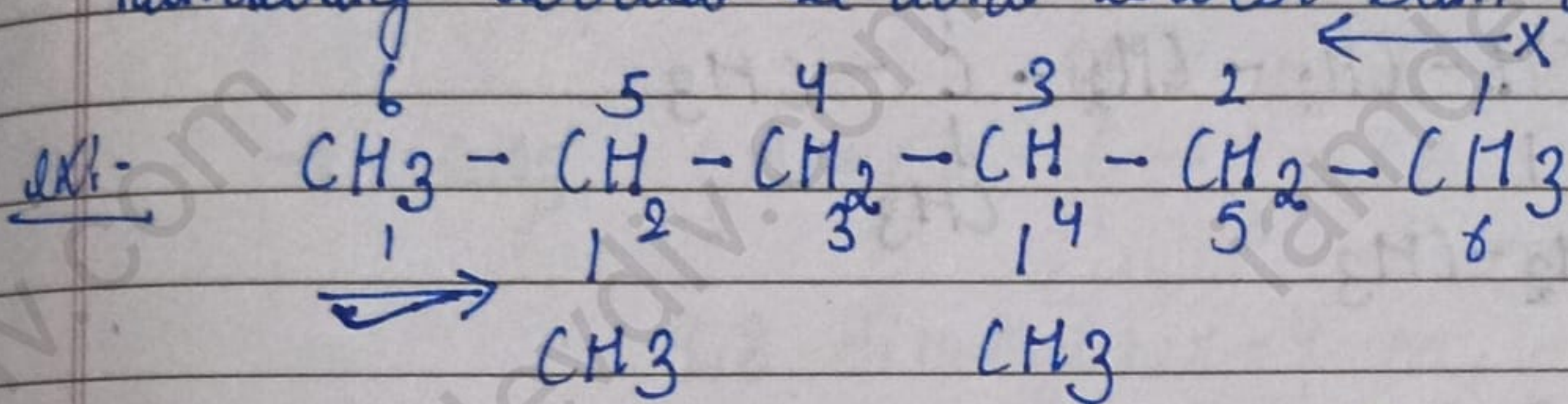


IUPAC Nomenclature organic compound

Rules

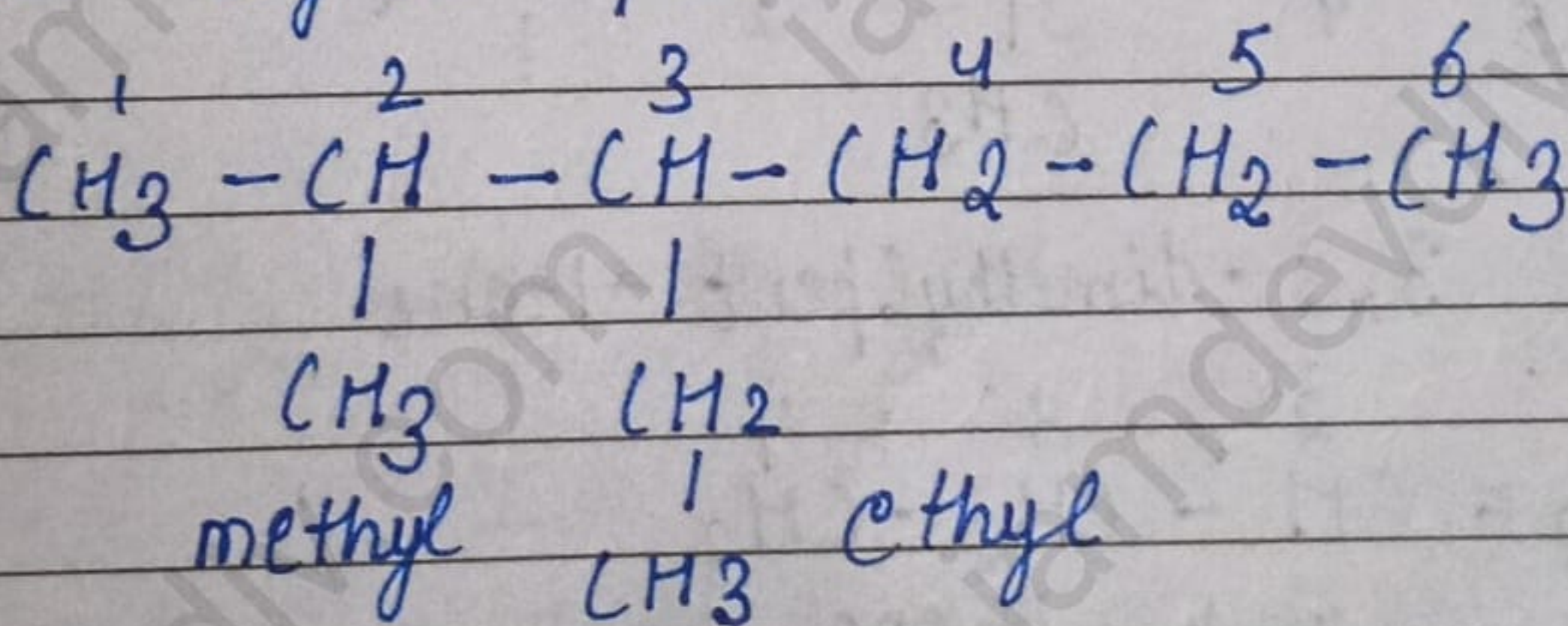
1. Longest Carbon chain is always selected
2. When the substituent is present on carbon chain the numbering would be done lowest sum rule.



$$2 + 4 = 6 \quad \checkmark$$

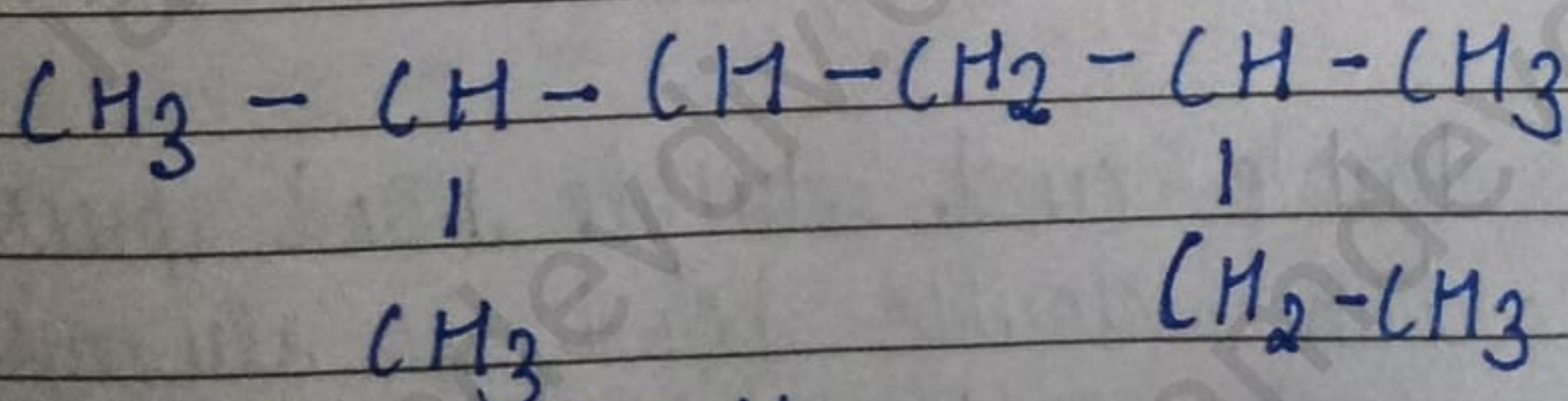
$$3 + 5 = 8$$

3. The naming of the substituents would be done according to English alphabetical order.

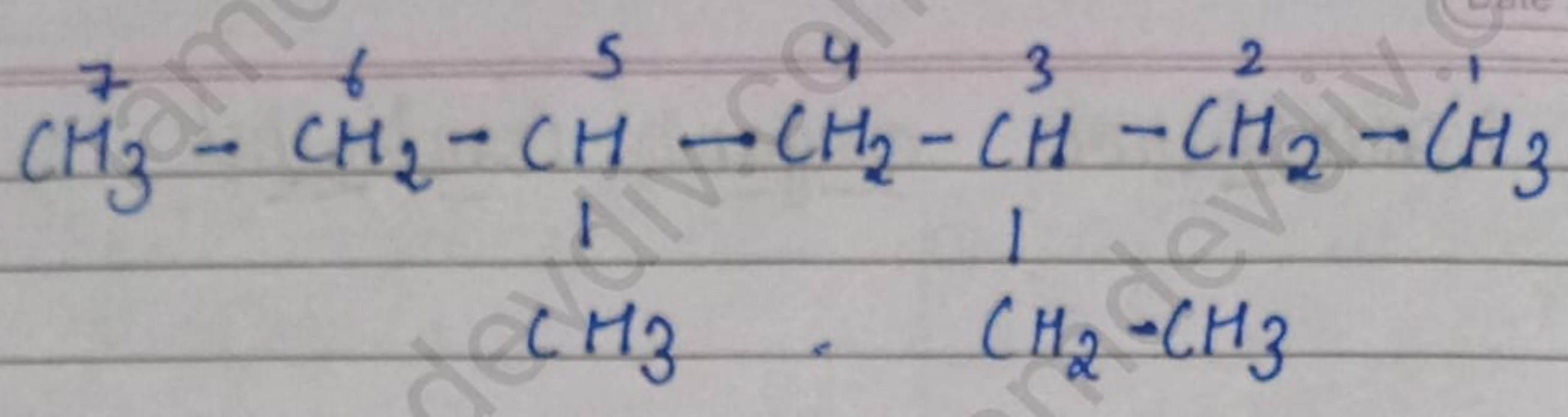


3-ethyl, 2-methyl hexane ✓

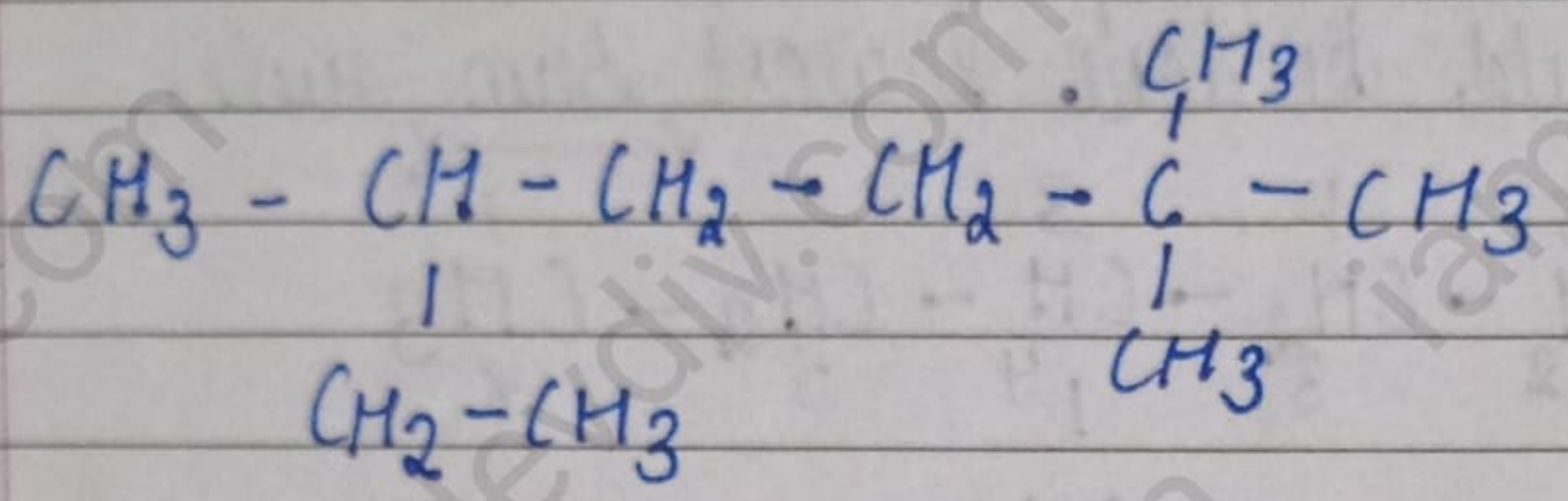
2-methyl, 3-ethyl hexane X



2,5-dimethyl heptane

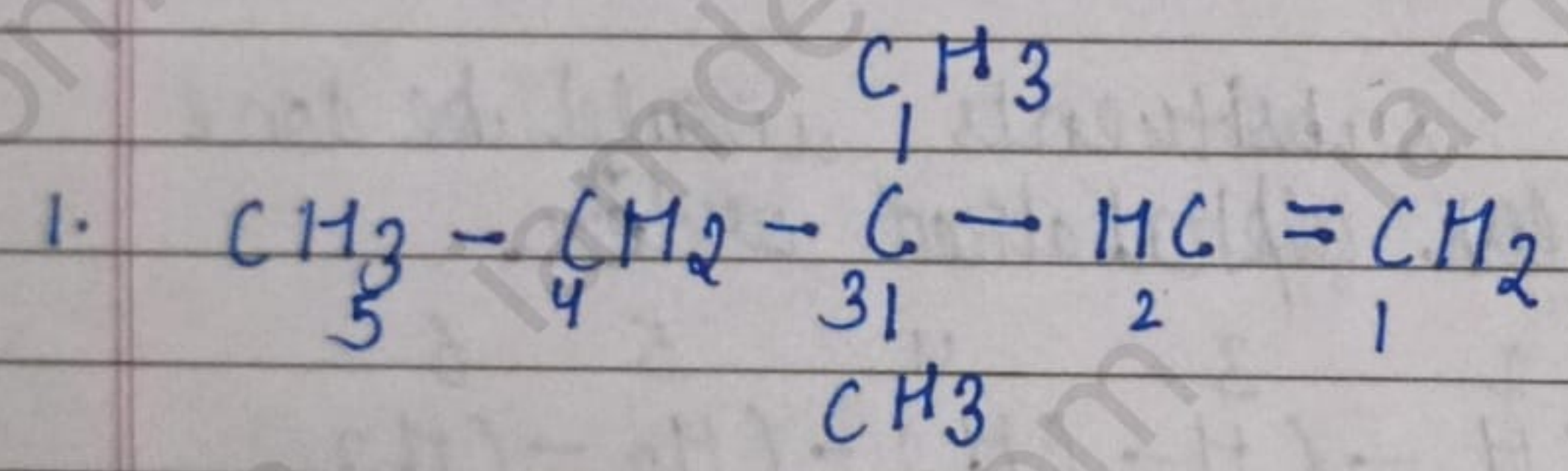


3-ethyl, 5-methyl heptane

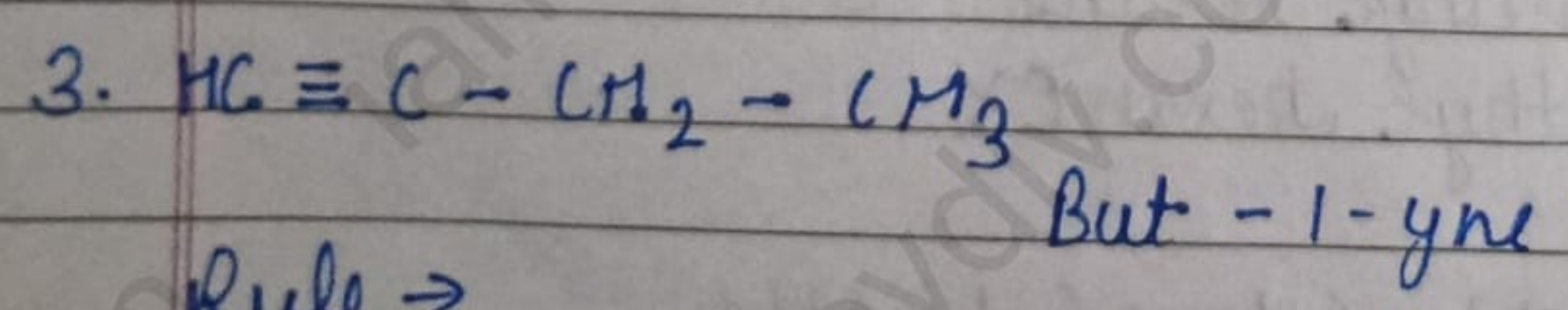
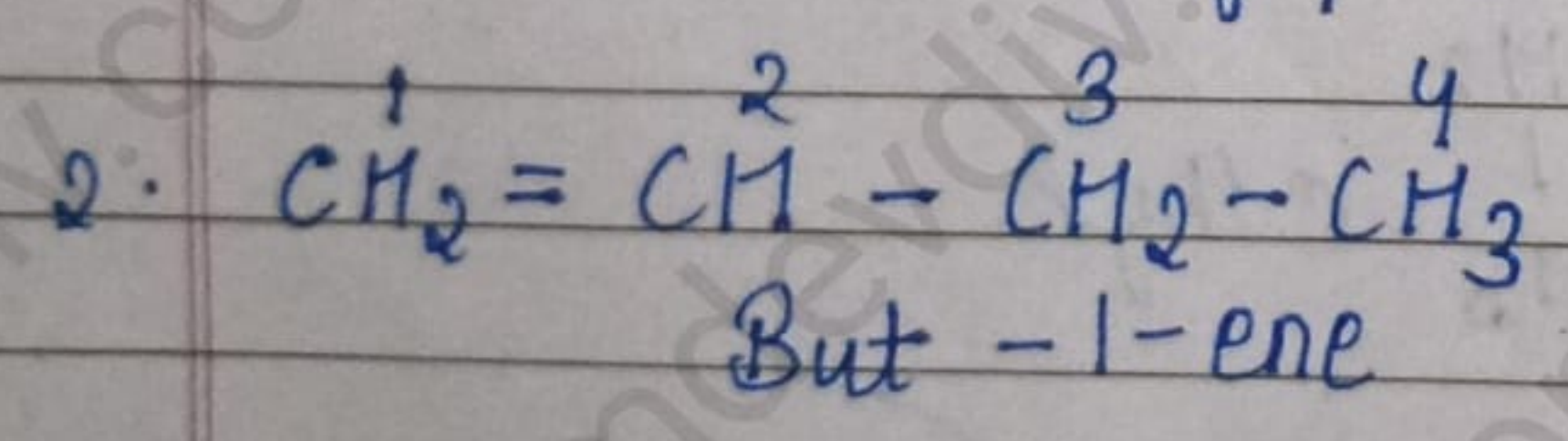


2, 2, 5-trimethyl heptane

4. In case of unsaturated hydrocarbons

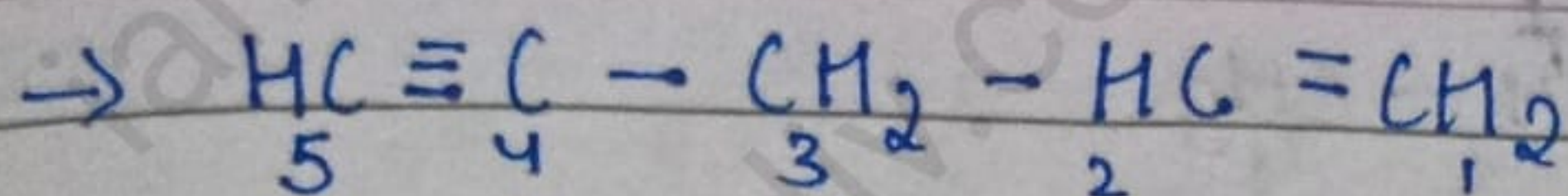


3, 3 - dimethyl pent - 1-ene

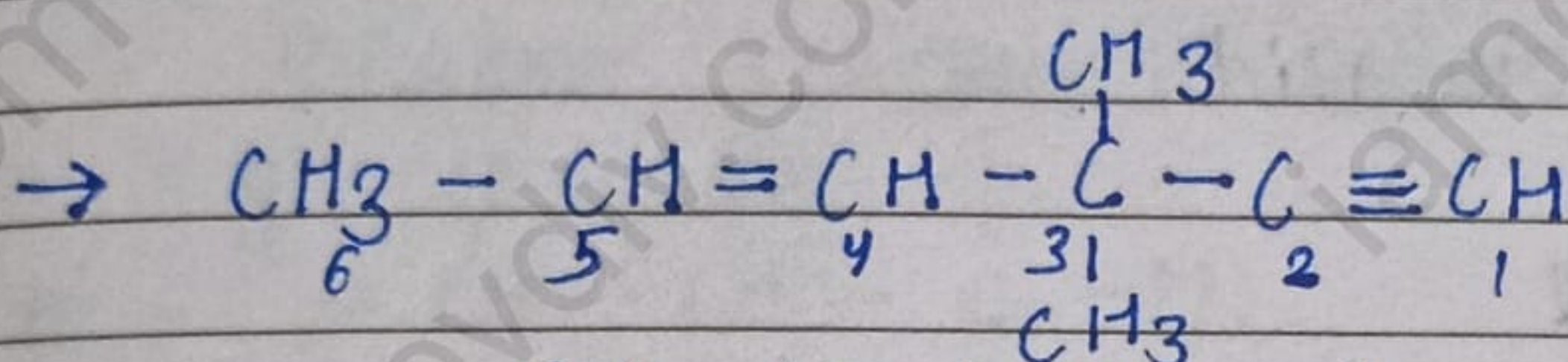
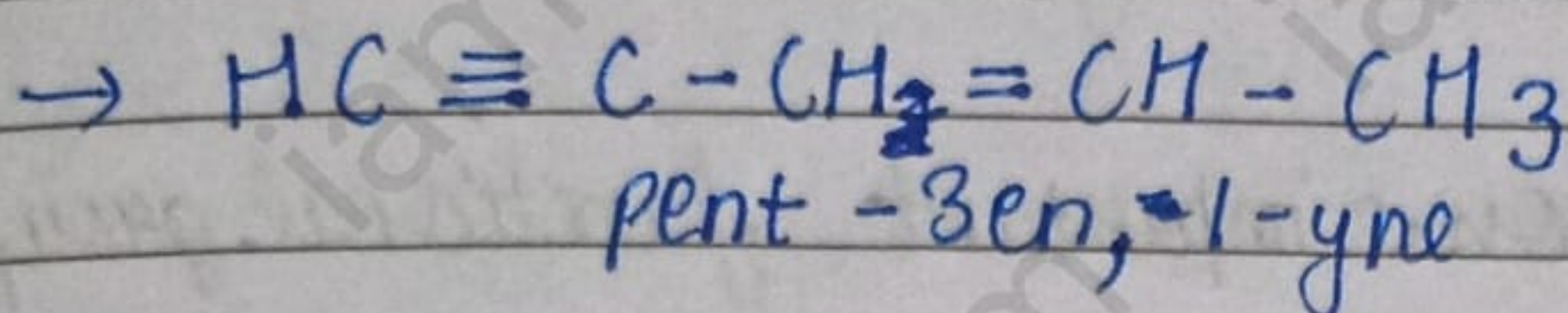


Rule →

In case of double and triple bond present on equivalent carbon double bond is always preferred over triple bond and while writing the name alphabetical order should be follow.



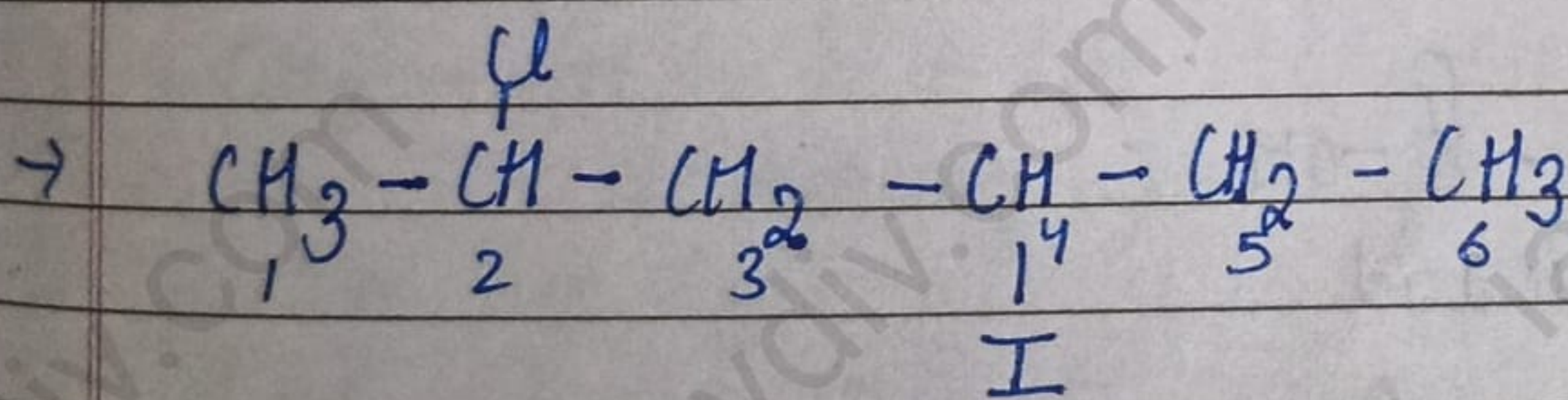
pent-1-en-4-yne



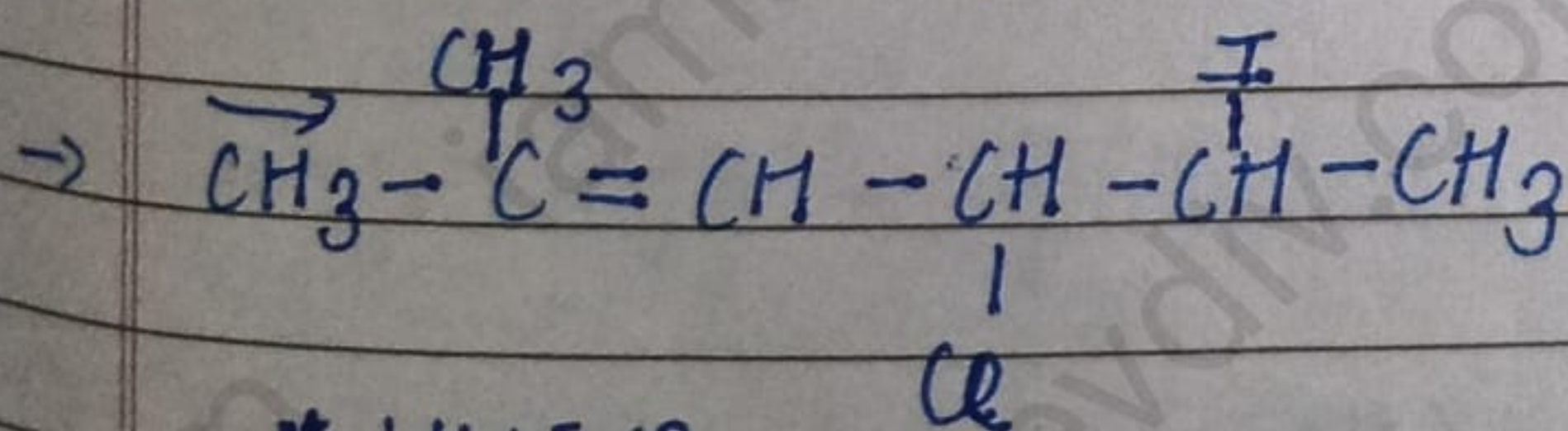
3,3-dimethyl hex-4-en-1-yne

* IUPAC Nomenclature of Haloalkanes

→ Halogen in the haloalkanes is always considered as substituent if there are more than 1 substituent present alphabetic order should be followed

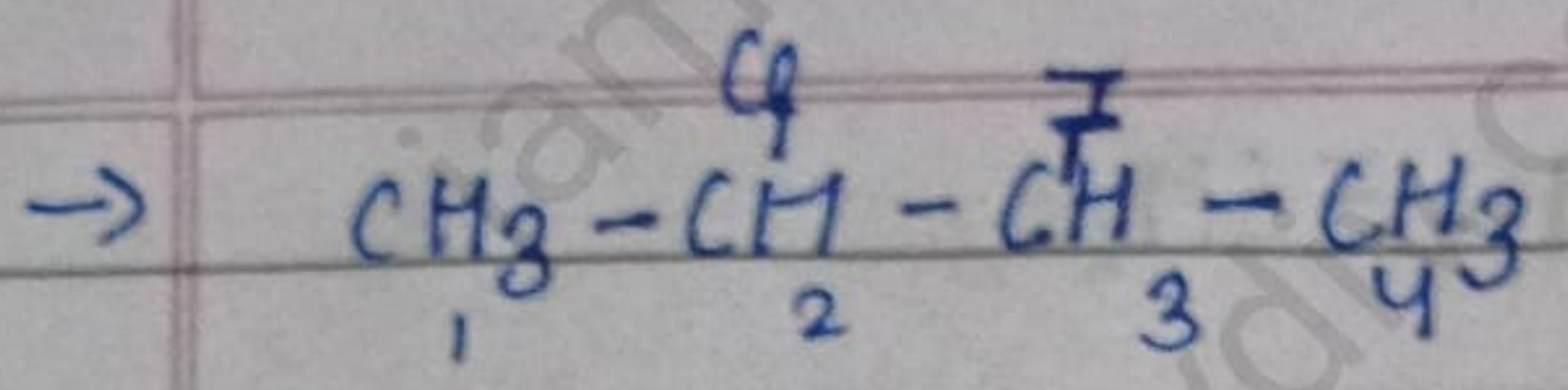


2-Chloro, 4-Iodo hexane



$$4 + 4 + 5 = 13$$

4-chloro, 5-Iodo, 2-methyl hex-2-ene



2 Chloro, 3 Iodo Butane

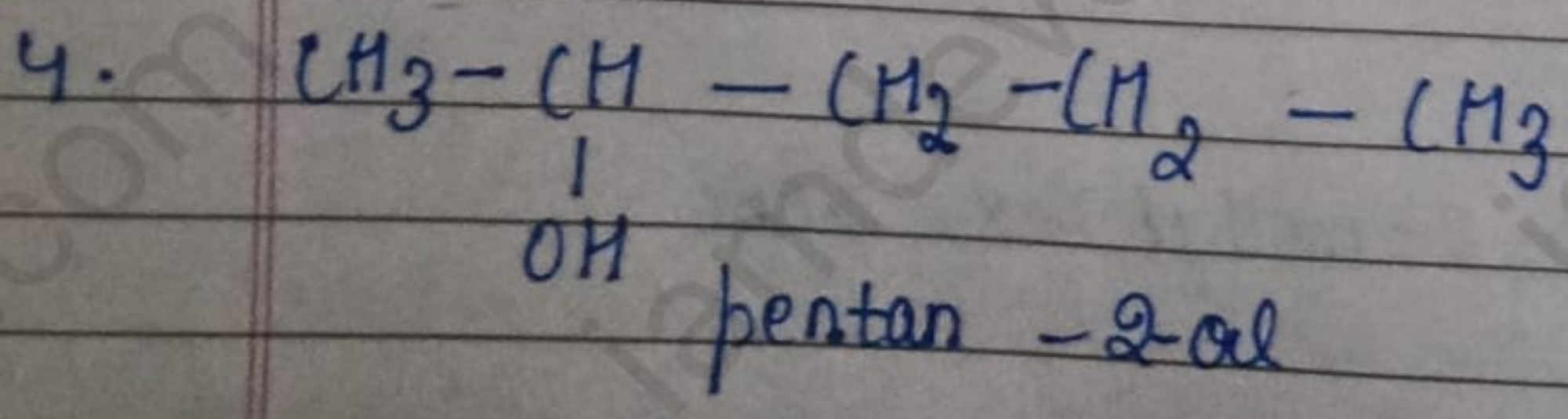
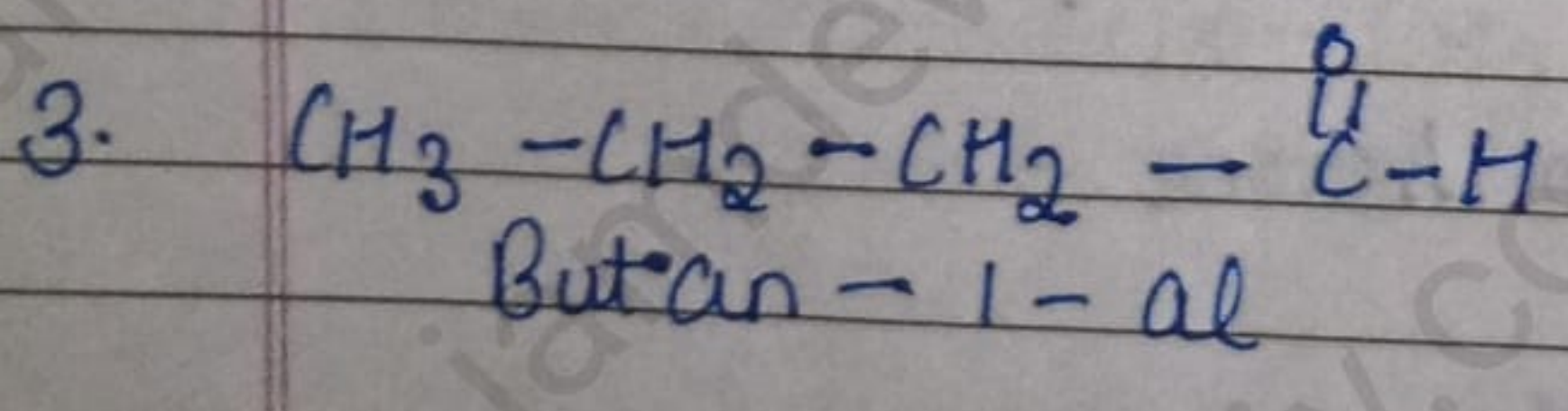
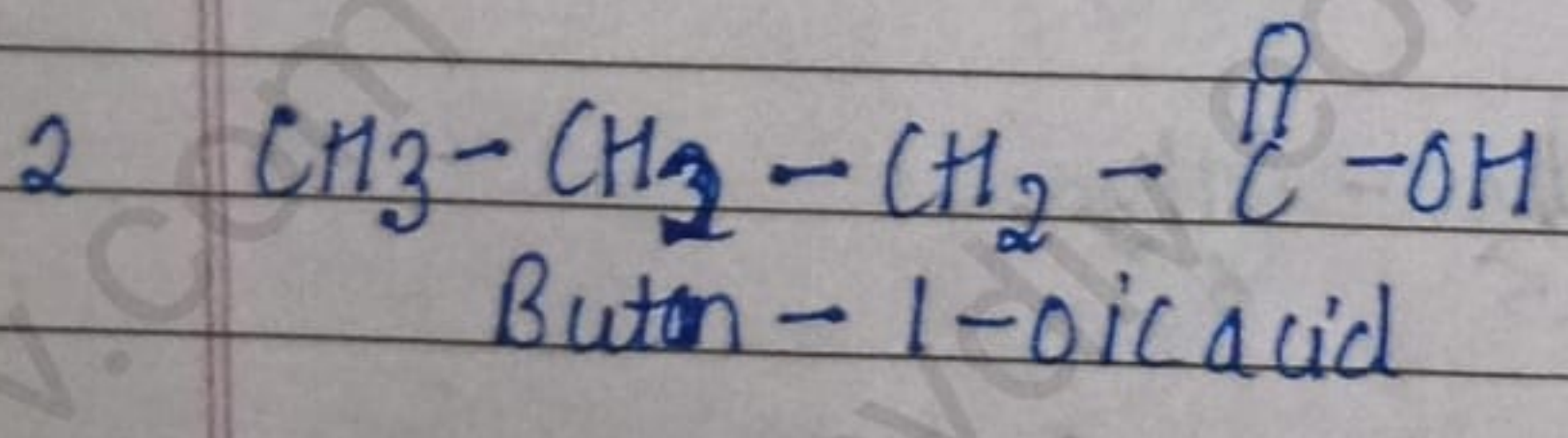
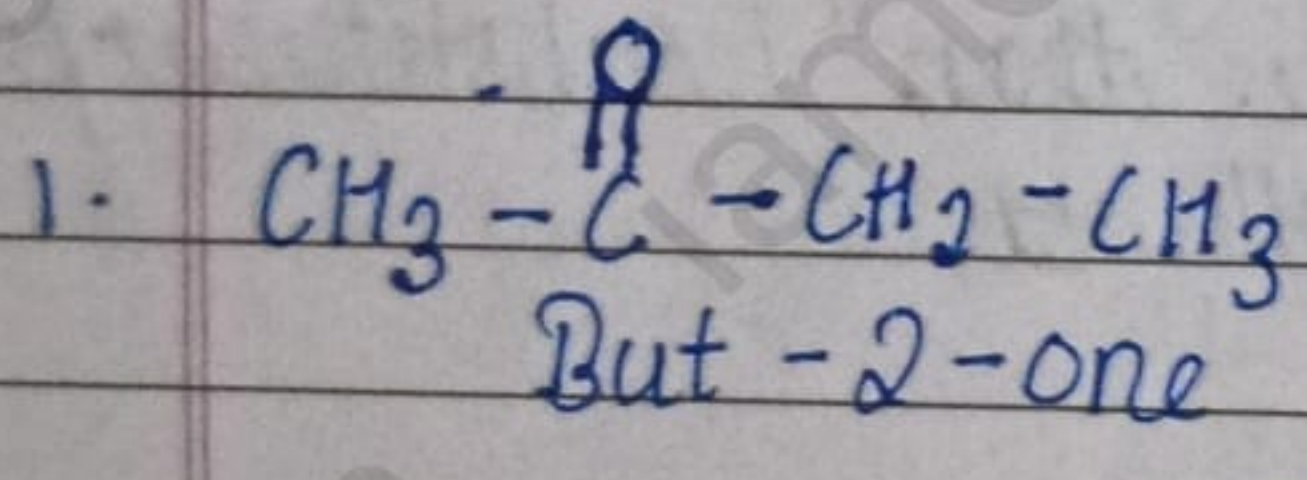
IUPAC of some important functional groups

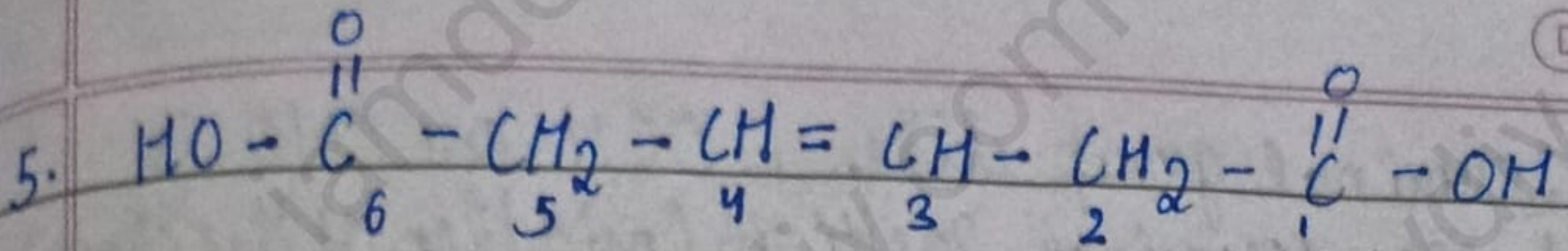
$\rightarrow -\text{COOH} \rightarrow$ oic acid

$\rightarrow -\overset{\text{O}}{\parallel}{\text{C}}-\text{H} \rightarrow$ al

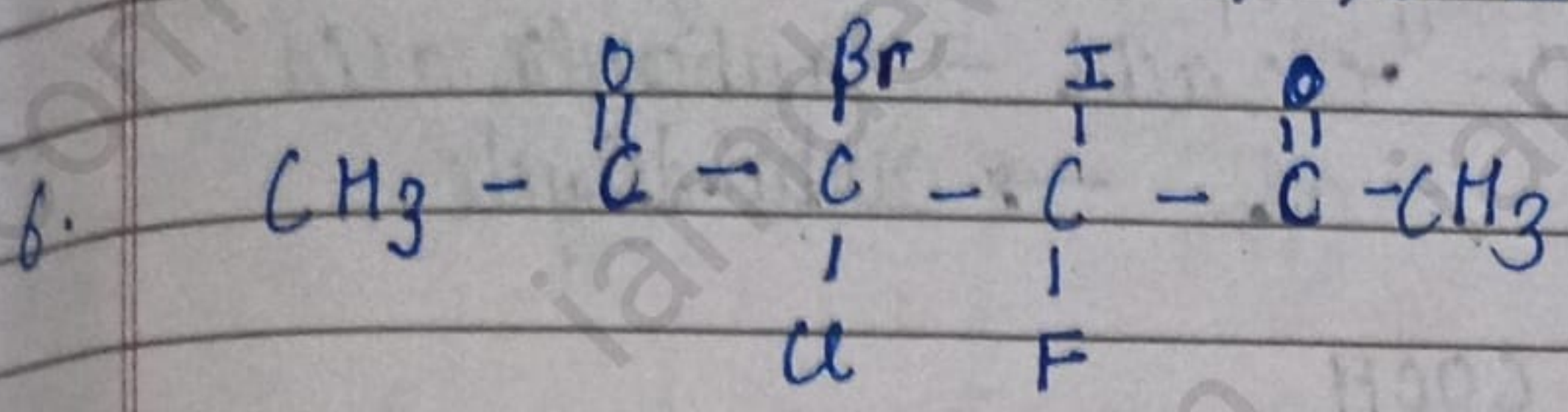
$\rightarrow -\overset{\text{O}}{\parallel}{\text{C}}-\text{R} \rightarrow$ -one

$\rightarrow -\text{OH} \rightarrow$ -ol

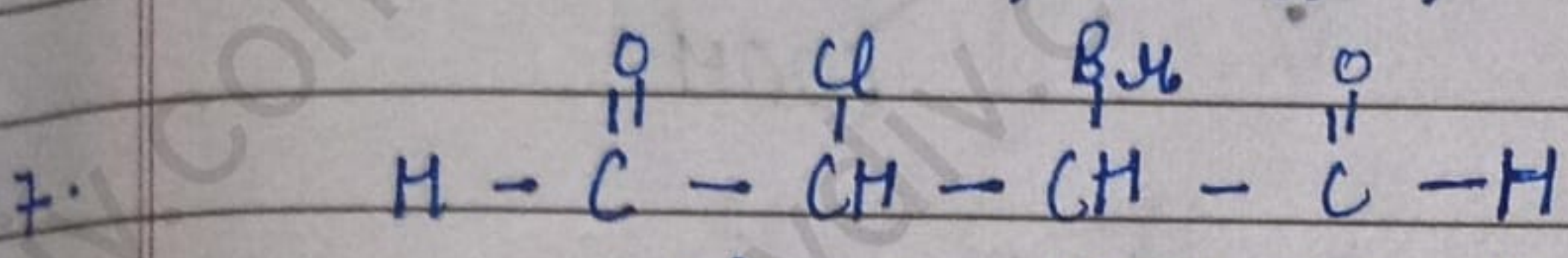




Hex-3-ene, 1,6-dioic acid

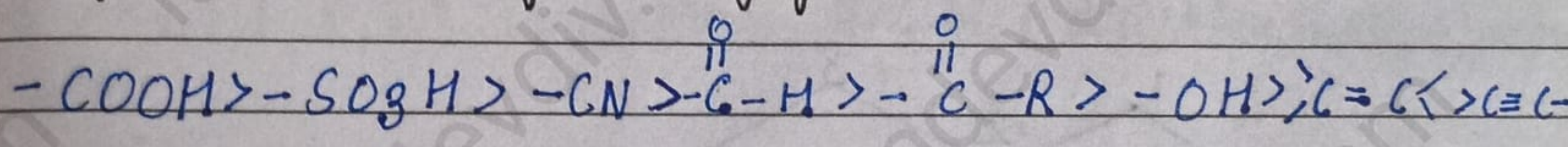


3-Bromo, 3-chloro, 4-fluoro, 4-iodo hexane-2,5-dioic acid

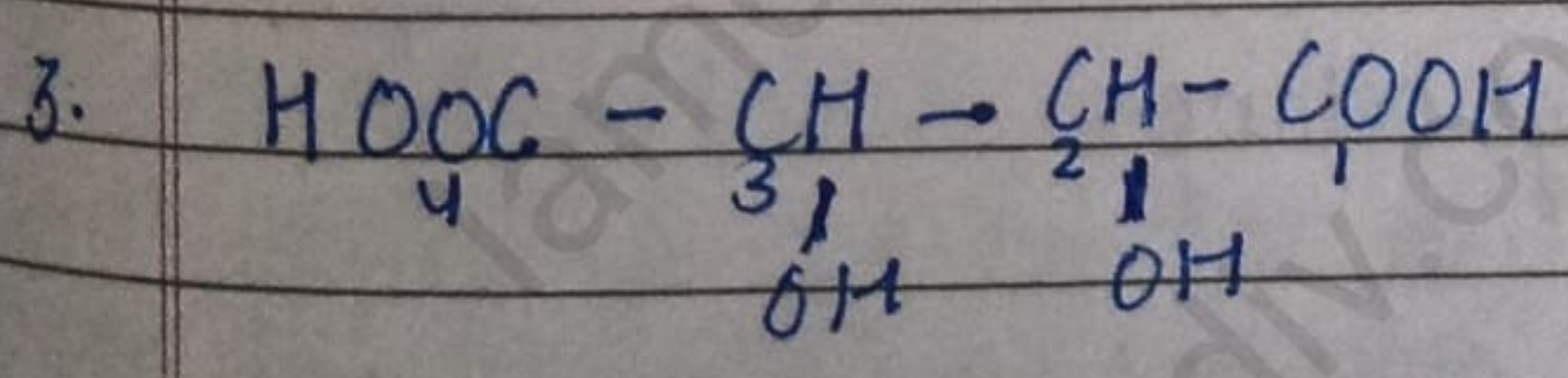
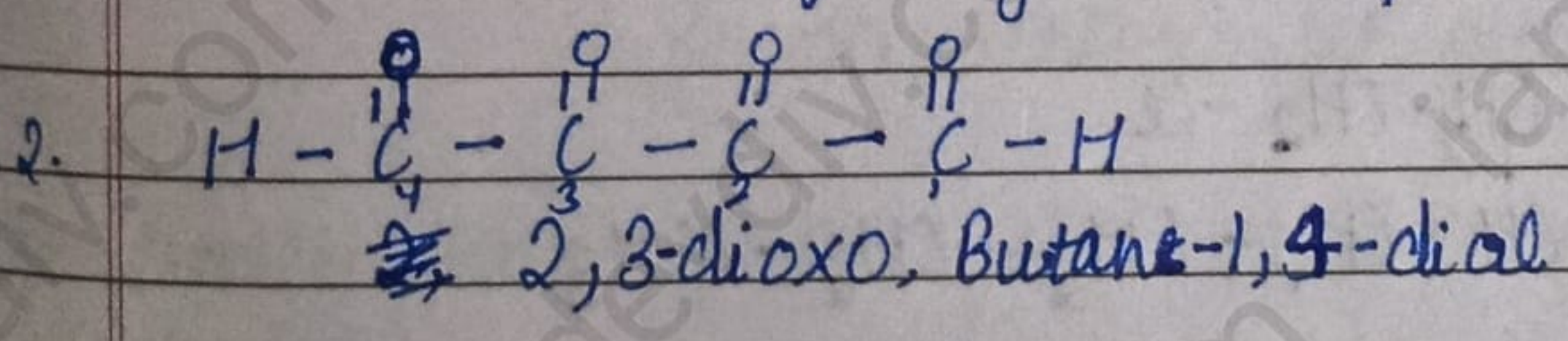
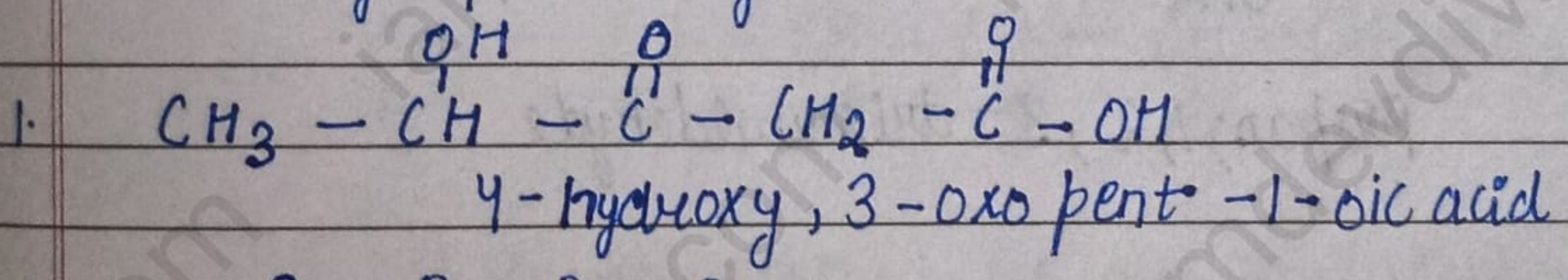


2-bromo, 3-chloro, diebut, 1,4-dial

Preference table for polyfunctional compound

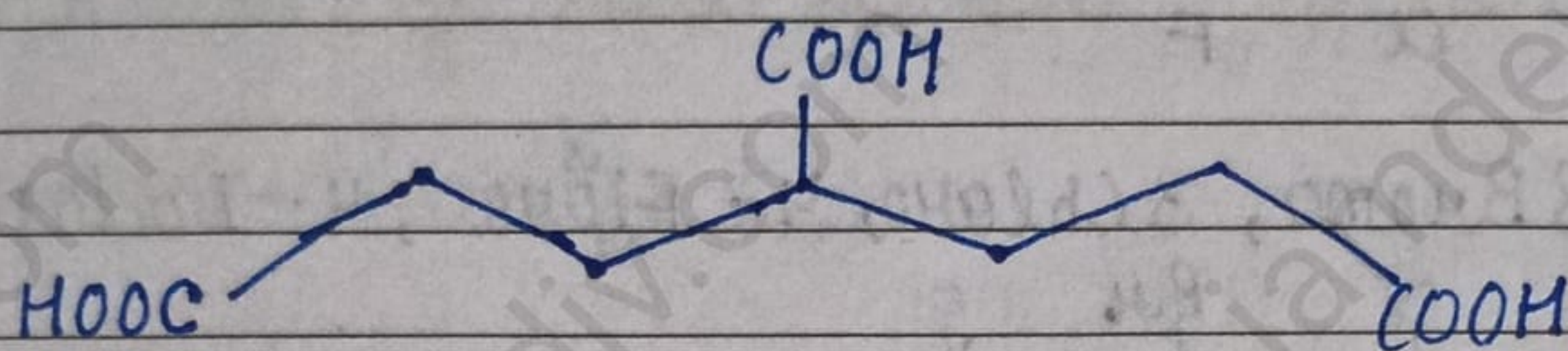


→ Functional group is only one



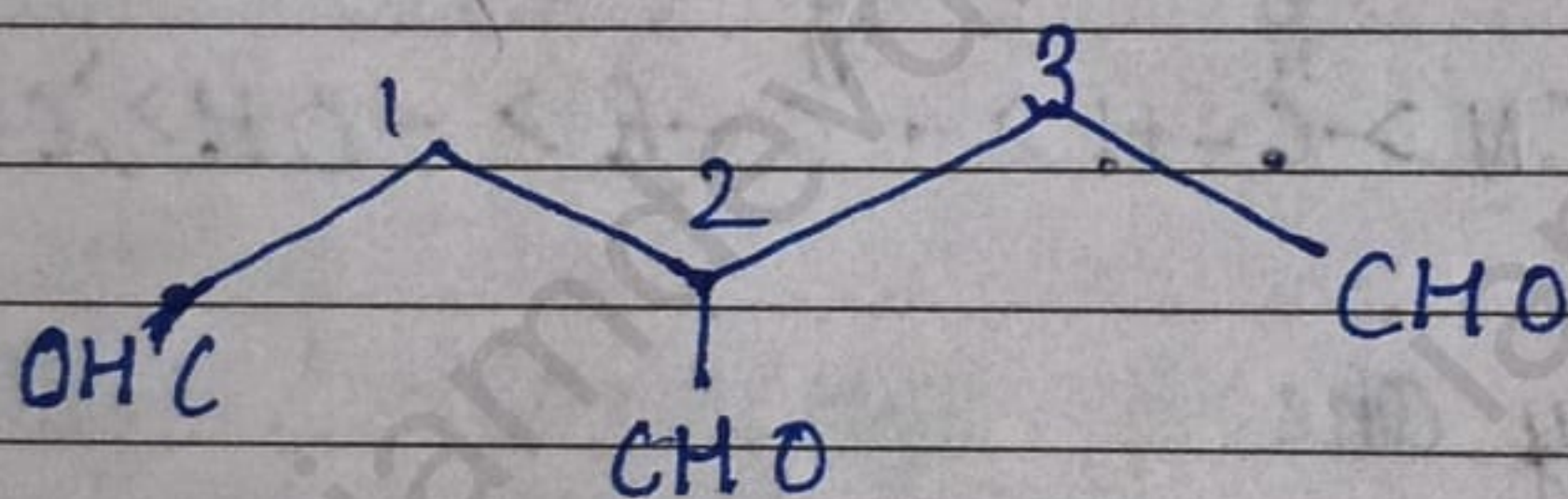
2,3-dihydroxy butan, 1,4-dioic acid

Rule:- If the terminal group like COOH or CHO is present at non-terminal position (middle of the chain) then the name of the group will be after including the carbon for ex:-
 $\text{-oic acid} \rightarrow \text{carboxylic acid}$
 $\text{-al} \rightarrow \text{carbaldehyde}$



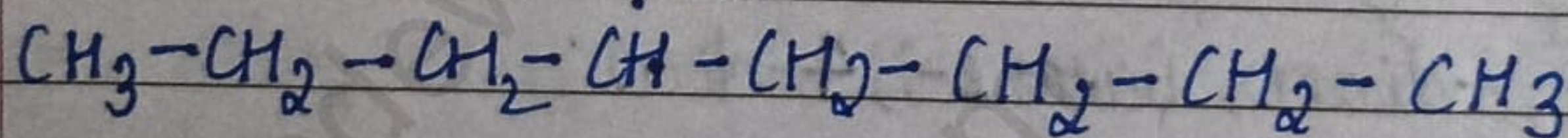
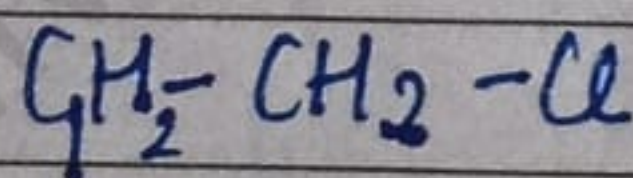
heptane, 1, 4, 7-tricarboxylic acid X

pentane 1, 3, 5-tricarboxylic acid ✓



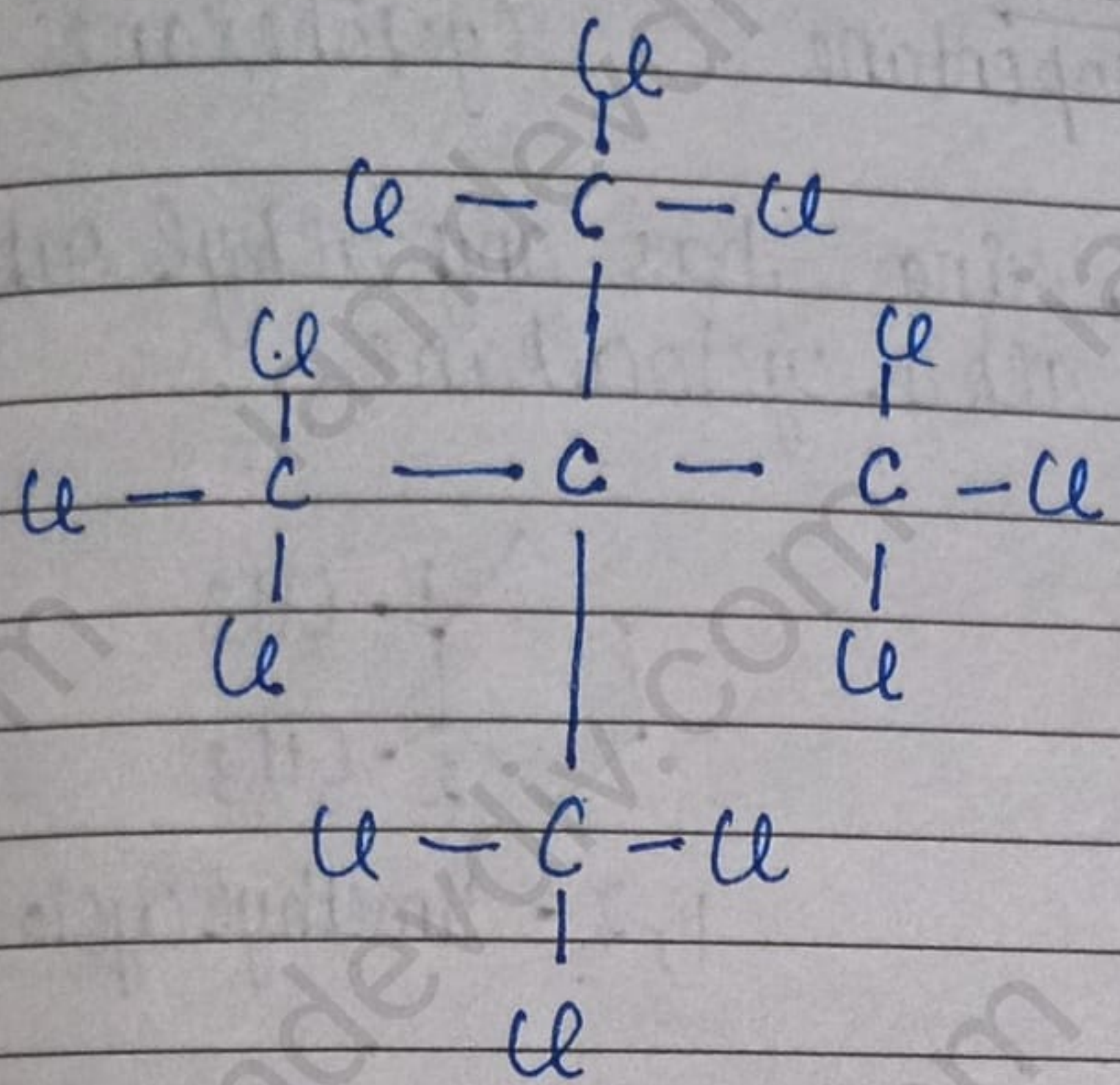
propane; 1, 2, 3-tricarbaldehyde

★



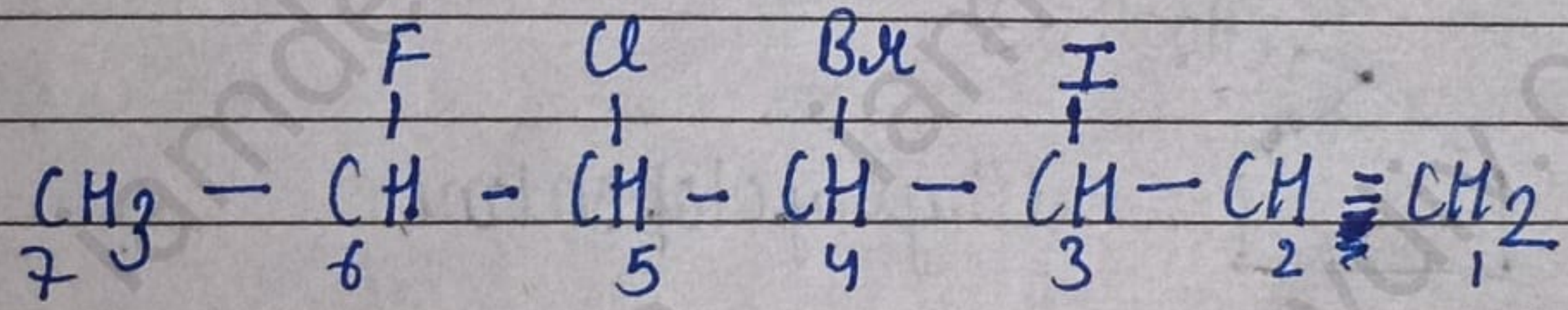
4-chloroethyl octane

★



1,1,1,3,3,3 -hexachloro 2,2 bis (trichloromethyl)propane

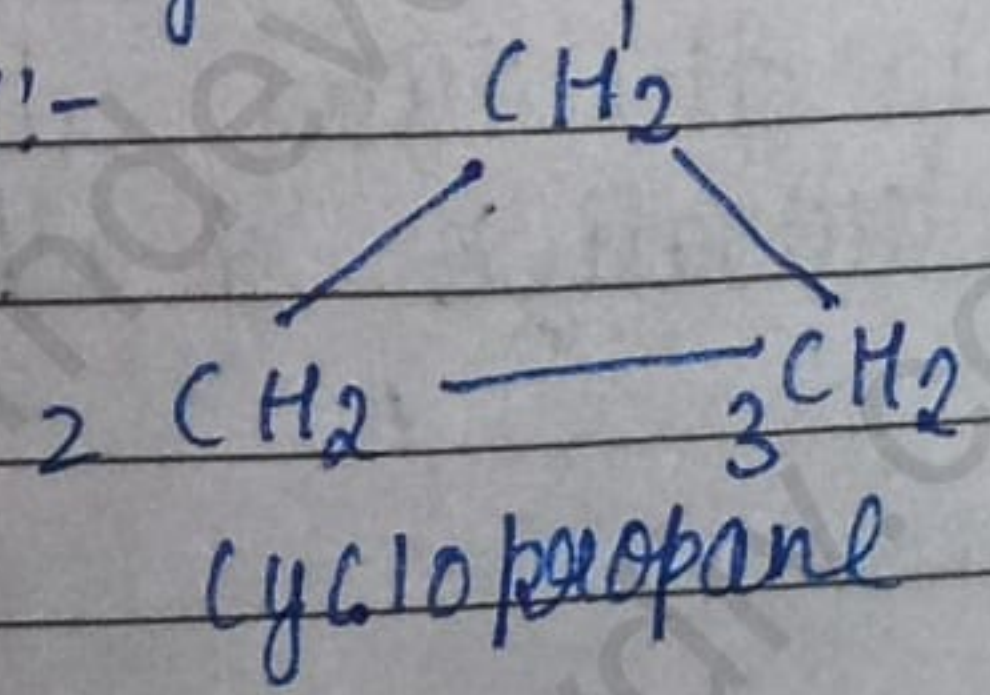
★

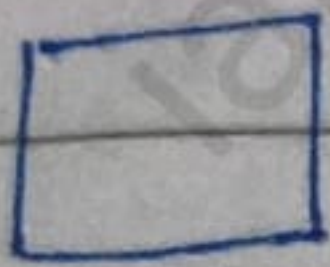


4-Bromo, 5Chloro, 6 Fluoro, 3 Iodo heptene

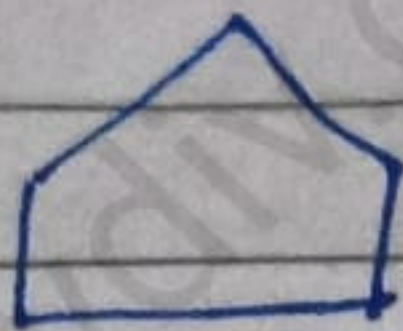
Nomenclature of alicyclic compound

In cycloalkanes the naming would be done by adding prefix cyclo to the name of the alkane depending upon no. of carbon atom. for ex:-

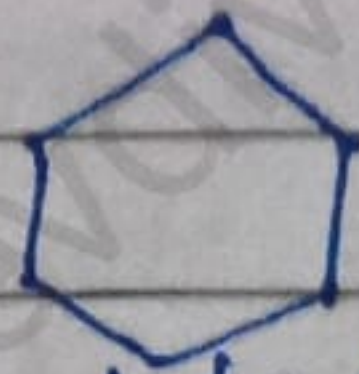




cyclobutane



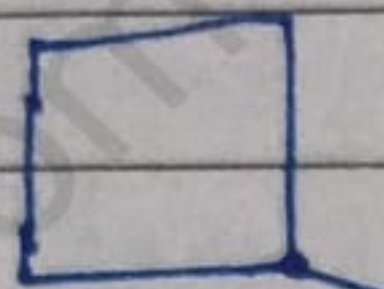
cyclopentane



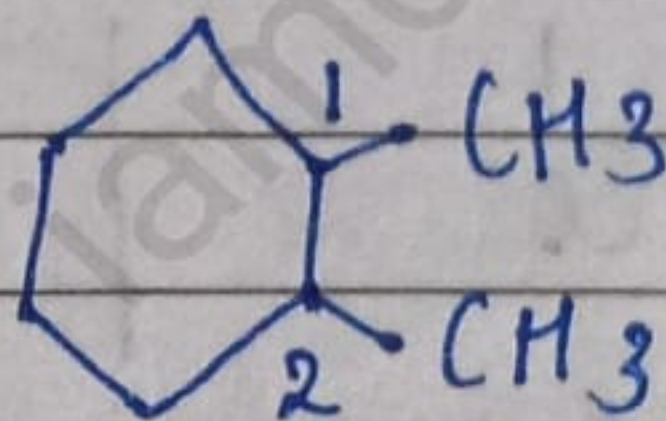
Cyclohexane

→ If the cyclo alkane ring has any alkyl substituent it is known as alkyl cycloalkane

Ex:-



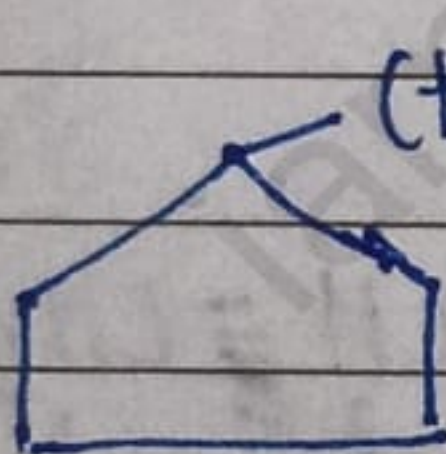
CH₃
methylcyclobutane



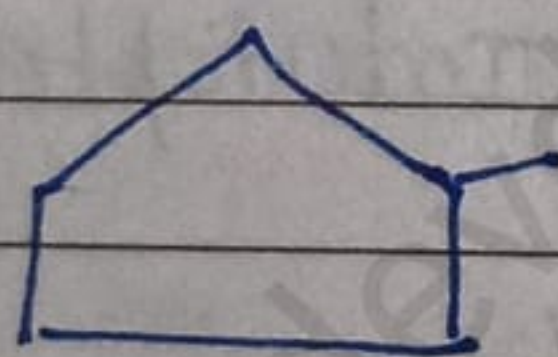
1,2 - dimethylcyclohexane

→ If the ring contains equal no. of carbon or more than the carbon chain the compound would be named as the derivative of cycloalkanes.

Ex:-



CH₂-CH₃
ethylcyclopentane

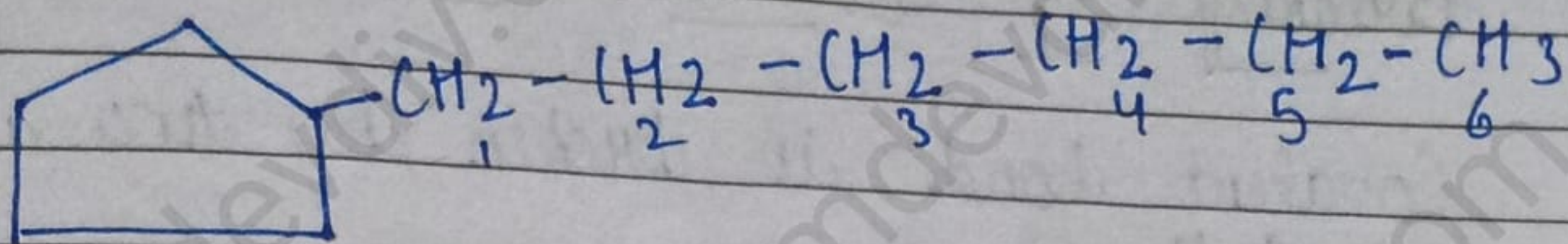


CH₂-CH₂-CH₂-CH₂-CH₃

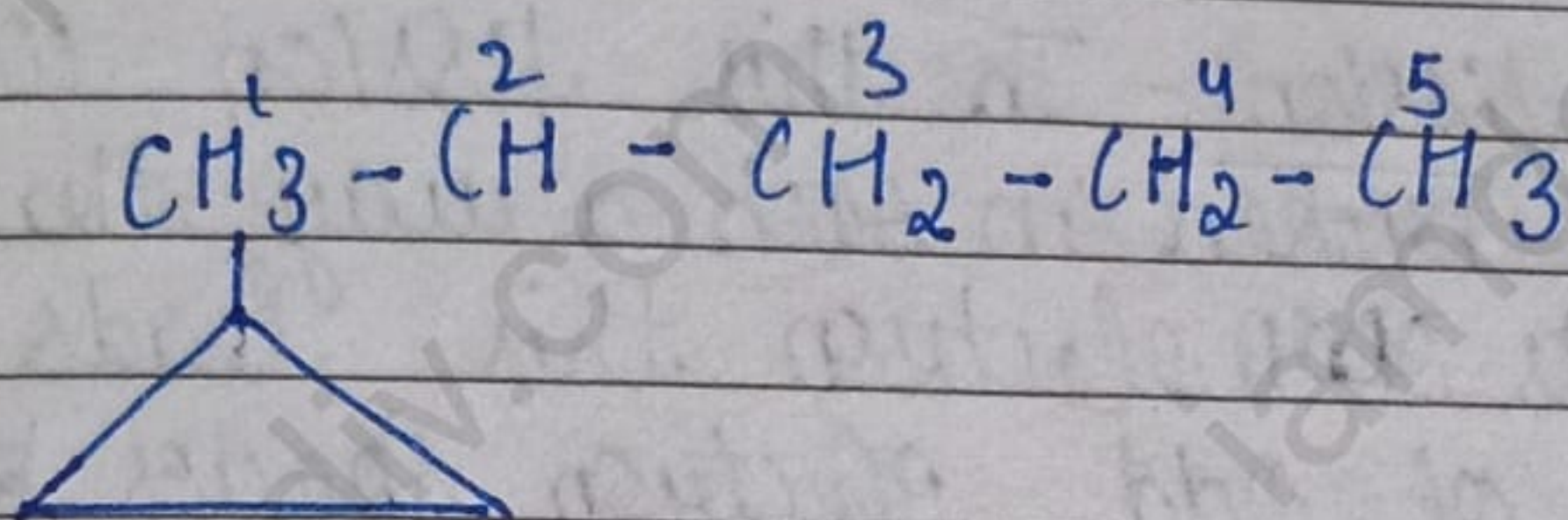
pentylcyclopentane

→ If the chain contains greater no. of carbon atom than in the ring the compound will be regarded as derivative of alkane chain

Ex:-

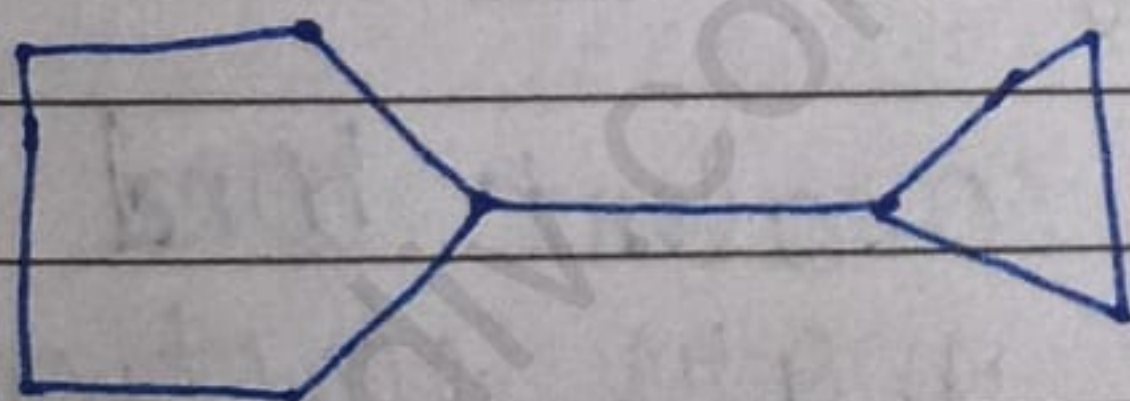


1-cyclopentyl hexane

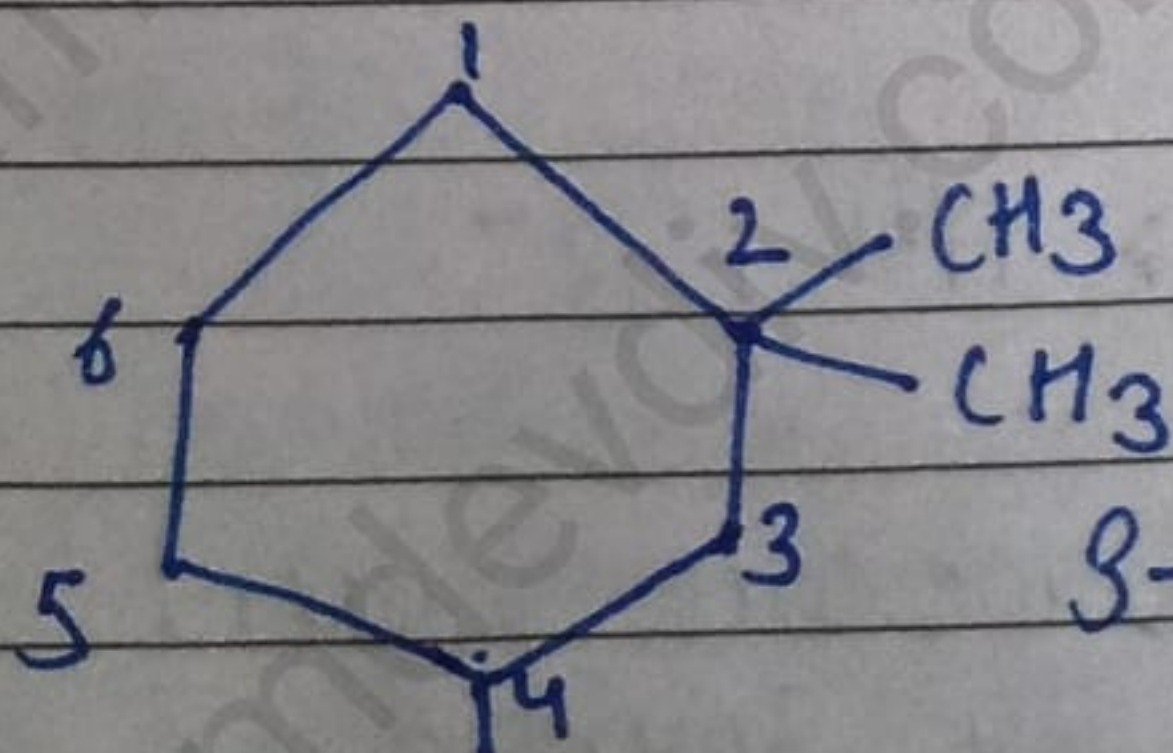


2-cyclobutyl propyl pentane

→ If there are two rings present and bonded with a single bond the smaller ring would be substituent and the larger one will be parent cyclic chain.



1-cyclopropyl cyclopentane



3-ethyl, 1,1, - dimethyl cyclohexane

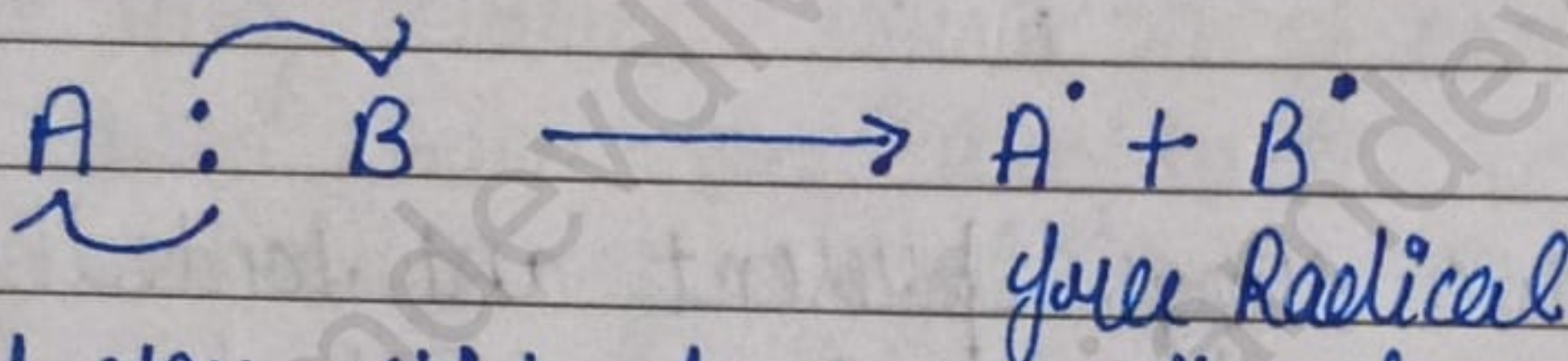
1-ethyl, 3,3 - dimethyl cyclohexane x

Breaking of Covalent Bond

Covalent bond is broken by two ways:-

1. Homolytic
2. Heterolytic.

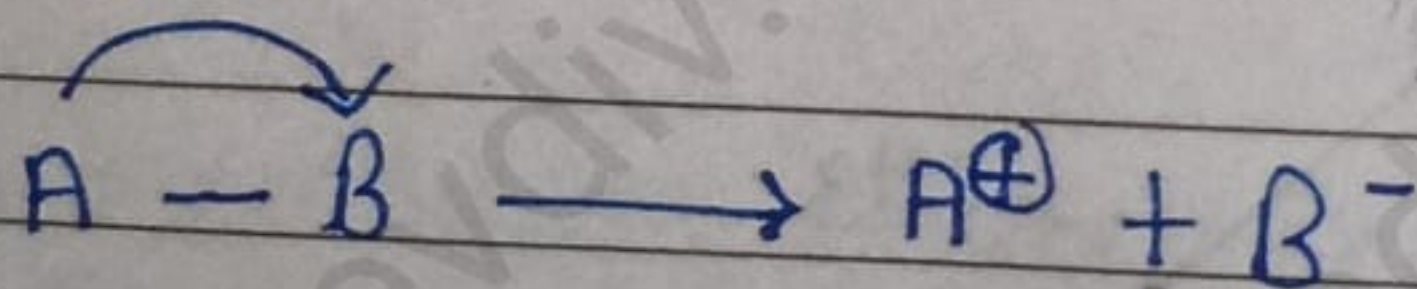
→ Homolytic fission: - In this fission covalent bond is broken in such a way that each resulting species gets one electron this leads to the formation of odd electron species known as free radical



The factor which favours the formation of free radicals is the small difference between electronegativity

Heterolytic breaking of bond

~~The~~ In this fission a covalent bond is broken in such a way more electronegative species gains both the electron and less electronegative will lose it.



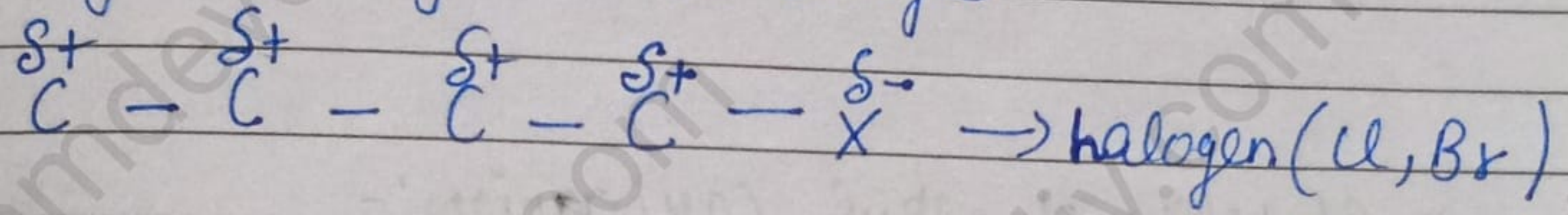
If the +ve & -ve charge are present on Carbon atom they will be termed as carbocation / Carbanion respectively.

Note:- The energy required for homolytic fission is always greater than that for heterolytic.

* Electronic displacement in a covalent bond

1. Inductive effect

In a covalent bond between two atoms having different electronegativities the e-pair shift towards the atom having higher electronegativity resulting in the origin of small fractional charges



→ Properties of inductive effect

- It is a permanent effect.
- It operates through σ bond only.
- Electron never leave their original atomic orbital.
- This effect is unidirectional.
- Its magnitude decreases with increase in distance

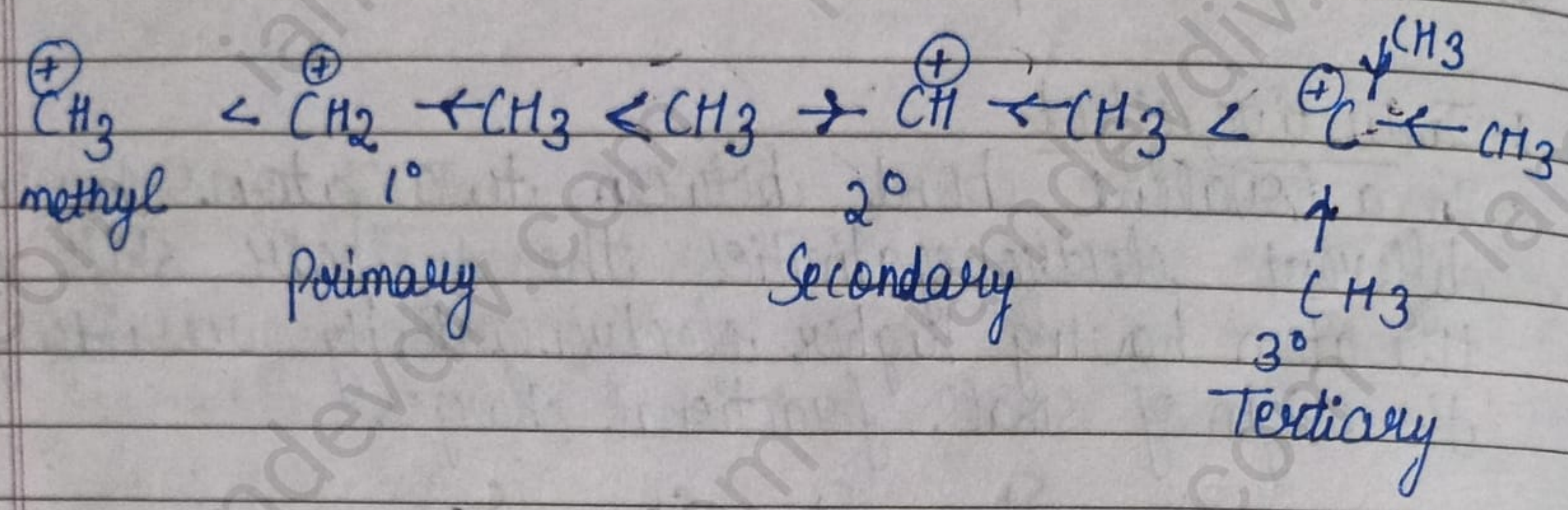
+I group and -I group

+I → which donates electron through sigma (σ) bond is known as +I for ex:- alkyl group (CH_3 , O^- , COO^- , etc)

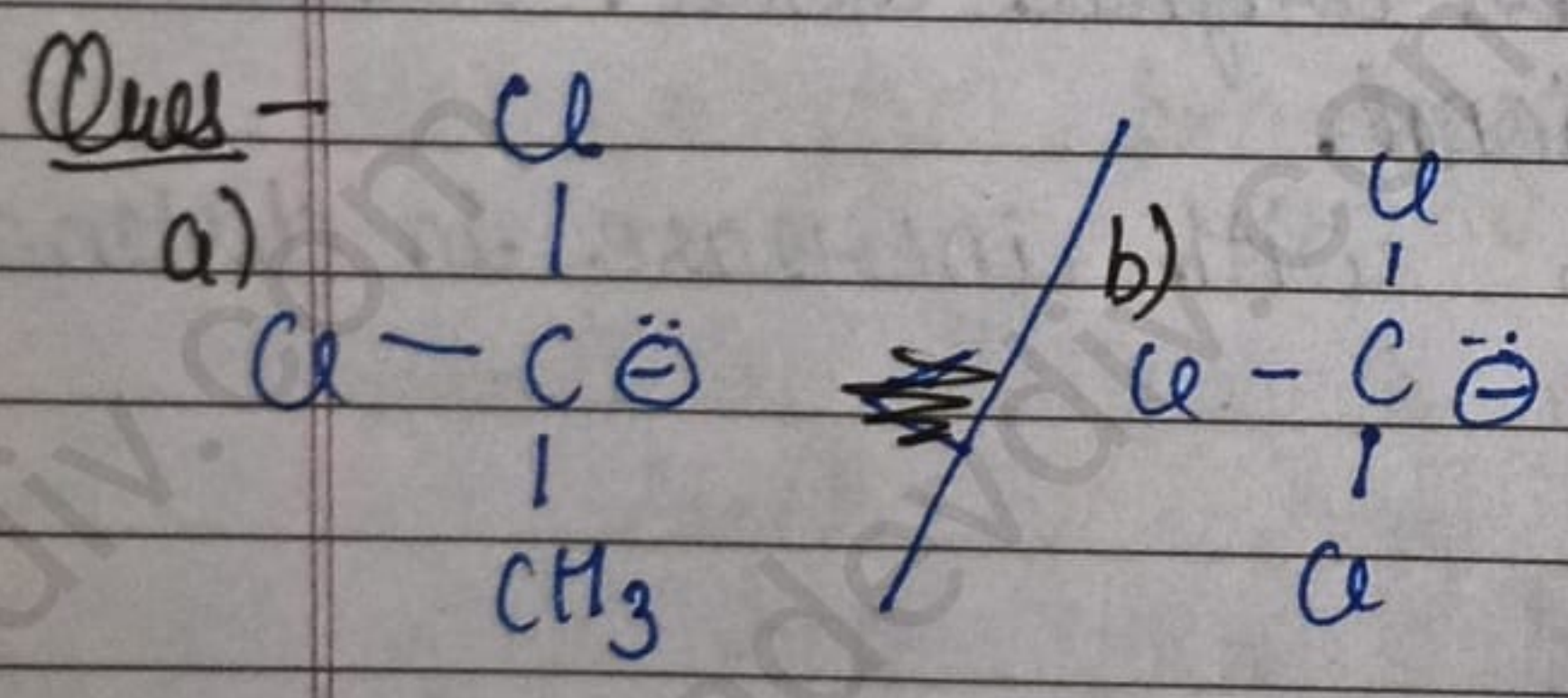
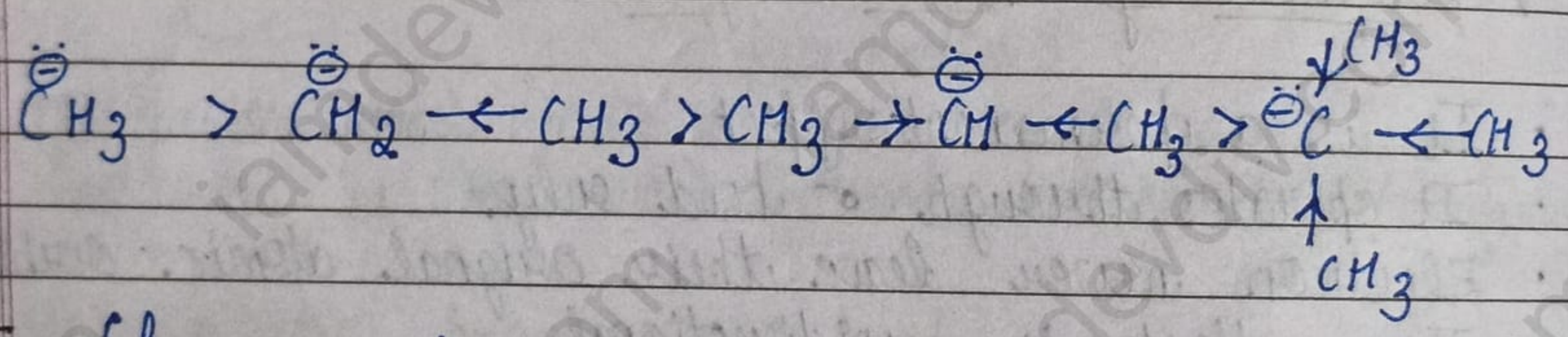
-I → which withdraws electron through σ bond are known as -I for ex:- Halogens (F, Cl, Br, I), OH (alcohol), NH_2

Applications of Inductive Effect

→ Stability of alkyl carbocation:-



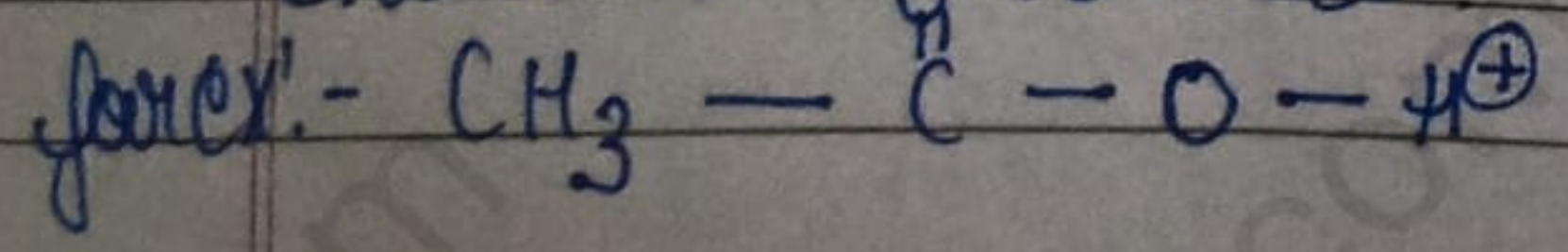
→ Stability of alkyl carbanion:-

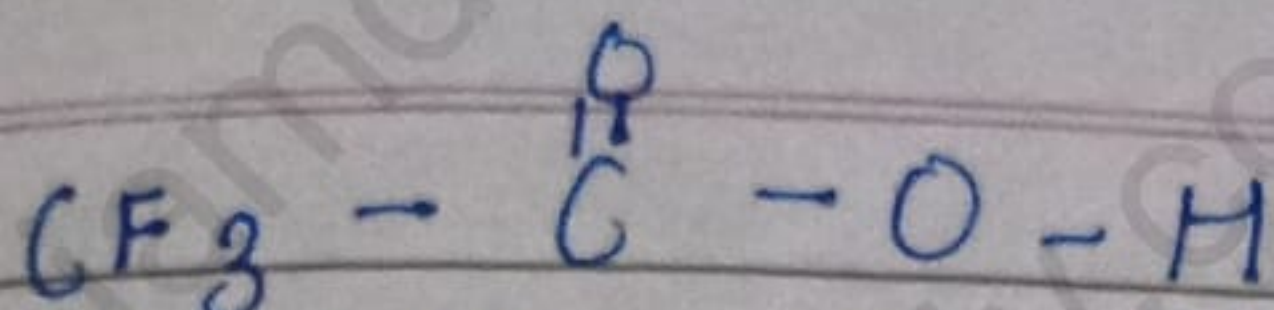


→ (b) is more stable

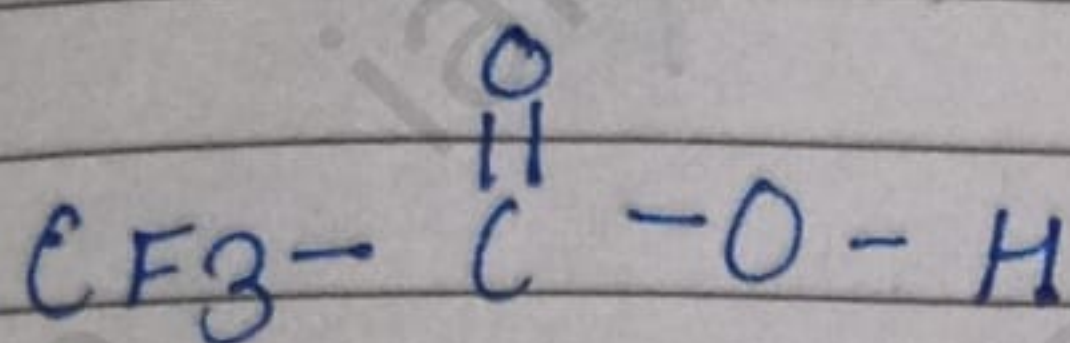
→ Stability of carboxylic acid:-

Electron withdrawing group stabilizes the acid anion (conjugate base) and hence the acidic character increases

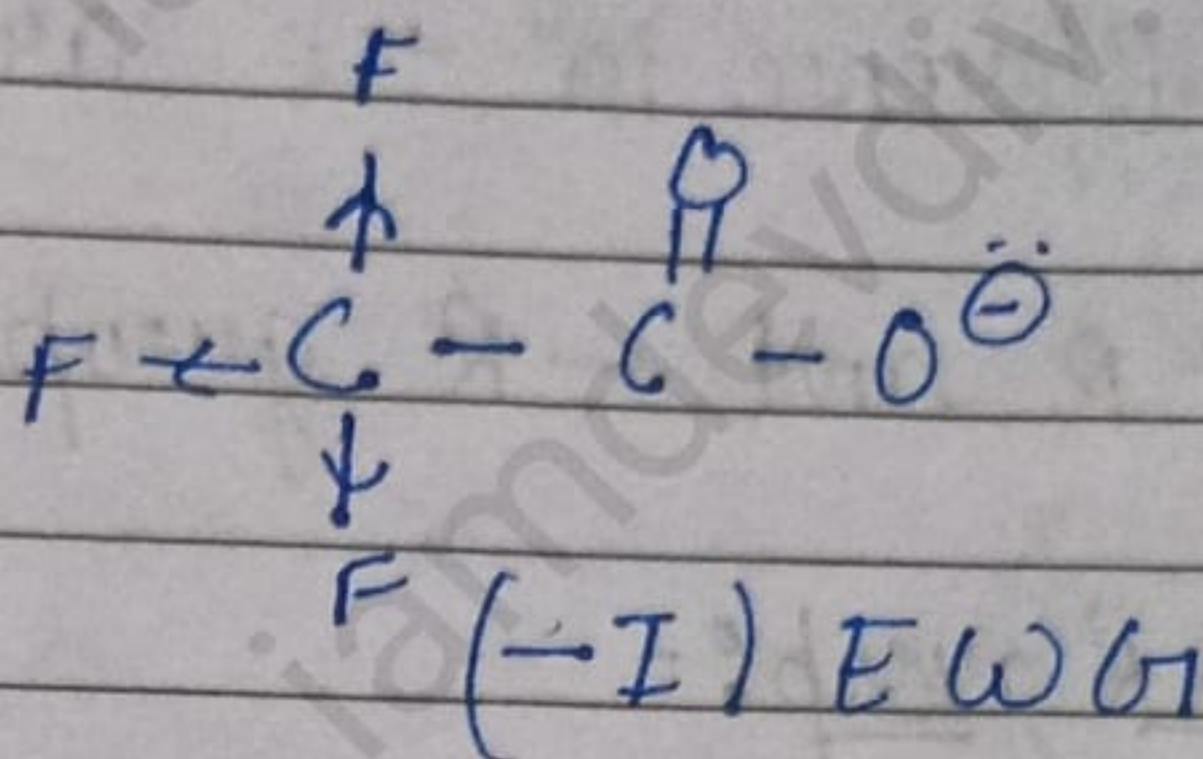




In both of them the last one would ^{have} greater acidic strength because its conjugate base is more stable due to -I of Fluorine



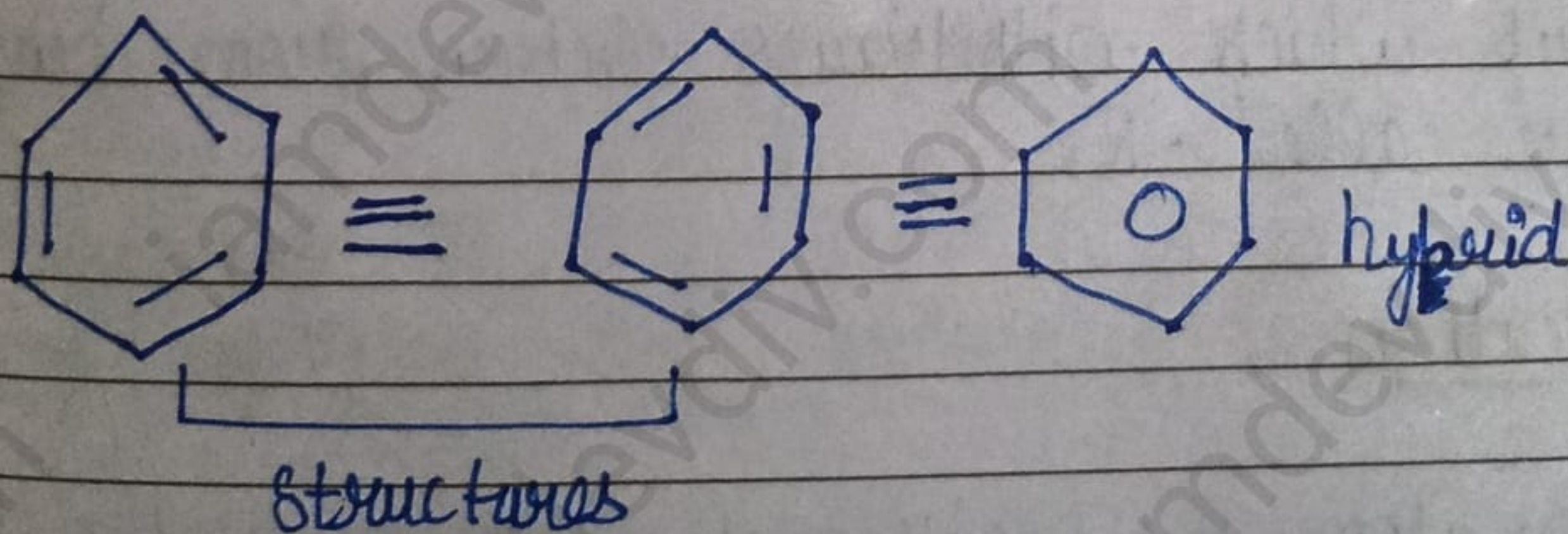
(+I) EWG



Q-(A) CF_3COOH , (B) CCl_3COOH
→ B is more stable

Resonance:- In case of certain molecules when a ^{single} simple structure cannot decide all the properties of the molecule then the molecule is supposed to have many structures which are called Resonating Structures and the actual structure is called Resonance hybrid

Conditions for Resonance



→ Conditions for Resonance

- Same position of atom
- Same no. of paired or unpaired electrons
- Difference in the arrangement of electrons

→ +R and -R groups

+R group:-

- The group which donate electrons to benzene ring by resonance are called +R

Identification

- If the key atom has negative charge or lone pair it will be +R

for ex:- NH_2 , Cl , OH , $\text{O}-\text{CH}_3$, O^- , X , etc.

-R group:-

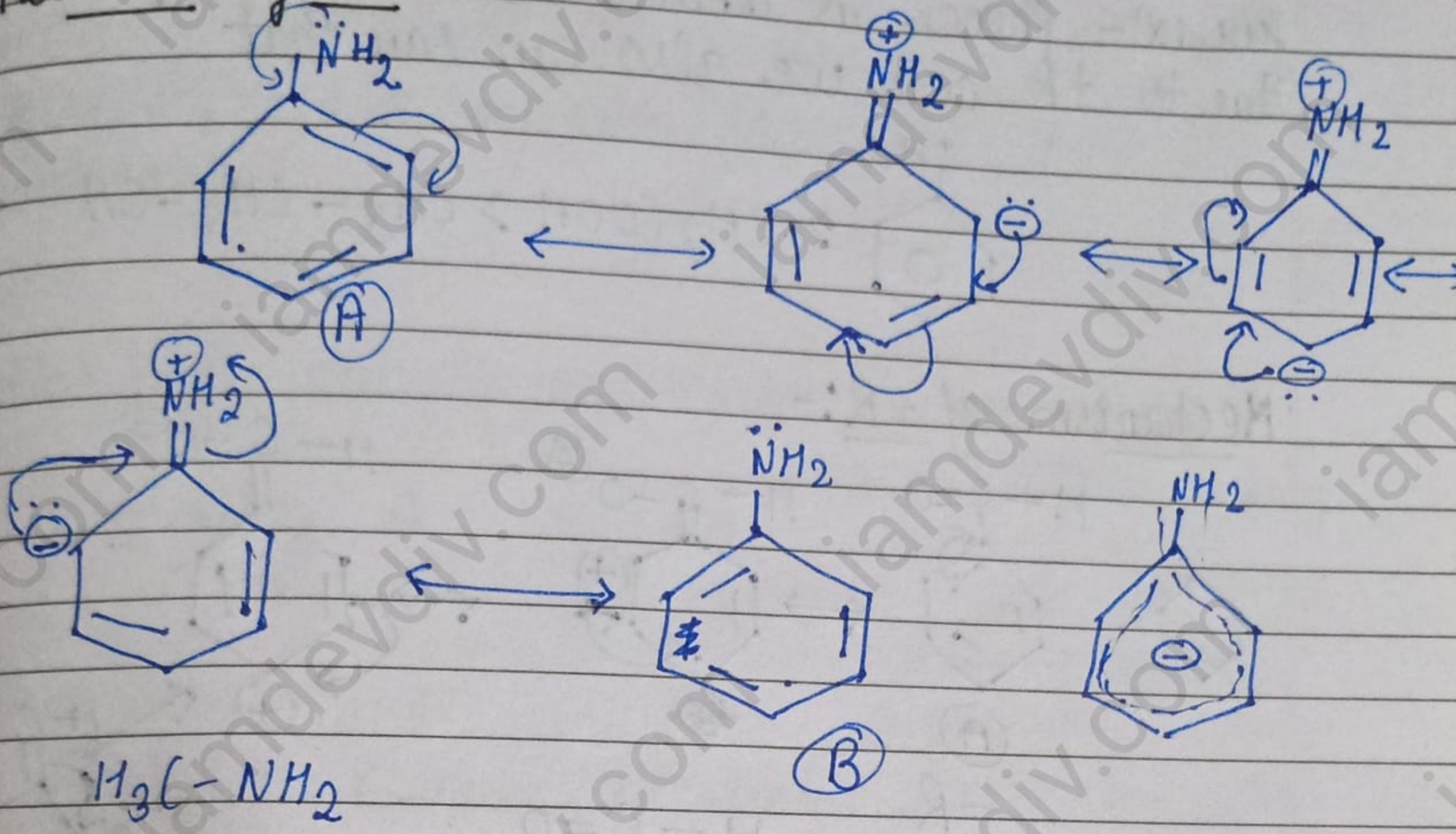
The group which withdraws electron from benzene ring are called -R

Identification

- If the key atom has positive charge or bonded to electro-negative atom through multiple bond it will be -R.

Ex:- $\text{H}-\text{C}=\text{O}$, $\text{C}\equiv\text{N}$, $\text{N}=\text{O}$, $\text{O}=\text{C}-\text{OH}$

Mechanism of +R:-



- Due to Resonance molecule become stable
- Due to Resonance C-C single bond length decreases
- Non polar structures are more stable than dipolar and structures in which there is less charge separation are more stable than those with more charge separation.
- All the atoms taking part in resonance should be coplanar
- $2p-2p > 2p-3p > 2p-4p$

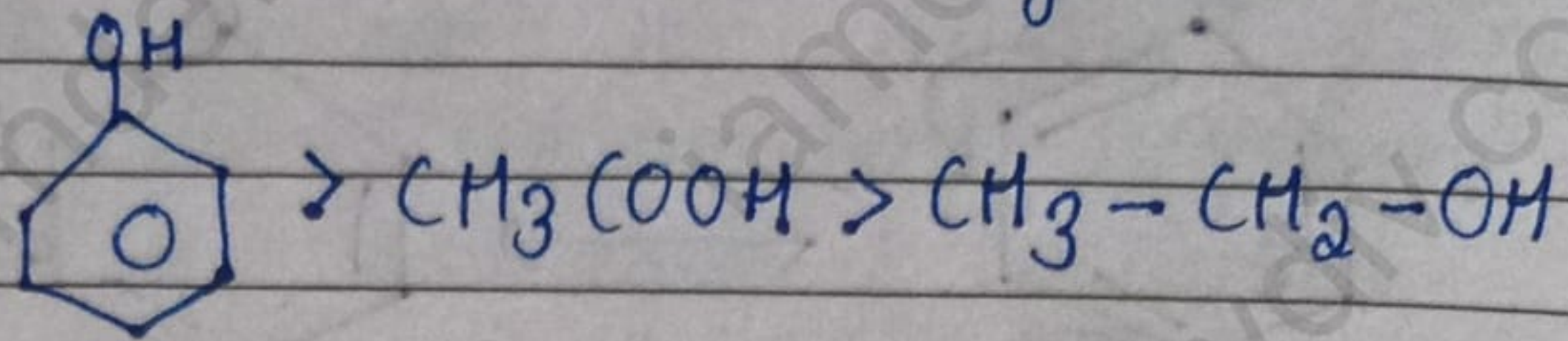
Mechanism of -R

→ Strength of Acid with respect to Resonance

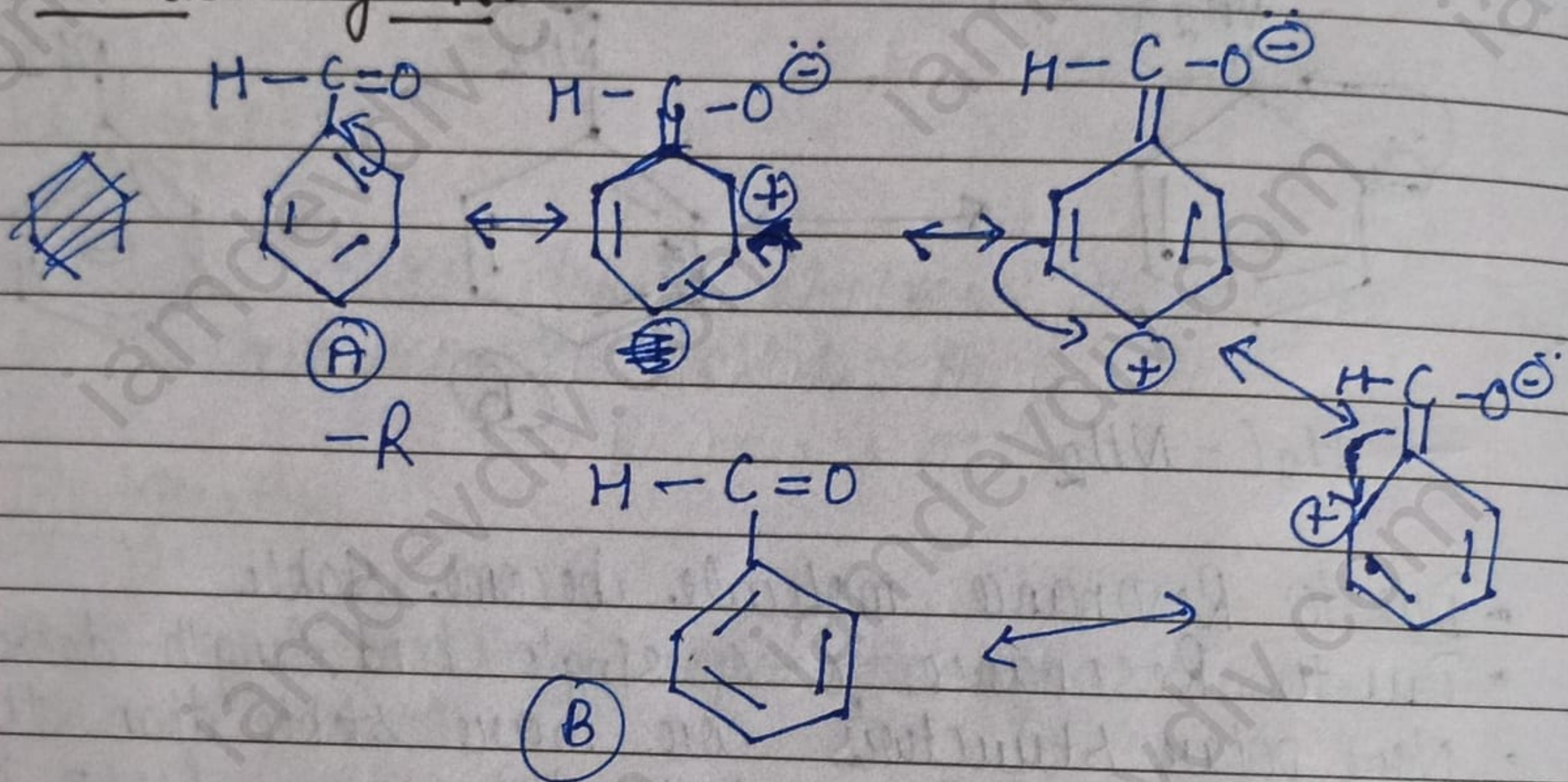
The Acidic ~~Acidic~~ strength is totally dependent upon stability of conjugate base

Acidic strength \propto stability of conjugate base

for ex:- phenol is better acid than CH_3COOH (Acetic acid) due to +R and we also can say that



Mechanism of -R:-



★ Hyperconjugation:-

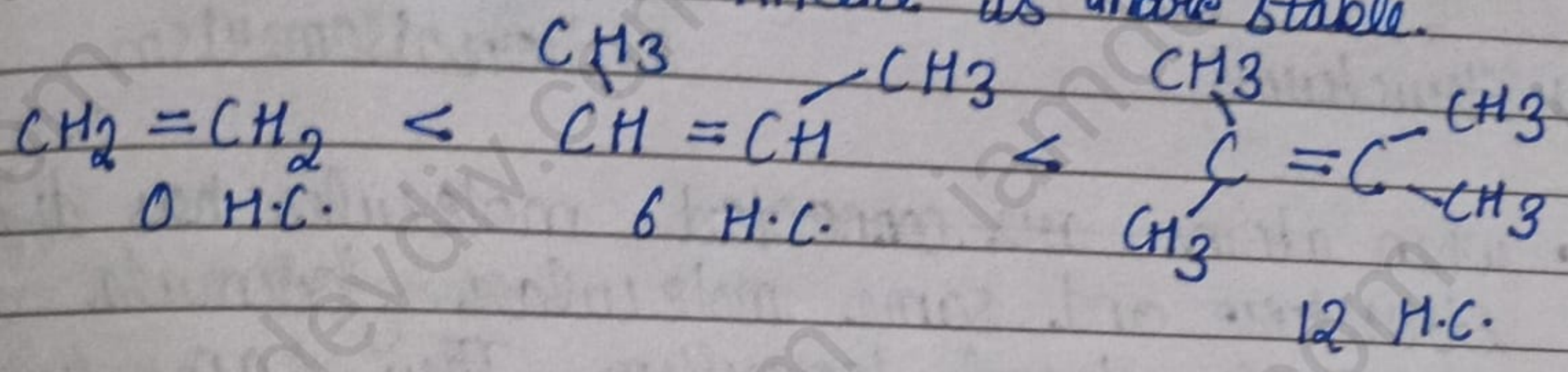
→ Conditions for Hyperconjugation:-

- Compound should have at least sp^2 hybridised carbon.
- Alpha carbon with respect to sp^2 hybrid carbon should have at least 1 hydrogen atom.

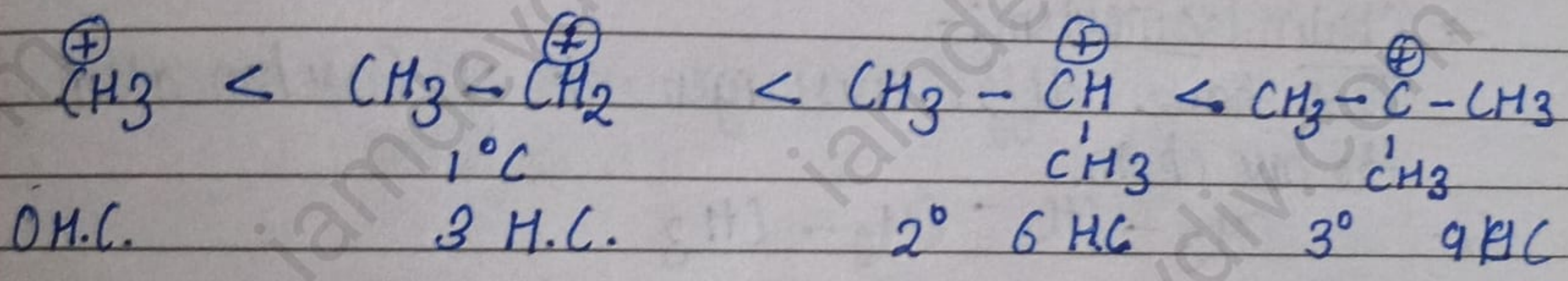
Types of Hyperconjugation:-

1. Sigma σ (C-H), π conjugation (Alkenes)
 Carbocation

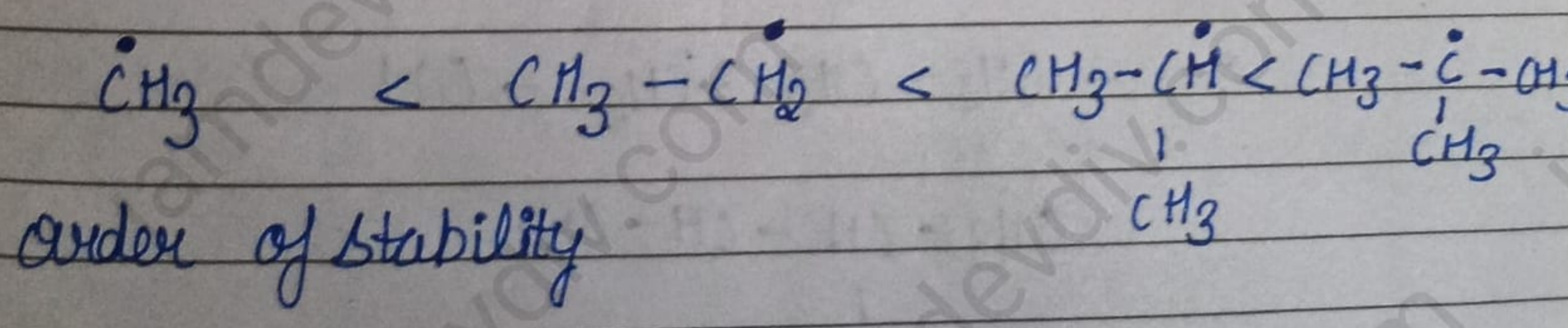
(i) ~~Most~~ More substituted Alkene is more stable.



(ii) σ (C-H), +ve charge. (Carbocation)



3. σ (C-H) and odd e- conjugation



★ 4. Isomerism:-

Different compounds with same molecular formula are called isomers and the existence of this phenomenon is isomerism.

Types of Isomerism

1. Structural

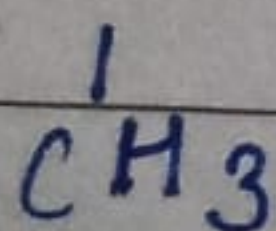
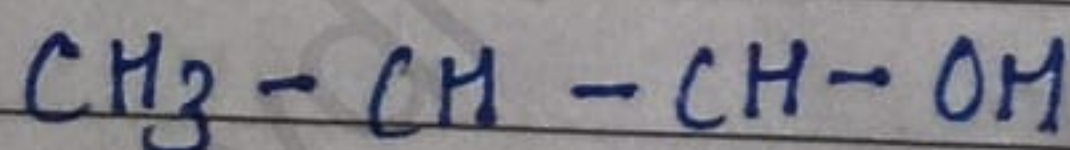
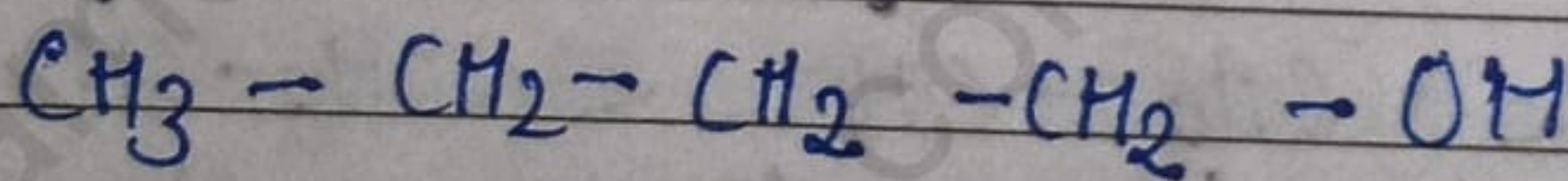
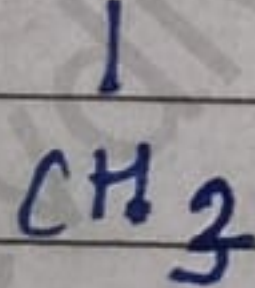
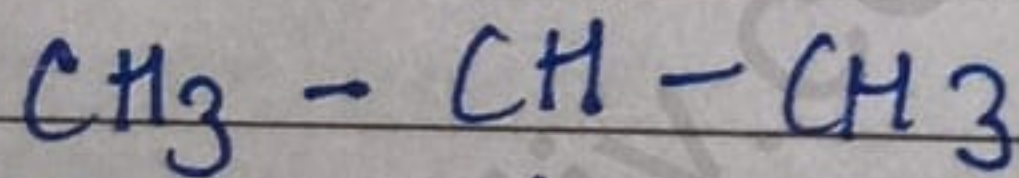
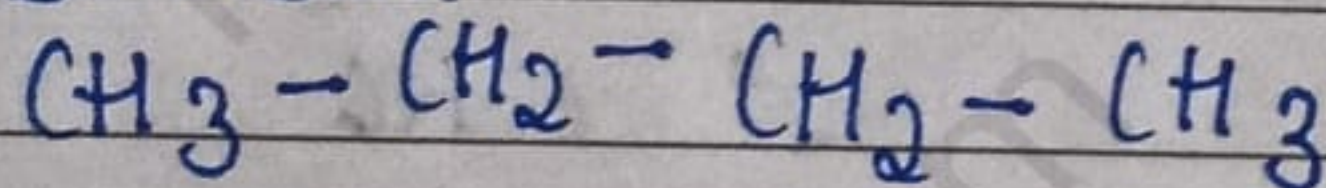
2. Stereoisomerism

- When atoms are connected molecules have different structure and same molecular formula are called structural isomerism. They can further be divided into following categories.

→ Chain Isomerism:-

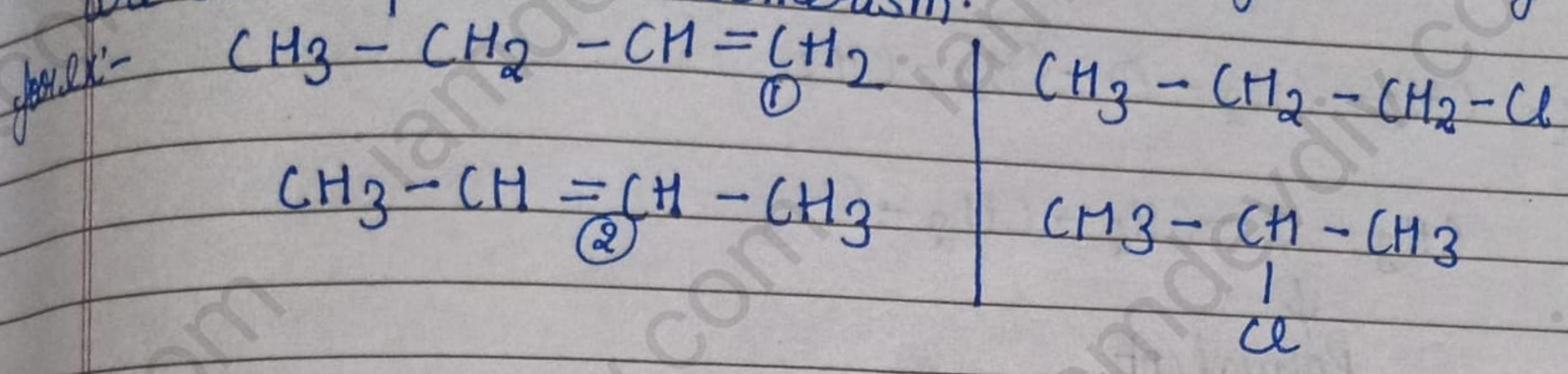
These have different arrangement of carbon atoms forming the base chain.

Ex:-



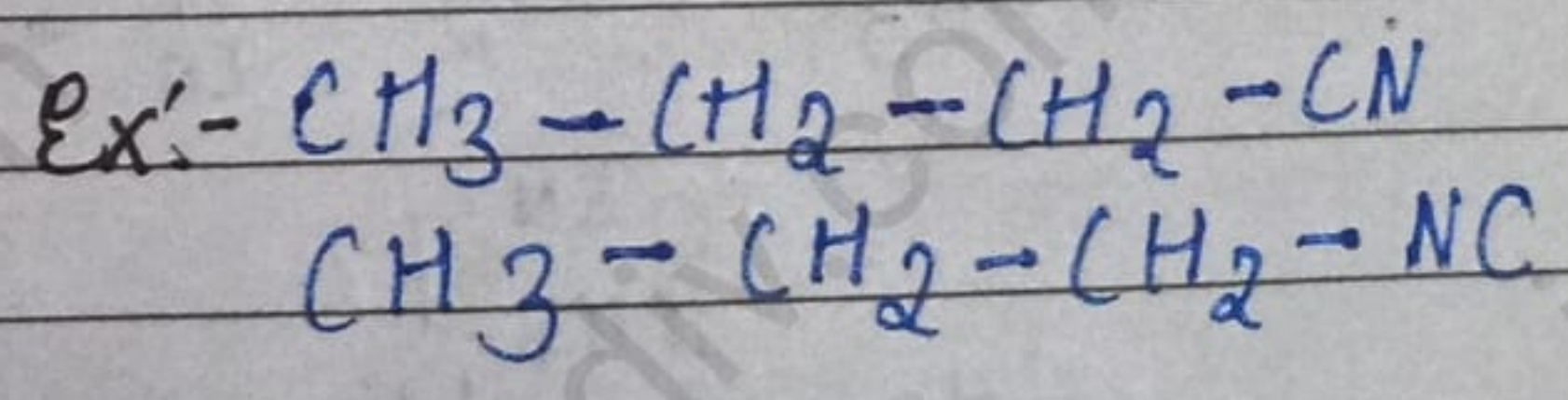
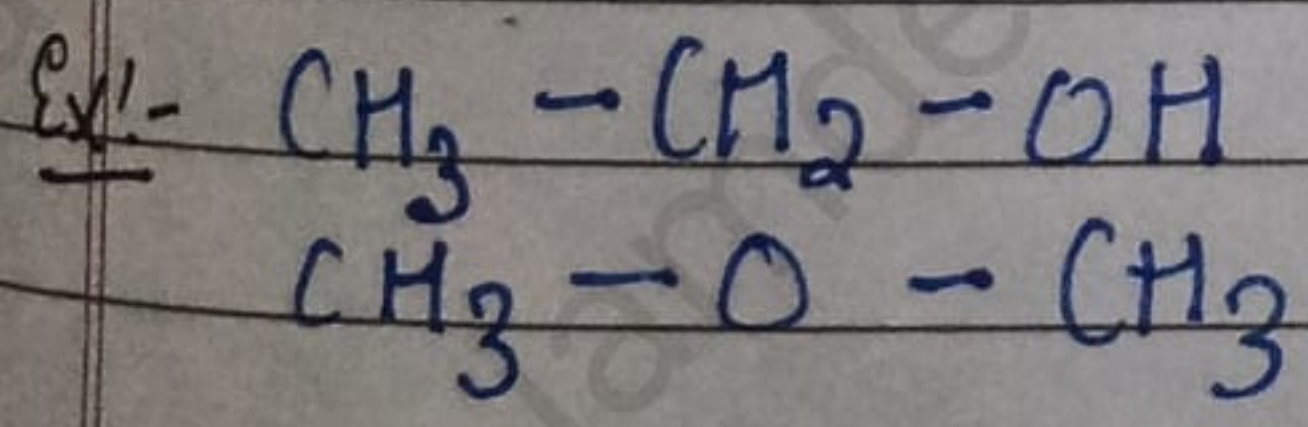
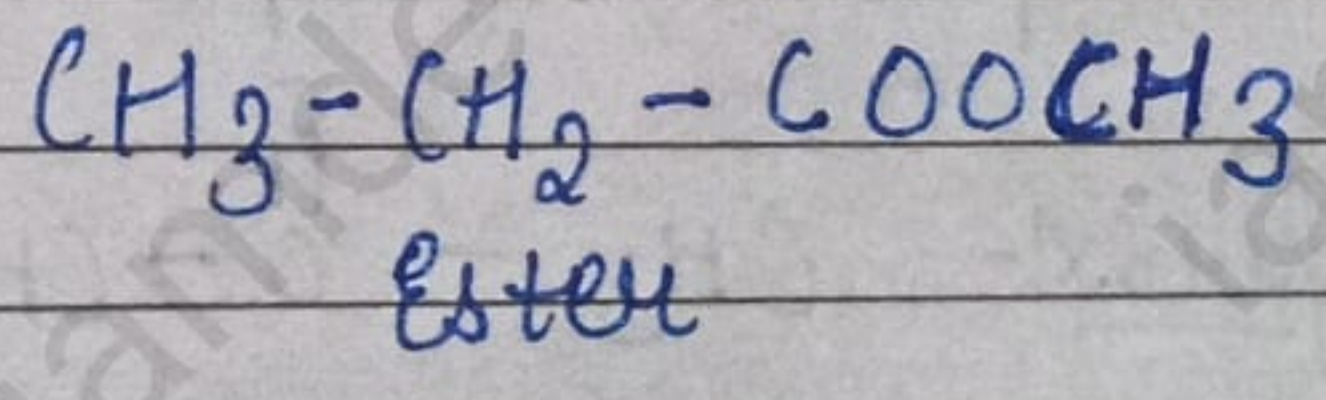
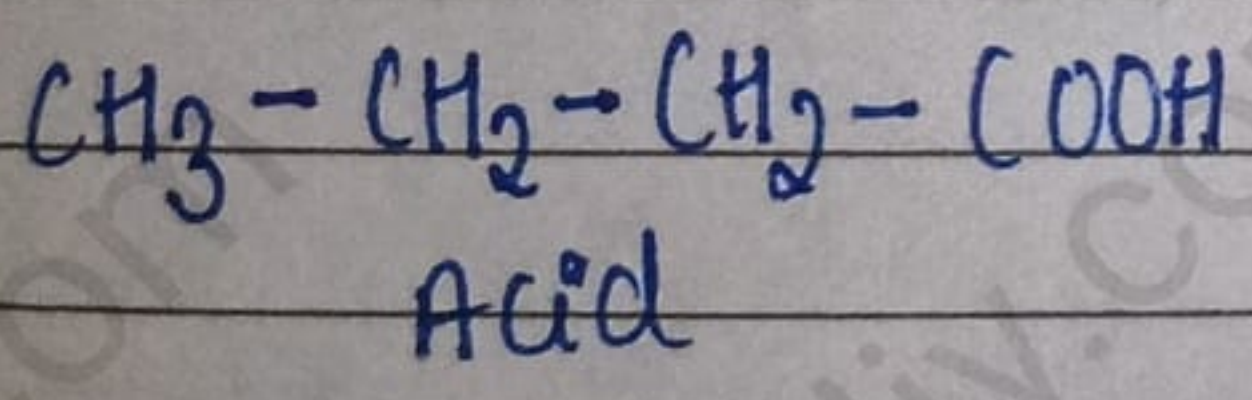
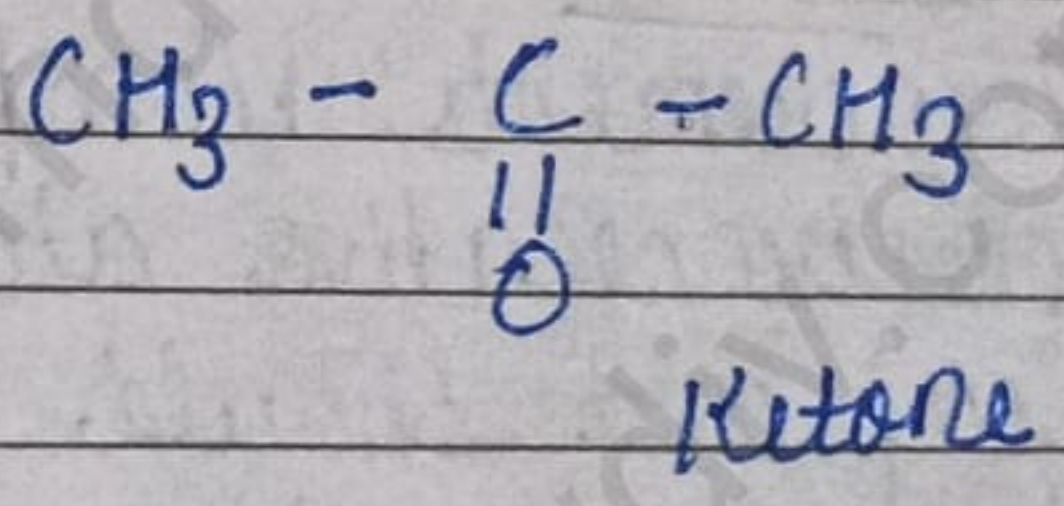
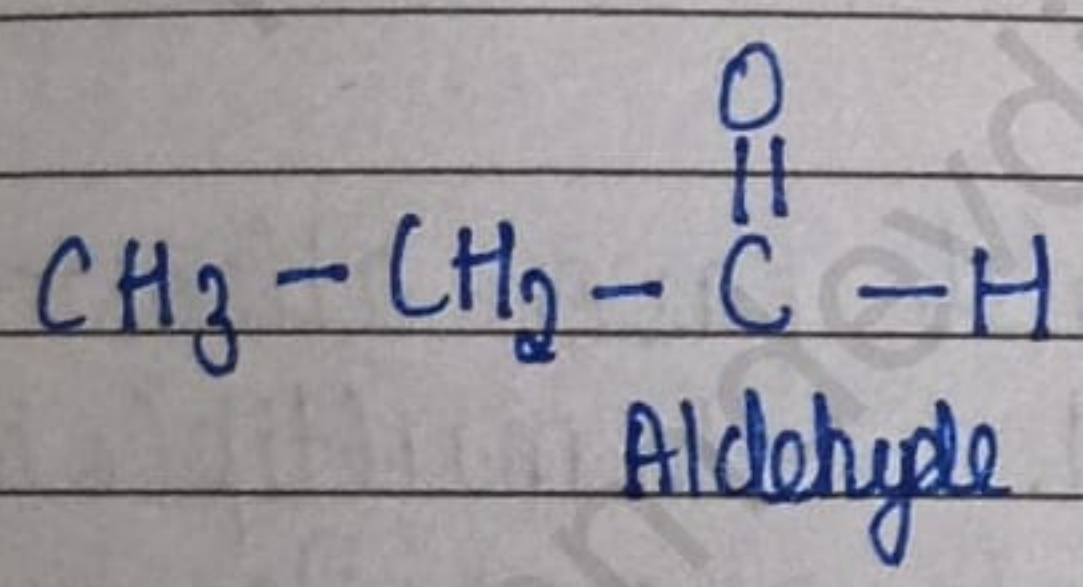
→ Positional Isomerism:-

They are different compounds having same molecular formula but differ in the position of same functional group are called positional isomerism.

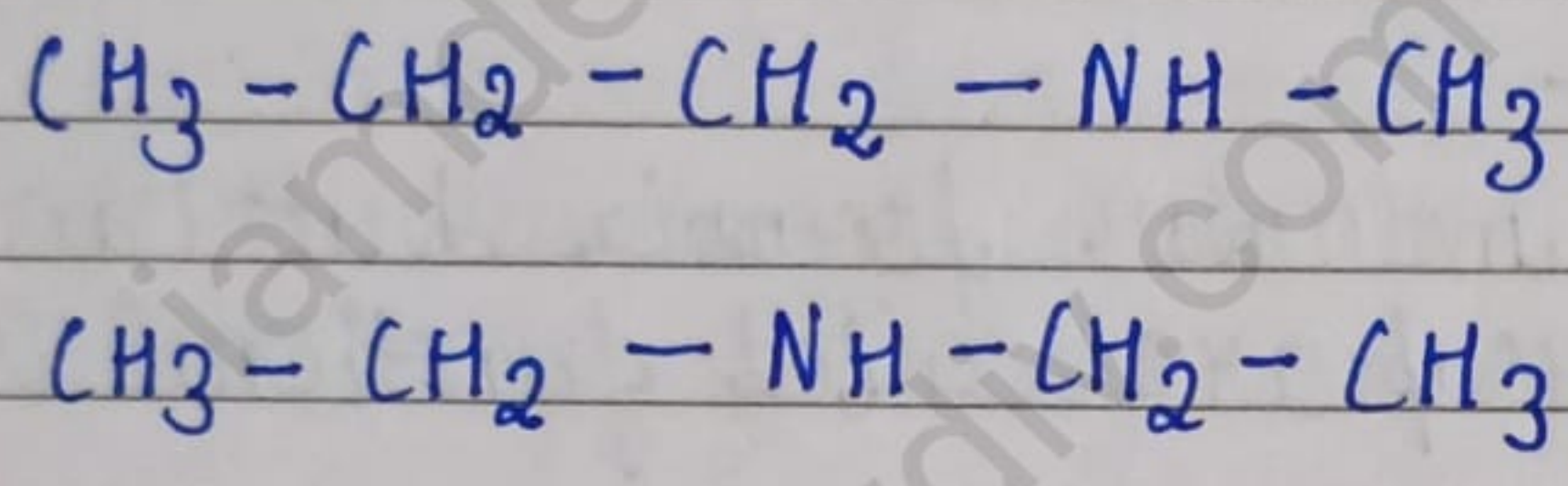
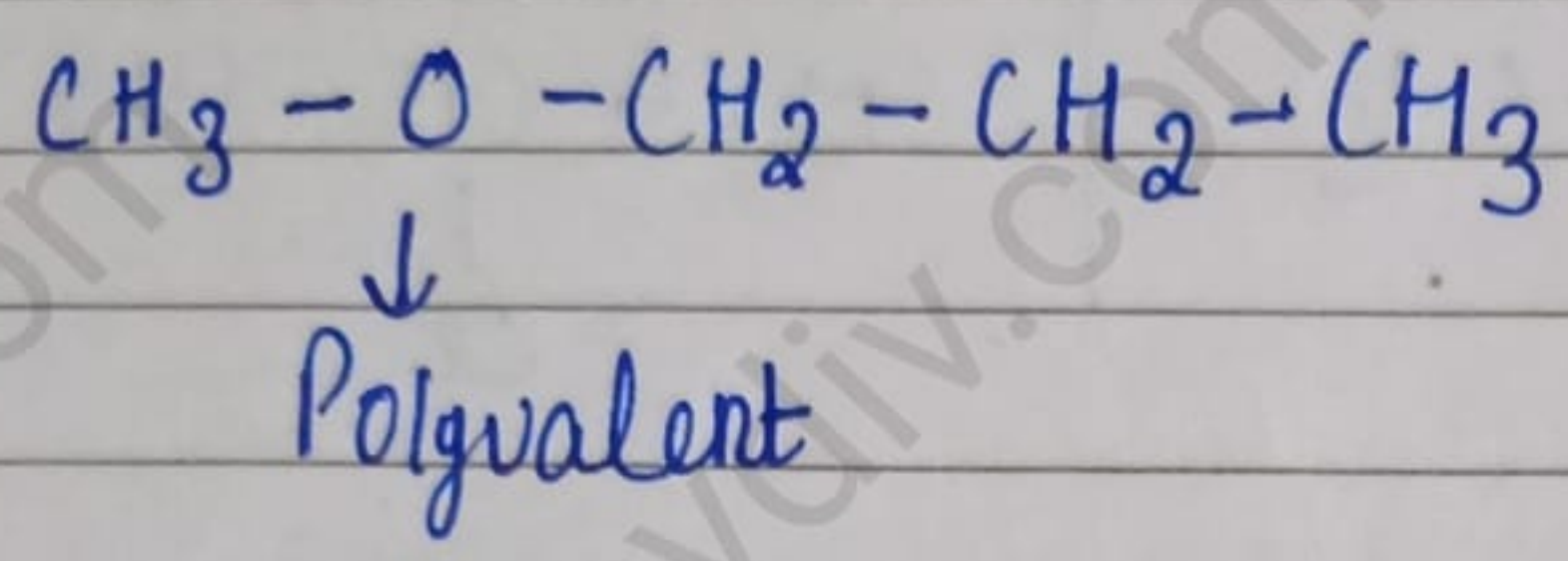
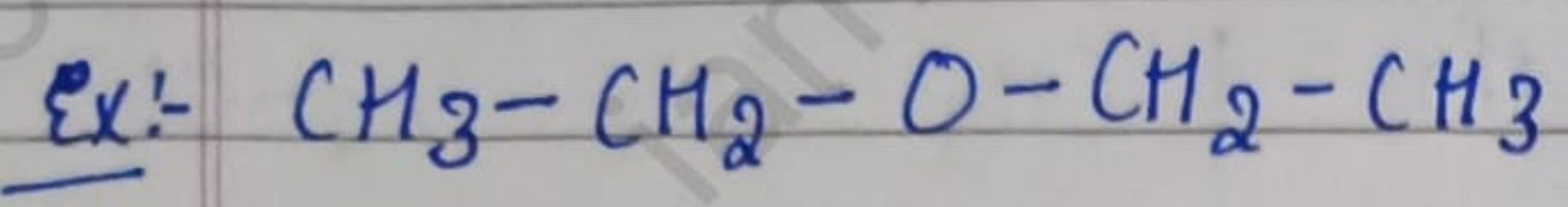


→ Functional Isomerism:-

Compounds with same molecular formula but having different functional group are called functional isomerism.



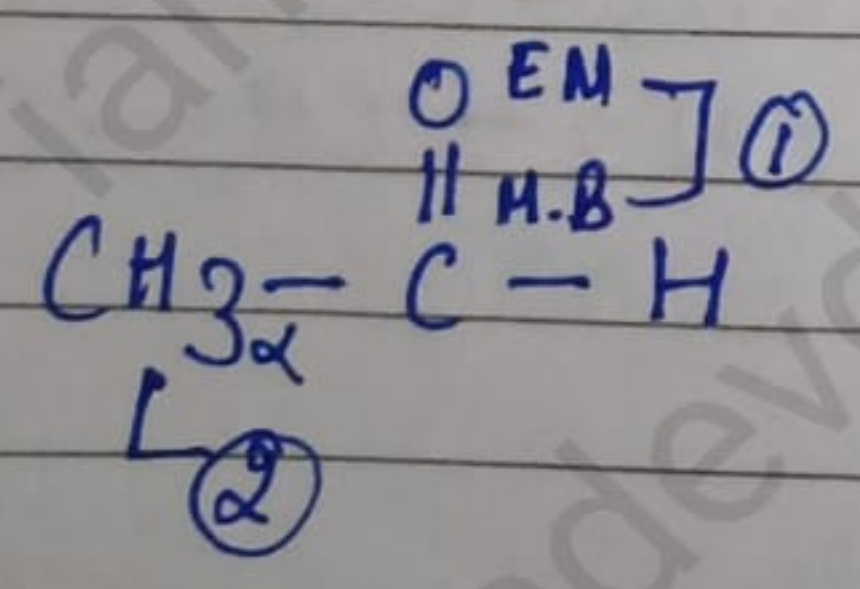
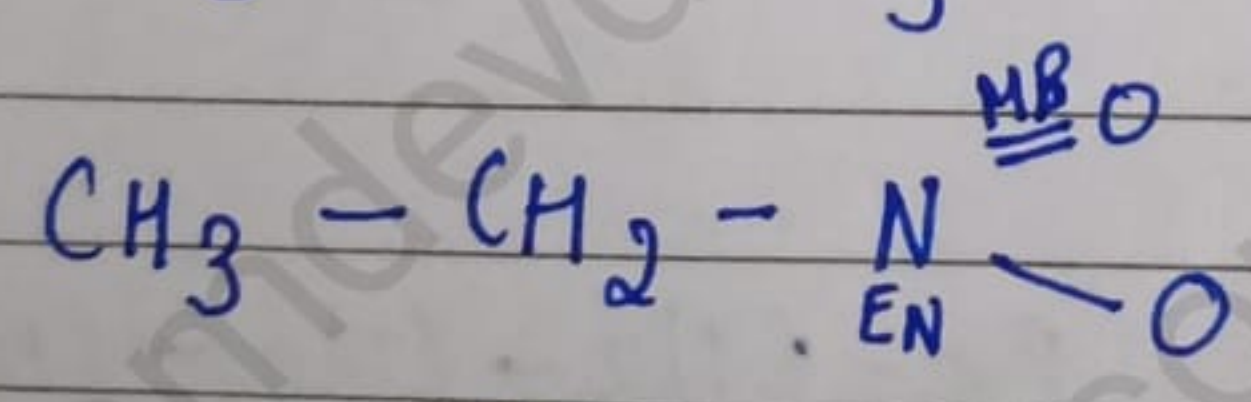
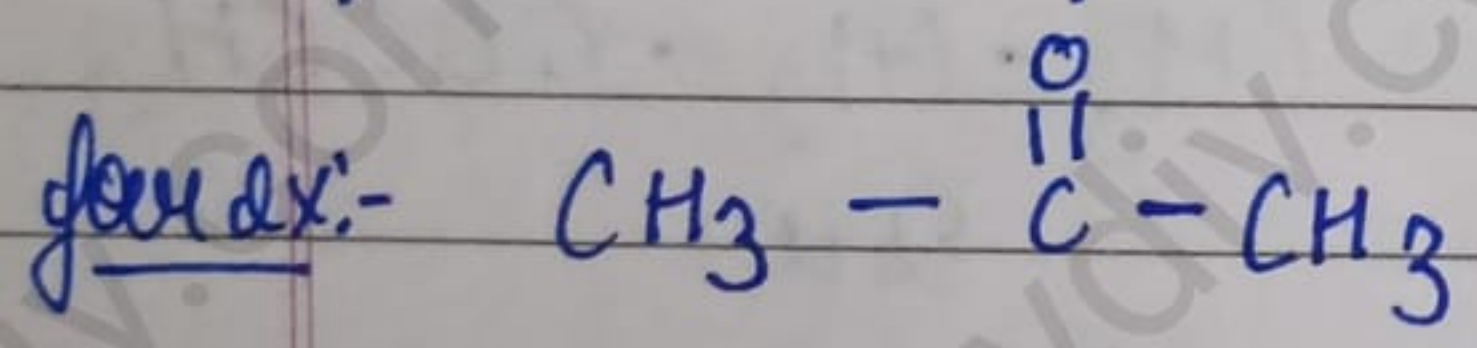
4. Metamerism :- This type Isomerism arises due to difference in the nature of Alkyne group attached to polyvalent atom or functional group



5. Tautomerism :-

Requirements :- 1. Compound should have at least one electronegative atom bonded with multiple bond

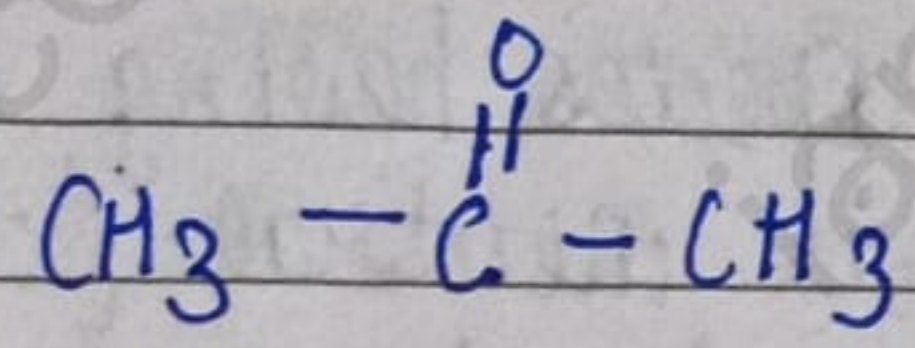
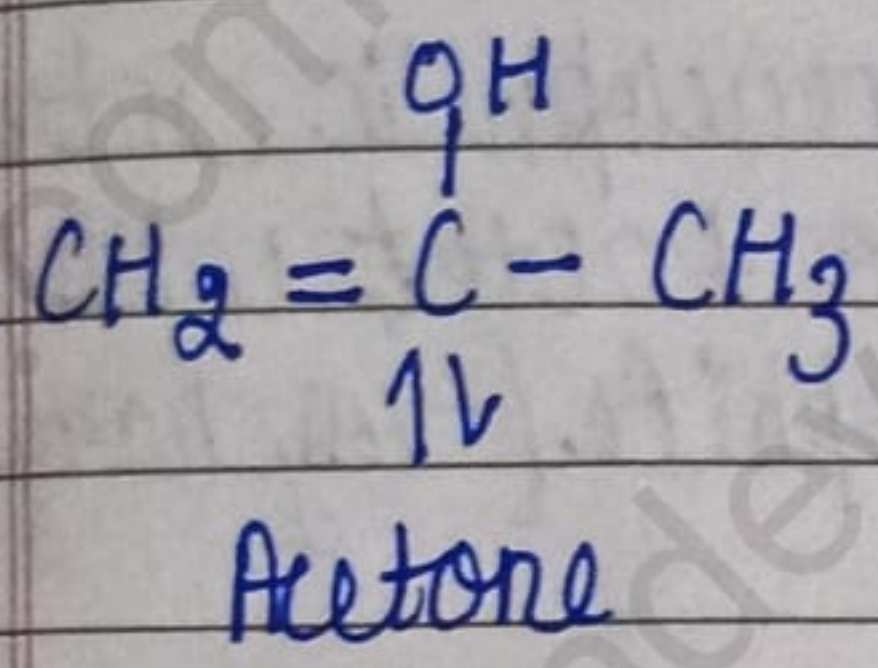
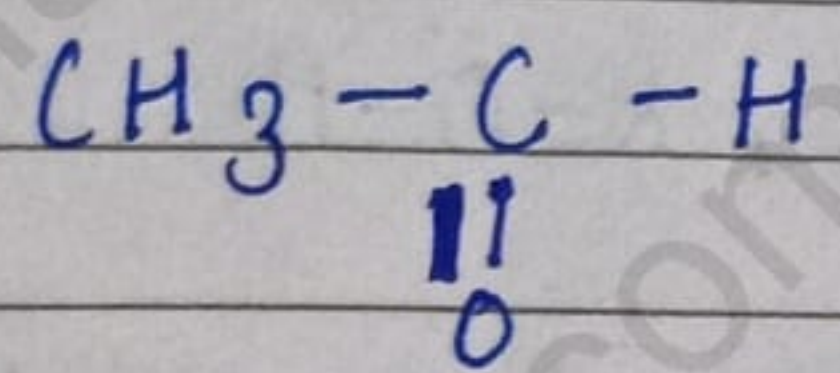
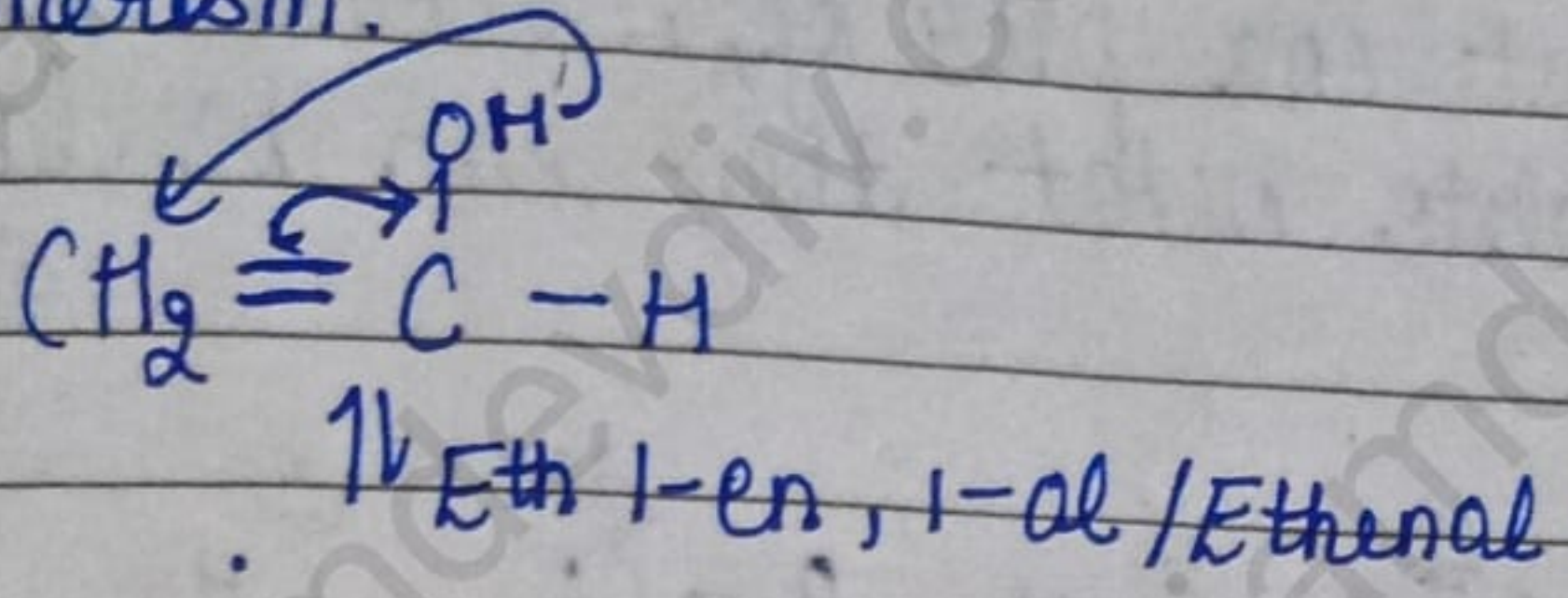
2. Compound should have at least one acidic hydrogen present on alpha carbon of molecule.



→ Cause of Tautomerism :-

Migration of hydrogen from alpha carbon to Electronegative metal which is bonded with multiple bond is the cause

of Tautomerism.



It shows Tautomerism

→ Electrophile and Nucleophile

• Electrophile:-

1. They have incomplete octet that is ~~is~~ they are electron deficient in nature. can be classified into two categories

• Charged electrophile:-

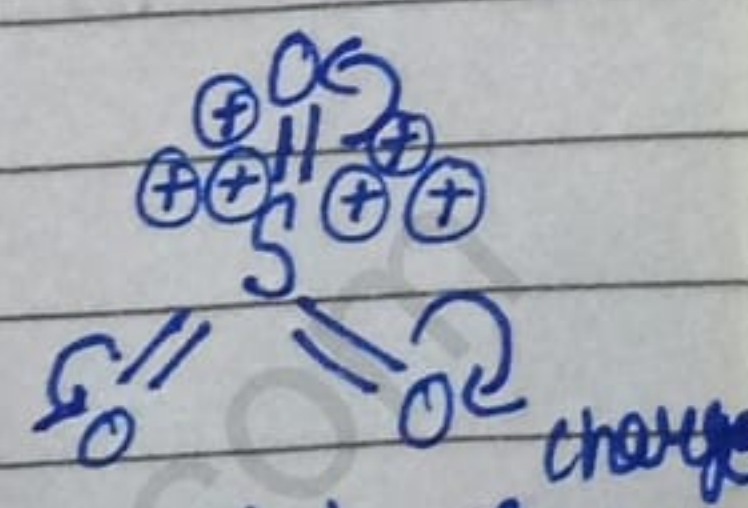
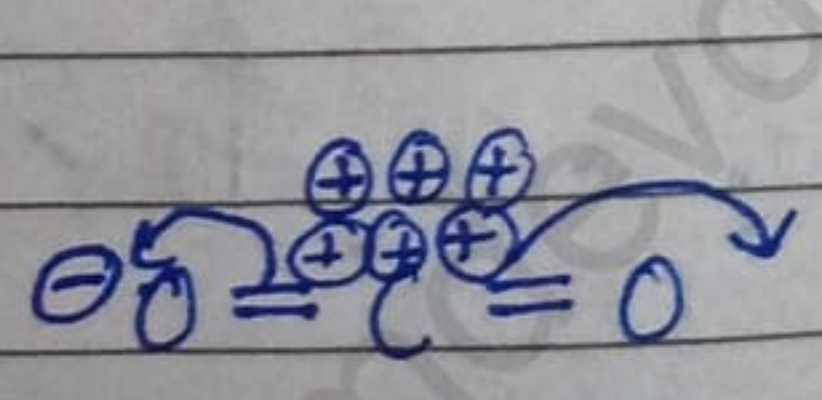
2. positively charged species in which central atom has incomplete octet are called charged electrophile.

ex:- H^+ / Ca^+ , Br^+ / CH_3^+

NH_4^+ → Not an electrophile

• Neutral Electrophile:-

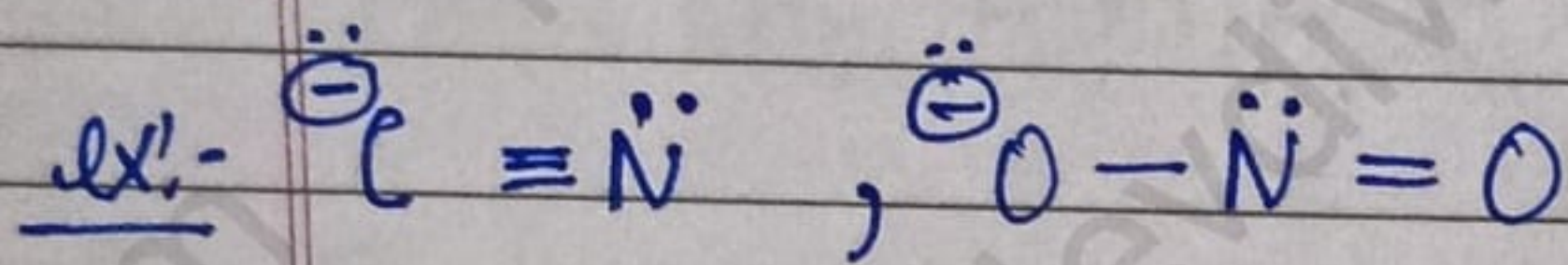
Ex:- AlCl_3 BF_3
 octet incom. Incomplete



Nucleophile Radicals are also electrophile because they don't have any

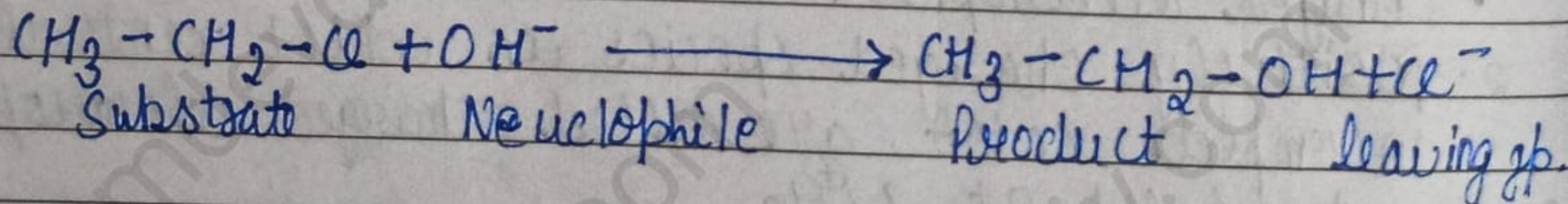
Nucleophile: They have at least one pair of ^{extra} electron. They have complete octet they can be classified into 3 types:-

1. Charged Nu[⊖] → Cl[⊖], :O[⊖]-H, R-O[⊖], CH₃[⊖]
2. Neutral Nu^(dp) → H₂O, NH₃, R-O-H
3. Ambident Nu[⊖] → Species having two nucleophilic centres in which one is neutral (complete octet with 1dp atleast) and other is charged nucleophile (-ve charge) behaves as Ambident Nucleophile.

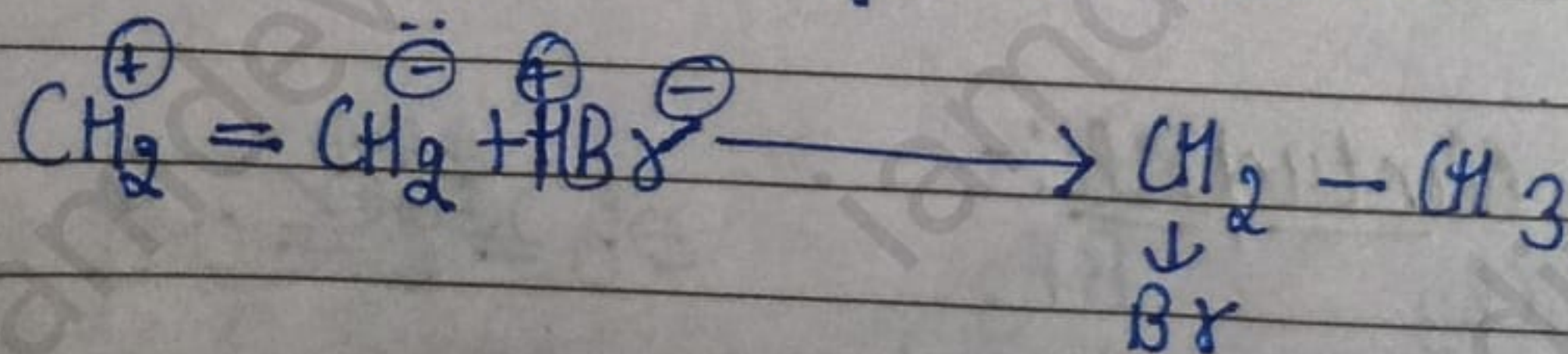


Types of Organic Reaction

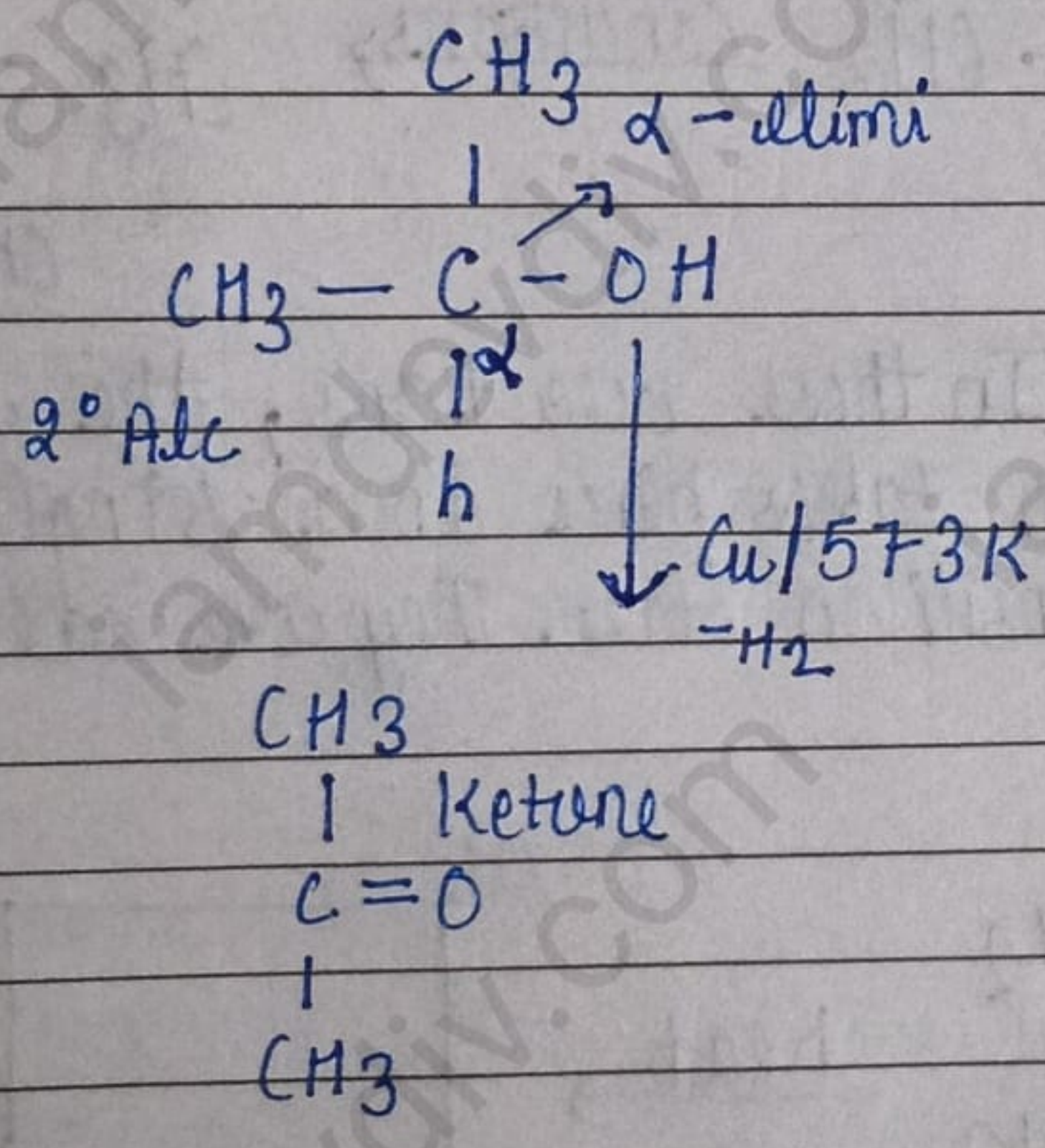
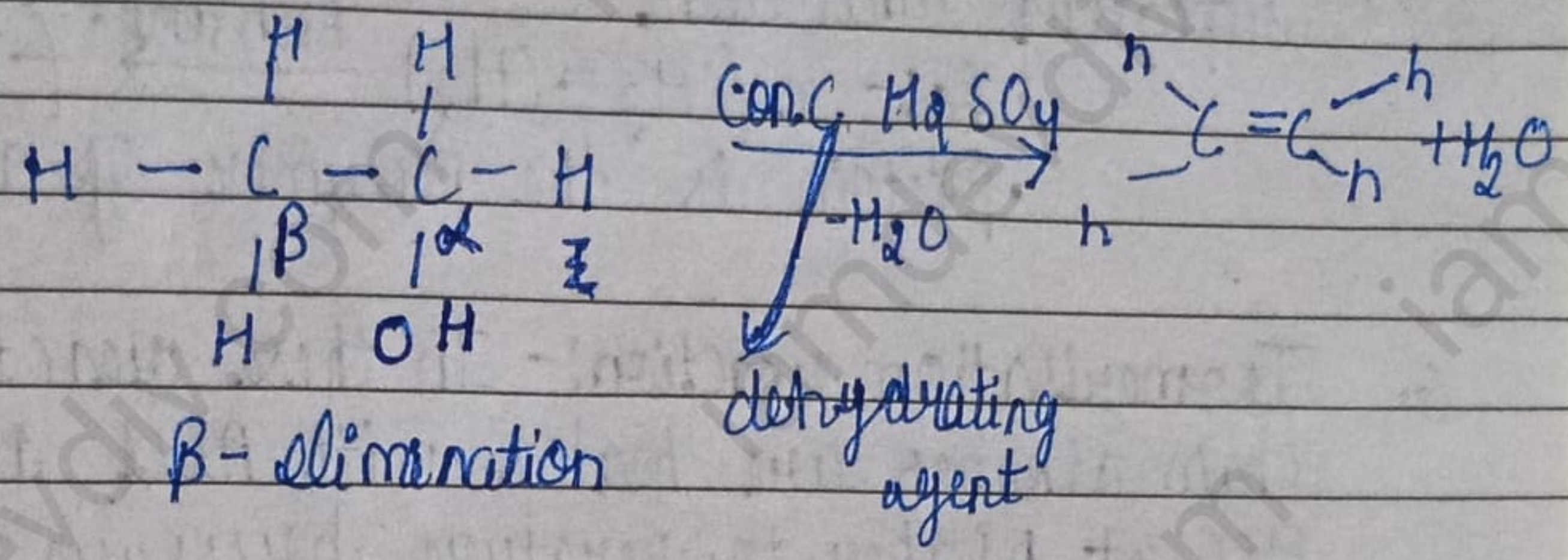
1. Substitution Reaction:- In these reactions one or more atoms or group is substituted by another atom or group.



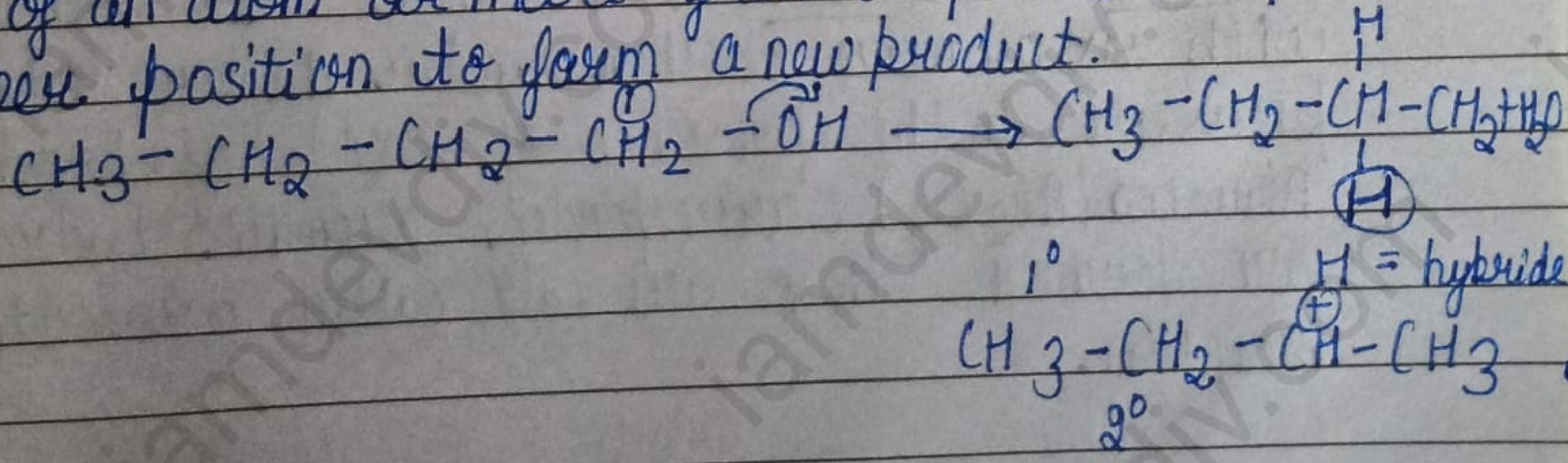
2. Addition Reaction:- In these reactions attacking molecules adds and the multiple bond gets converted into single bond.



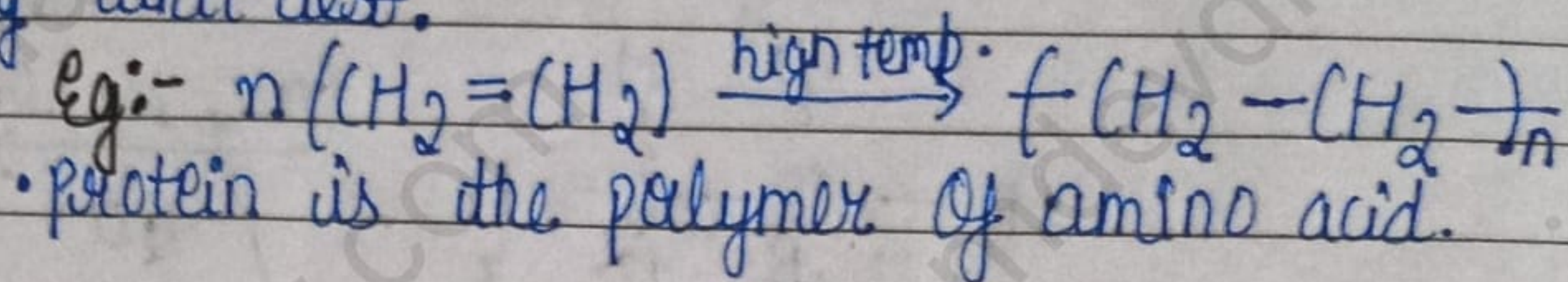
Elimination Reaction:- In these reactions two atoms or group either from adjacent position or same position gets eliminated ~~to~~ leading to the formation of multiple bonds.



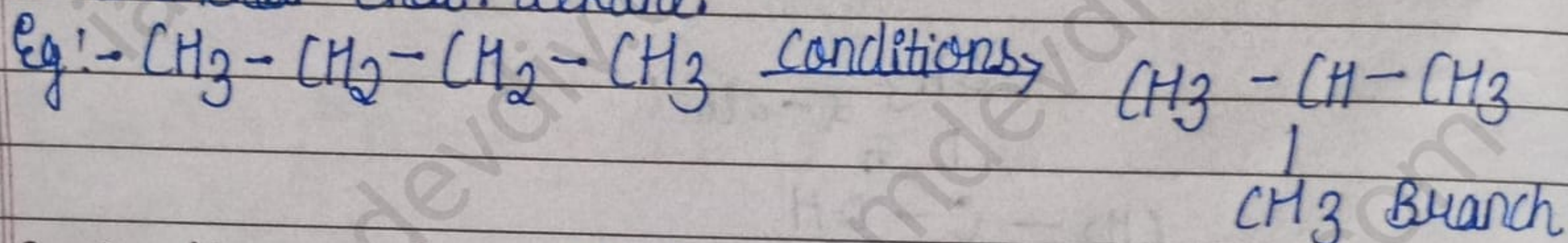
Rearrangement Reaction:- In these reactions there is a shift of an atom or more from a particular position to other position to form a new product.



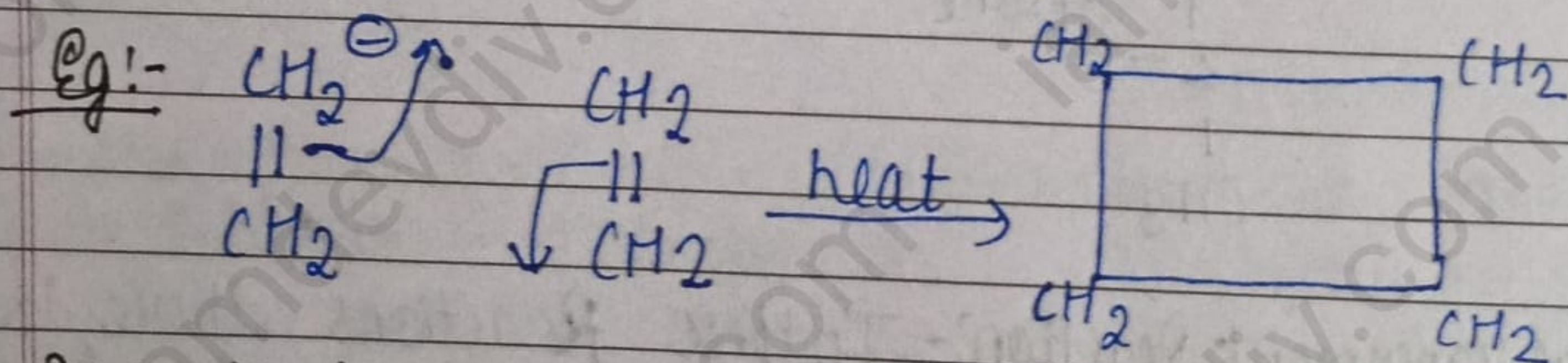
5. polymerisation: - In these type of reaction, small molecules of same or different compounds combine to form bigger molecule of higher molecular mass. The small molecule is called monomer which is repeating unit also.



6. Isomerisation reaction: - In these reaction when straight chain alkanes are heated with AlCl_3 in the presence of HCl at higher temperature pressure. These are converted to branched chain alkane.



7. Pericyclic reaction: - In these reactions, the bond breaking and bond formation takes place in a single step through cyclic transition state. They are called pericyclic reaction.



8. Aromatisation reaction: - In these reaction, alkanes with six or more carbon under higher temperature pressure in the presence of oxide of chromium or Alumina (Al_2O_3) corresponding aromatic hydrocarbon are formed these are called aromatisation reaction.

Eg:-

