:

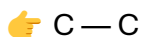
Compounds in which **all bonds are single bonds** are called **saturated compounds**.

Example: Ethane (C₂H₆)

Stepwise Formation:

Step 1:

Join carbon atoms



Step 2:

Each carbon has 4 valency

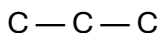
👉 Remaining valencies filled with Hydrogen

👉 Final structure:

Each carbon bonded to **3 Hydrogen atoms**

◇ **Another Example: Propane (C₃H₈)**

👉 Structure:



(Add hydrogen to satisfy valency)

Properties of Saturated Compounds

- Only single bonds
- Less reactive
- Stable

👉 Called:

Alkanes

◇ **2. UNSATURATED CARBON COMPOUNDS**

👉 Definition:

Compounds having **double or triple bonds** between carbon atoms

Example 1: Ethene (C₂H₄)

Formation:

Step 1:

C — C

Step 2:

One valency remains

Step 3:

👉 Form **double bond**

👉 Structure:

C = C

Example 2: Ethyne (C₂H₂)

👉 Carbon needs 3 bonds

👉 Structure:

C ≡ C (Triple bond)

Types of Unsaturated Compounds

Type	Bond	Name
Double bond	C=C	Alkene
Triple bond	C≡C	Alkyne

Properties of Unsaturated Compounds

- More reactive
- Undergo addition reactions
- Less stable than saturated

FINAL UNDERSTANDING

- Saturated → Single bonds → Stable
- Unsaturated → Double/Triple bonds → Reactive

◇ KEY POINTS

- Saturated = single bond
- Unsaturated = double/triple bond

◇ RECALL LINK

👉 Previous:

- Covalent bonding

👉 Now:

- Types of bonds in carbon

◇ MNEMONIC

👉 “SDT”

- S = Single → Saturated
- D = Double
- T = Triple

◇ EXAM LINE (VERY IMPORTANT)

👉 “Saturated compounds contain only single bonds, while unsaturated compounds contain double or triple bonds.”

◇ QUICK TABLE

Feature	Saturated	Unsaturated
Bonds	Single	Double/Triple
Reactivity	Low	High
Stability	High	Low

◇ COMMON MISTAKE

✗ All hydrocarbons are same

✓ They differ by bond type

◇ HIGH-VALUE QUESTION

👉 Why unsaturated compounds are more reactive?

✓ Due to presence of multiple bonds

TOPIC: CHAINS, BRANCHES AND RINGS

◇ 1. CARBON CHAINS (STRAIGHT CHAIN)

Carbon atoms can join to form **long chains**.

👉 Examples:

No. of Carbon	Name	Formula
---------------	------	---------

1	Methane	CH ₄
2	Ethane	C ₂ H ₆
3	Propane	C ₃ H ₈
4	Butane	C ₄ H ₁₀
5	Pentane	C ₅ H ₁₂
6	Hexane	C ₆ H ₁₄

👉 Structure example:

C – C – C – C (Straight chain)

◇ 2. BRANCHED CHAINS

Carbon chains can also form **branches**

👉 Example: Butane (C₄H₁₀)

Two structures possible:

- Straight chain
- Branched chain

⚡ STRUCTURAL ISOMERS (VERY IMPORTANT)

👉 Definition:

Compounds having **same molecular formula but different structures**

👉 Example:

C₄H₁₀ (Butane) has:

- Normal butane
- Iso-butane

👉 Result:

✓ Different physical properties

◇ 3. RING STRUCTURE (CYCLIC COMPOUNDS)

Carbon atoms can form **closed rings**

👉 Example:

- Cyclohexane (C₆H₁₂)

👉 Structure:

Hexagonal ring

◇ 4. UNSATURATED RING (IMPORTANT)

👉 Example:

- Benzene (C₆H₆)

👉 Contains:

- Alternating double bonds

◇ 5. HYDROCARBONS

👉 Definition:

Compounds containing only:

Carbon + Hydrogen

📄 Types of Hydrocarbons

Type	Bond	Name
Single	C-C	Alkane
Double	C=C	Alkene
Triple	C≡C	Alkyne

◇ 6. HETEROATOMS & FUNCTIONAL GROUPS

👉 Carbon also bonds with:

- Oxygen (O)
- Nitrogen (N)
- Chlorine (Cl)
- Sulphur (S)

👉 These are called:

Heteroatoms

⚡ FUNCTIONAL GROUP (VERY IMPORTANT)

👉 Definition:

An atom/group that **replaces hydrogen** and gives **special properties**


Examples:

Functional Group	Representation
Alcohol	-OH
Aldehyde	-CHO
Carboxylic acid	-COOH

FINAL UNDERSTANDING

Carbon forms:

- Chains
- Branches
- Rings

 This leads to:

- ✓ Huge variety of compounds
- ✓ Different properties

◇ KEY POINTS

- Carbon forms different structures
- Same formula → different structures (isomers)

◇ RECALL LINK

 Catenation:

- Carbon forms chains

 Now:

- Chains → branches → rings

◇ MNEMONIC

 “CBR”

- C = Chain
- B = Branch
- R = Ring

◇ EXAM LINE (VERY IMPORTANT)

 “Structural isomers have same molecular formula but different structures.”

◇ QUICK DIFFERENCE

Type	Shape
Chain	Straight
Branched	Side chain
Ring	Closed

◇ COMMON MISTAKE

✗ All compounds with same formula are same

✓ Structure changes properties

◇ HIGH-VALUE QUESTION

👉 What are hydrocarbons?

✓ Compounds containing only carbon and hydrogen

📖 TOPIC: FUNCTIONAL GROUPS (DETAILED)

🧠 MAIN CONCEPT (CENTER EXPLANATION)

◇ What is a Functional Group?

👉 Definition:

A **functional group** is an atom or group of atoms that:

- Replaces hydrogen in a hydrocarbon
- Gives **specific properties** to the compound

⚡ WHY FUNCTIONAL GROUP IS IMPORTANT?

👉 It decides:

- Chemical properties
- Reactions
- Smell, taste, behavior

👉 Example:

- Alcohol → -OH
- Acid → -COOH

IMPORTANT FUNCTIONAL GROUPS (MUST LEARN)

◇ 1. Alcohol (-OH)

👉 Formula: R-OH

👉 Example: Ethanol

👉 Properties:

- Liquid
- Used in sanitizer

◇ 2. Aldehyde (-CHO)

👉 Formula: R-CHO

👉 Example: Ethanal

👉 Position:

✓ Always at **end of chain**

◇ 3. Ketone (>C=O)

👉 Formula: R-CO-R

👉 Example: Propanone

👉 Position:

✓ Always **middle of chain**

◇ 4. Carboxylic Acid (-COOH)

👉 Formula: R-COOH

👉 Example: Ethanoic acid

👉 Properties:

- Acidic
- Sour smell

◇ 5. Haloalkane (-Cl, -Br, -I)

👉 Example:

- Chloromethane

◇ 6. Alkene (C=C)

👉 Double bond present

◇ 7. Alkyne (C≡C)

👉 Triple bond present



SUMMARY TABLE (VERY IMPORTANT)

Group	Formula	Suffix
Alcohol	-OH	-ol
Aldehyde	-CHO	-al
Ketone	-CO-	-one
Acid	-COOH	-oic acid
Alkene	C=C	-ene
Alkyne	C≡C	-yne
Halo	-Cl	chloro



KEY UNDERSTANDING

- 👉 Functional group = identity of compound
- 👉 Same carbon chain + different group = different compound



IUPAC NAMING RULES (BASICS)



STEP-BY-STEP METHOD

◇ STEP 1: Longest Carbon Chain

👉 Find longest continuous carbon chain

◇ STEP 2: Identify Functional Group

👉 Which group is present?

◇ STEP 3: Numbering

👉 Number chain from side:

✓ Where functional group gets **lowest number**

◇ STEP 4: Root Name (No. of Carbons)

Carbon	Name
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex

◇ STEP 5: Add Suffix

👉 Based on functional group:

- Alcohol → ol
- Acid → oic acid
- Alkene → ene

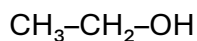
◇ STEP 6: Add Prefix (if needed)

👉 For side groups:

- Methyl ($-\text{CH}_3$)
- Chloro ($-\text{Cl}$)

EXAMPLES (VERY IMPORTANT)

◇ Example 1:

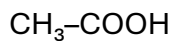


👉 2 carbons → Eth

👉 $-\text{OH}$ → Alcohol

✓ Name = **Ethanol**

◇ Example 2:

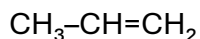


👉 2 carbons → Eth

👉 Acid group

✓ Name = **Ethanoic acid**

◇ Example 3:



👉 3 carbons → Prop

👉 Double bond

✓ Name = **Propene**

◇ Example 4:



👉 3 carbons → Prop

👉 Ketone

✓ Name = **Propanone**

◇ MNEMONIC

👉 “A A K C”

- A = Alcohol
- A = Aldehyde
- K = Ketone
- C = Carboxylic acid

◇ EXAM LINE (VERY IMPORTANT)

👉 “Functional groups determine the chemical properties of carbon compounds.”

◇ COMMON MISTAKES

✗ Wrong numbering

✓ Always give lowest number to functional group

◇ HIGH-VALUE QUESTIONS

👉 Define functional group

👉 Name compounds using IUPAC

👉 Identify group in compound

◇ SUPER TRICK

👉 Name =

Prefix + Root + Suffix

FINAL REVISION LINE

👉 Carbon chain + Functional group = Compound name

TOPIC: HOMOLOGOUS SERIES

◇ 1. What is Homologous Series?

👉 Definition:

A homologous series is a **group of organic compounds**:

- Having the **same functional group**
- Having **similar chemical properties**
- Showing a **gradual change in physical properties**

KEY IDEA

👉 Same functional group → same behavior

👉 Chain length changes → physical properties change

◇ 2. EXAMPLE (ALCOHOL SERIES)

Compound	Formula
Methanol	CH ₃ OH
Ethanol	C ₂ H ₅ OH
Propanol	C ₃ H ₇ OH
Butanol	C ₄ H ₉ OH

👉 All have:

✓ Functional group = -OH

✓ Similar chemical properties

◇ 3. DIFFERENCE BETWEEN MEMBERS

👉 Successive compounds differ by:

👉 **-CH₂ group (VERY IMPORTANT)**

Example:

- CH₄ → C₂H₆ → difference = CH₂
- C₂H₆ → C₃H₈ → difference = CH₂

◇ 4. GENERAL FORMULA

◇ **Alkanes:**

👉 C_nH_{2n+2}

◇ **Alkenes:**

👉 C_nH_{2n}

◇ **Alkynes:**

👉 C_nH_{2n-2}

◇ 5. PHYSICAL PROPERTIES CHANGE

👉 As molecular mass increases:

- Boiling point ↑
- Melting point ↑
- Size ↑

👉 Example:

Methane < Ethane < Propane

◇ 6. CHEMICAL PROPERTIES SAME

👉 Because:

- Same functional group

👉 Example:

All alcohols show similar reactions

FINAL UNDERSTANDING

👉 Homologous series =

Same group + gradual change

◇ KEY POINTS

- Same functional group
- Difference = $-\text{CH}_2$
- Same chemical properties

◇ RECALL LINK

👉 Functional group decides properties

👉 Now: same group = same reaction

◇ MNEMONIC

👉 “ CH_2 RULE”

Every next member = $+\text{CH}_2$

◇ EXAM LINE (VERY IMPORTANT)

👉 “Successive members of a homologous series differ by a $-\text{CH}_2$ unit.”

◇ QUICK TABLE

Property	Change
Chemical	Same
Physical	Gradual change

◇ COMMON MISTAKE

✗ All properties same

✓ Only chemical properties same

◇ HIGH-VALUE QUESTION

👉 Why chemical properties same?

✓ Because same functional group

◇ NUMERICAL TRICK

👉 Mass difference = **14 u**

(12 for C + 2 for H)

TOPIC: NOMENCLATURE OF CARBON COMPOUNDS (IUPAC BASICS)

◇ 1. WHAT IS NOMENCLATURE?

👉 Nomenclature means:

Systematic naming of carbon compounds

👉 Based on:

- Carbon chain
- Functional group
- Type of bonds

⚡ 2. BASIC STRUCTURE OF NAME

👉 Name =

Prefix + Root + Suffix

◇ 3. ROOT WORD (No. of Carbon Atoms)

Carbon	Name
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex

◇ 4. STEP-BY-STEP NAMING RULES

☑ STEP 1: Count Carbon Atoms

👉 Example:

3 carbons → **Prop**

☑ STEP 2: Identify Type of Bond

Bond	Suffix
Single	ane
Double	ene
Triple	yne

☑ STEP 3: Identify Functional Group

Group	Suffix
-OH	ol
-CHO	al
-CO-	one
-COOH	oic acid

☑ STEP 4: Remove 'e' (IMPORTANT RULE)

👉 If suffix starts with vowel:

Example:

- Propane → remove 'e'

👉 Propan + one = **Propanone**

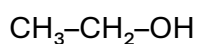
☑ STEP 5: Add Prefix (if needed)

👉 For:

- Halogens → chloro, bromo
- Side chains → methyl

🔪 IMPORTANT EXAMPLES

◇ Example 1:



👉 2 carbons → Eth

👉 Alcohol

✓ Name = **Ethanol**

◇ Example 2:

$\text{CH}_3\text{-CH}_2\text{-Br}$

👉 2 carbons → Eth

👉 Halogen

✓ Name = **Bromoethane**

◇ Example 3:

$\text{CH}_3\text{-CO-CH}_3$

👉 3 carbons → Prop

👉 Ketone

✓ Name = **Propanone**

◇ Example 4:

$\text{CH}_3\text{-CH=CH}_2$

👉 Double bond

✓ Name = **Propene**

◇ Example 5:

$\text{CH}_3\text{-COOH}$

👉 Acid

✓ Name = **Ethanoic acid**

⚡ IMPORTANT RULES FROM NCERT

◇ Rule 1:

👉 Same homologous series → similar naming pattern

◇ Rule 2:

👉 Unsaturated compounds:

- ane → ene / yne

◇ Rule 3:

👉 Functional group priority is important

📖 ANSWER TO NCERT QUESTIONS

? 1. Structural isomers of Pentane

👉 Total = 3 isomers

? 2. Two properties of carbon

✓ Catenation

✓ Tetravalency

? 3. Cyclopentane

👉 Formula = C_5H_{10}

👉 Ring structure

? 4. Draw structures

(i) Ethanoic acid → CH_3-COOH

(ii) Bromopentane → $C_5H_{11}Br$

(iii) Butanone → $CH_3-CO-CH_2-CH_3$

(iv) Hexanal → $CH_3-(CH_2)_4-CHO$

👉 Yes, bromopentane has **isomers**

? 5. Name compound

(i) CH_3-CH_2-Br

✓ **Bromoethane**

◇ KEY POINTS

- Name = Prefix + Root + Suffix
- Functional group decides suffix

◇ MNEMONIC

👉 “PROS”

- P = Prefix
- R = Root
- S = Suffix

◇ EXAM LINE (VERY IMPORTANT)

👉 “The naming of carbon compounds is based on the length of carbon chain and functional groups present.”

◇ COMMON MISTAKES

- ✗ Forget removing ‘e’
- ✗ Wrong numbering

◇ SUPER TRICK

👉 Always:

1. Find longest chain
2. Identify functional group
3. Apply suffix

FINAL REVISION LINE

👉 Count → Identify → Name

TOPIC: CHEMICAL PROPERTIES OF CARBON COMPOUNDS

1. COMBUSTION REACTION

👉 Definition:

Burning of carbon or its compounds in oxygen.

☑ General Reaction:

- $C + O_2 \rightarrow CO_2 + \text{heat} + \text{light}$
- $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{heat} + \text{light}$
- $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O + \text{heat} + \text{light}$

💧 IMPORTANT POINTS

- Produces **heat + light**
- Example: fuels (LPG, petrol)

🌀 Types of Flame

Type	Reason
Blue flame	Complete combustion
Yellow flame	Incomplete combustion

⚠ Important Concept

- 👉 Saturated compounds → Clean flame
- 👉 Unsaturated compounds → Sooty flame

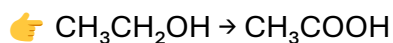
⚡ 2. OXIDATION REACTION

👉 Definition:

Addition of oxygen or removal of hydrogen.

☑ Example:

Alcohol → Acid



🔬 Oxidizing Agents

- Alkaline $KMnO_4$
- Acidified $K_2Cr_2O_7$

👉 These **add oxygen**

⚡ 3. ADDITION REACTION

👉 Definition:

Addition of atoms to unsaturated compounds

☑ Example:

$C_2H_4 + H_2 \rightarrow C_2H_6$ (in presence of Ni catalyst)

🧠 Important Application

👉 Hydrogenation of oils

- Vegetable oil \rightarrow Saturated fat

⚠ Health Concept

- Unsaturated fats \rightarrow Healthy
- Saturated fats \rightarrow Harmful

⚡ 4. SUBSTITUTION REACTION

👉 Definition:

Replacement of one atom by another

☑ Example:

$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$ (sunlight)

💧 Key Idea

👉 Hydrogen replaced by chlorine

🎯 FINAL UNDERSTANDING

👉 Carbon compounds show:

- Combustion

- Oxidation
- Addition
- Substitution

◇ KEY POINTS

- Combustion → heat + light
- Oxidation → oxygen added
- Addition → unsaturated → saturated
- Substitution → replace atom

◇ RECALL LINK

👉 Earlier:

- Saturated vs Unsaturated

👉 Now:

- Their reactions

◇ MNEMONIC

👉 “COAS”

- C → Combustion
- O → Oxidation
- A → Addition
- S → Substitution

◇ EXAM LINE (VERY IMPORTANT)

👉 “Unsaturated hydrocarbons undergo addition reactions while saturated hydrocarbons undergo substitution reactions.”

◇ COMMON MISTAKES

- ✗ Mixing addition & substitution
- ✗ Forget catalyst in addition

◇ HIGH-VALUE QUESTION

👉 Why unsaturated compounds more reactive?

✓ Due to double/triple bonds

◇ DIAGRAM IDEA (FOR PDF)

- Flame types
- Hydrogenation reaction
- Substitution reaction

◇ REAL-LIFE LINK

- 👉 Black utensil → incomplete combustion
- 👉 Vanaspati → hydrogenated oil

EXAM BOOST (VERY IMPORTANT)

✓ Balanced Equation (must learn)

- $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

✓ 2 MARK QUESTION

- 👉 Define oxidation reaction with example

✓ 3 MARK QUESTION

- 👉 Explain addition reaction with example

FINAL REVISION LINE

- 👉 Burn → Oxidise → Add → Replace

TOPIC: SOME IMPORTANT CARBON COMPOUNDS

ETHANOL & ETHANOIC ACID

1. ETHANOL ($\text{C}_2\text{H}_5\text{OH}$)

◇ Basic Properties

- Colourless liquid

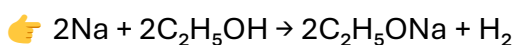
- Soluble in water
- Commonly called **alcohol**
- Used in:
 - Medicines (cough syrup, tincture iodine)
 - Fuel
 - Sanitizers

Health Effect

- Small amount → intoxication
- Large amount → harmful
- Long-term → serious health damage

Reactions of Ethanol

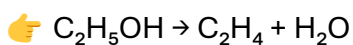
(i) Reaction with Sodium



✓ Produces **Hydrogen gas**

✓ Forms **Sodium ethoxide**

(ii) Dehydration Reaction



(Conc. H_2SO_4 , 443 K)

✓ Forms **Ethene (unsaturated compound)**

 H_2SO_4 acts as **dehydrating agent**

SPECIAL CONCEPT

◇ Denatured Alcohol

 Ethanol + poisonous substances → unsafe for drinking

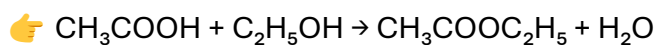
2. ETHANOIC ACID (CH₃COOH)

◇ Basic Properties

- Weak acid
- Vinegar (5–8% solution)
- Freezes in winter → **Glacial acetic acid**

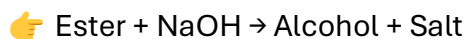
⚡ Reactions of Ethanoic Acid

(i) Esterification Reaction



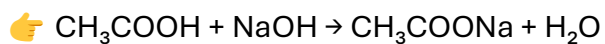
- ✓ Forms **Ester (sweet smell)**
- ✓ Used in perfumes

(ii) Saponification



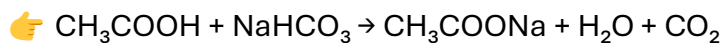
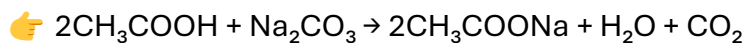
- ✓ Used in **soap making**

⚡ (iii) Reaction with Base



- ✓ Neutralisation reaction

⚡ (iv) Reaction with Carbonates



- ✓ CO₂ gas → turns limewater milky

FINAL UNDERSTANDING

👉 Ethanol → Alcohol

👉 Ethanoic Acid → Acid

👉 Both are **commercially important**

◇ KEY POINTS

- Ethanol → gives H_2 with Na
- Ethanol → forms ethene on heating
- Ethanoic acid → weak acid
- Ester → sweet smell

◇ RECALL LINK

👉 Alcohol + Acid → Ester

◇ MNEMONIC

👉 “Ethanol → H_2 + Ethene”

👉 “Acid → Ester + CO_2 ”

◇ EXAM LINE (VERY IMPORTANT)

👉 “Esterification is the reaction between an alcohol and a carboxylic acid to form an ester and water.”

◇ COMMON MISTAKES

✗ Writing strong acid for ethanoic acid

✗ Forgetting catalyst in esterification

◇ HIGH-VALUE QUESTION

👉 Why ethanoic acid is weak?

✓ Partial ionisation

◇ DIAGRAM IDEAS (FOR PDF)

- Ester formation setup
- CO₂ test with limewater
- Ethanol → Ethene

NCERT QUESTIONS – ANSWERS

? 1. Distinguish Alcohol & Carboxylic Acid

Test	Alcohol	Carboxylic Acid
Litmus	No change	Turns blue → red
NaHCO ₃ test	No reaction	CO ₂ gas produced

? 2. What are Oxidising Agents?

☞ Substances that **add oxygen or remove hydrogen**

✓ Example: KMnO₄, K₂Cr₂O₇

FINAL REVISION LINE

☞ Alcohol → H₂ + Alkene

☞ Acid → Ester + Salt + CO₂

TOPIC: SOAPS AND DETERGENTS

1. WHAT IS SOAP?

☞ Soap = Sodium/Potassium salts of long-chain carboxylic acids

◇ Structure of Soap Molecule

Soap has **two ends**:

- **Hydrophilic (water-loving head)** → dissolves in water
- **Hydrophobic (oil-loving tail)** → attaches to dirt/oil

🌀 2. CLEANING ACTION OF SOAP

◇ Key Concept: Micelle Formation

👉 Soap forms **micelles**

✓ Structure:

- Oil/dirt → inside
- Water-loving heads → outside

🔄 Process

1. Soap surrounds dirt
2. Forms micelle
3. Dirt gets trapped inside
4. Washed away with water

💡 Result

👉 Clothes become clean

⚡ 3. WHY DOES SOAP NOT WORK IN HARD WATER?

◇ Hard Water Contains:

- Calcium (Ca^{2+})
- Magnesium (Mg^{2+})


✗ Reaction:

Soap + Ca^{2+} → Insoluble substance (scum)

Result:

- Less foam
- More soap required

4. WHAT ARE DETERGENTS?

 Detergents = Sodium salts of sulphonic acids

Properties:


- Work in **hard water**
- Do not form scum

5. SOAP vs DETERGENT

Property	Soap	Detergent
Hard water	Not effective	Effective
Scum formation	Yes	No
Foam	Less	More

FINAL UNDERSTANDING

 Soap cleans by **micelle formation**

 Detergents work even in **hard water**

KEY POINTS

- Soap = carboxylic salt
- Detergent = sulphonic salt
- Micelle → cleaning

◇ RECALL LINK

👉 Earlier:

- Polar & non-polar substances

👉 Now:

- Soap connects both

◇ MNEMONIC

👉 “Head loves water, Tail loves dirt”

◇ EXAM LINE (VERY IMPORTANT)

👉 “Soap cleans by forming micelles which trap oily dirt inside and remove it with water.”

◇ COMMON MISTAKES

✗ Soap works in hard water

✗ Confusing micelle structure

◇ HIGH-VALUE QUESTION

👉 Why detergents better than soap?

✓ No scum formation

◇ DIAGRAM IDEA (VERY IMPORTANT)

👉 Draw:

- Micelle structure (oil inside, heads outside)

? 1. Can detergent check hardness of water?

✗ No

👉 Because detergents work in both hard & soft water

? 2. Why is agitation necessary?

👉 Agitation helps:

- Soap to mix properly
- Micelles to form faster
- Dirt to detach from clothes

FINAL REVISION LINE

👉 Soap → Micelle → Clean

👉 Hard water → Problem → Use detergent