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3e

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)

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

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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



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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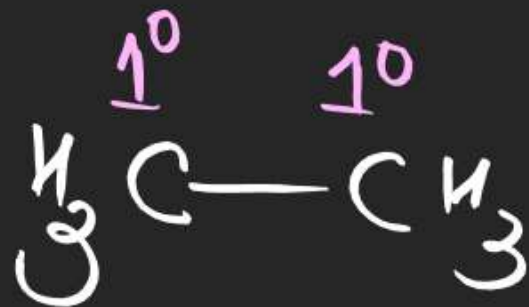
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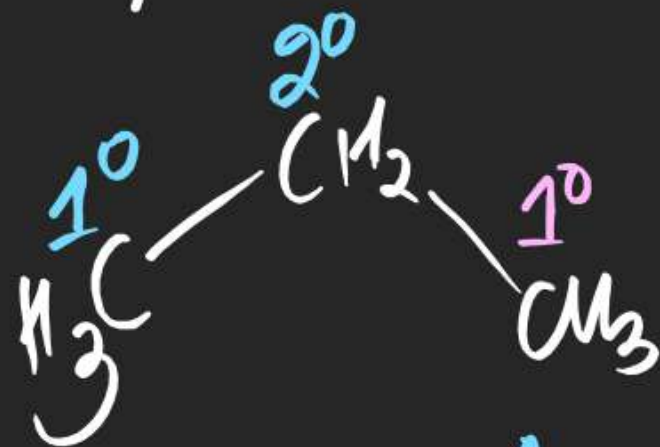
Basic Organic chemistry!

(i) Types of Carbon \rightarrow Primary Carbon / 1° Carbon \Rightarrow Carbon attached with 1 C or more "C"
 \rightarrow Secondary Carbon / 2° Carbon \Rightarrow _____ 2C
 \rightarrow Tertiary Carbon / 3° Carbon \Rightarrow _____ 3C
 \rightarrow Quaternary Carbon / 4° Carbon \Rightarrow _____ 4C

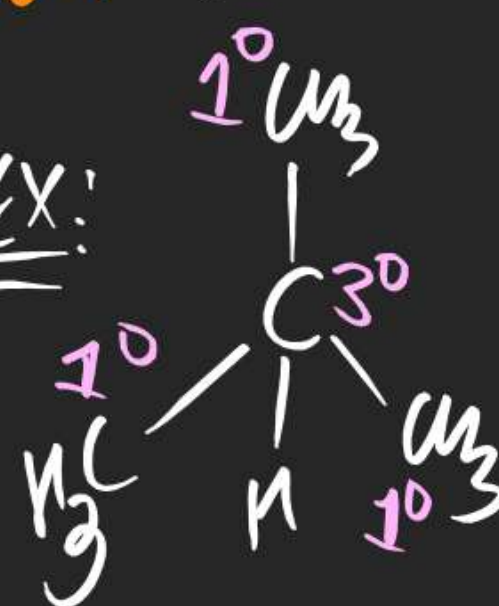
Ex



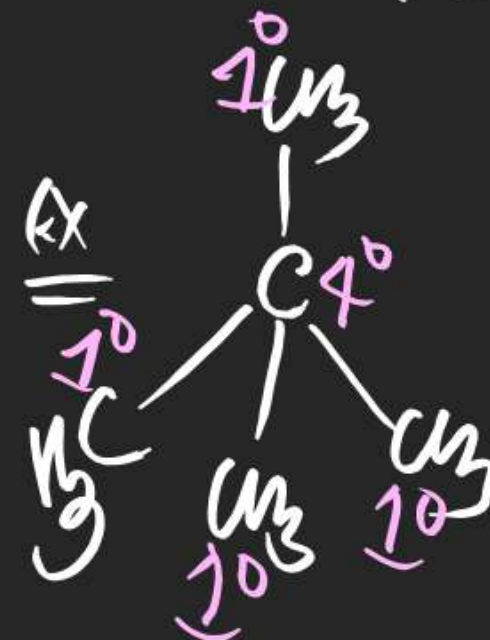
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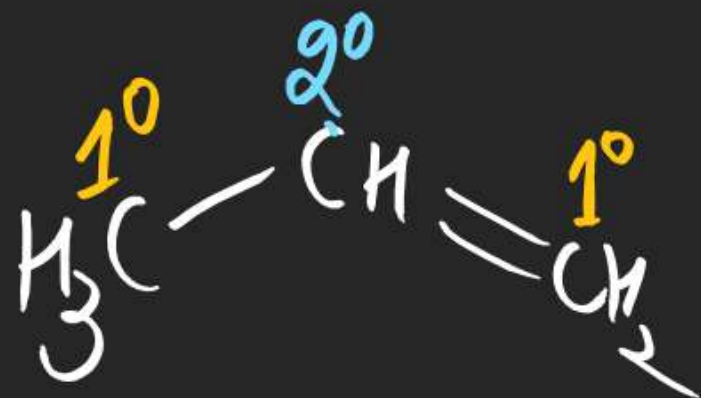
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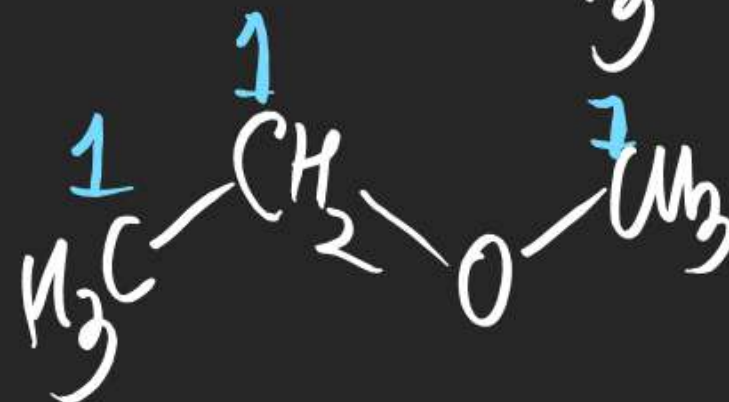
Ex



Ex-5:



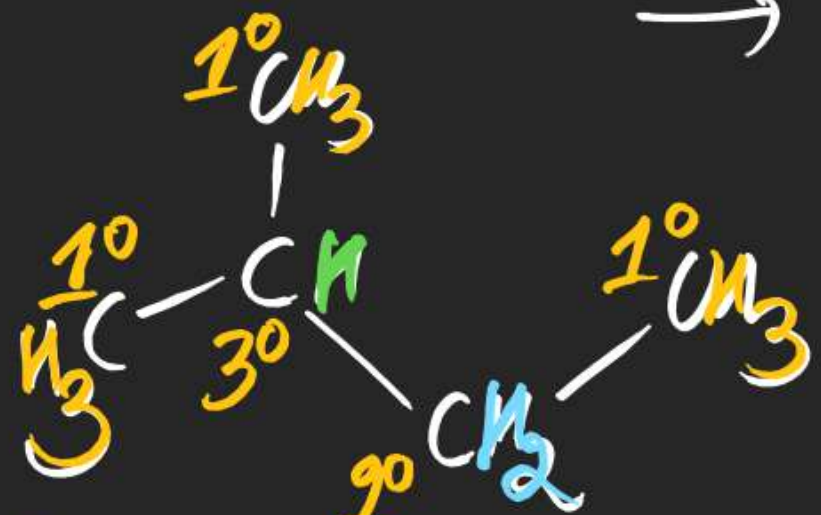
Ex-6:



(ii) Types of Hydrogen:

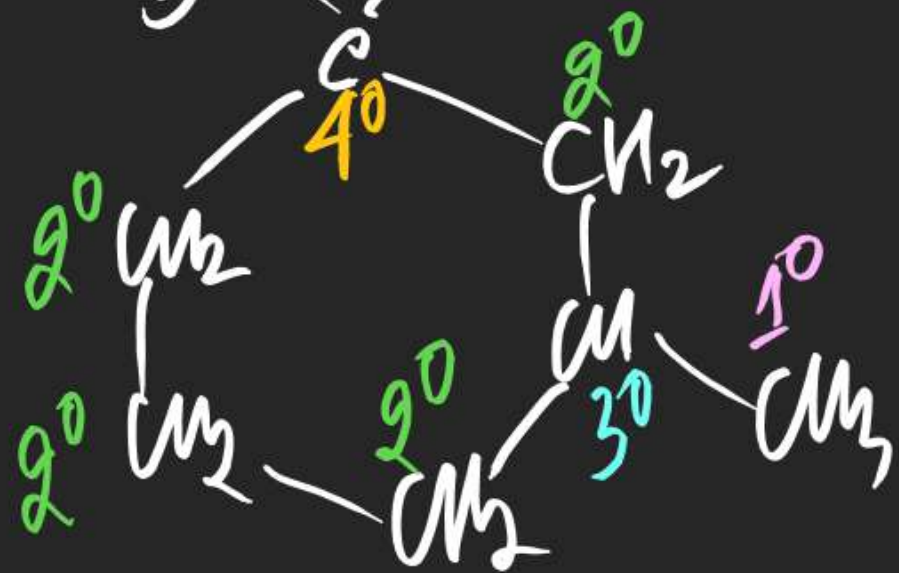
- Primary Hydrogen/ 1°H \Rightarrow H attached at 1° Carbon
- Secondary Hydrogen/ 2°H \Rightarrow 2° Carbon
- Tertiary Hydrogen/ 3°H \Rightarrow 3° Carbon

Ex:-

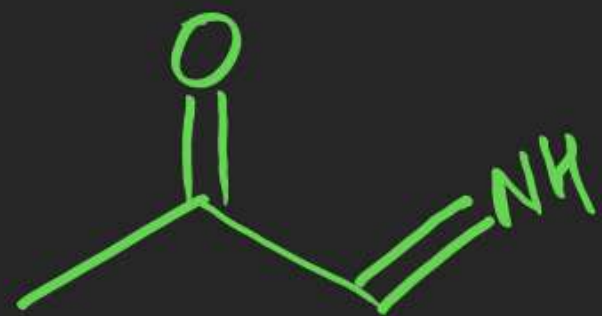
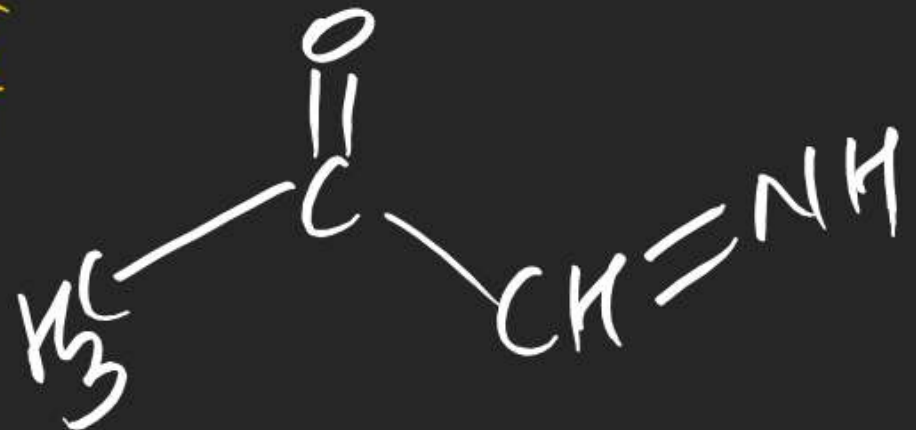


4°C	3°C	2°C	1°C	3°H	2°H	1°H
0	1	1	3	1	2	9
1	1	4	3	1	8	9

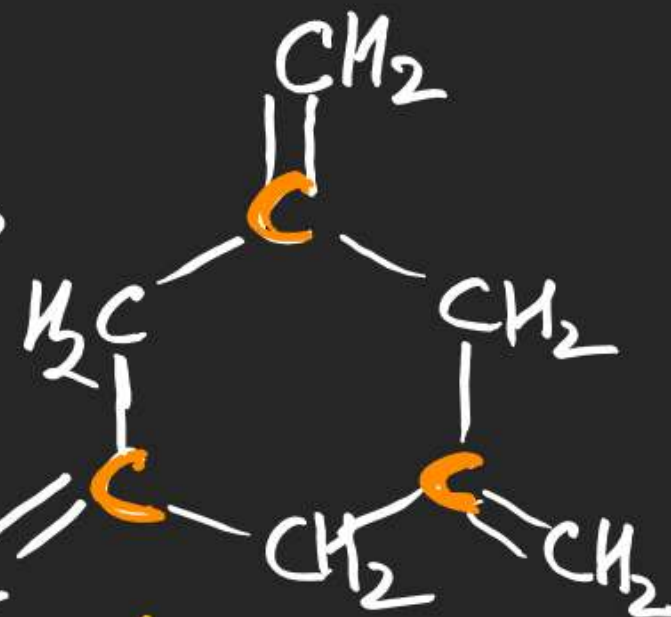
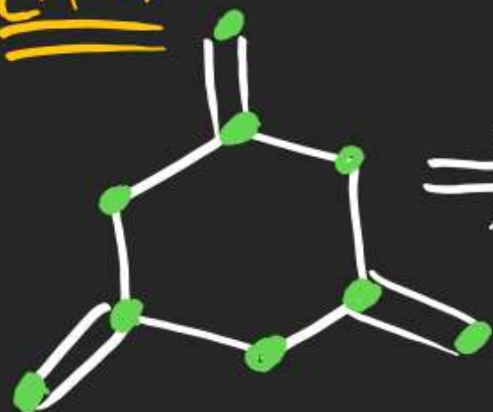
Ex:-



EX-5

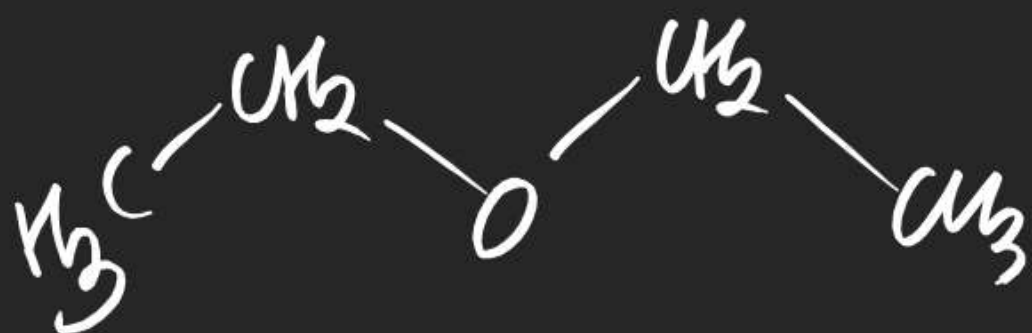


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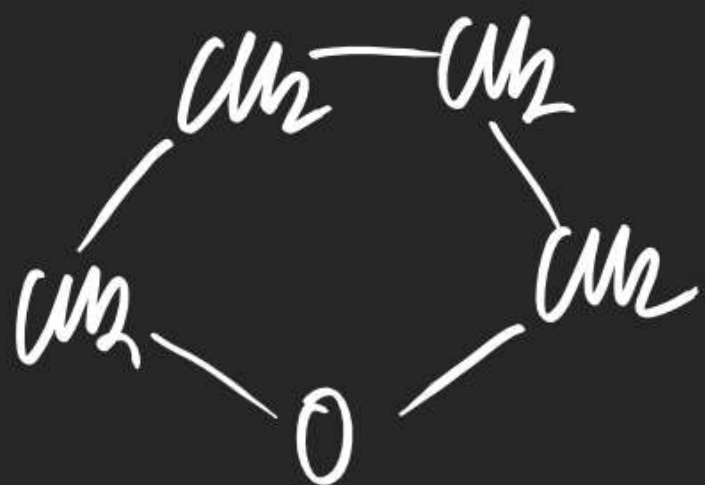


(C₉H₁₂)

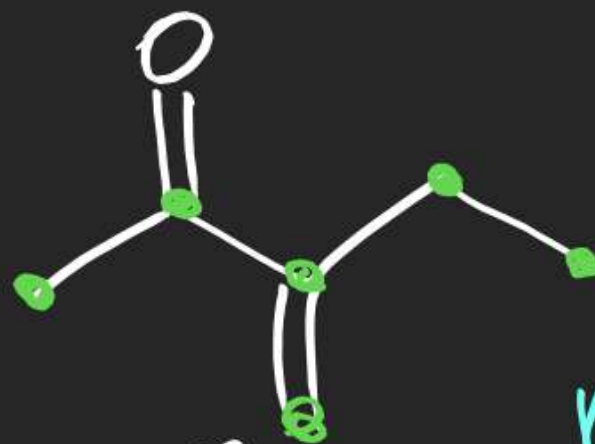
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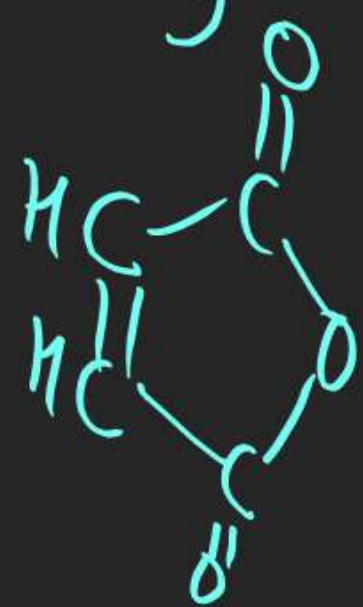
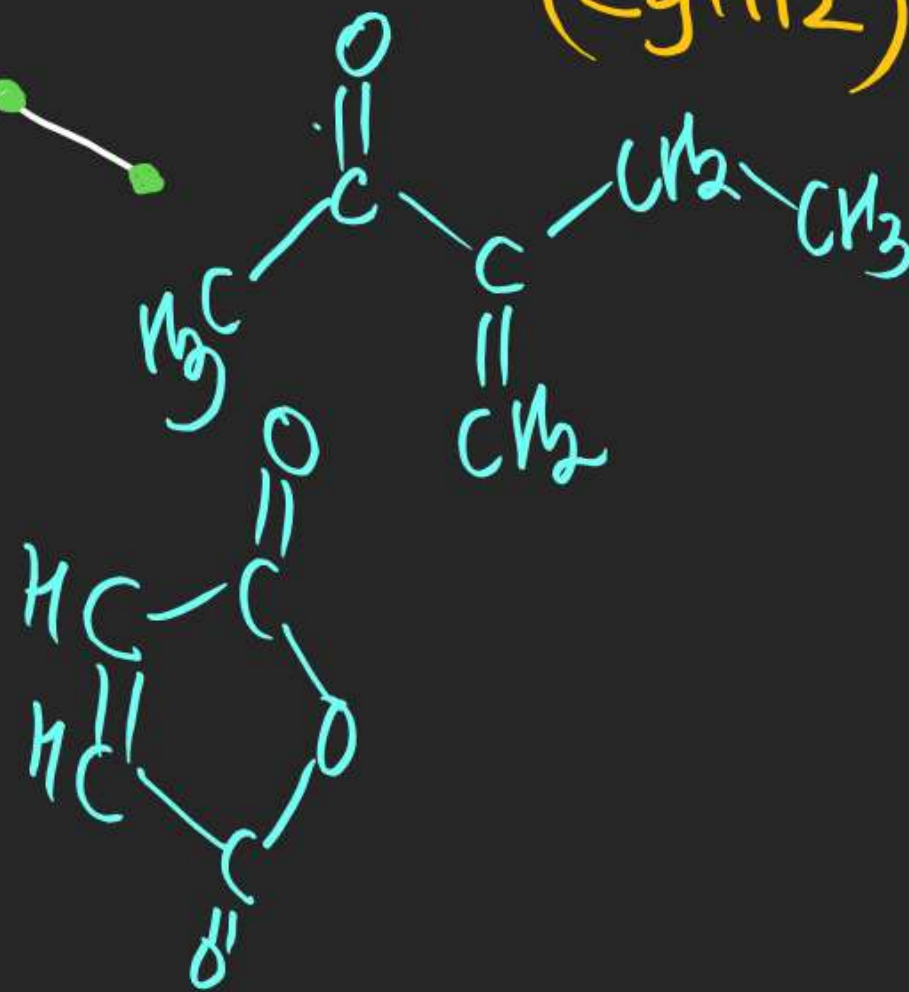
EX-7



EX-9

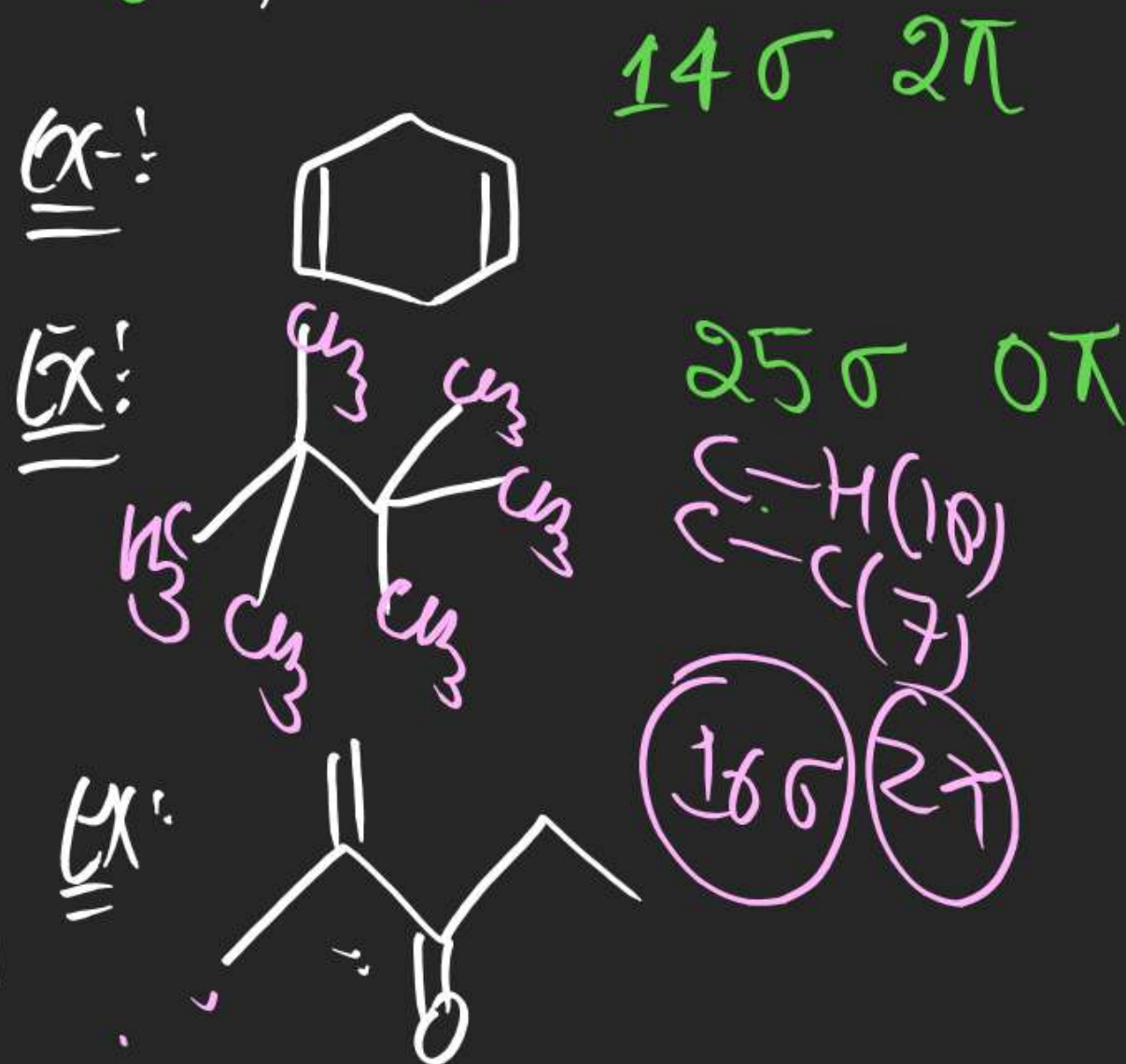
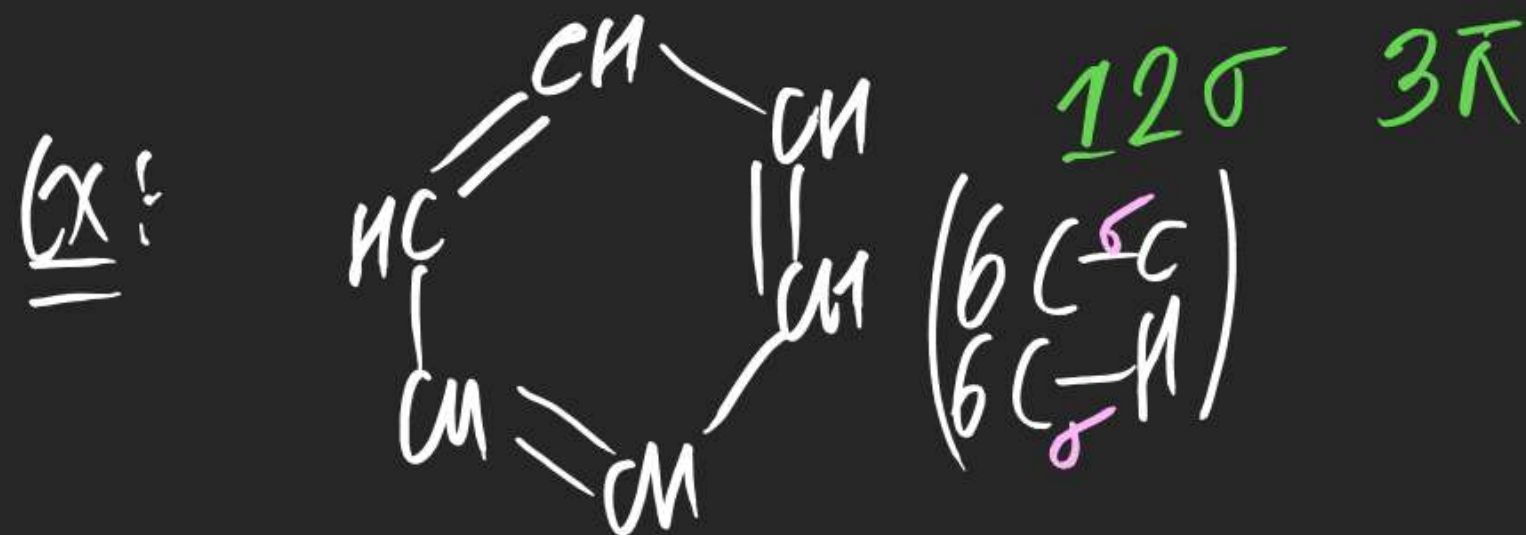
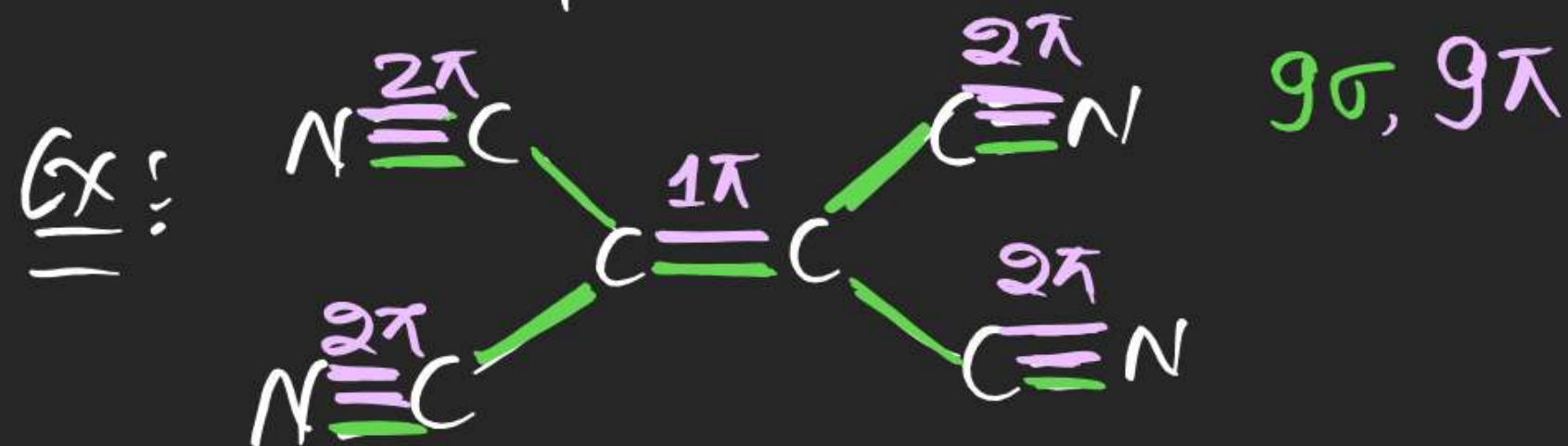
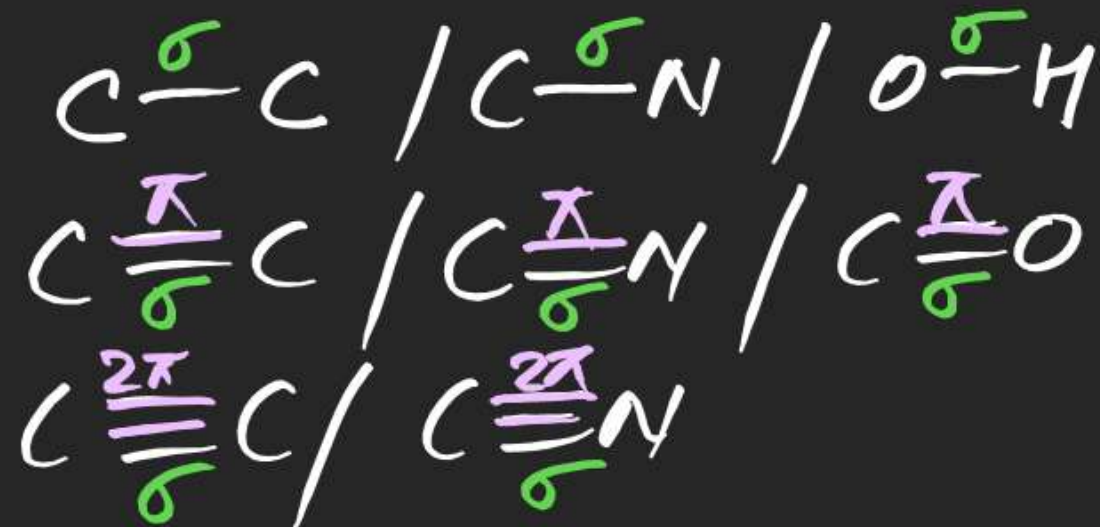


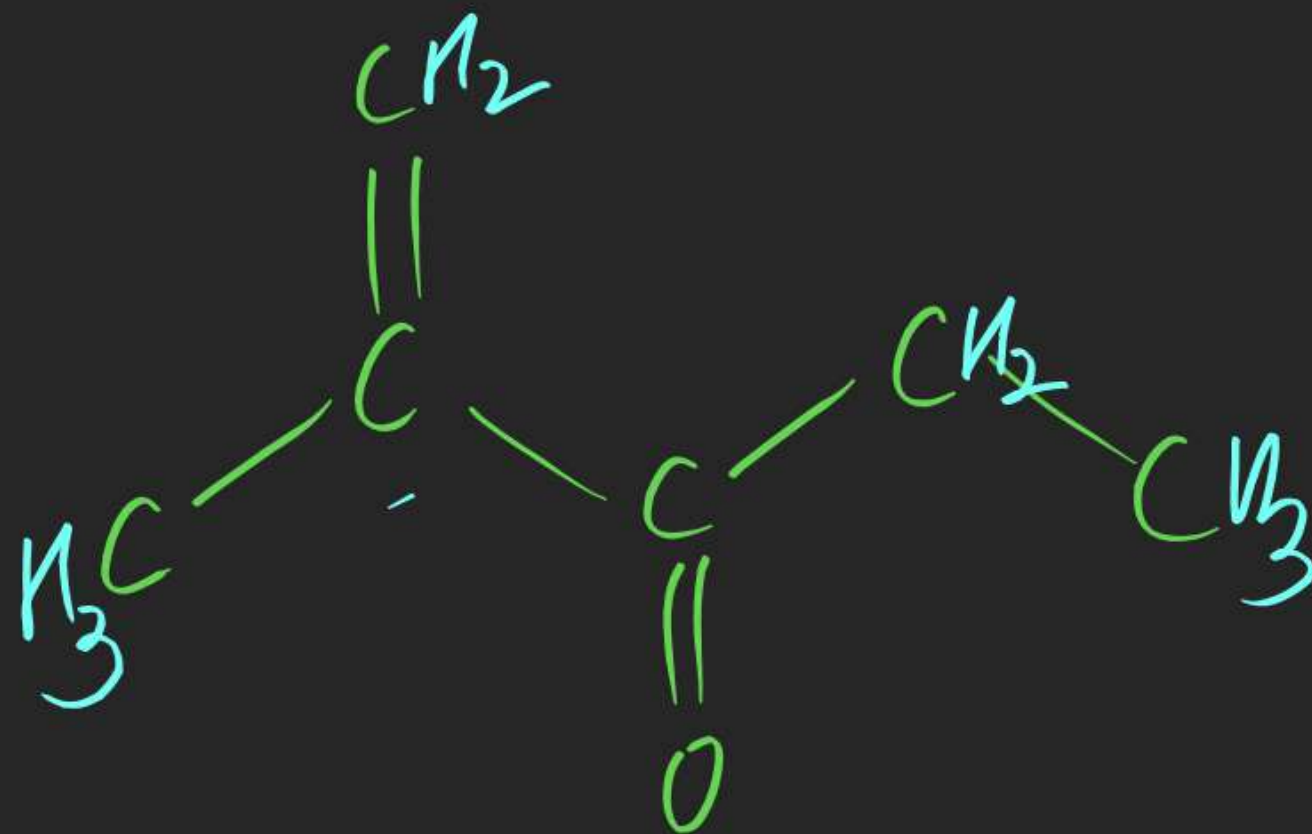
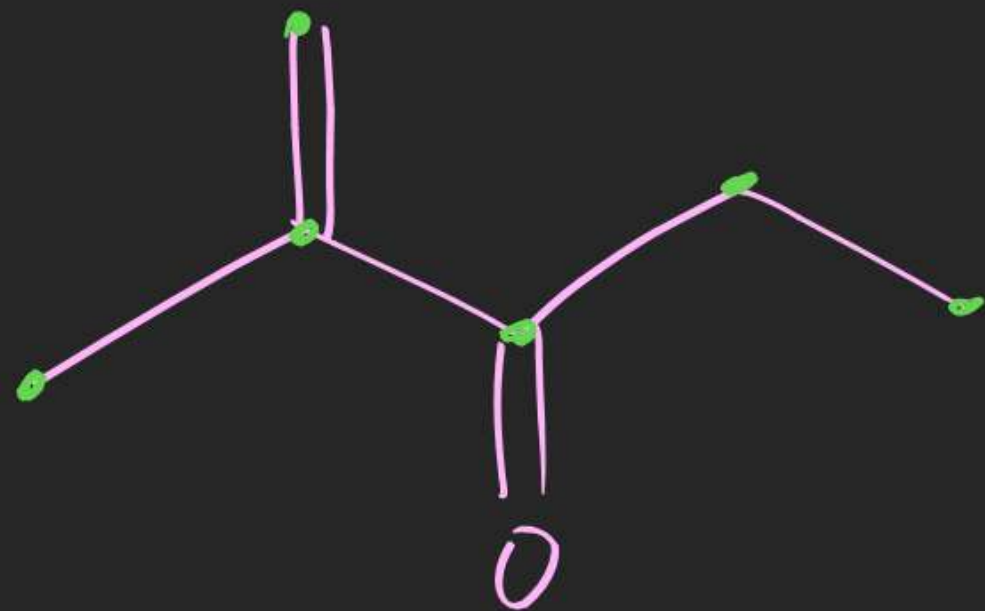
EX-10



(#) σ & π Bond

Each Single Bond \Rightarrow 1σ
 Each double Bond \Rightarrow 1σ + 1π
 Each Triple Bond \Rightarrow 1σ + 2π



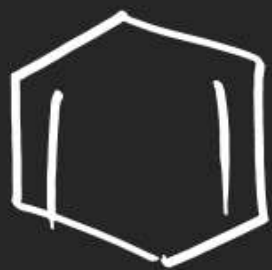


(1) Double Bond Equivalent (DBE)
 (or) Degree of Unsaturation (DOU)
 (or) Index of Hydrogen deficiency (IHD)

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

When str. is not given

Ex-1:



DBE = DOU = IHD
 $= 1 + 2$
 $= 3$

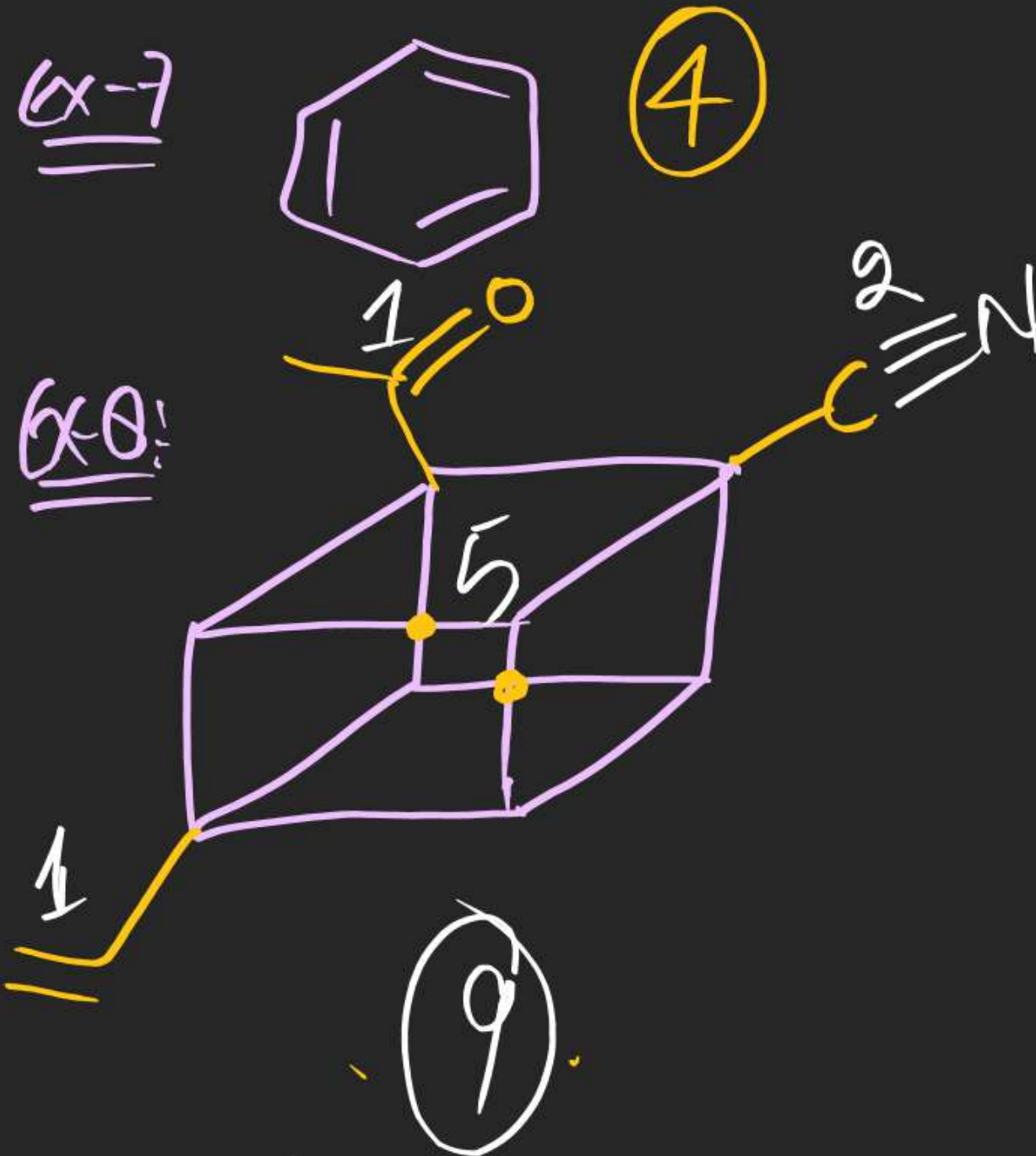
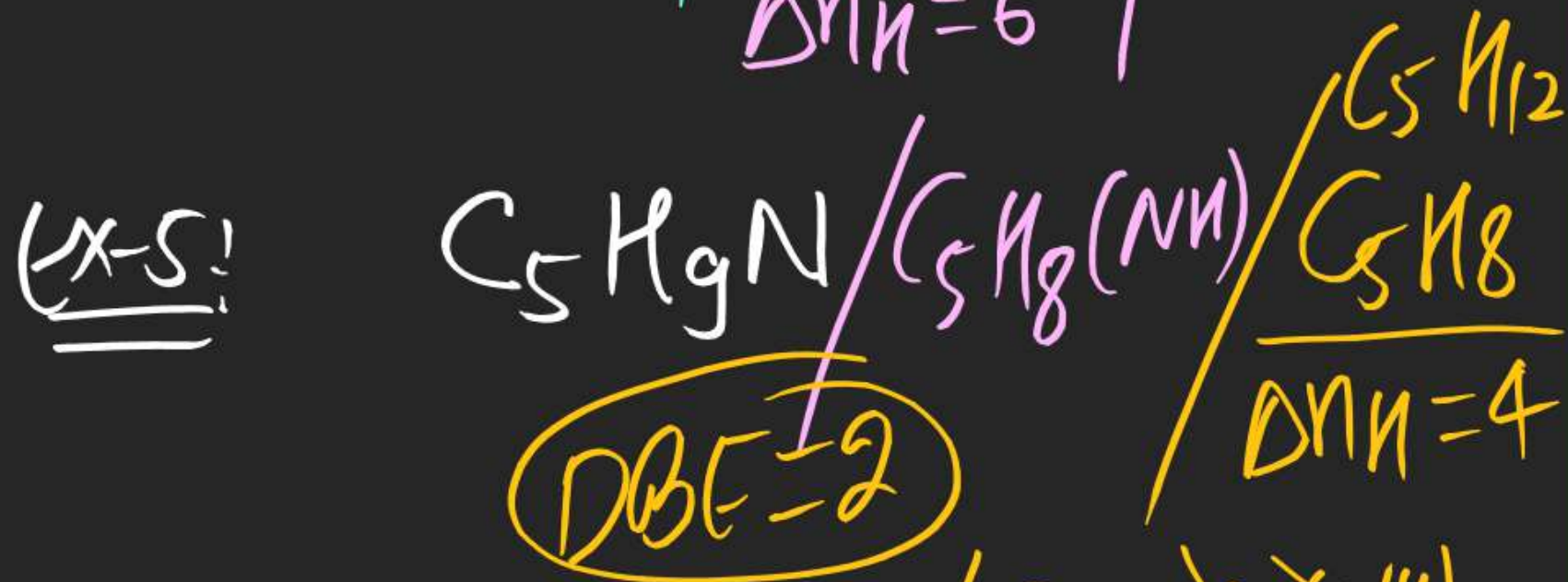
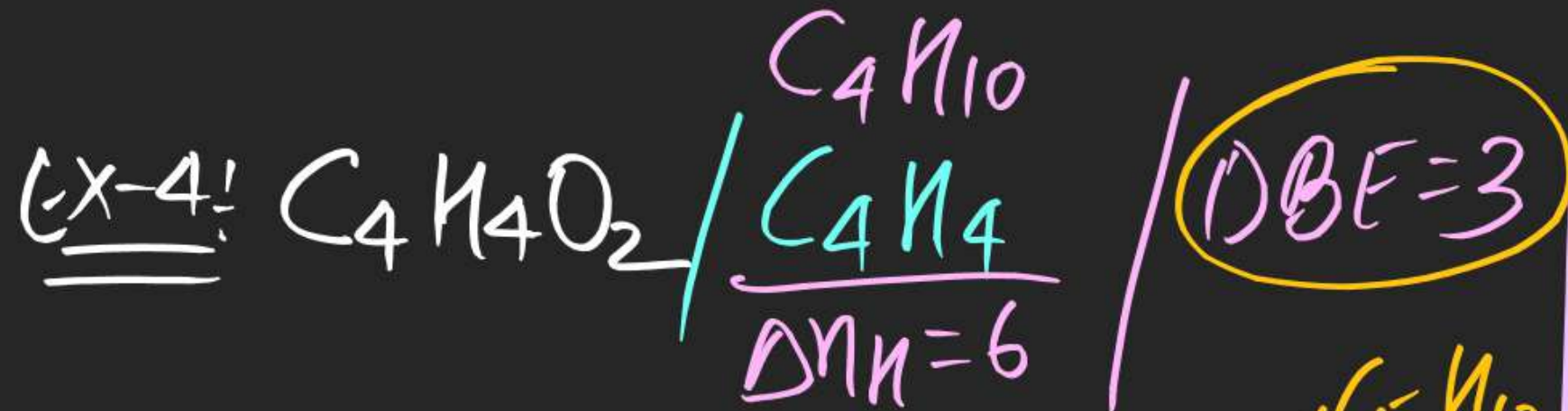
Alkane $C_n H_{2n+2}$

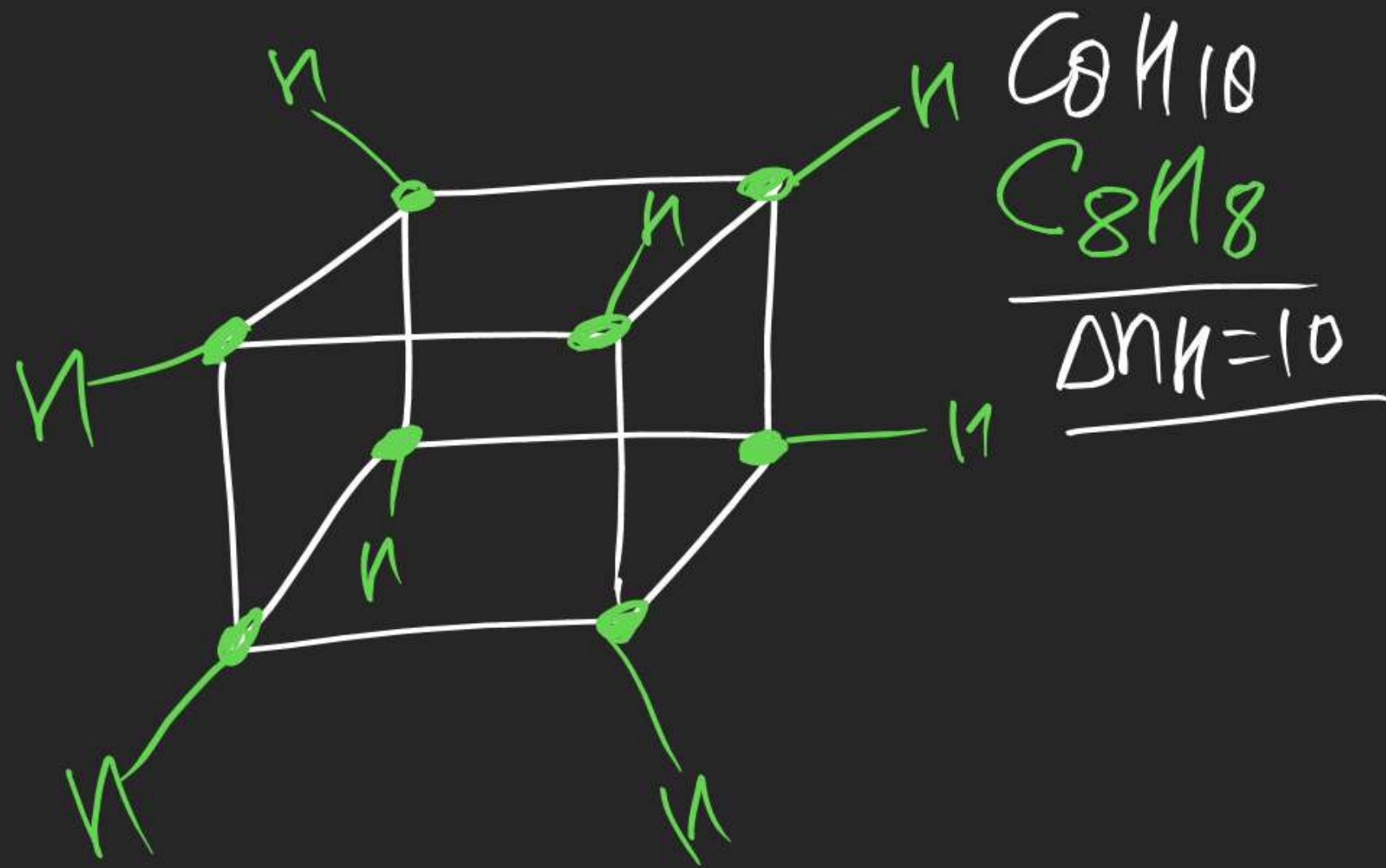
Ex-2: $C_8 H_{18}$
 $C_8 H_8$

$\Delta n_H = 10$

DBE = DOU = IHD
 $= \frac{\Delta n_H}{2} = \frac{10}{2} = 5$

Note (i) monovalent atom ($-F, -Cl, -Br, -I, -D, -T$) \Rightarrow Replace By "H"
 (ii) Bivalent atom (O) \Rightarrow Neglect these atoms.
 (iii) Trivalent atom (N) \Rightarrow Neglect (NH)



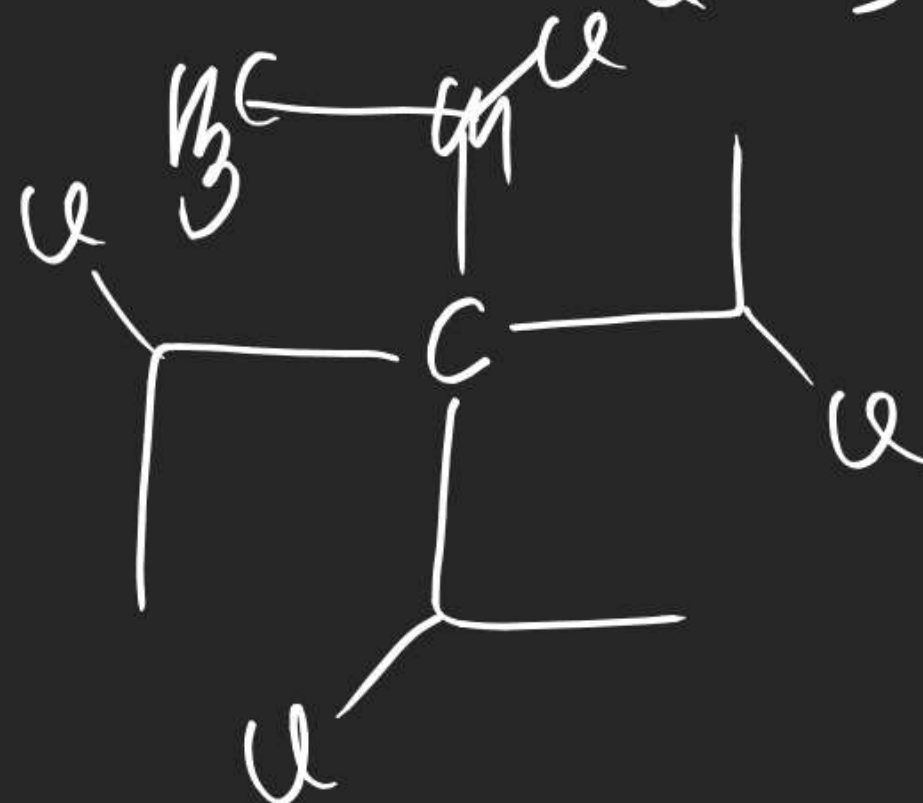
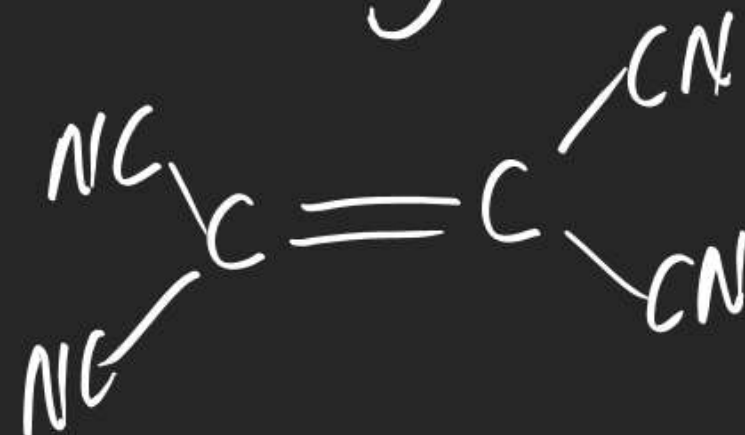
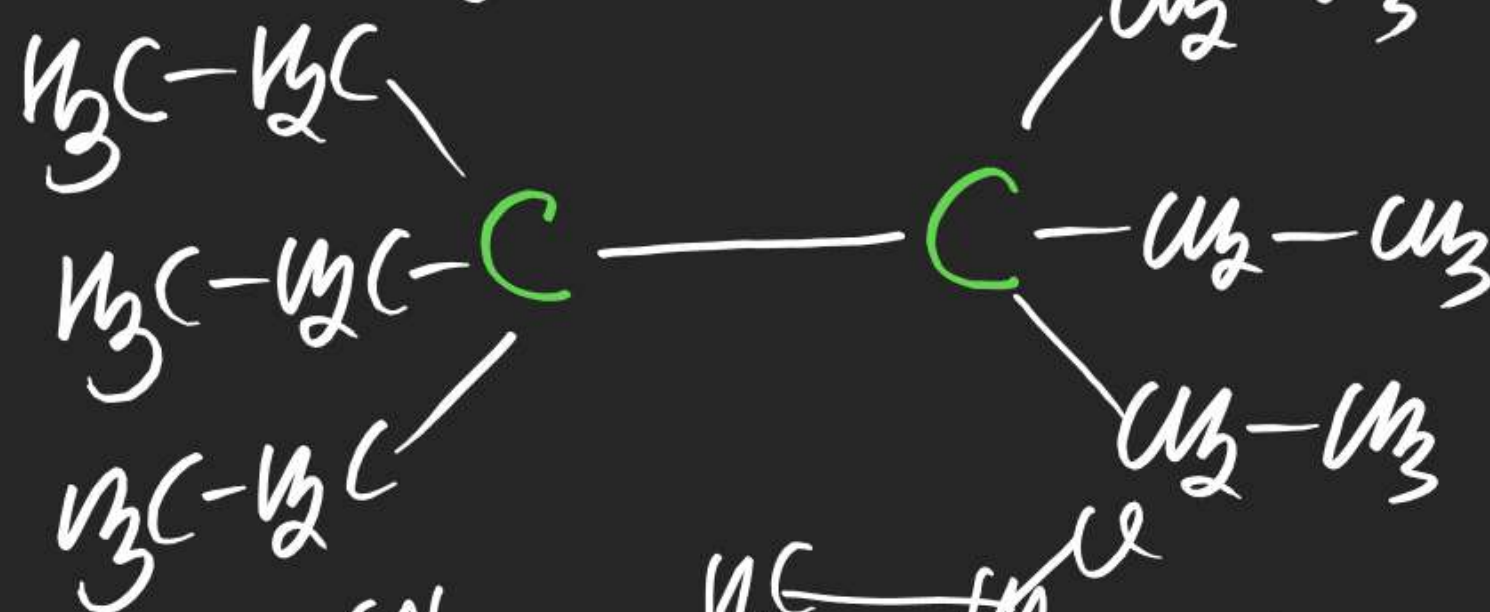
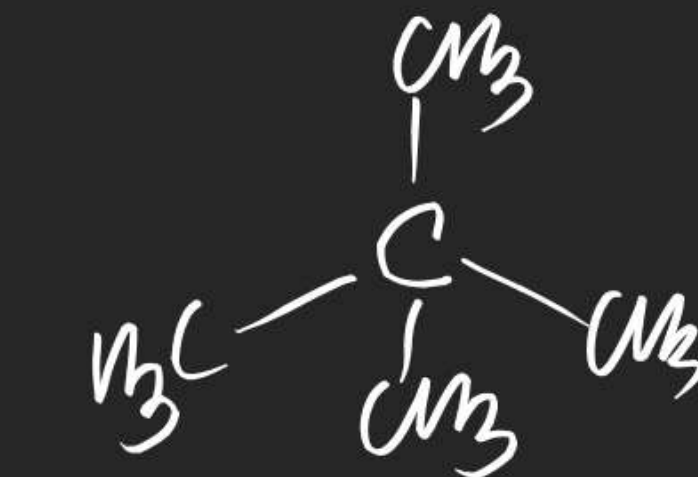
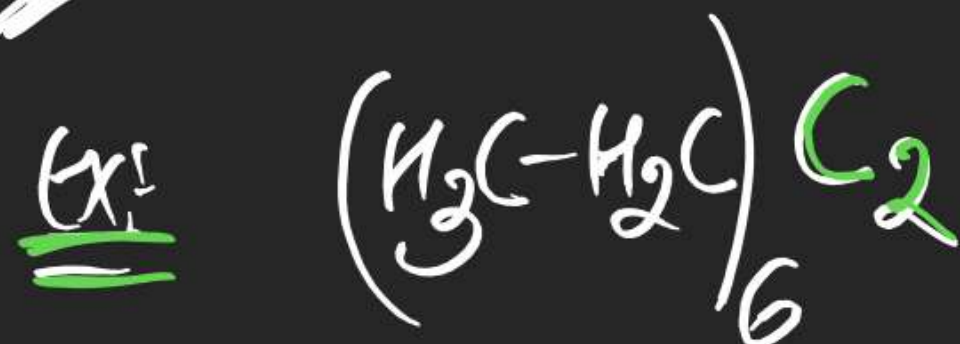


$$DBE = 5 = \text{Total No. of Ring} + \text{Total No. of } \pi \text{ Bond}$$

$$\Rightarrow 5 = T_R + 0$$

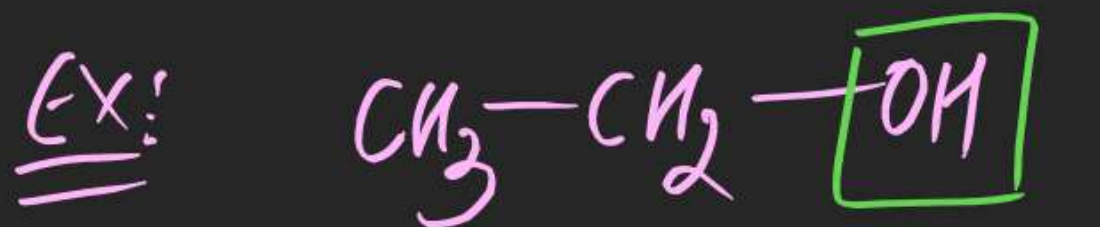
$$\Rightarrow \boxed{5 = T_R}$$

(#) Condense Formula:

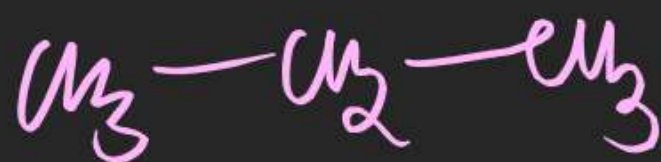


Functional Groups:

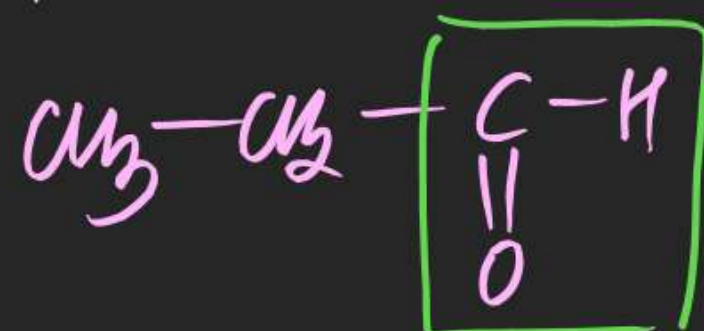
⇒ Segment of a compound which is responsible for compounds chemical properties.



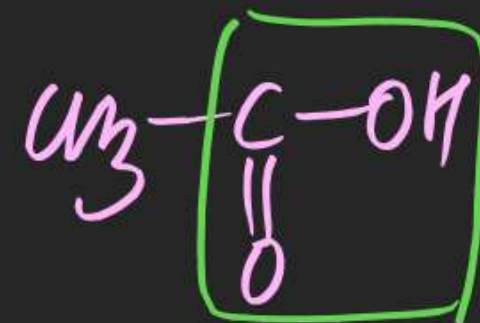
Functional group Alcohol



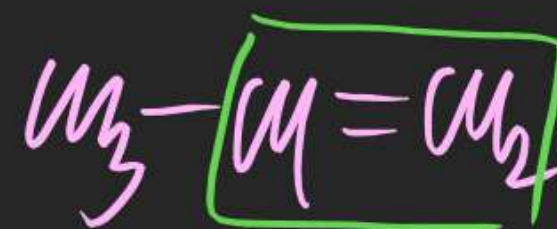
No Functional group



Aldehyde

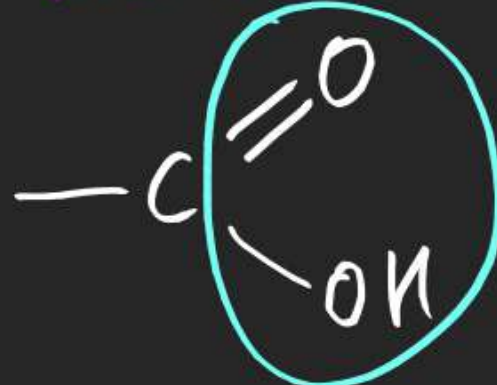
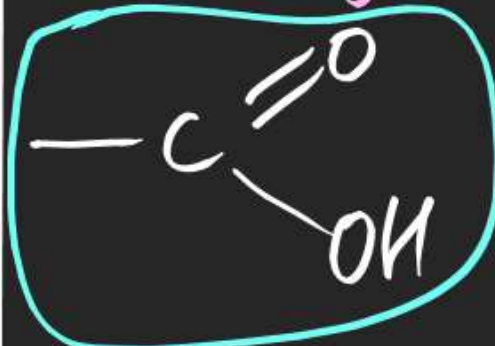


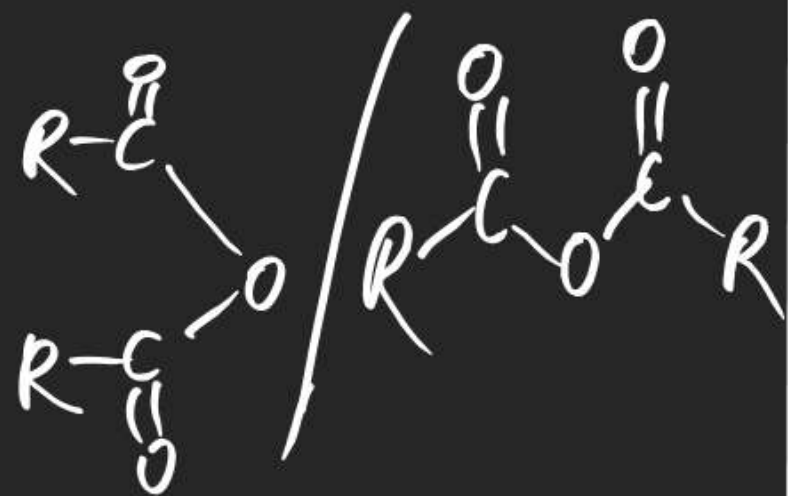
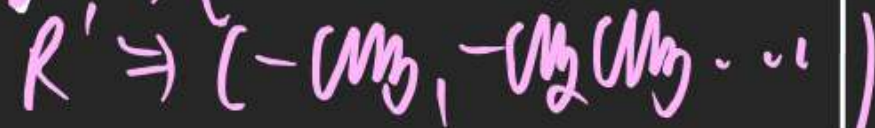
Carboxylic Acid



Alkene

Table of Functional Groups:

Functional Groups	Prefix	Suffix	Suffix*
<p>(1) <u>Carboxylic Acid</u></p> $R-\overset{\overset{O}{\parallel}}{C}-OH / R-CO_2H$ <p>$R \Rightarrow (H, CH_3, -CH_2CH_3, Ph \dots)$</p>	Carboxy	<p>oic Acid</p> 	<p>Carboxylic Acid</p> 
<p>(2) <u>Sulphonic Acid</u></p> $R-\overset{\overset{O}{\parallel}}{S}(=O)(OH) / R-SO_3H$ <p>$R \Rightarrow (-CH_3, -CH_2CH_3, -Ph \dots)$</p>	Sulpho	<p>Sulphonic Acid</p>	<p>Sulphonic Acid</p>

(3) Acid anhydride(4) Ester

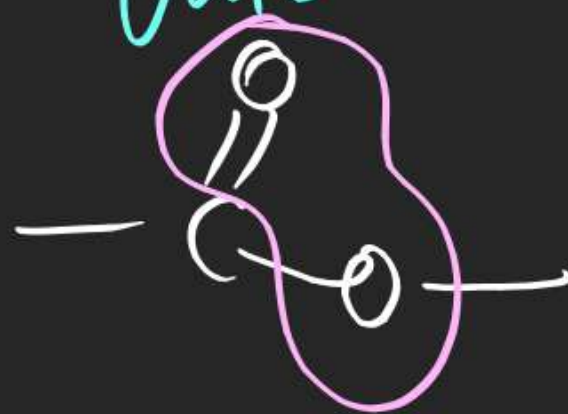
Alkoxy Carbonyl

Alkanoxy oxy

oic anhydride

Carboxylic Acid
anhydride

oate



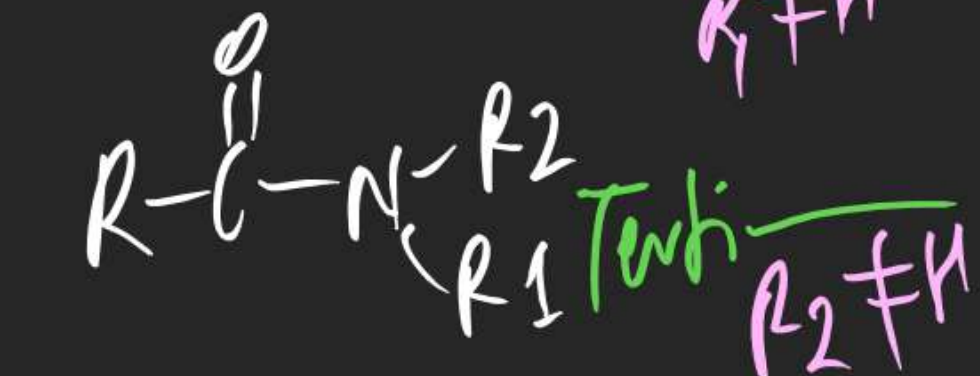
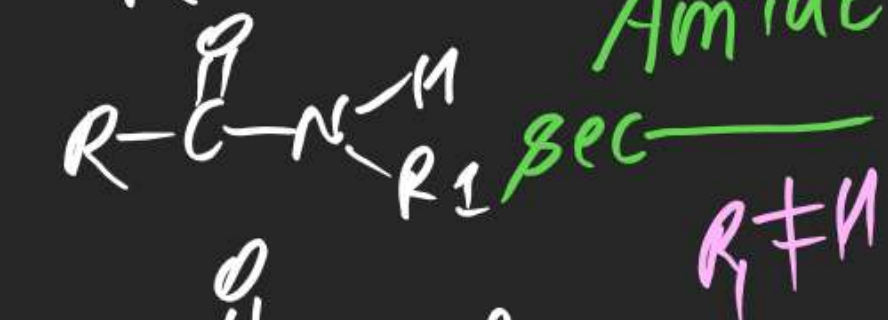
Carboxylate



(5) Acid Halide

where $X \Rightarrow F, Cl, Br, I$

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

(6) Acid Amide

halo Carbonyl

oyl halide

Carbonyl halide

Carbamoyl

Amide

Carboxamide

(7) Cynide(8) Aldehyde(9) Ketone

$R_1 \neq H, R_2 \neq H$

Note! smallest ketone
at least 3 'C'

Cyno

oxo

Formyl

oxo

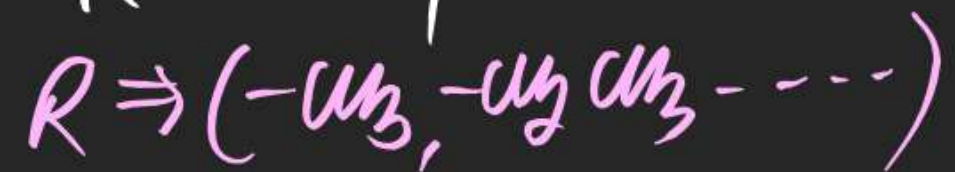
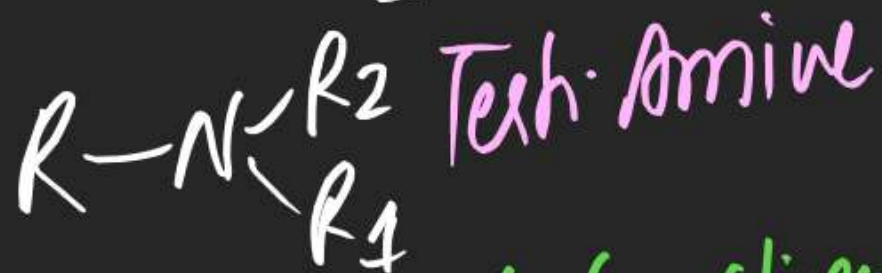
Nitrile

al

one

Carbonitrile

Carbalddehyde

(10) Alcohol(11) Amine

All are diff. functional groups

Hydroxy

ol

Amino

Amine

(12) Ether



(13) Halogen



(14) Nitro



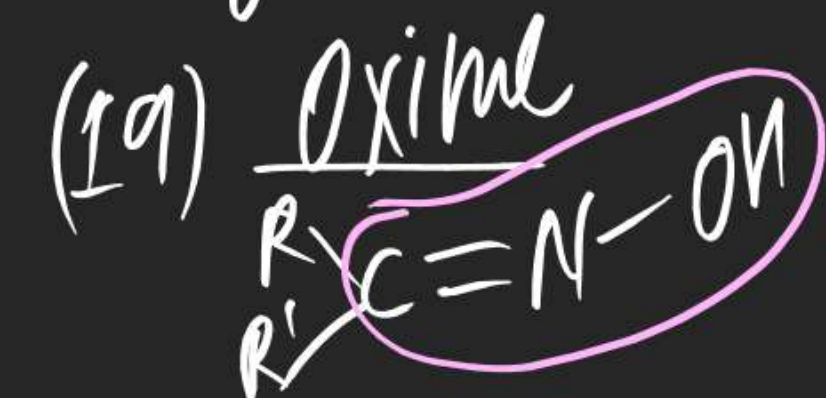
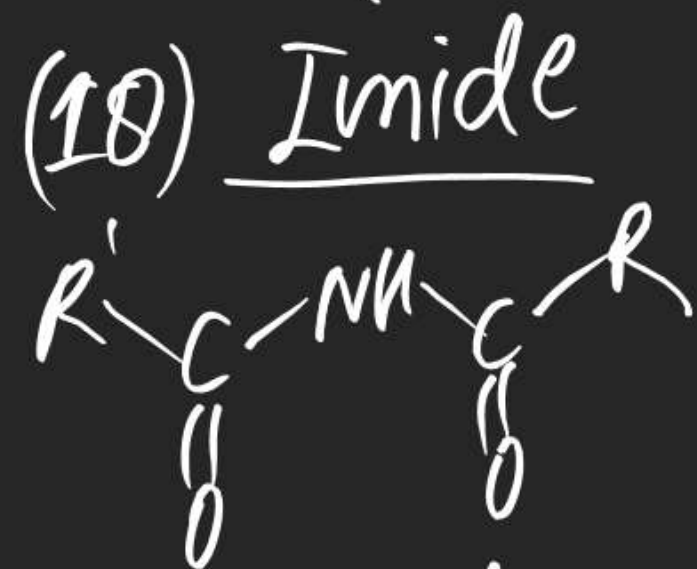
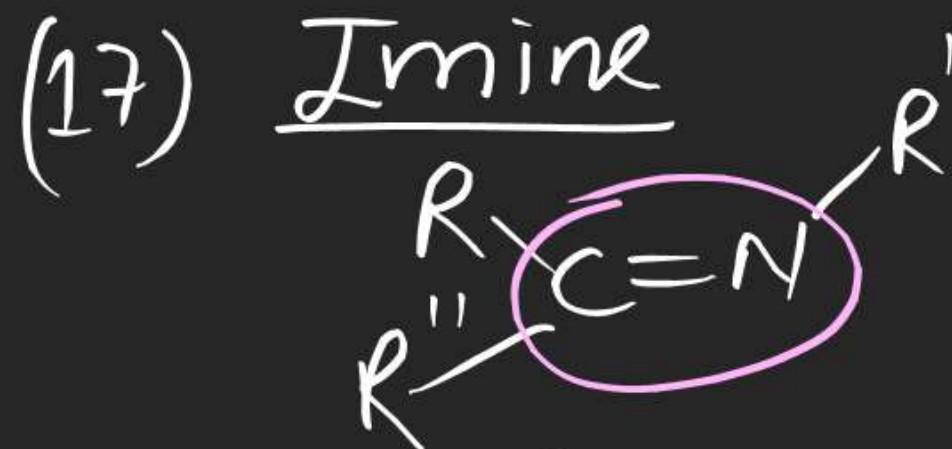
(15) Nitrite
 $R-ONO$

oxy

halo

Nitro

Nitrito



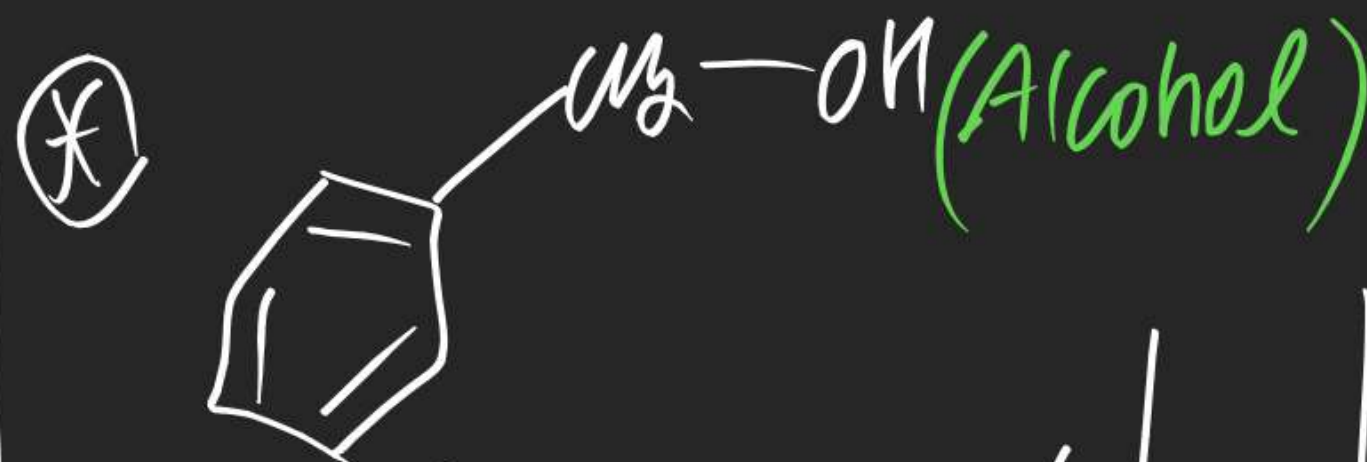
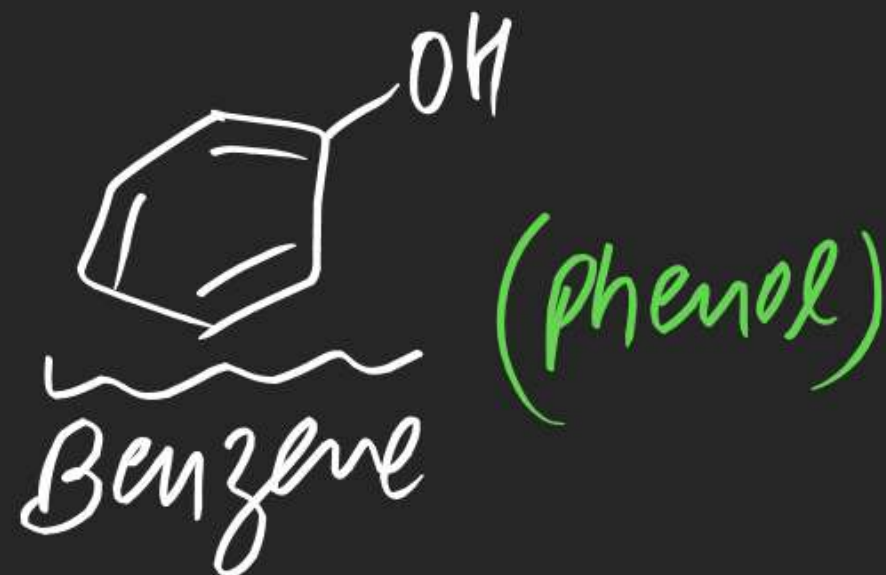
(20) Thiol
 $R-SH$

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

(22) isocyanide
 $R-NC$

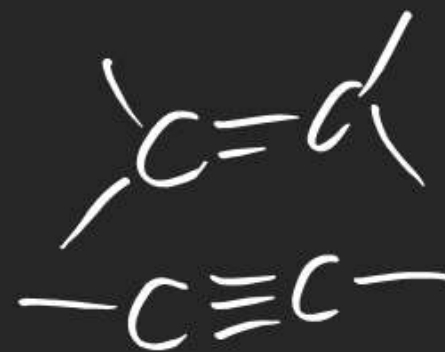
(23) Diazo
 $R-N=N-$

(24) Phenol



(25) Alkene

(26) Alkyne



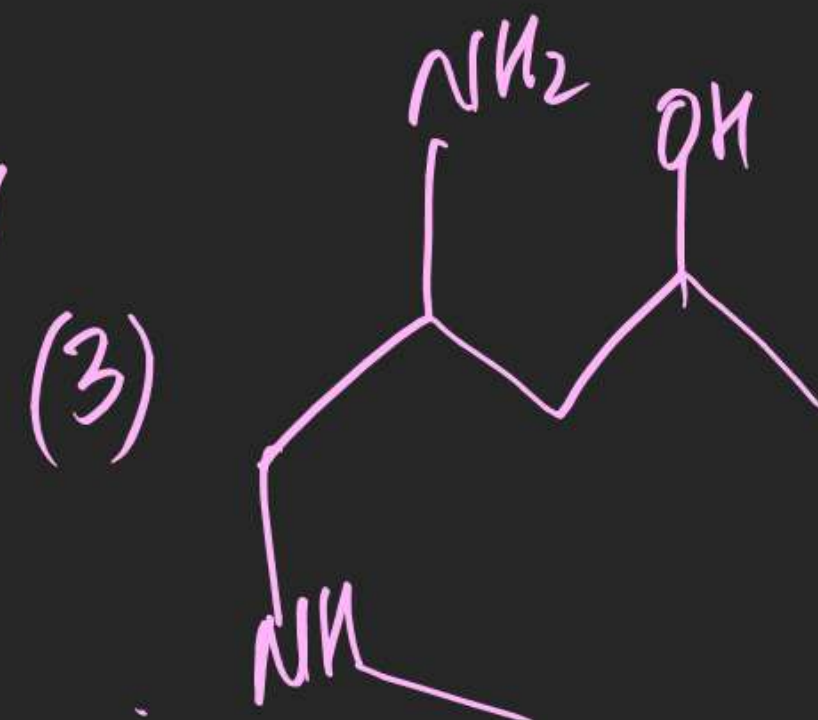
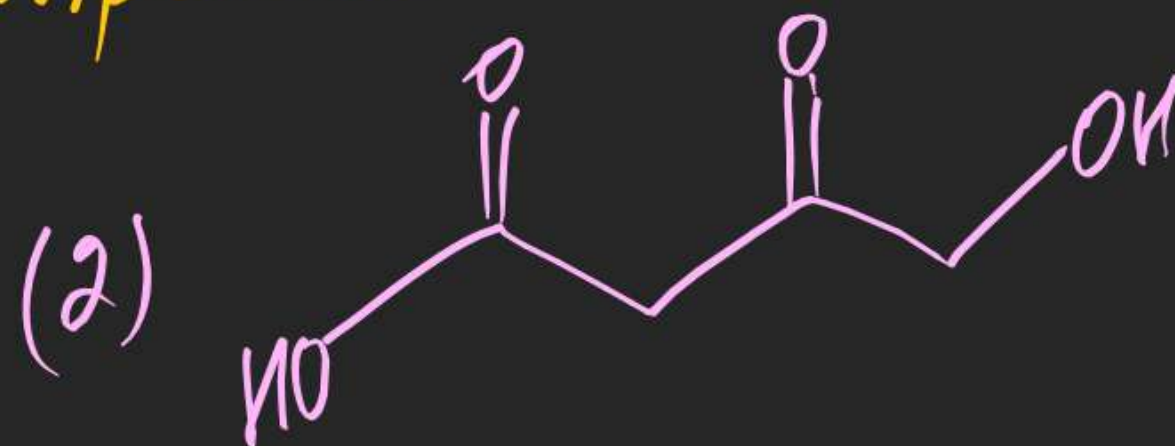
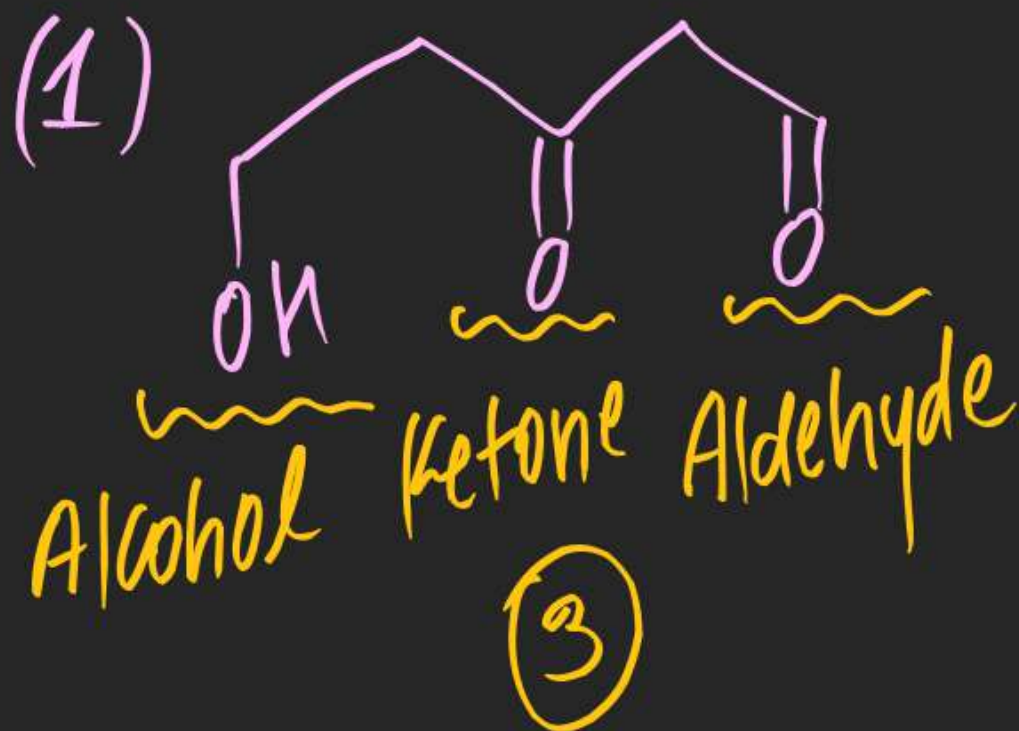
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 yne

Note (i) Primary, sec & Tertiary Acid amides are diff. F groups.

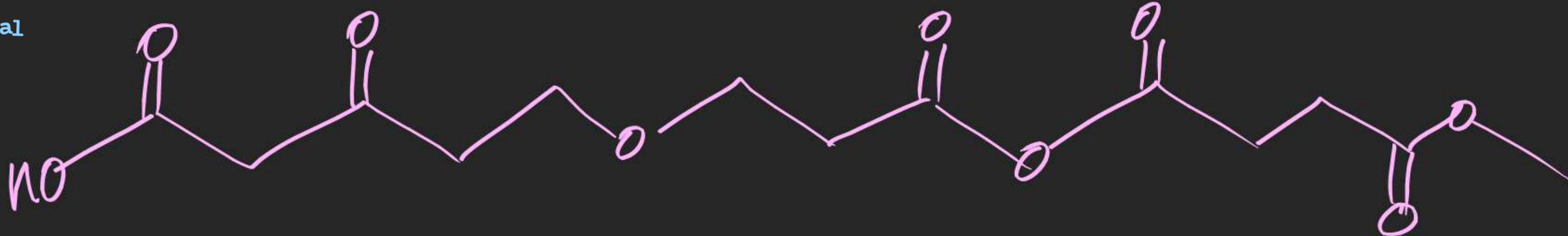
(ii) Amines

(iii) Alcohol & phenol are diff. F-groups

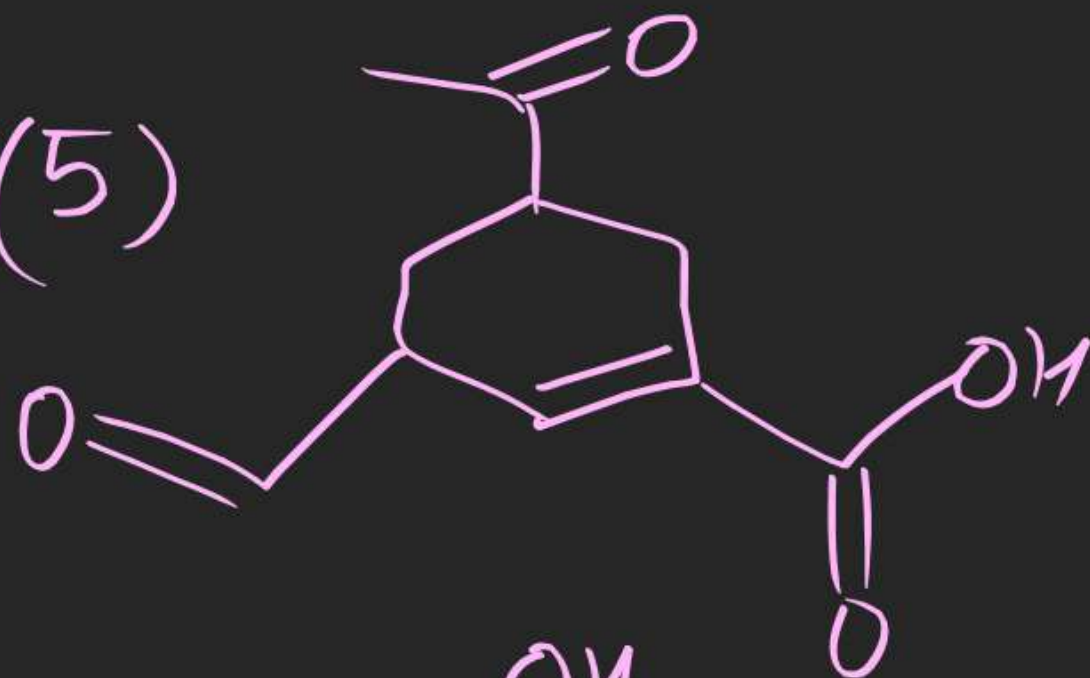
Ex-1: Find Total No. of different functional groups in following compound.



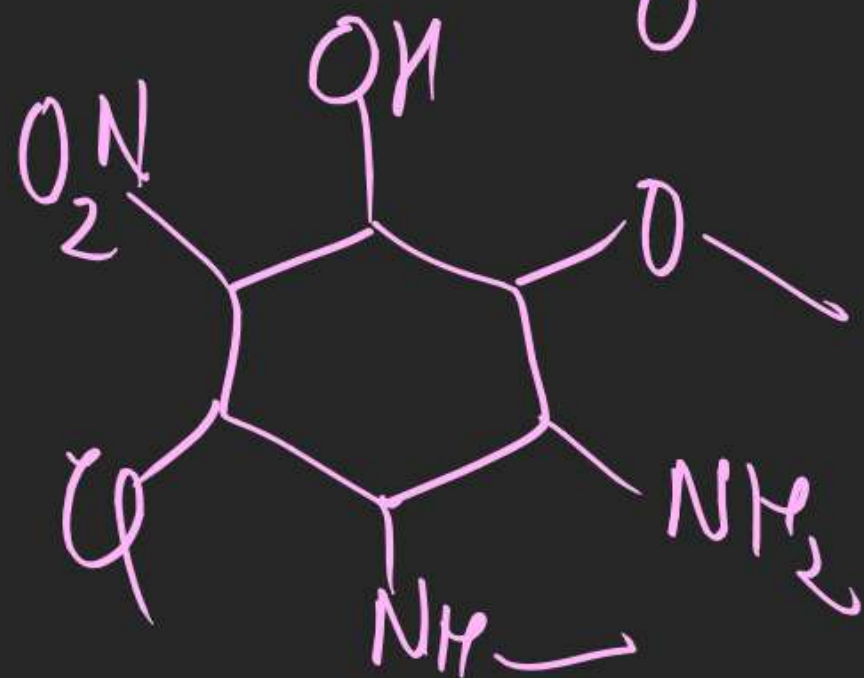
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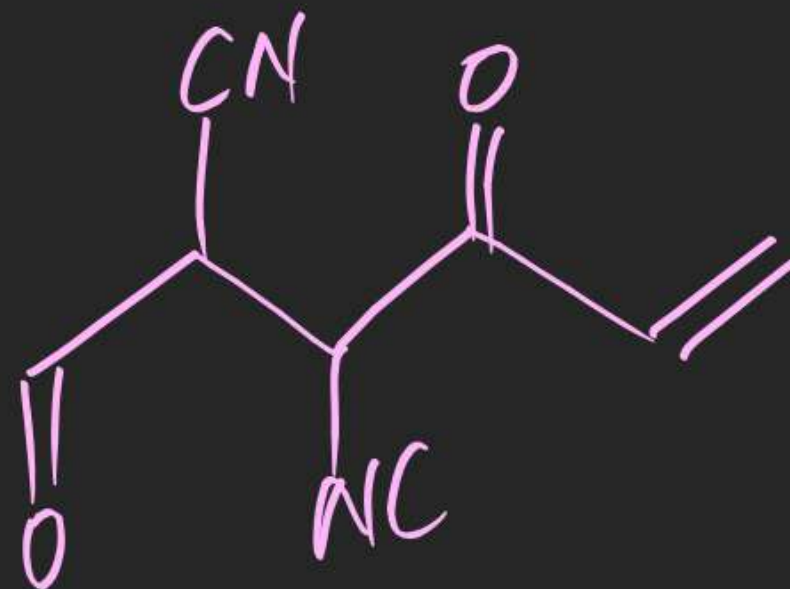
(5)



(6)



(7)



(8)

