

# Carbon & Its Compounds - Cheat Sheet

## Characteristics of Carbon

- **Valency:** 4 (forms 4 covalent bonds)
- **Bond type:** Covalent (shares electrons)
- **Catenation:** Ability to form long chains/rings with other carbon atoms
- **Tetravalency:** Combines with H, O, N, Cl, etc.

## Allotropes of Carbon

Allotrope	Structure	Example/Use
Diamond	3D tetrahedral	Cutting tools
Graphite	Layers of hexagonal carbon	Lubricant, conductor
Fullerene ( $C_{60}$ )	Spherical	Nanotechnology

## Hydrocarbons

Type	Bond	General Formula	Example
Alkanes	Single	$C_nH_{2n+2}$	$CH_4$ (Methane)
Alkenes	Double	$C_nH_{2n}$	$C_2H_4$ (Ethene)
Alkynes	Triple	$C_nH_{2n-2}$	$C_2H_2$ (Ethyne)

## Functional Groups

Functional Group	Formula	Example
Alcohol	-OH	Ethanol ( $C_2H_5OH$ )
Aldehyde	-CHO	Ethanal ( $CH_3CHO$ )
Ketone	-CO-	Propanone ( $CH_3COCH_3$ )
Carboxylic Acid	-COOH	Ethanoic acid ( $CH_3COOH$ )
Ester	-COO-	Ethyl acetate ( $CH_3COOC_2H_5$ )

## Homologous Series

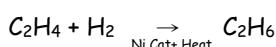
- Series of compounds with same functional group & similar properties.
- Difference:  $-CH_2-$  (14 u) in molecular mass.
- Example:  $CH_4, C_2H_6, C_3H_8 \dots$

## Chemical Properties & Key Reactions

### 1. Combustion:



### 2. Addition Reaction (for unsaturated hydrocarbons - also for hydrogenation of oils)



### 3. Substitution Reaction (for alkanes)



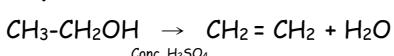
(Chloromethane, Dichloromethane,  
Trichloromethane (Chloroform), Tetrachloromethane)

### 4. Oxidation (for ethanol)



Aq. Solution of Alkaline Potassium Permanganate or  
Acidified Potassium Dichromate are oxidizing  
agents that provide nascent Oxygen, [O]

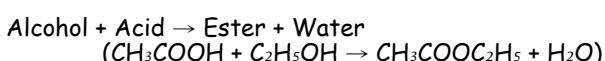
### 5. Dehydration (for ethanol)



### 6. Ethanol with Na



### 7. Esterification:



### 8. Saponification:



## Important Compounds

Compound	Formula	Use
Ethanol	$C_2H_5OH$	Alcoholic drinks, fuel
Ethanoic Acid	$CH_3COOH$	Vinegar, preservative
Soap	Sodium/potassium salt of fatty acid ( $R-COONa$ )	Cleansing
Detergent	Sulphonate/sulphate salt ( $R-SO_3Na$ or $R-OSO_3Na$ )	Cleansing in hard water

## Soap vs Detergent

Property	Soap	Detergent
Composition	Sodium or potassium salt of a fatty acid	Sodium or ammonium salt of a sulphonate or sulphate
General Formula	$R-COONa$ (where R = long alkyl chain, e.g. $C_{17}H_{35}-$ )	$R-SO_3Na$ or $R-OSO_3Na$
Example	Sodium stearate ( $C_{17}H_{35}COONa$ ) - main ingredient in many soaps	Sodium lauryl sulphate ( $C_{12}H_{25}OSO_3Na$ ) or Sodium alkyl benzene sulphonate ( $R-C_6H_4-SO_3Na$ )
Works in hard water?	✗ Forms scum (with $Ca^{2+}$ / $Mg^{2+}$ )	✓ Works well, even in hard water
Type of cleansing agent	Natural / biodegradable	Synthetic / usually non-biodegradable

