



Cengage EXAM CRACK Series®

# Problems and Solutions in ORGANIC CHEMISTRY for JEE (Main and Advanced)

Updated with  
Chapterwise Solved JEE (Main) 2023  
and JEE (Advanced) 2022 Questions

**Surendra K. Mishra**  
(SKM Sir)

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## Problems & Solutions in ORGANIC CHEMISTRY for JEE (Main and Advanced)

is designed to help aspiring engineers focus on the subject of Organic Chemistry from two standpoints:

1. To develop their caliber, aptitude, and attitude for the engineering field and profession.
2. To strengthen their grasp and understanding of the concepts of the subjects of study and their applicability at the grassroots level.

An array of exercises will expose the students to the variety and nature of questions that they can expect to face in JEE. The coverage and features of this book make it highly useful for all those preparing for JEE and aspiring to become engineers.

### Key Features

- Includes questions and problems from previous years' JEE papers, which will help students understand the pattern of the questions asked in the examination
- Features all types of problems asked in JEE (Main & Advanced):
  - Single Correct Answer Type
  - Multiple Correct Answers Type
  - Comprehension Type
  - Matching Column Type
  - Numerical Value Type
  - Archives [up to JEE (Main) Jan 2023 & JEE (Advanced) 2022 Questions]
- Provides hints and solutions to exercises and problems

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**Surendra K. Mishra**  
(SKM Sir)

(Co-founder, Director Nucleus Eduacademy, Kota, Rajasthan and Head of Department – Organic Chemistry) is the author of this book and the mentor of Chitraang Murdia (AIR 1, JEE Advanced 2014), Himanshu Gaurav Singh (AIR 2, JEE Advanced 2019), Govind Lahoti (AIR 3, JEE Advanced 2014), Nishit Agarwal (AIR 6, IIT-JEE 2012), Amey Gupta (AIR 8, JEE Advanced 2014), Harshvardhan Agarwal (AIR 9, JEE Advanced 2020), and Lakshay Sharma (AIR 10, JEE Advanced 2017). He is also the mentor of Kshitiz Garg who won the gold medal for India in the International Chemistry Olympiad. He has also taught Sharvik Mittal (Silver Medalist), Kushal Babel (Bronze Medalist), and Aayush Kadam (Silver Medalist) (IChO 2018).

"I have been actively involved in the proofreading of this book and believe that it will give ample practice for all topics in Organic Chemistry for IIT-JEE. SKM Sir's teaching methodology relies on making concepts logical and mechanism-based which can be inherently seen in this book."

Chitraang Murdia  
(AIR 1, JEE Advanced 2014)

### Other Books on Chemistry

Problems and Solutions in Inorganic Chemistry for JEE (Main and Advanced)

Vishal Joshi  
(VJ Sir)

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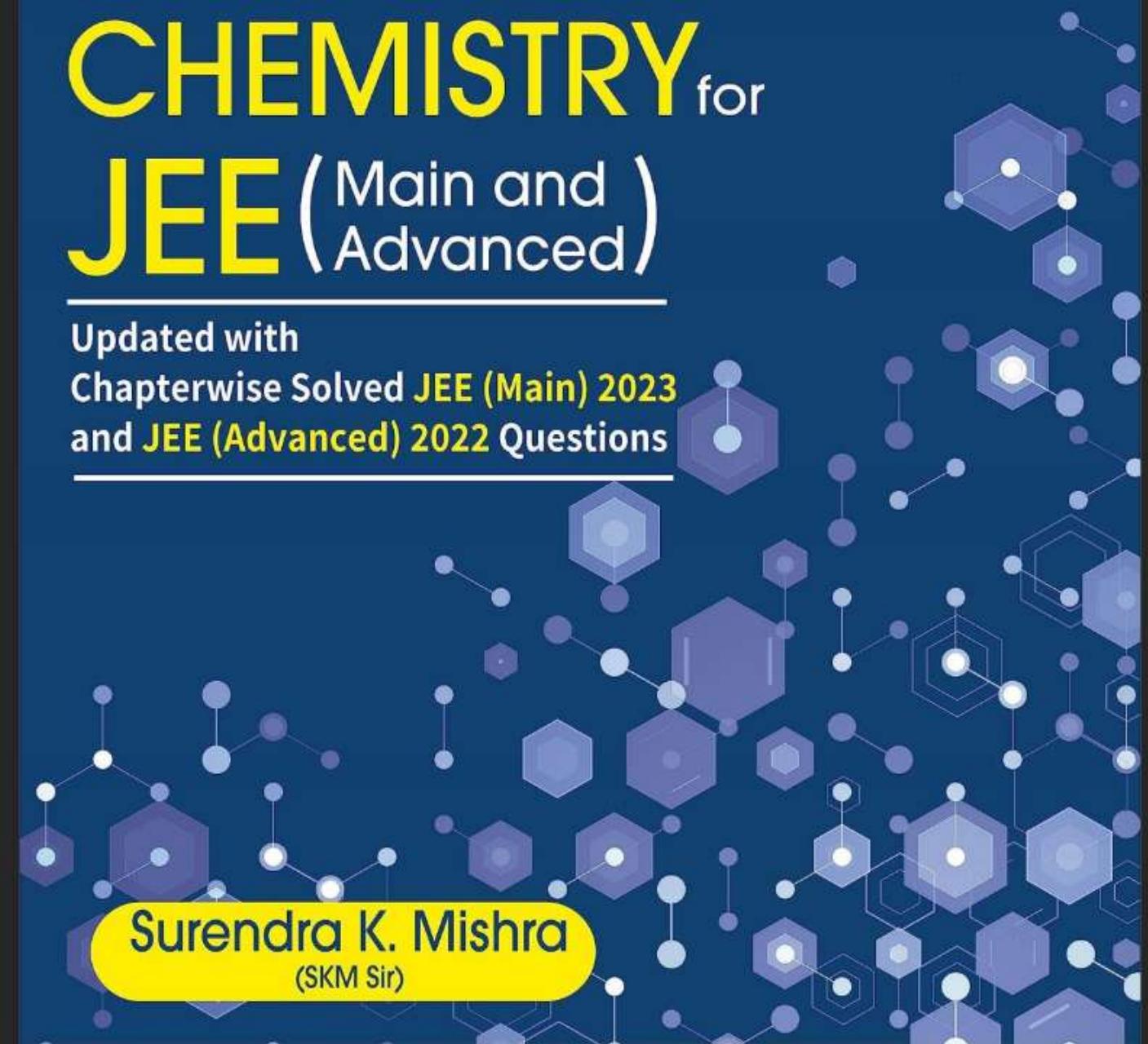
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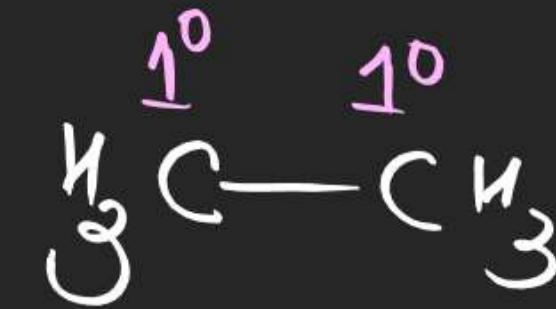
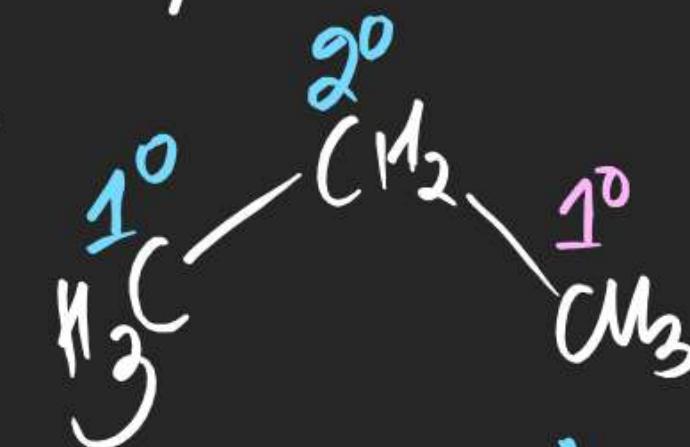
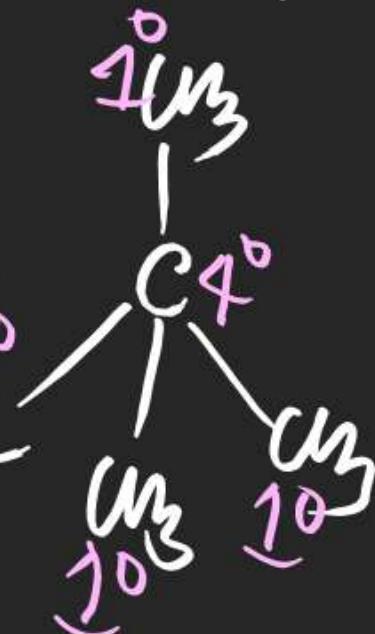
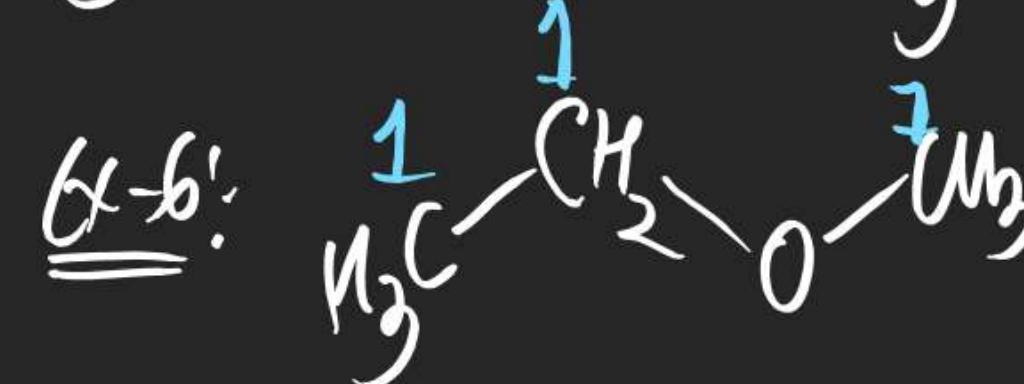
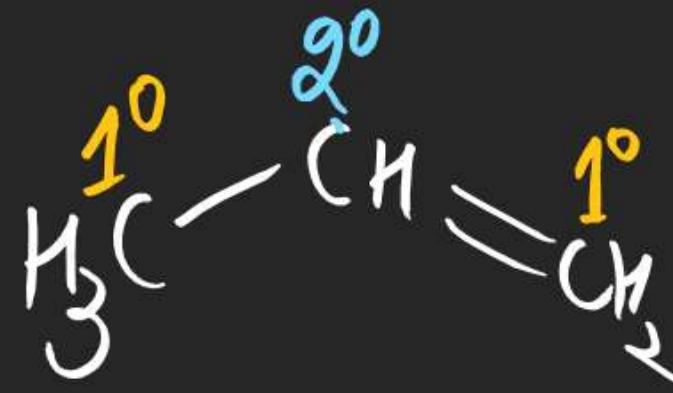
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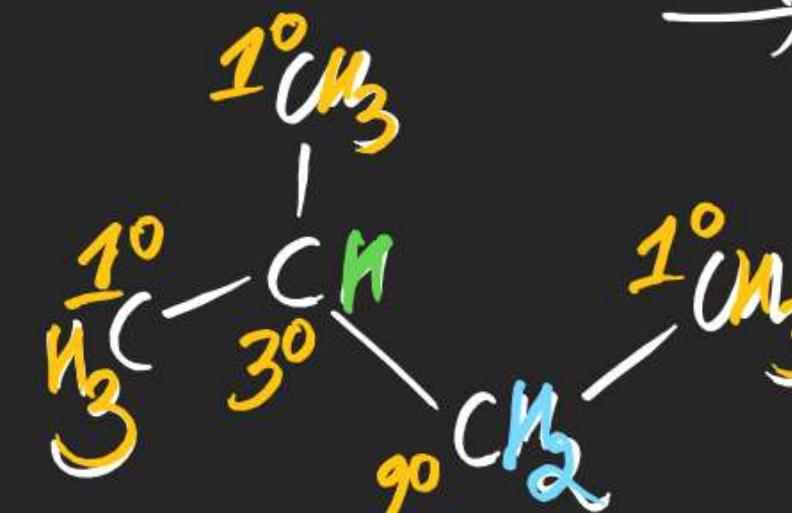


# Basic Organic chemistry:

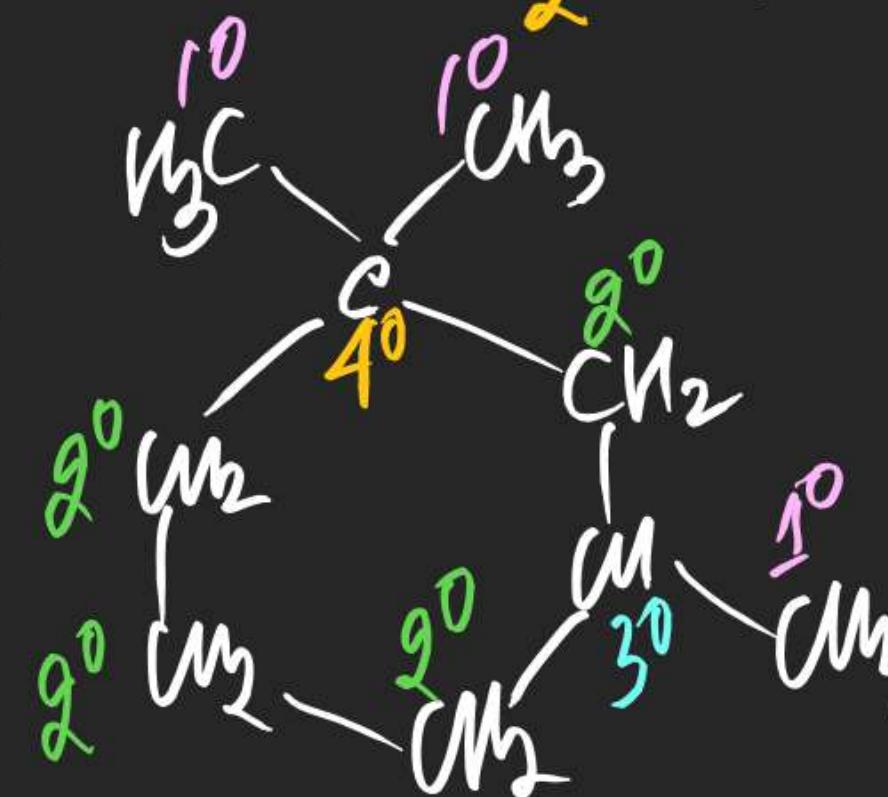
- (i) Types of Carbon → Primary Carbon /  $1^\circ$  Carbon ⇒ Carbon attached with 1C or none "C"  
     → Secondary Carbon /  $2^\circ$  Carbon ⇒ \_\_\_\_\_ 2C  
     → Tertiary Carbon /  $3^\circ$  Carbon ⇒ \_\_\_\_\_ 3C  
     → Quaternary Carbon /  $4^\circ$  Carbon ⇒ \_\_\_\_\_ 4C

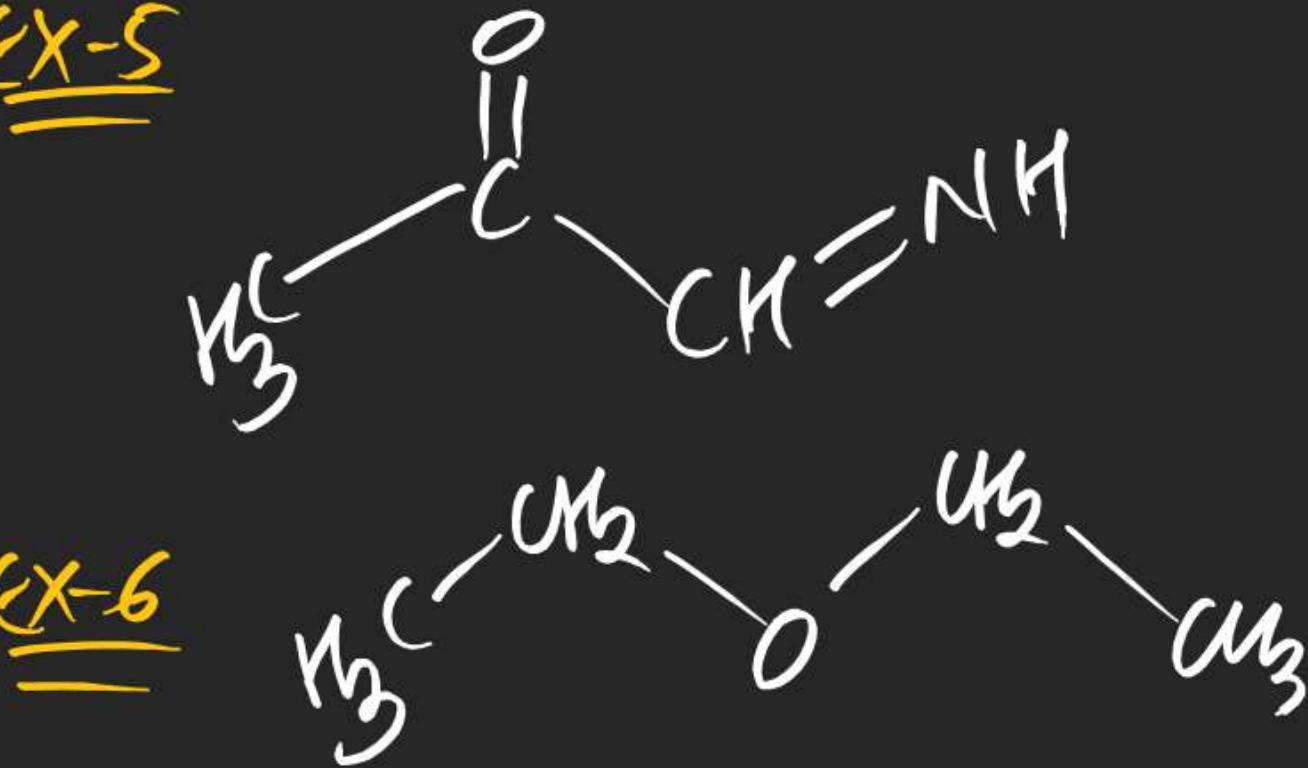
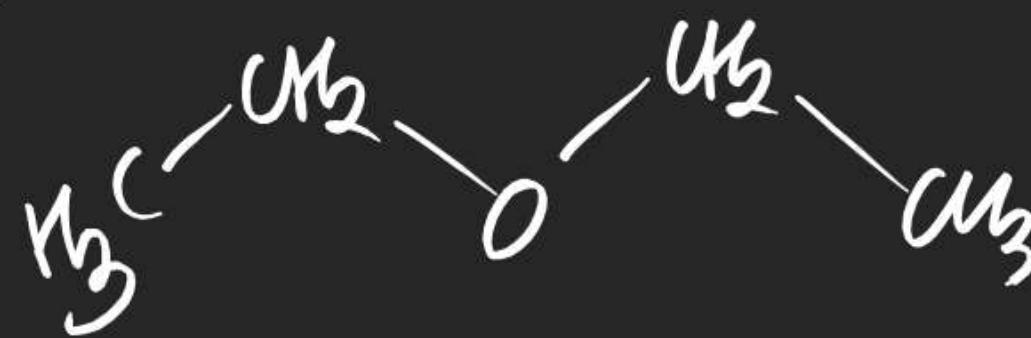
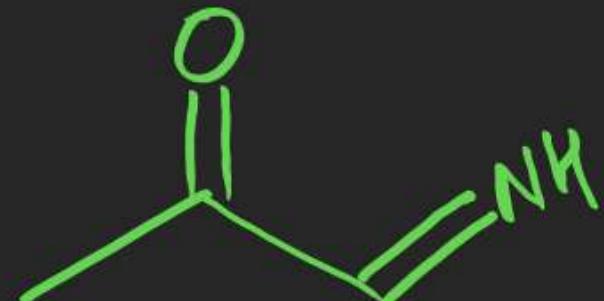
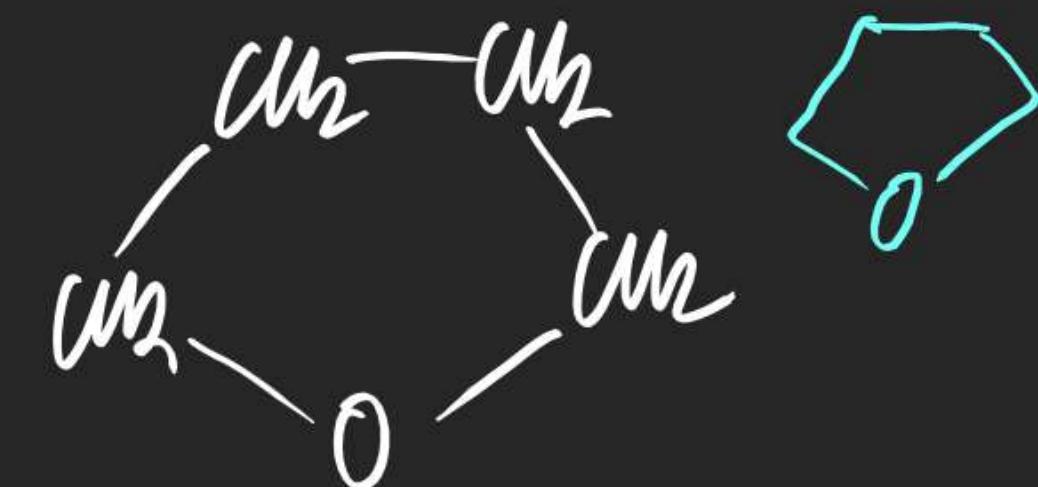
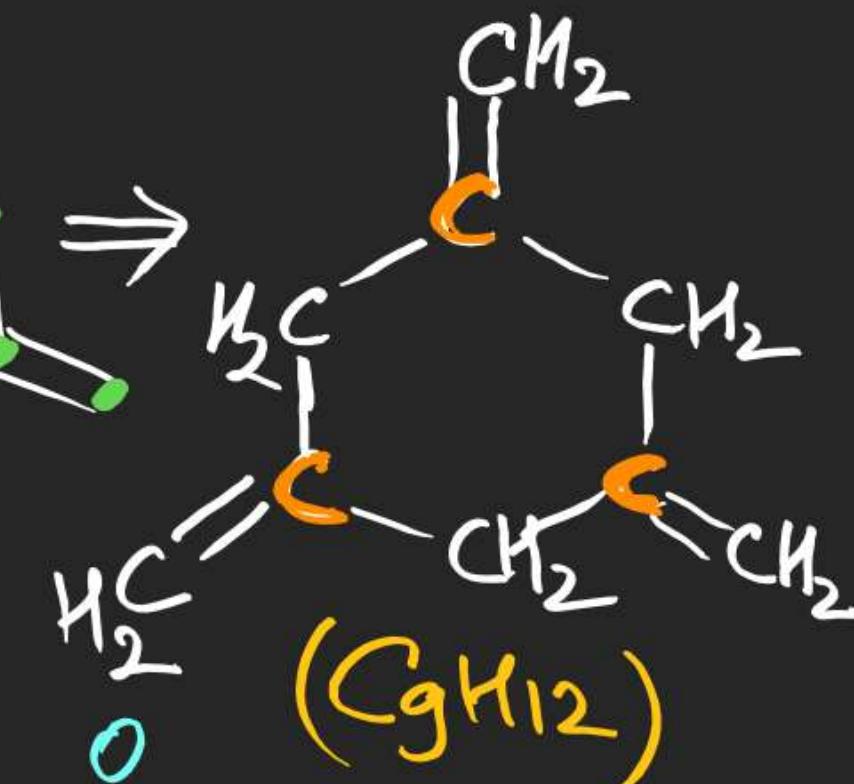
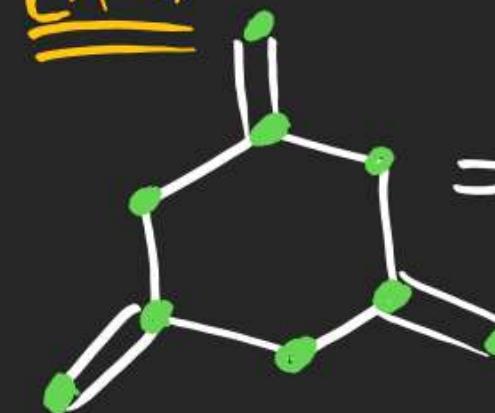
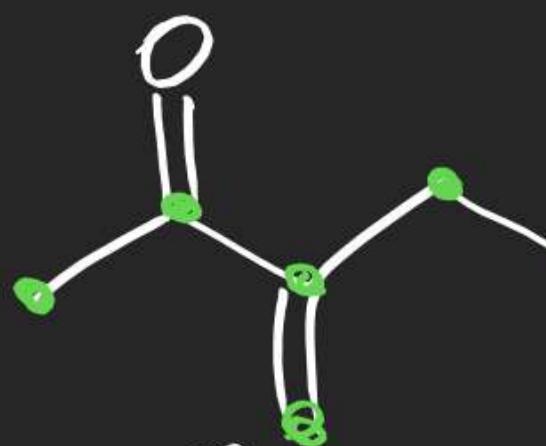
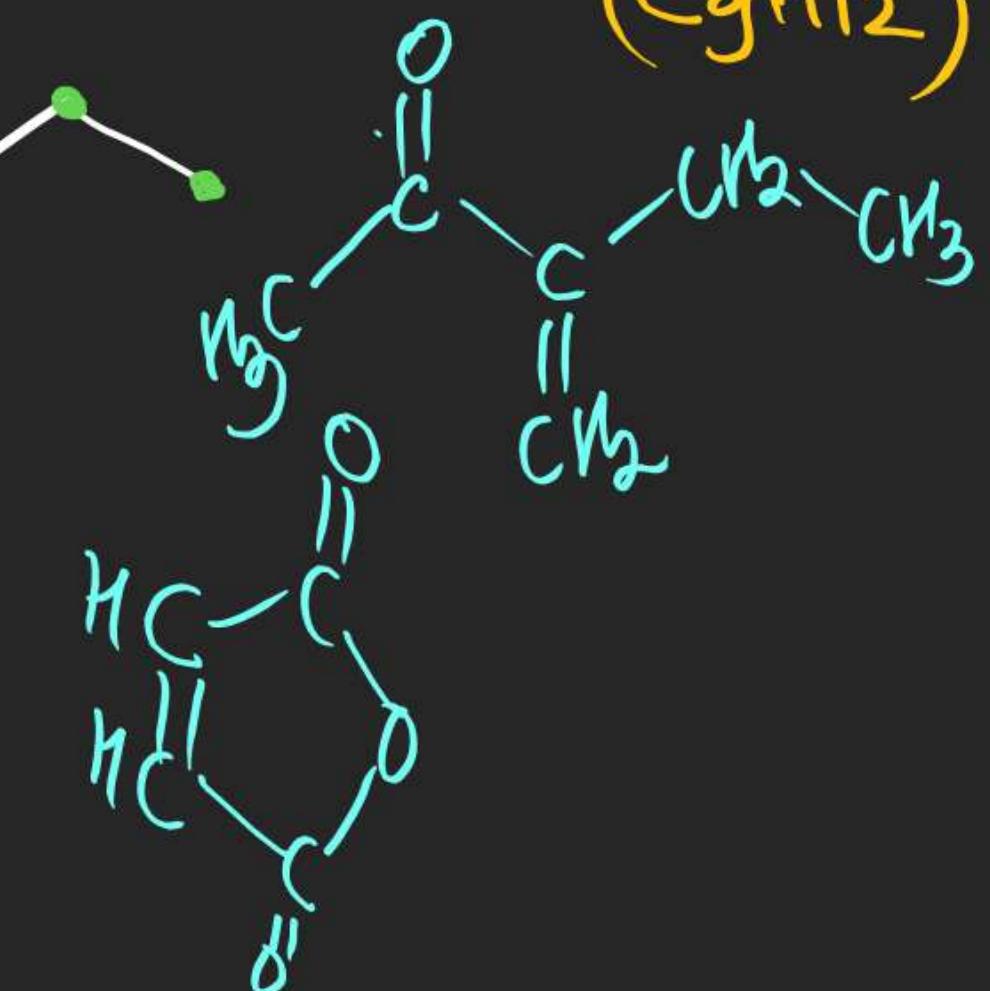
Ex:Ex:Ex:Ex:Ex-5:

(ii) Types of Hydrogen: → Primary Hydrogen /  $1^\circ H$  ⇒ H attached at  $1^\circ$  carbon  
 → Secondary Hydrogen /  $2^\circ H$  ⇒ \_\_\_\_\_  $2^\circ$  carbon  
 → Tertiary Hydrogen /  $3^\circ H$  ⇒ \_\_\_\_\_  $3^\circ$  carbon

Ex:-

$4^\circ C$	$3^\circ C$	$2^\circ C$	$1^\circ C$	$3^\circ H$	$2^\circ H$	$1^\circ H$
0	1	1	3	1	2	9
1	1	4	3	1	8	9

Ex:-

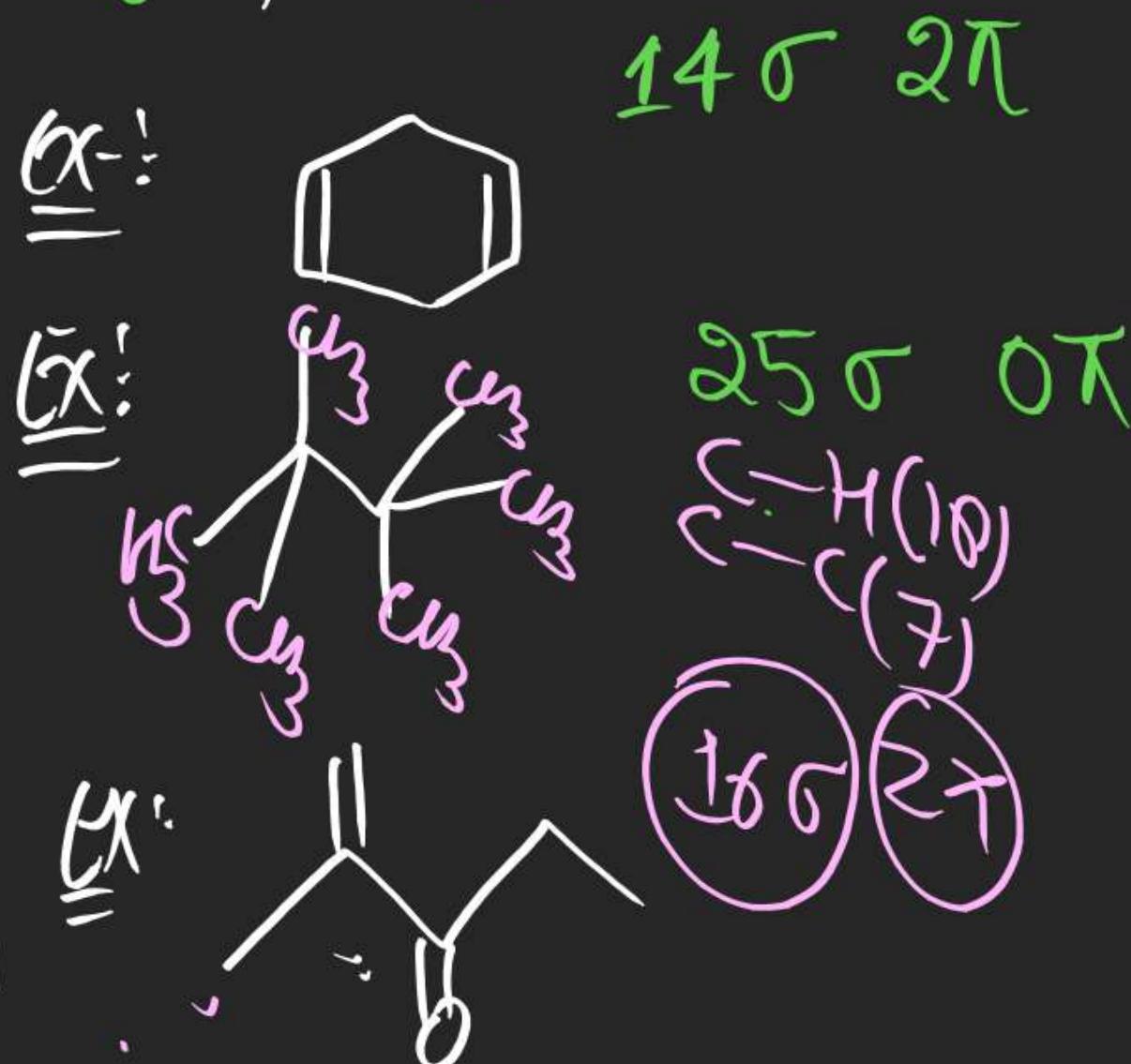
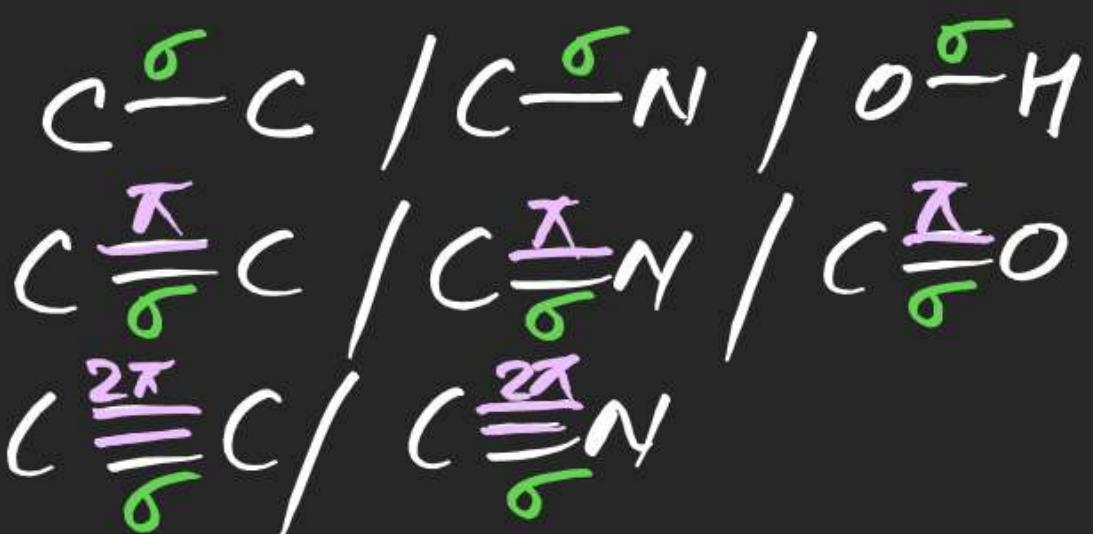
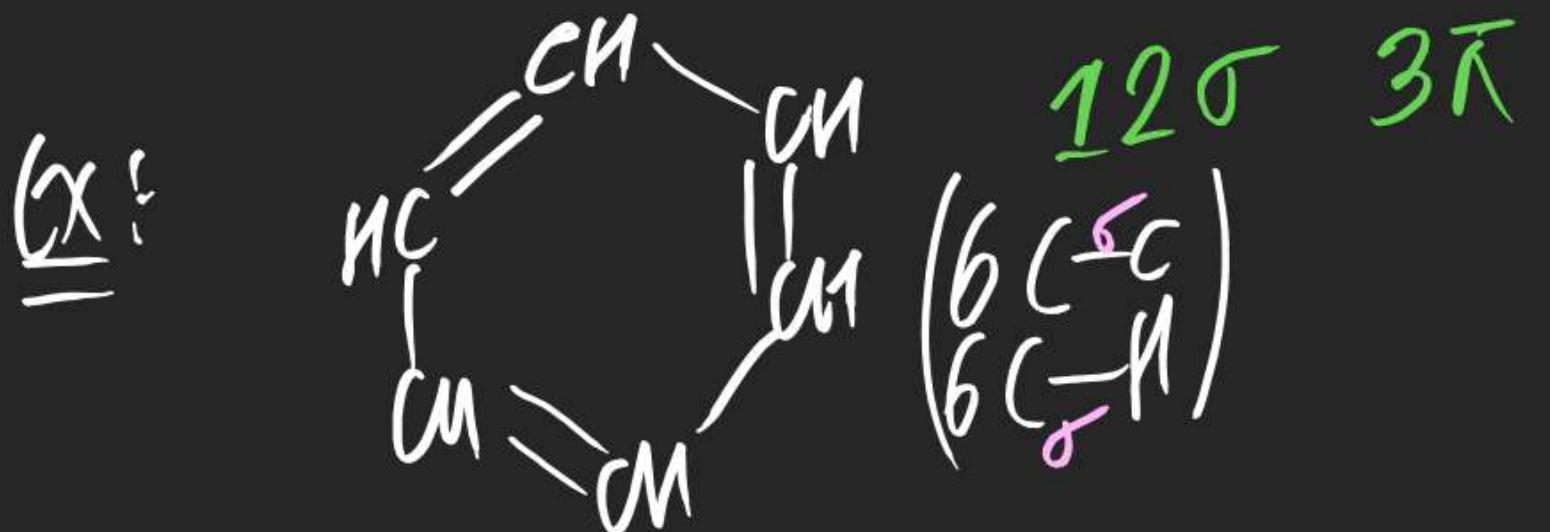
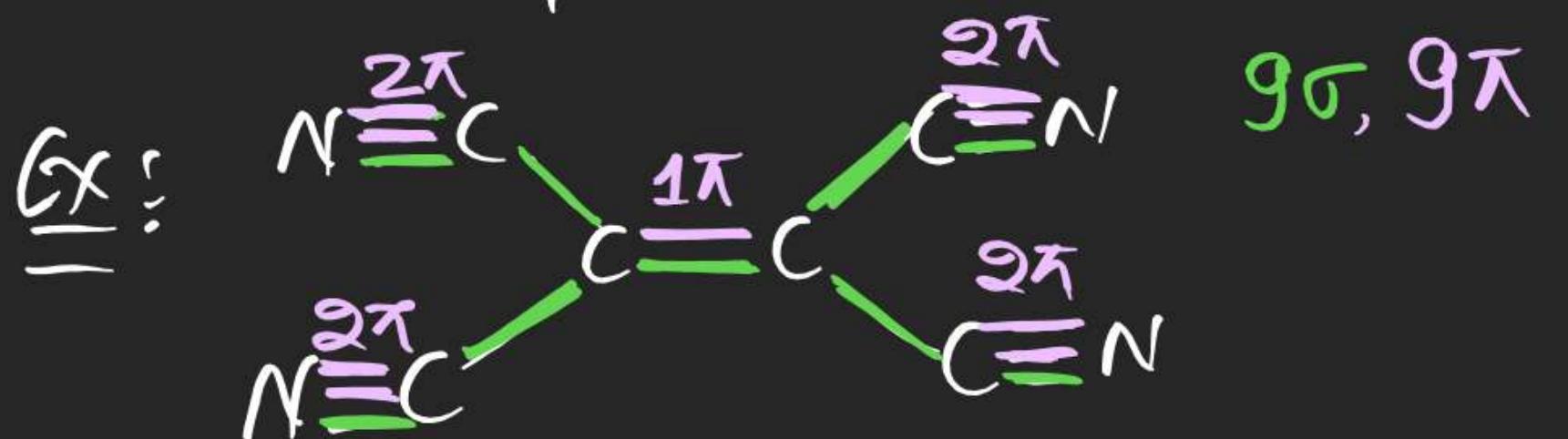
Ex-5Ex-6Ex-7Ex-8Ex-9Ex-10

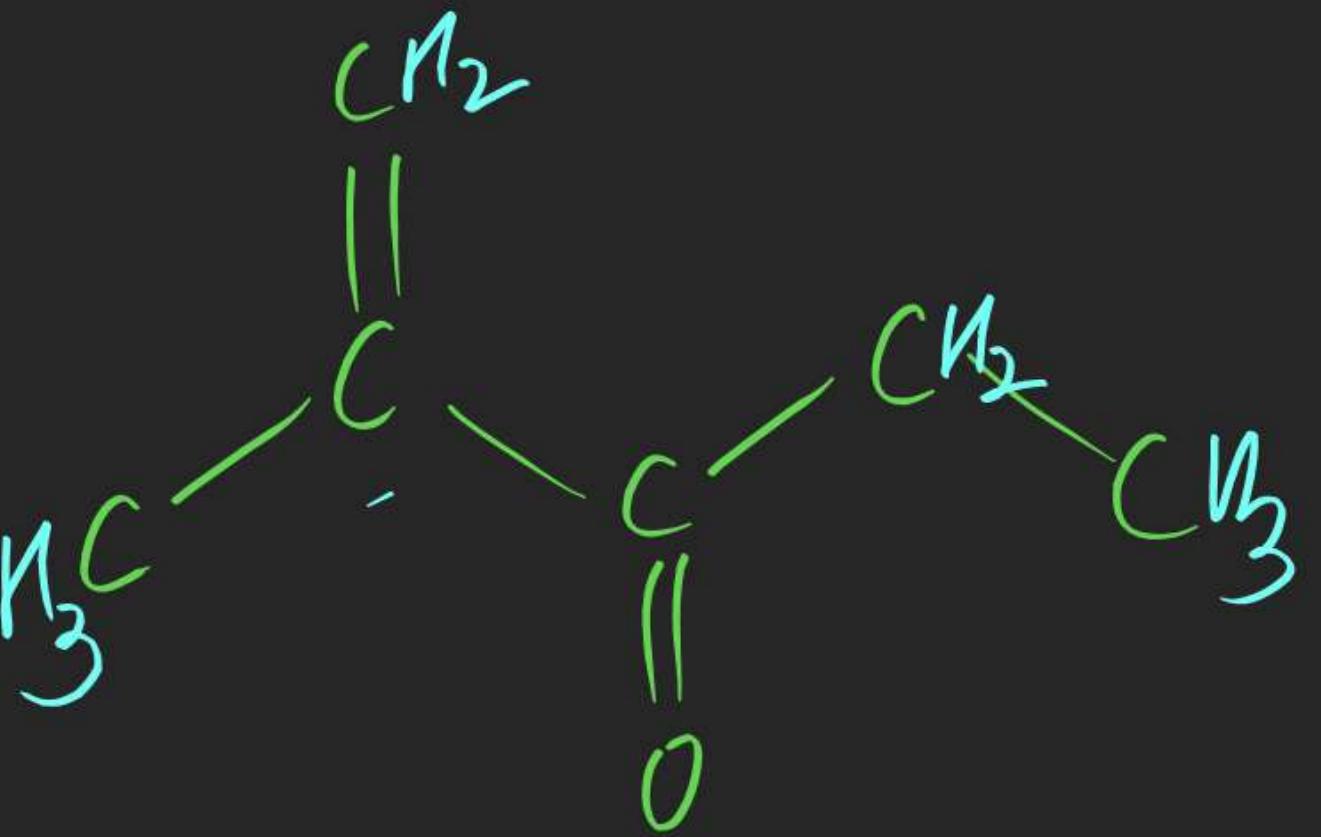
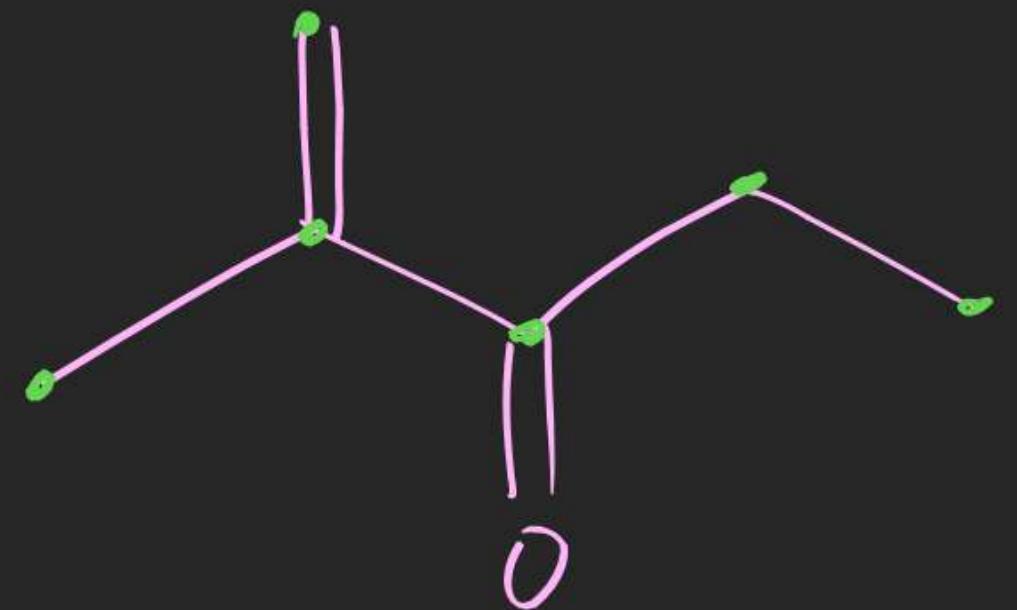
## (#) σ & π Bond

Each Single Bond  $\Rightarrow \underline{1\sigma}$

Each double Bond  $\Rightarrow \underline{1\sigma} + 1\pi$

Each Triple Bond  $\Rightarrow 1\sigma + 2\pi$





~~(+) T/F~~

(+) Double Bond Equivalent (DBE)

(-) Degree of Unsaturation (DOU)

(or) Index of Hydrogen deficiency (IHD)

$\Delta n_H = \frac{\text{Total No. of Rings} + \text{Total No. of } \pi \text{ Bonds}}{2}$

When Str. is given

Ex-1:

$$\begin{aligned} DBE &= DOU = IHD \\ &= 1 + 2 \\ &= 3 \end{aligned}$$

Alkane  $C_n H_{2n+2}$

Ex-2:

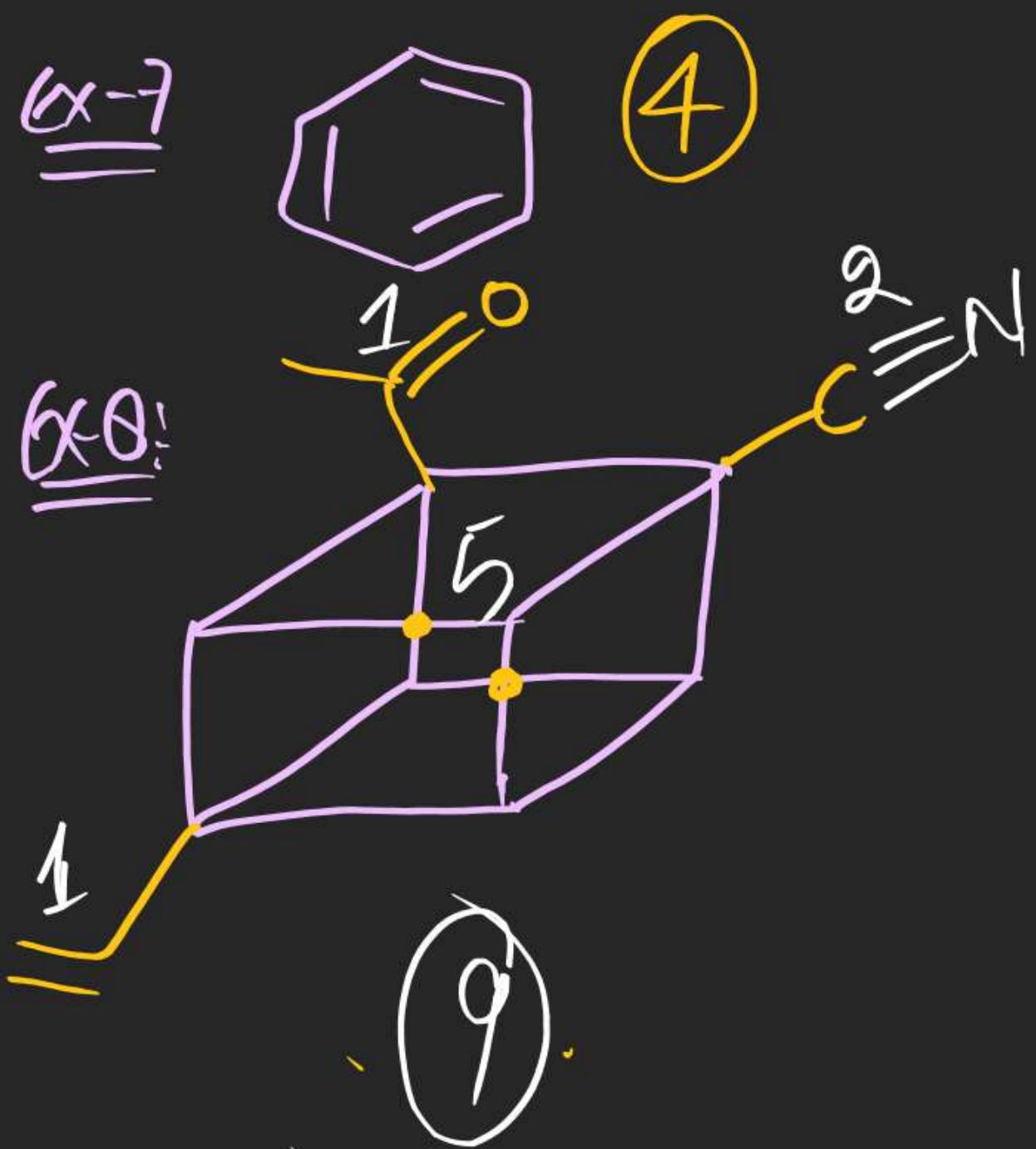
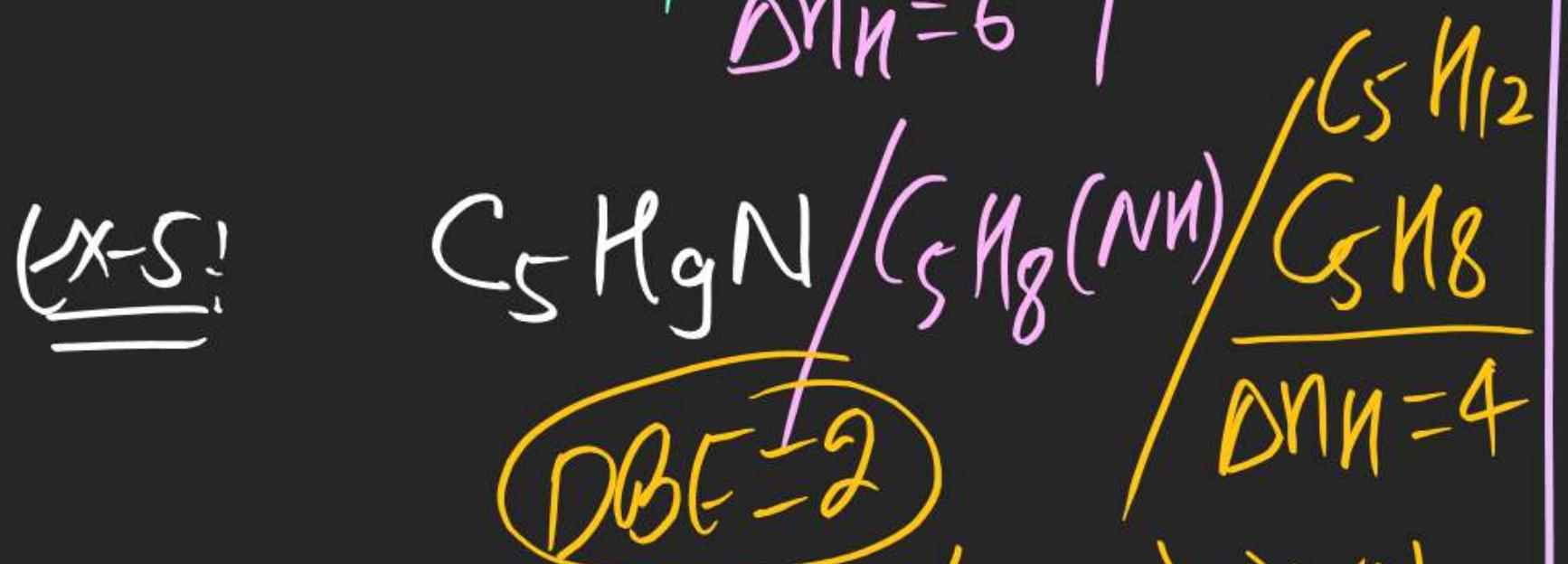
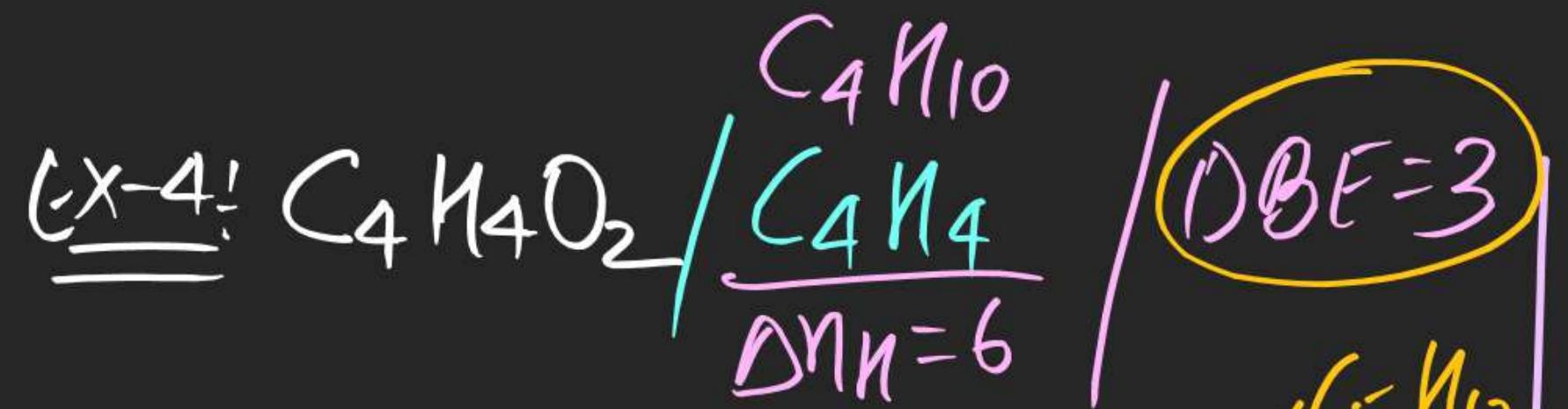
$\Delta n_H = 10$

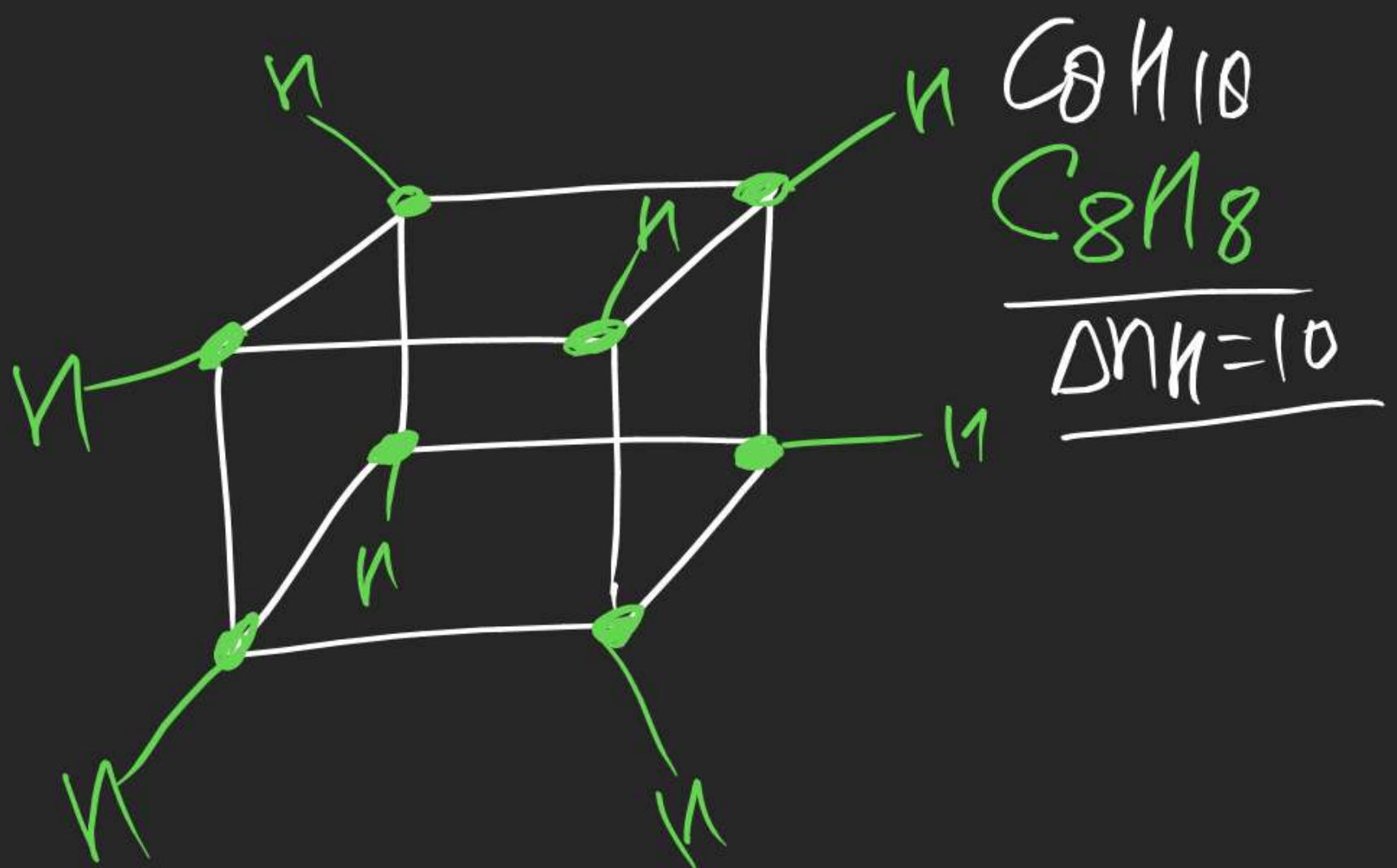
$$\begin{aligned} DBE &= DOU = IHD \\ &= \frac{\Delta n_H}{2} = \frac{10}{2} = 5 \end{aligned}$$

Note (i) monovalent atom ( $-F, -Cl, -Br, -I, -F, -D, -T$ )  $\Rightarrow$  Replace By "H"

(ii) Bivalent atom (O)  $\Rightarrow$  Neglect these atoms.

(iii) Trivalent atom (N)  $\Rightarrow$  Neglect NN.

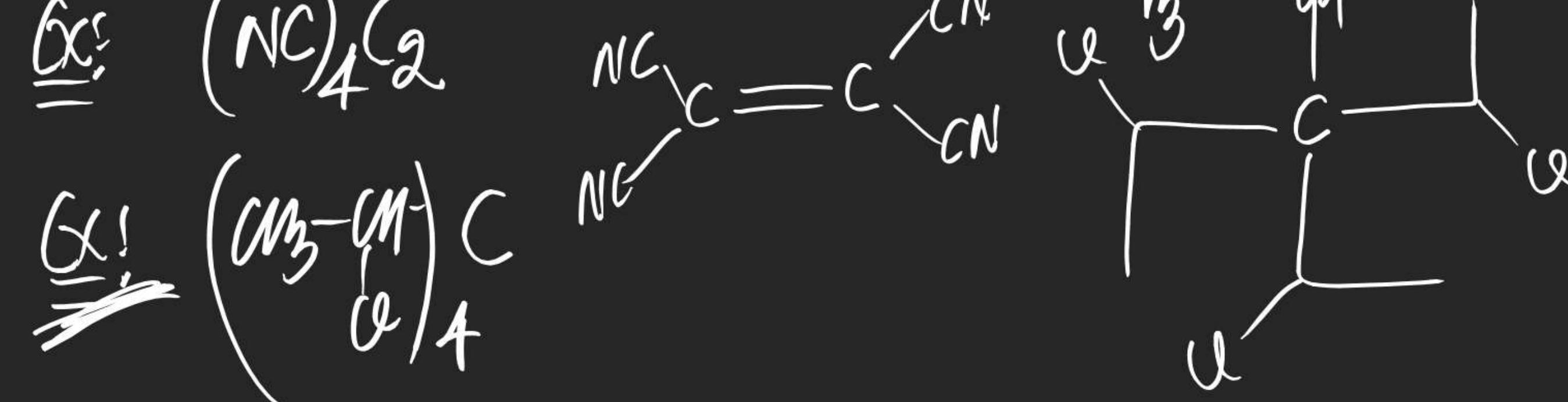
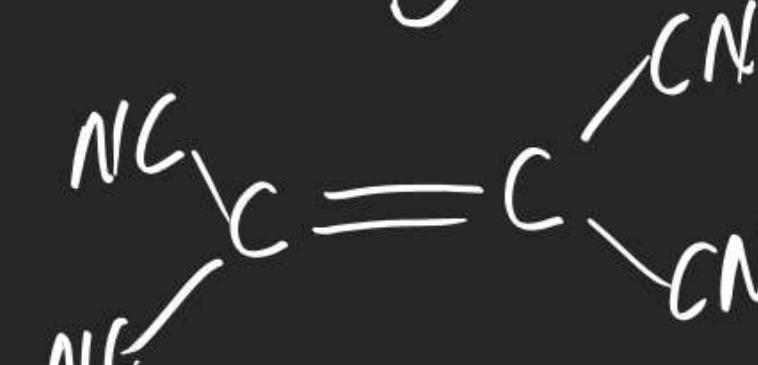
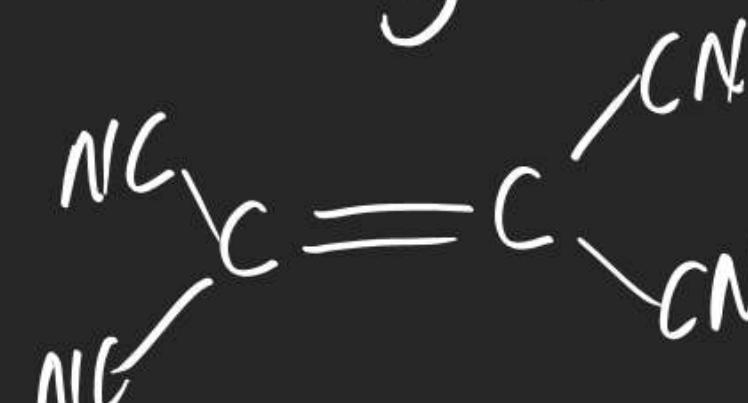
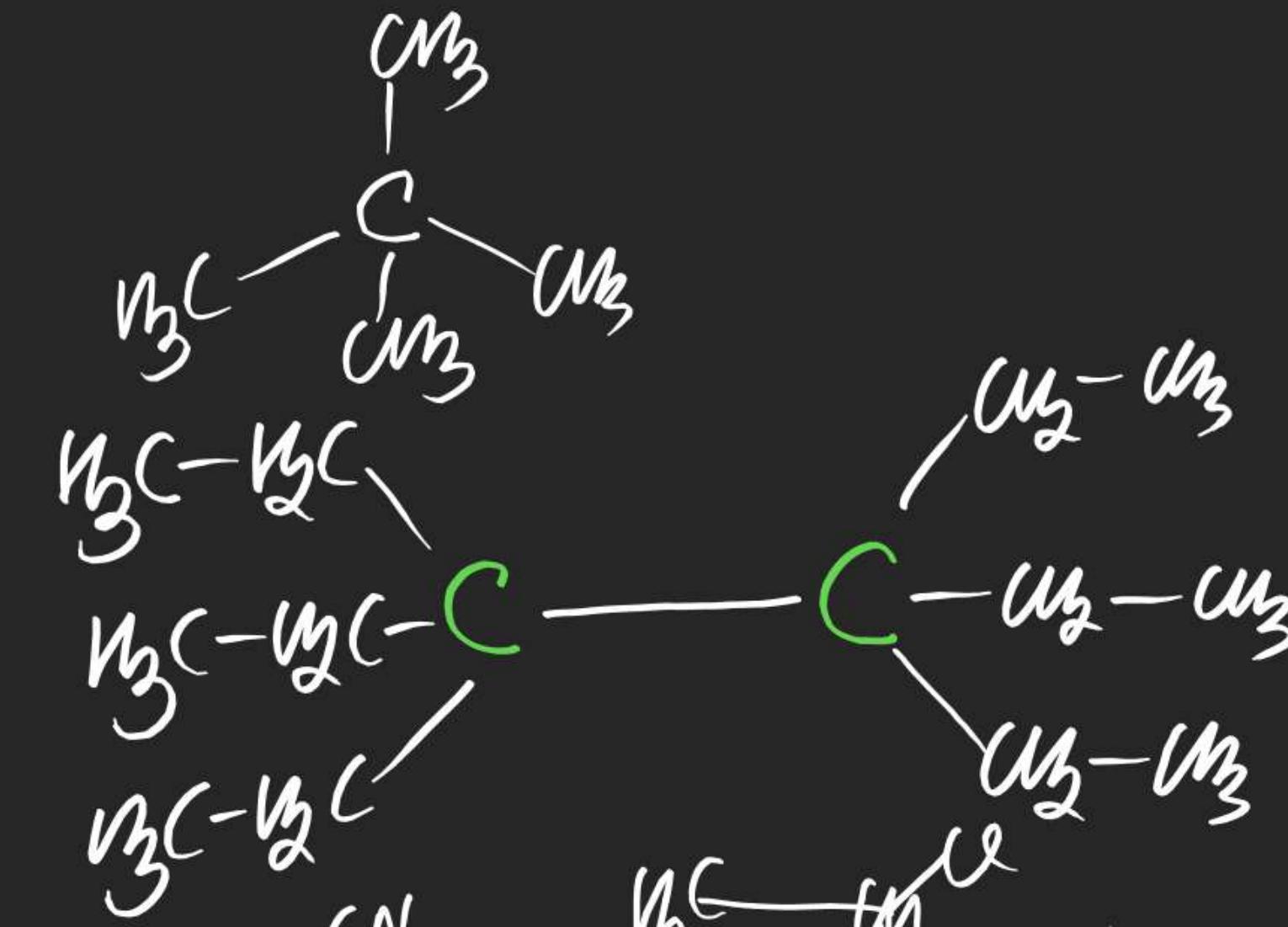




$DBE = 5 = \text{Total No. of Ring} + \text{Total No. of } \pi \text{ bond}$

$$\Rightarrow 5 = TR + 0$$
$$\Rightarrow \boxed{5 = TR}$$

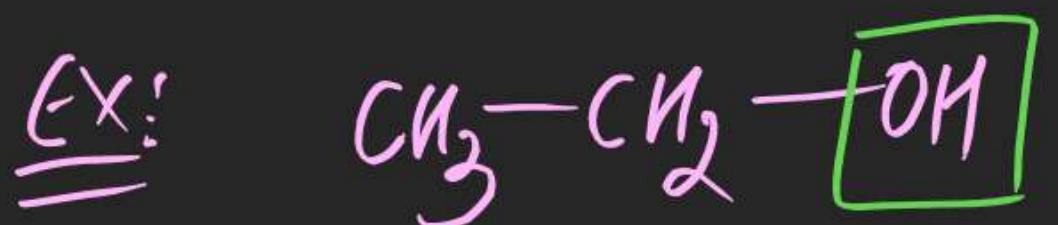
## (#) Condense Formula:



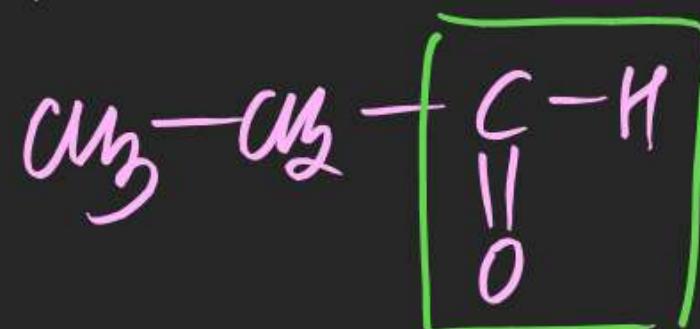
## Functional Groups:

⇒ Segment of a compound which is responsible for compound's chemical properties.

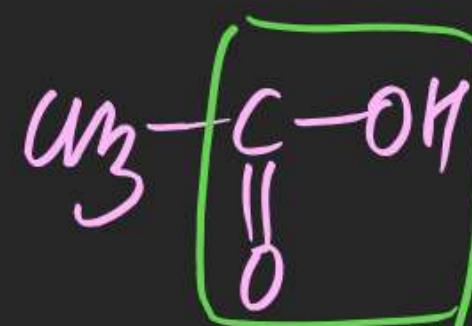
Ex:



functional group  
Alcohol



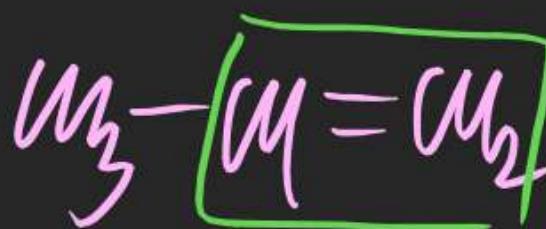
Aldehyde



Carboxylic Acid



No functional group



Alkene

# Table of Functional Groups:

Functional Groups

[Prefix]

[Suffix]

Suffix\*

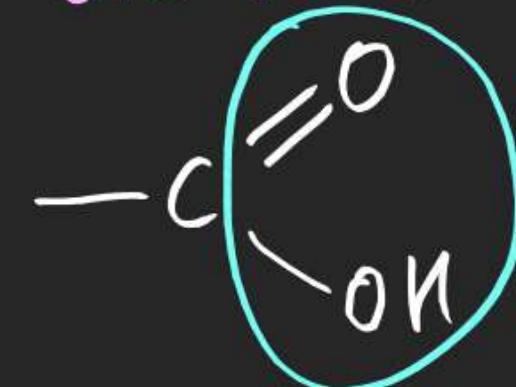
(1) Carboxylic Acid



$R \Rightarrow (\text{H}, \text{CH}_3, -\text{CH}_2\text{CH}_3, \text{Ph}, \dots)$

Carboxy

Oic Acid



(2) Sulphonic Acid

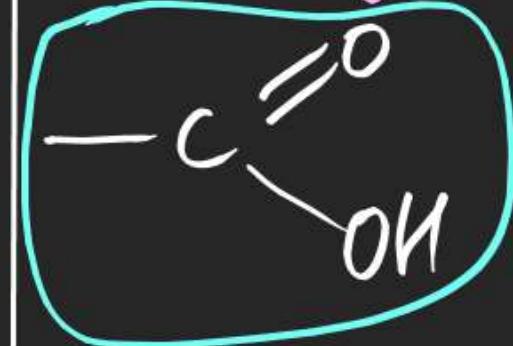


$R \Rightarrow (-\text{CH}_3, -\text{CH}_2\text{CH}_3, -\text{Ph}, \dots)$

Salpho

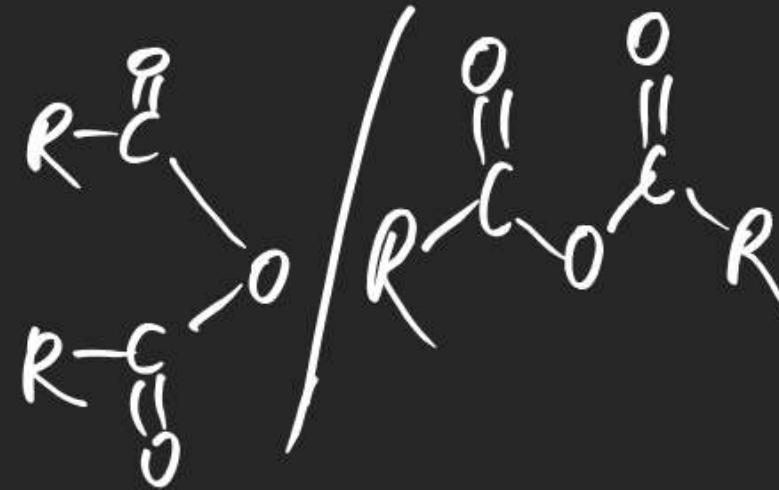
Sulphonic Acid

Carboxylic Acid

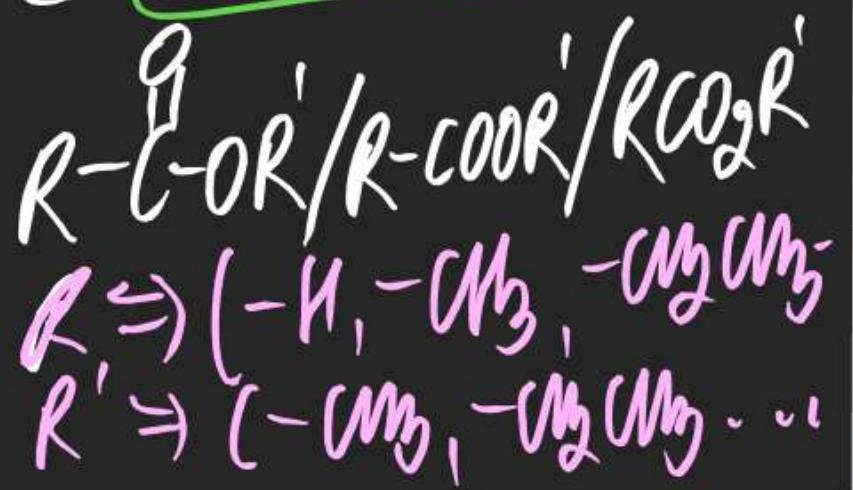


Sulphonic Acid

## (3) Acid anhydride

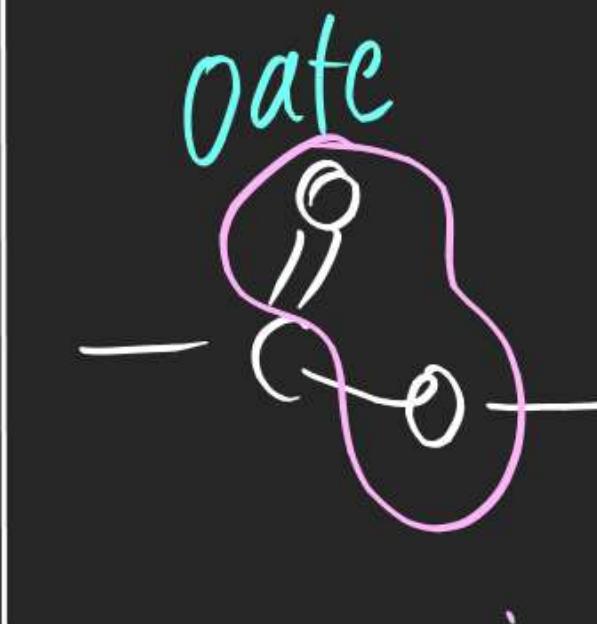


## (4) Ester



Alkoxy Carbonyl

Alkoxyl oxy



oic anhydride

Carboxylic Acid anhydride

Carboxylate



(5) Acid Halide

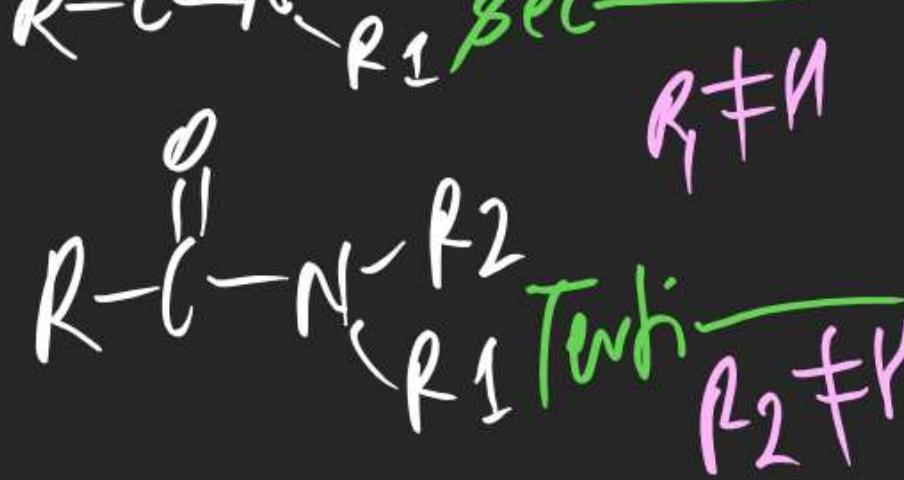
where  $X \Rightarrow \text{F, Cl, Br, I}$

$R \Rightarrow (\text{H, CH}_3, \text{CH}_2\text{CH}_3, \dots)$

halo Carbonyl

oyl halide

Carbonyl halide

(6) Acid Amide

Carbamoyl

Amide

Carboxamide

(7) Cynide

Cyno

Nitroile

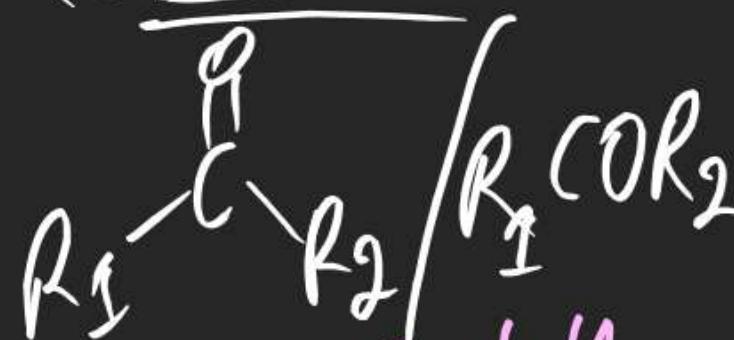
Carbonitrole

(8) Aldehyde

OXO

al

Carbaldehyde

(9) Ketone

$R_1 \neq H, R_2 \neq H$   
Note: Smallest ketone  
 at carbonyl "C"

OXO

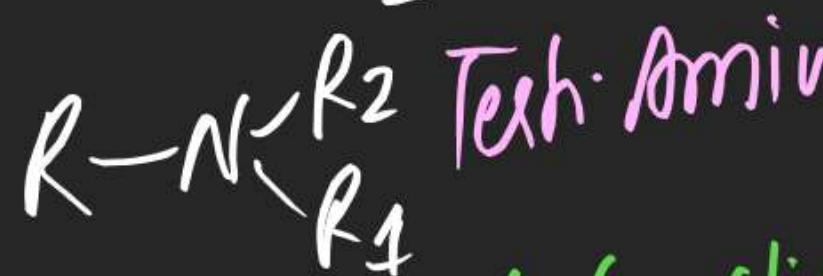
one

(10) Alcohol

$R \Rightarrow (-CH_3, -CH_2CH_3, \dots)$

Hydroxy

ol

\_(11) Amine

All are diff. functional groups

Amino

Amine

\_

(12) Ether

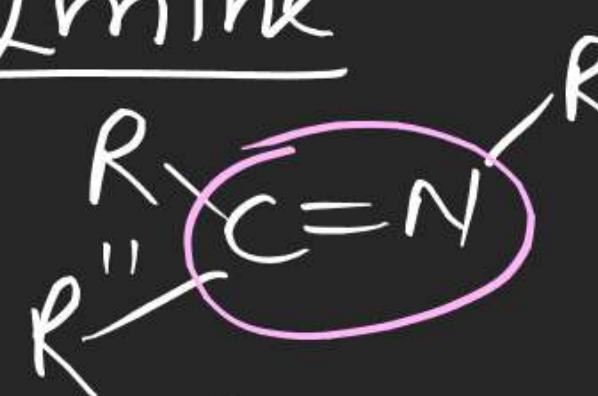
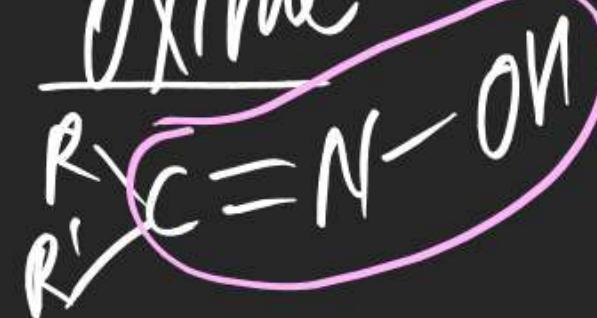
oxy

(13) Halogen(14) Nitro(15) Nitrite

Halo

Nitro

Nitrito

(16) Azide(17) Imine(18) Imide(19) Oxime

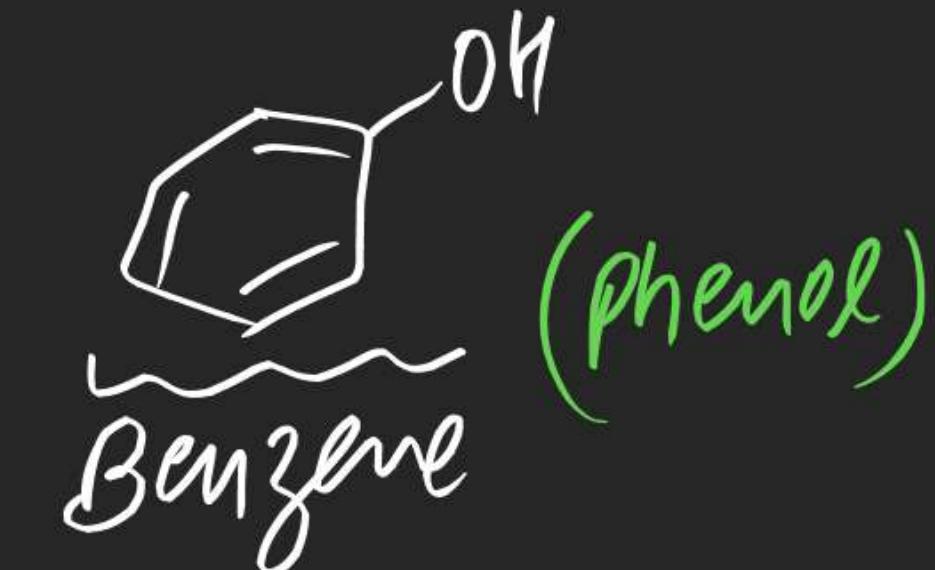
(20) Thiol  
 $R-SH$

(21) Thio Ethee  
 $R-S-R'$

(22) iso cyanide  
 $R-NC$

(23) Diago  
 $R-N=N-$

(24) Phenol



(25) Alkene

(26) Alkyne



ene

yne

- Note
- (i) Primary, sec & Tertiary Acid Amides are diff. F groups.
  - (ii) Amines
  - (iii) Alcohol & phenol are diff. F groups

Ex-1: Find Total NO. of different functional groups in  
following compound.

