REACTION & MECHANISM
(Lecture-5)

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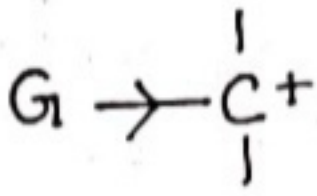
Degree-II (SUB.)
Chapter-'5'
Group-'C'

Stability of Carbocation

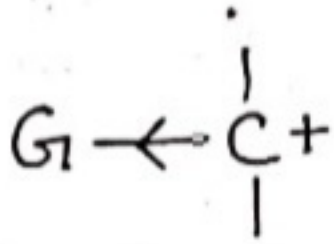
According to laws of Physics, the stability of a charged system is increased by dispersal of the charge.

Therefore, any factor that tends to spread out the +ve charge of the electron-deficient carbon and distribute it over the rest of the ion must stabilize a carbocation.

eg.



Where G = electron releasing, it disperses charge & hence stabilises cation.



Where G = electron withdrawing it intensifies charge & destabilises cation.

* An electron-releasing substituent tend to reduce the +ve ⊖ charge at the electron deficient carbon. Thus stabilizes the carbocation.

Conversely, an electron - withdrawing group tends to intensify the +ve charge on the electron - deficient carbon, and hence makes the carbocation less stable

Further, more the possibility for the dispersal Of the charge, more will be the stability Of the carbonium ion.

On the basis of the relative stabilises, carbocation may be classified into two classes,

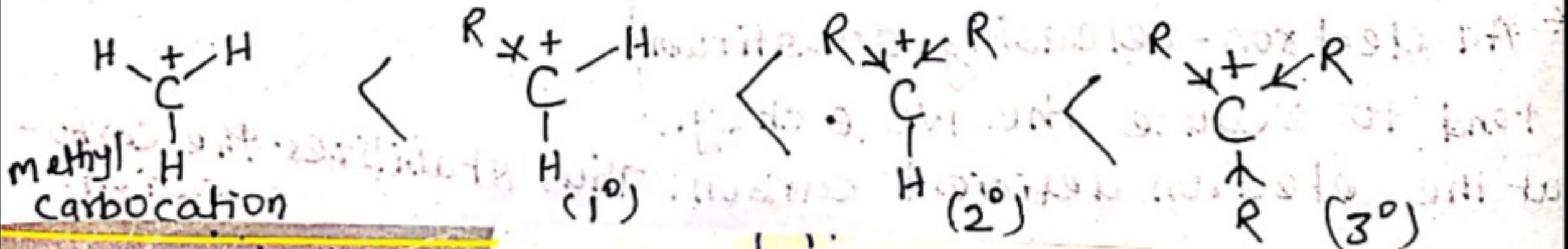
1. Transient (short lived) carbocation
2. Stable carbonium ions.

1. Transient carbonium ions

These carbonium ions, lacks extensive resonance stabilisation.

These are very reactive and combine readily with any molecule that can give a pair Of electrons.

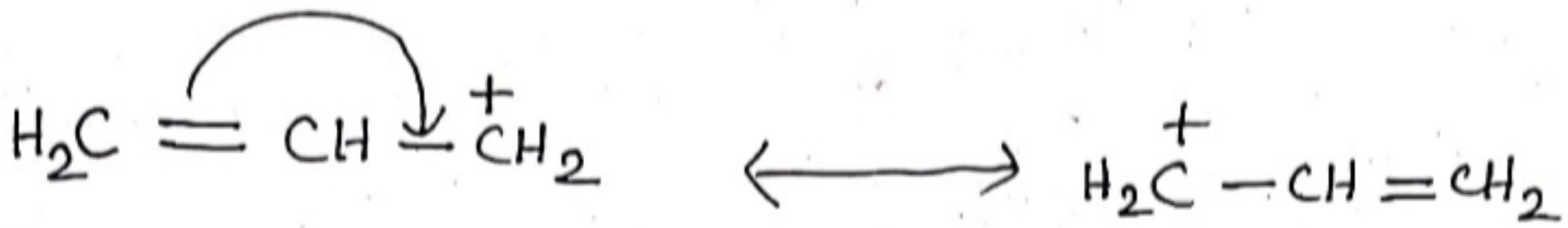
Relative stability



Base of Stability

Inductive effect of alkyl group.

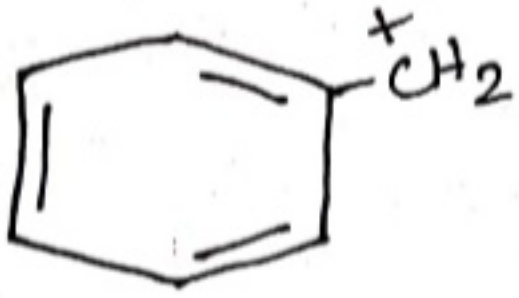
2. Stable carbocation :-



Allyl carbocation

* 2 Resonating structure.

* As no. of Resonating structure increases, stability increases.



5 - Resonating structure

Benzyl carbocation

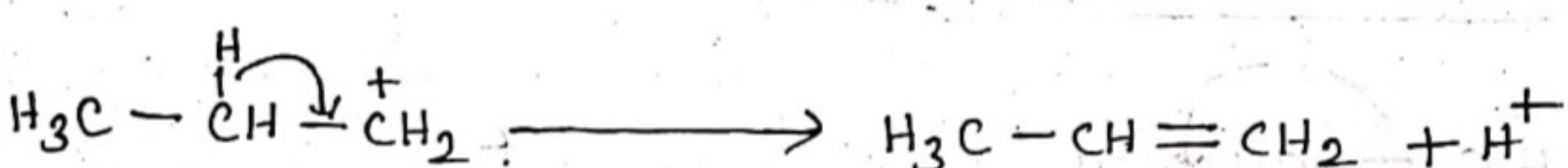
As no. of benzene ring increases stability of carbocation increases.

Some of the carbocation in their order of stability are given below :- - -

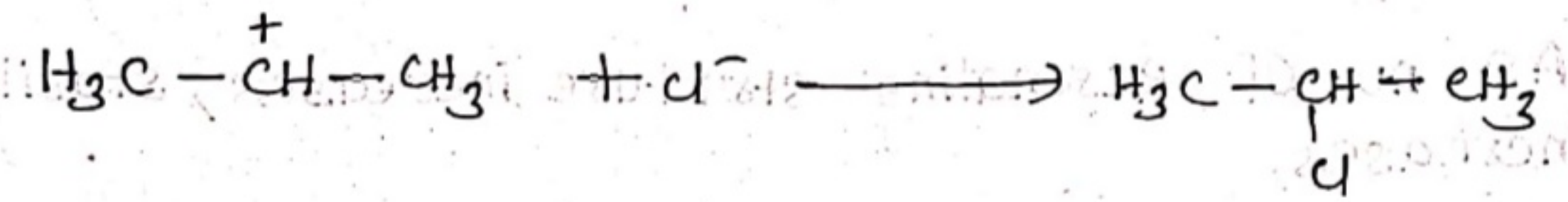
Tropylium cation > $(C_6H_5)_3C^+$ > $(C_6H_5)_2CH^+$ > $C_6H_5CH_2^+$ > $(CH_3)_3C^+$ > $(CH_3)_2CH^+$ > $CH_3CH_2^+$ > CH_3^+.

Reaction Of carbocation

1. The carbocation may be eliminate a hydrogen ion to form an alkene.



2. The carbocation may combine with a negative ion or other basic molecule.



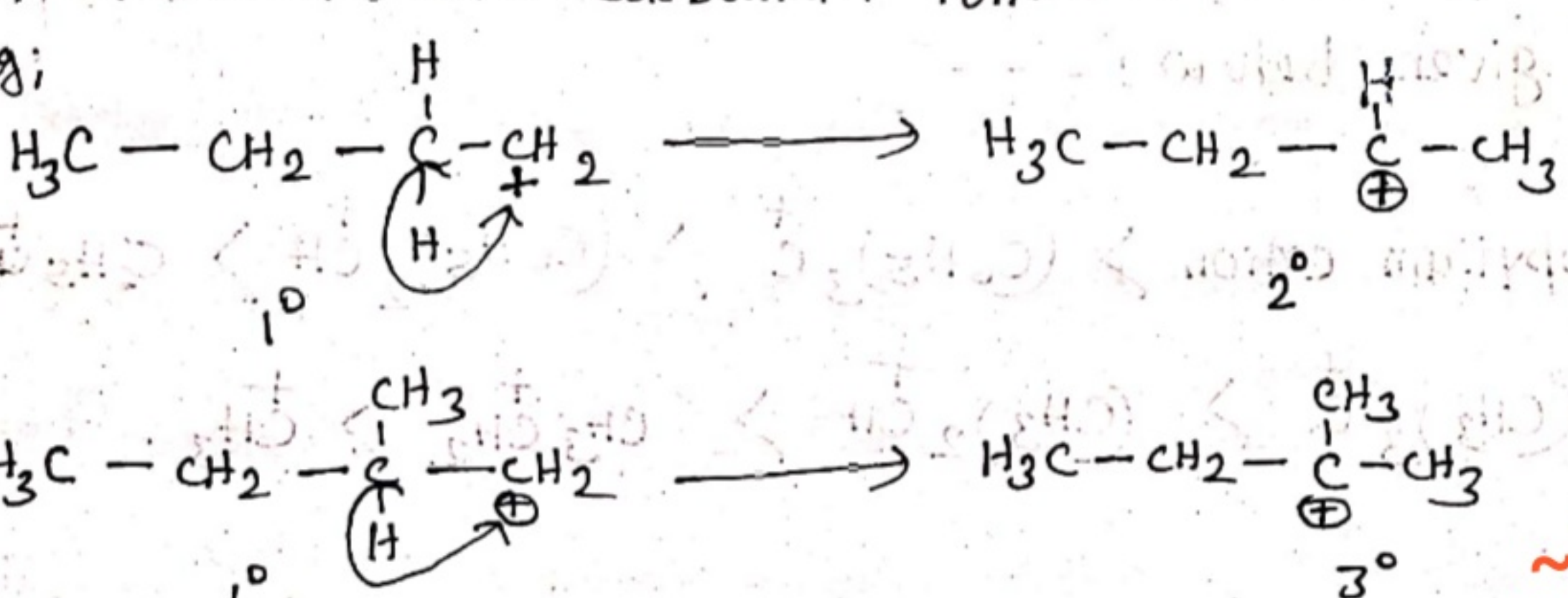
3. The carbonium ion may rearrange to a more stable carbonium ion.

∵ Stability of carbonium ion is in the order:-

$$3^\circ > 2^\circ > 1^\circ$$

where-ever a rearrangement of 1° to $2^\circ/3^\circ$ or 2° to 3° is possible it takes place easily leading to the formation of a more stable carbonium ion.

eg;



etc.

~End~