

Alkenes

MOP :-

1) from alkynes

a) Hydrogenation (Partial reduction) $H_2/Pd-C/Pd-BaSO_4/Lindlar's\ cat \longrightarrow 4$

b) Birch's reduction $Na/Li\ liq\ NH_3 \longrightarrow 5$

2) from alcohols

* dehydration

$Conc\ H_2SO_4\ (or)\ Conc\ H_3PO_4/\Delta \longrightarrow 6$
(or) H^+/Δ

3) from alkyl halides

* dehydrohalogenation

$Alc\ KOH/\Delta\ (or) \longrightarrow 9$

$\xrightarrow[\Delta]{NaOEt}$

4) from vicinal dihalides

* dehalogenation

$NaI/acetone\ (or)\ Zn \longrightarrow 16$

Properties:

① Addition of Hydrogen - $(H_2/Pd \text{ (or) } Ni \text{ (or) } Pt)$ > 17

② Addition of Halogen - $\left(\frac{X_2}{CCl_4}, \frac{X_2}{H_2O} \dots\right)$ > 17

③ Addition of HX - (HX) > 21

* Kharasch effect - $(HBr + Peroxide)$ > 25

④ Addition of Water - $(dil\ H_2SO_4 \text{ (or) } H^+/H_2O \text{ (or) } H_3O^+)$ > 27

⑤ Addition of Sulphuric acid - $(Cold\ Conc\ H_2SO_4)$ > 28

⑥ Hydroxylation

* Bayer's reagent - $(Cold\ alk.\ KMnO_4)$ > 29

⑦ Ozonolysis

reductive — $O_3 + CCl_4 / Zn$ (or) $Zn + H_2O$ > 30

oxidative — $O_3 + CCl_4 / H_2O$ (or) Hot $KMnO_4$ > 30

* Tests for unsaturation (Br_2 , Cold alk MnO_4)> 33

⑧ Polymerisation

.....> 33

⑨ Hydration of alkenes

a) Oxymercuration - demercuration
(OMDM) $\frac{1) Hg(OAc)_2}{2) NaBH_4 / OH^-}$ > 34

b) Hydroboration - oxidation
(HBO) $\frac{B_2H_6 / THF}{H_2O_2 / OH^-}$ > 35

MOP

1) from alkynes :-

A) Hydrogenation :- (Partial reduction)

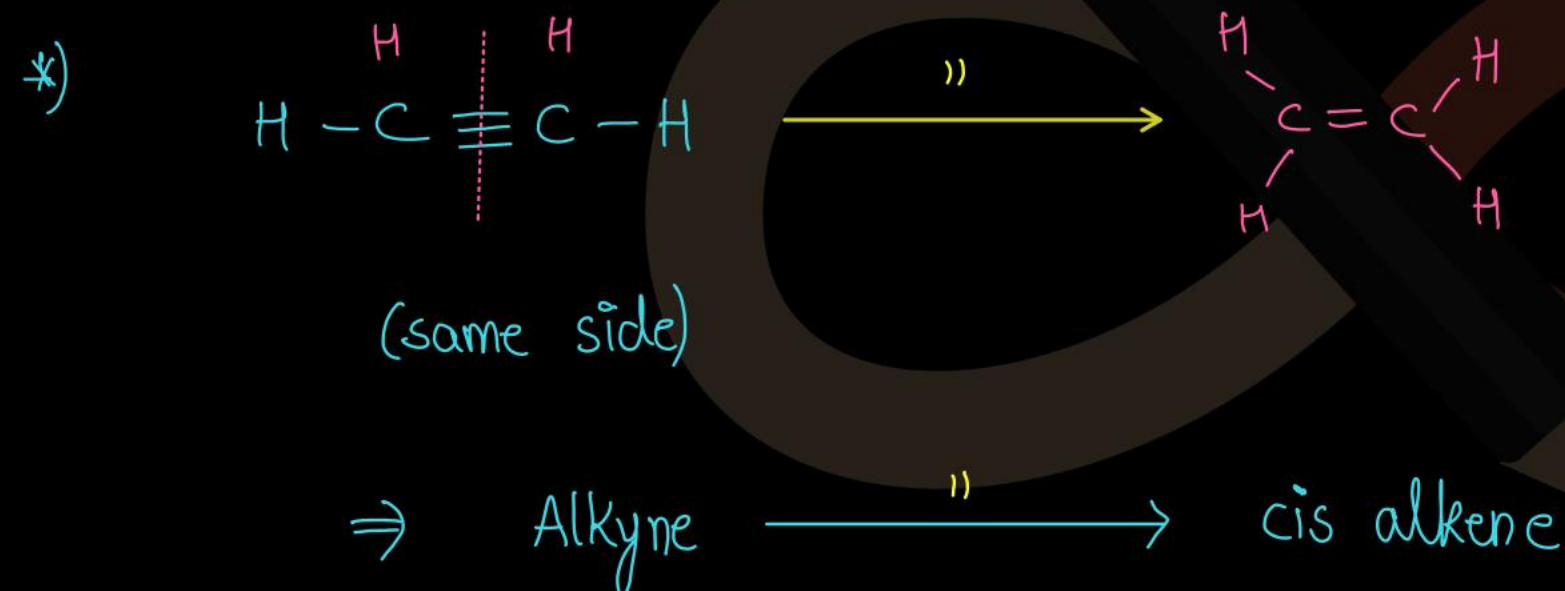
Reagent :- 1) $H_2 + Pd/BaSO_4$ $\xrightarrow{\text{poison}}$

2) $H_2 + Pd/C$ $\xrightarrow{\text{poison}}$

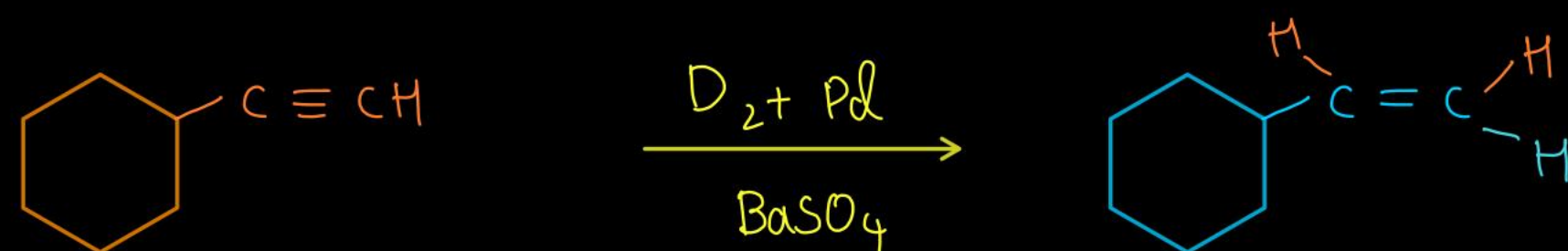
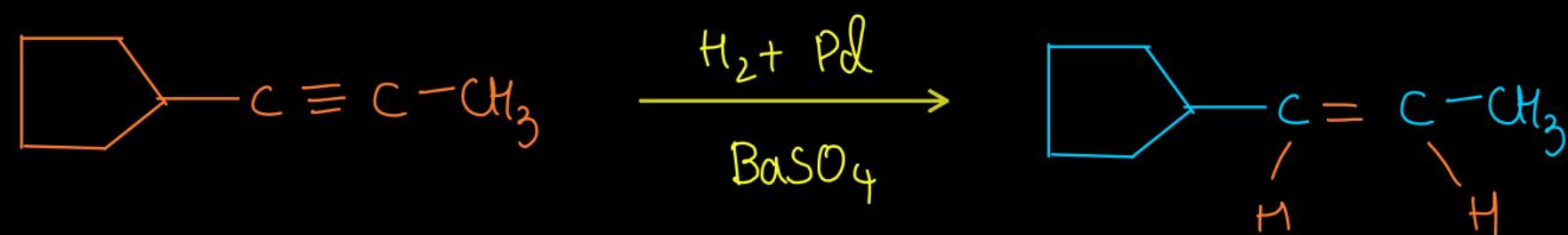
3) $CaCO_3$ / quinoline

4) $H_2 + \text{lindlar's catalyst}$

Partially deactivated palladised charcoal.



Ex:-

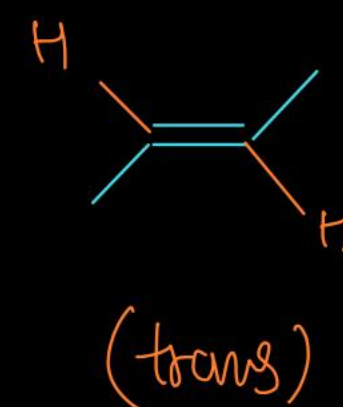
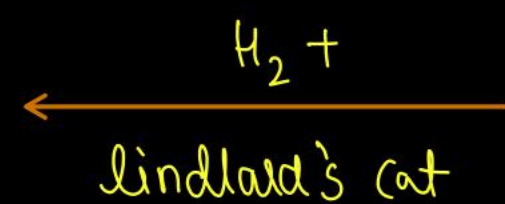
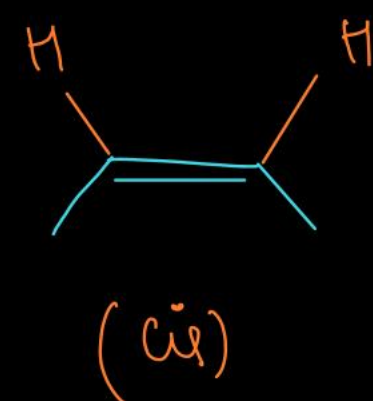
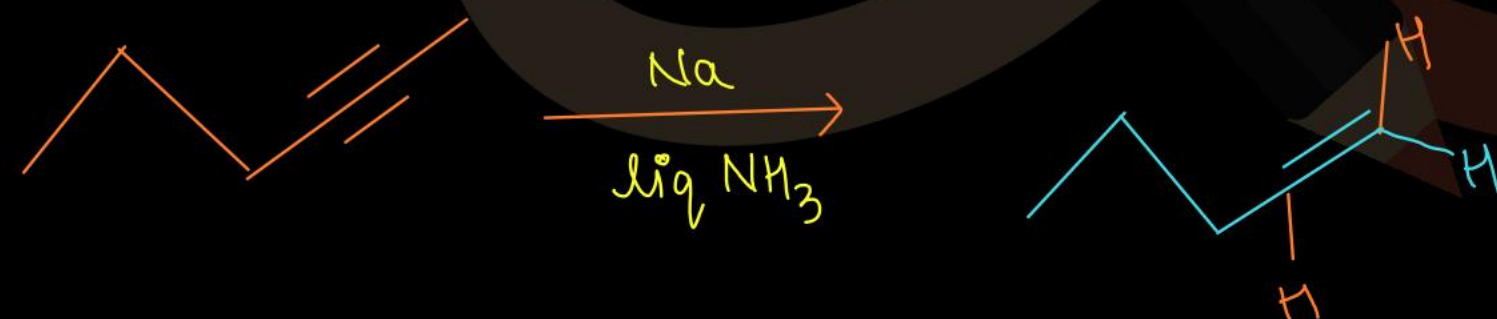
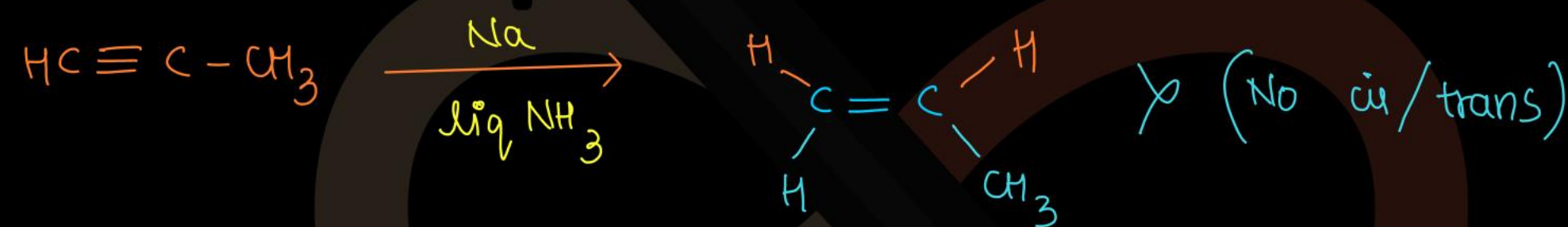
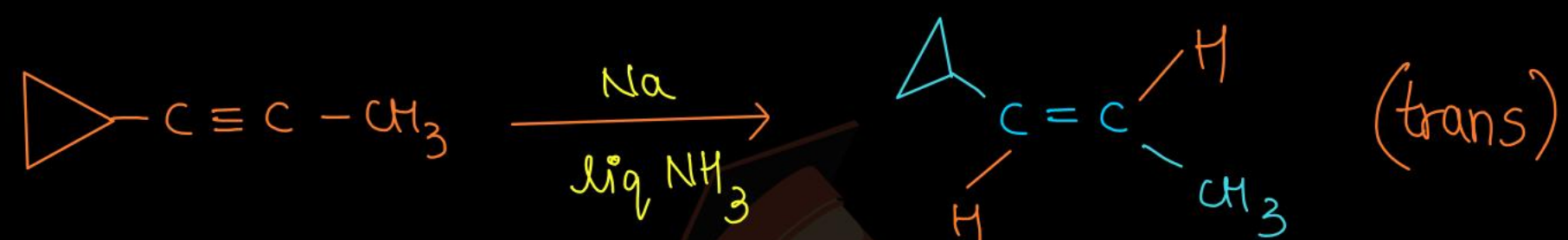


B) Birch's Reduction

Reagent :- $\text{Na/Li} + \text{liq. NH}_3$

Alkyne $\xrightarrow{\quad}$ trans alkene

Ex:-

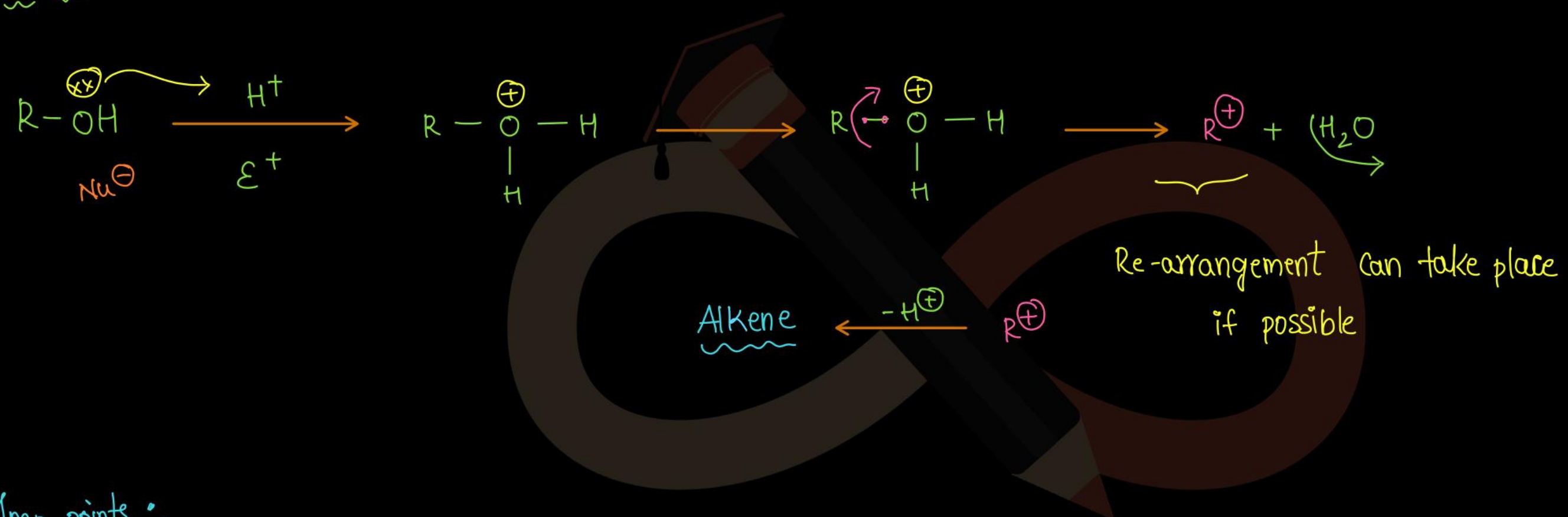


② from dehydration of Alcohols

Reagent :- 1) Conc $\text{H}_2\text{SO}_4/\Delta$, Conc $\text{H}_3\text{PO}_4/\Delta$

2) H^+/Δ

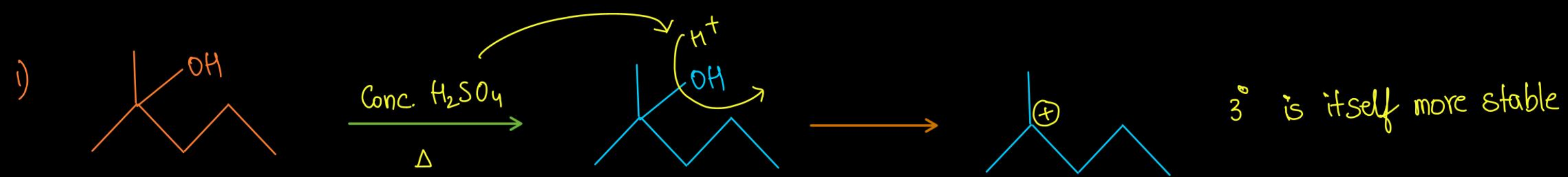
Mechanism



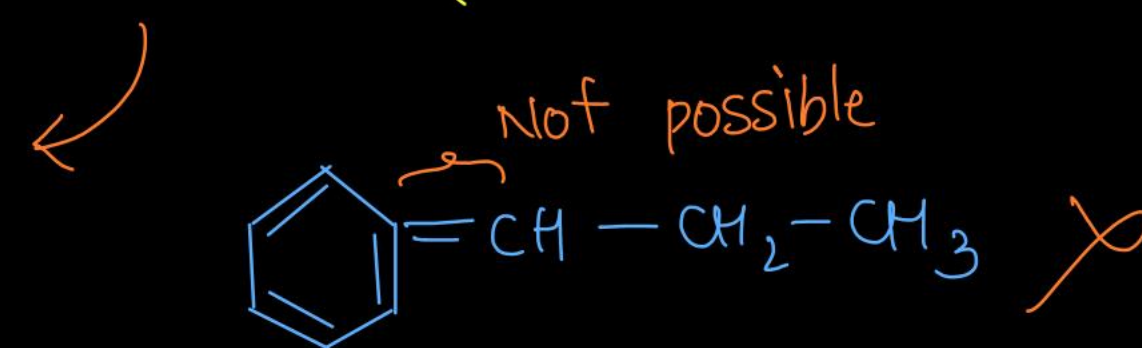
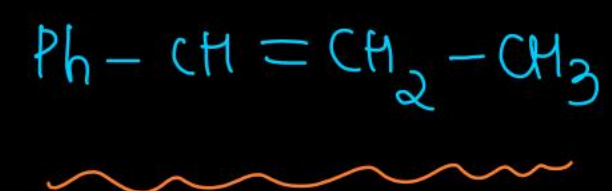
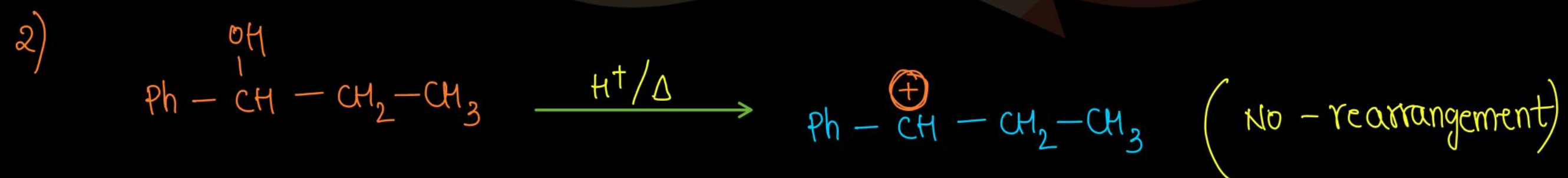
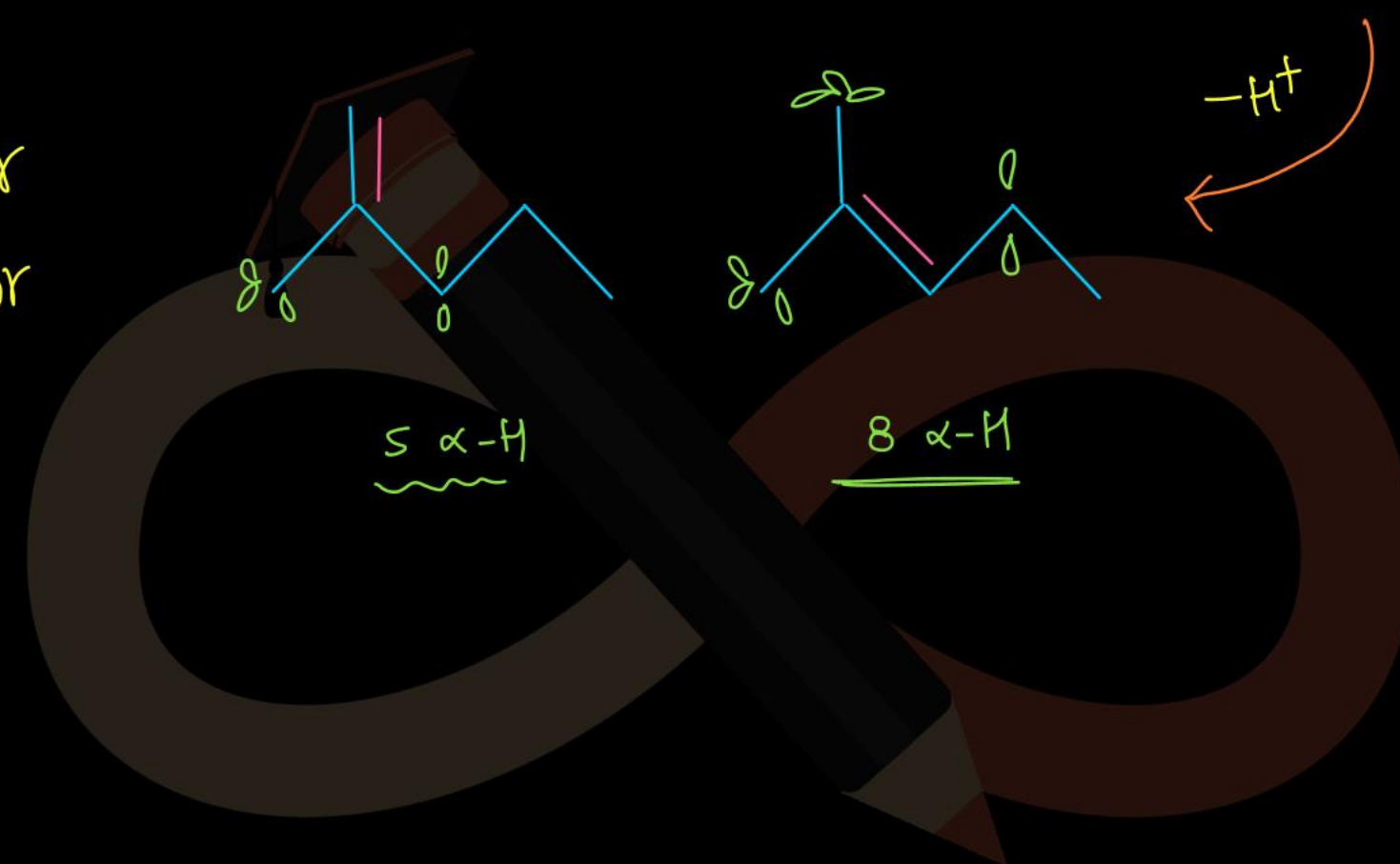
Imp points :-

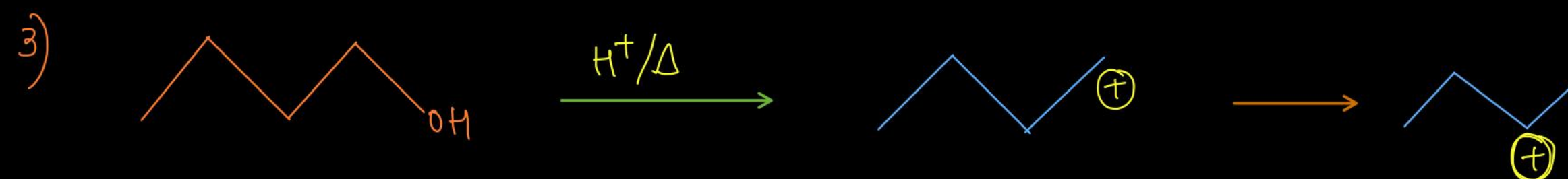
- 1) C^+ is formed
- 2) formation of C^+ is RDS
- 3) $\text{r.o.r} \propto$ stability of C^+
- 4) more stable alkene is major product

Practice :-

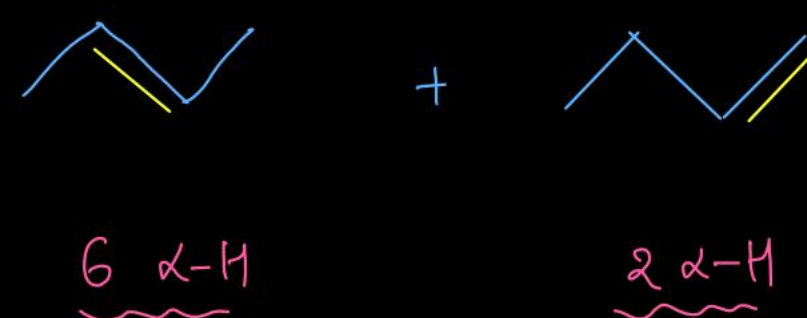


II $\rightarrow$ major
I $\rightarrow$ minor

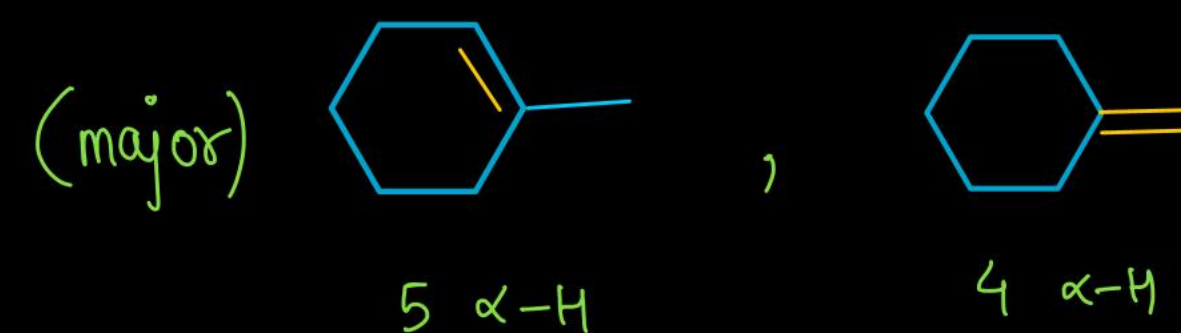
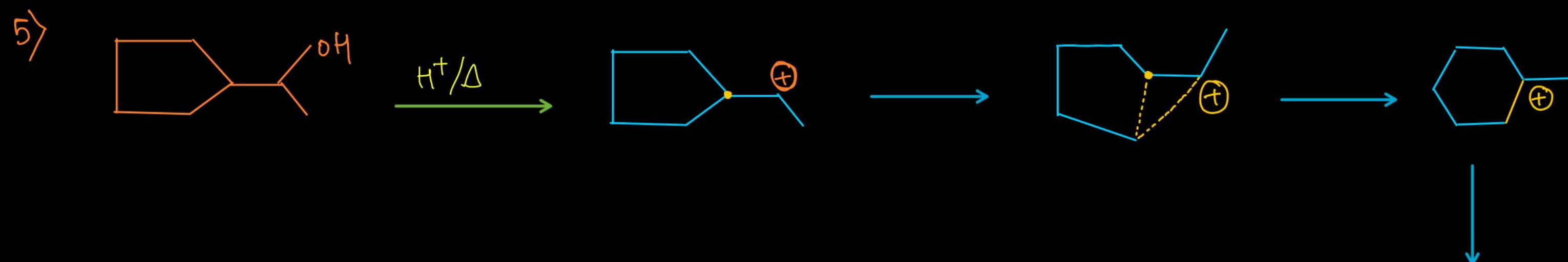




I is major



II is major



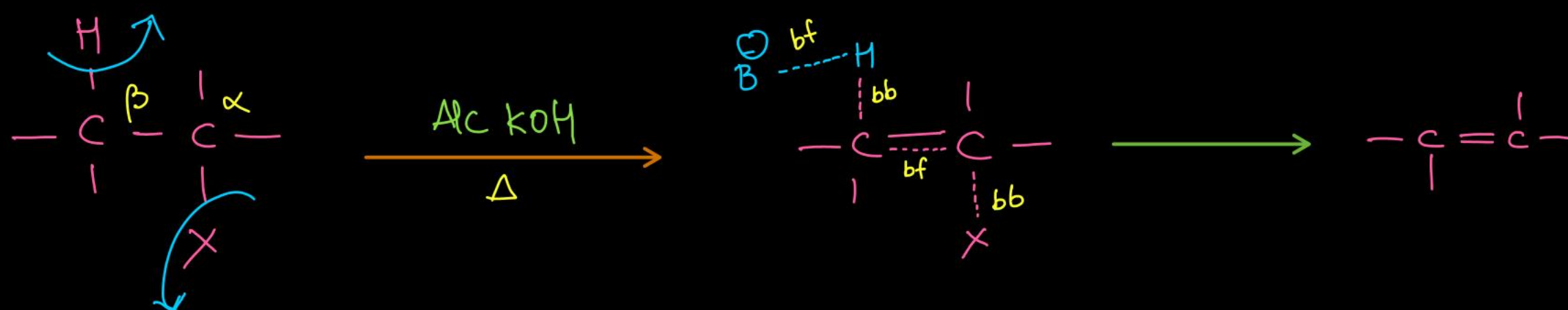
③ Dehydrohalogenation (removal of R-X)

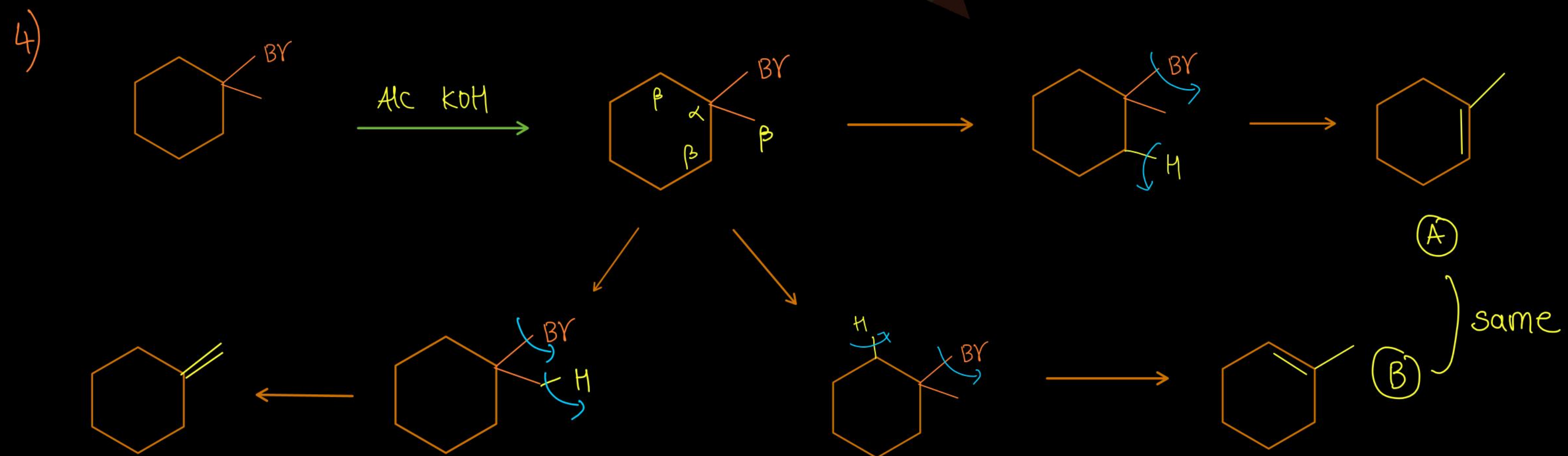
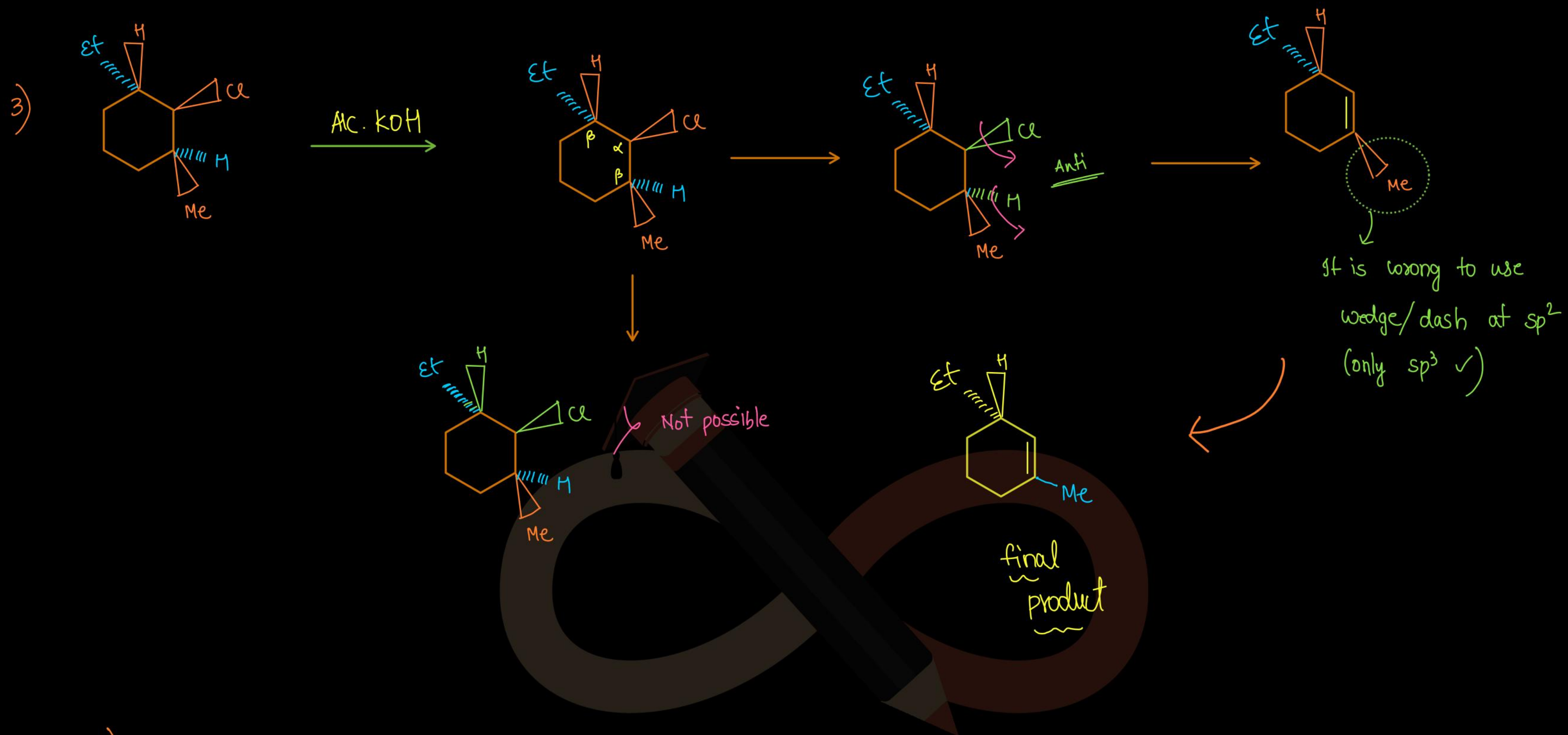


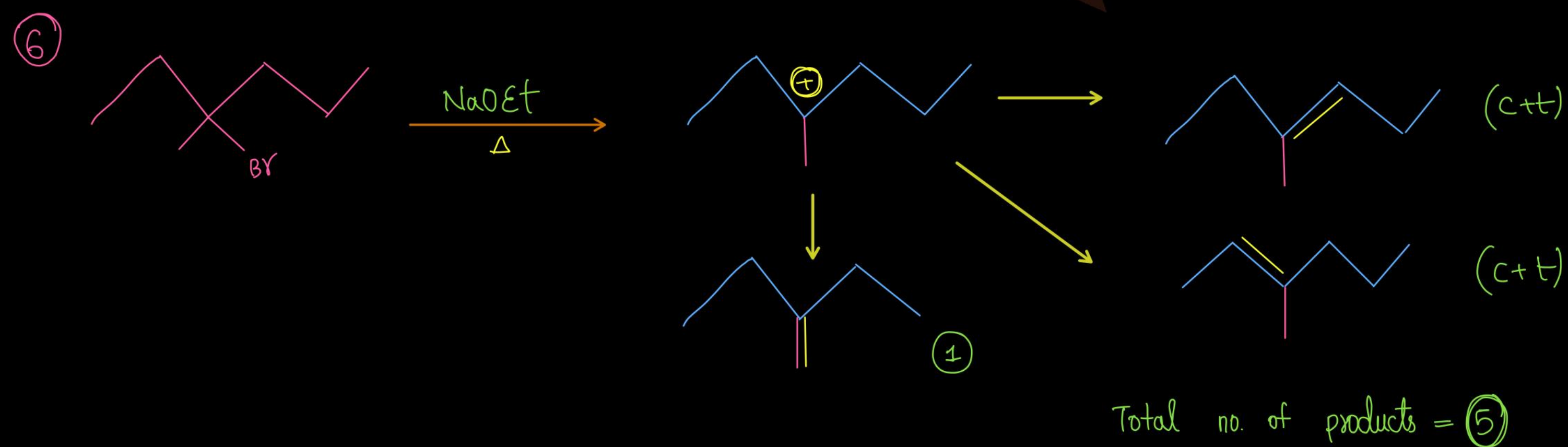
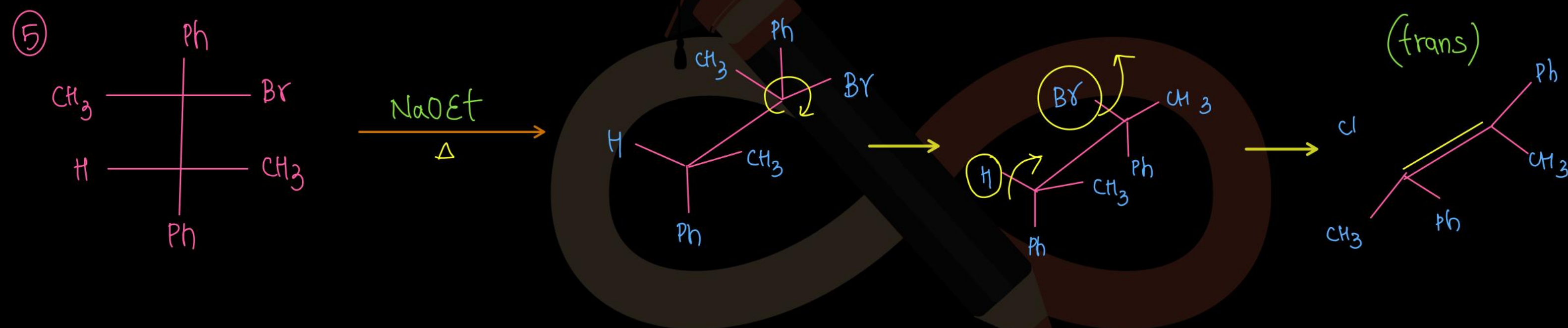
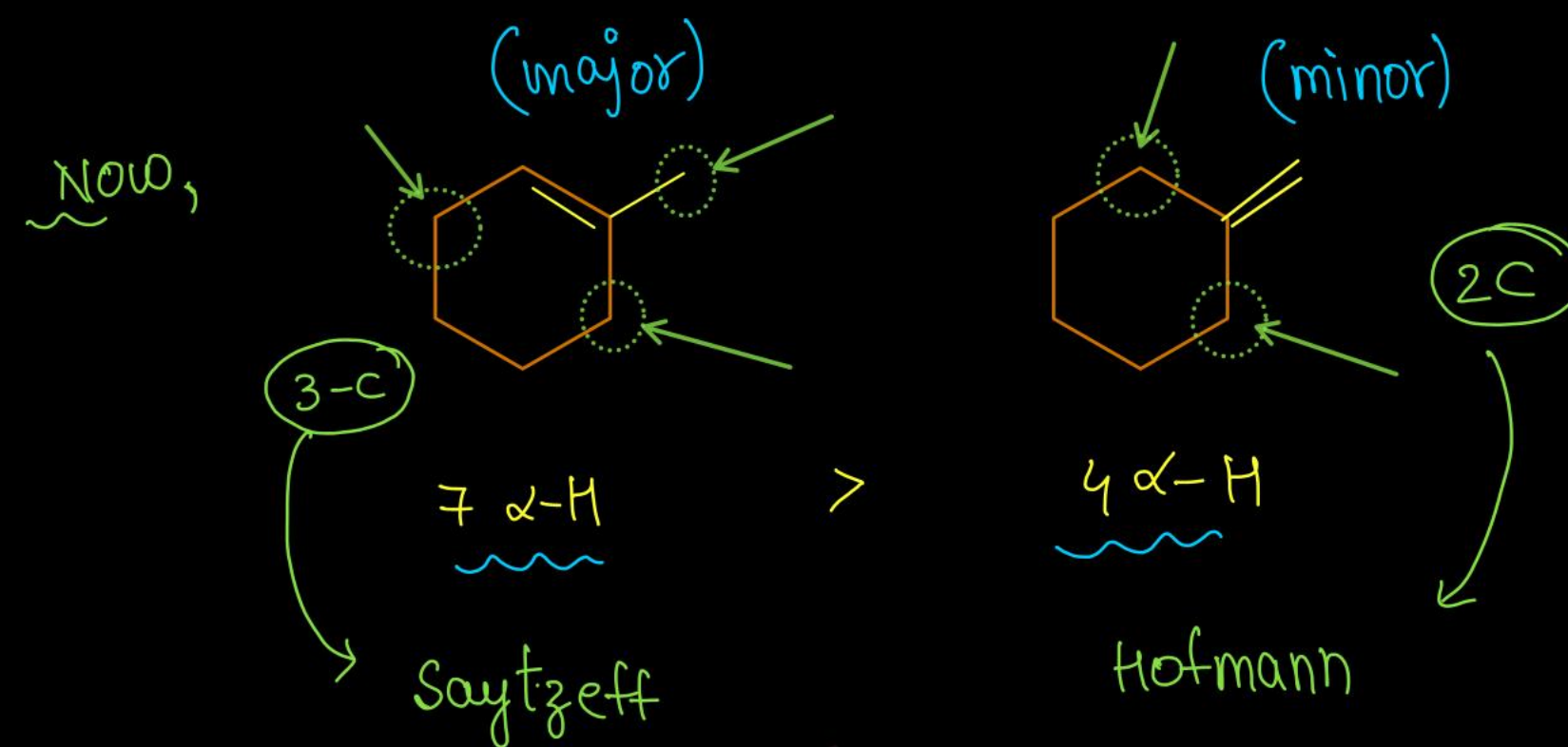
Reagent : Alc. KOH
(ROH + KOH)
or
(RO⁻K⁺)

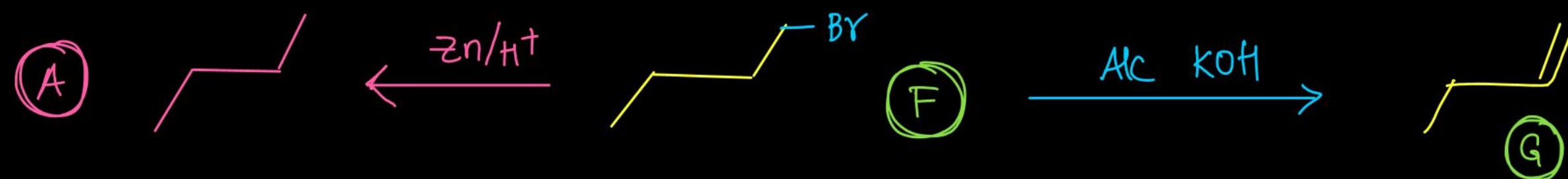
(α , β elimination)

α -halogen
 β -hydrogen } eliminate









Imp points :-

1) Anti elimination

2) No intermediate formation, no TS

3) $R-F < R-Cl < R-Br < R-I$

$3^\circ (R-Y) > 2^\circ > 1^\circ$

4) More stable alkene is the major product

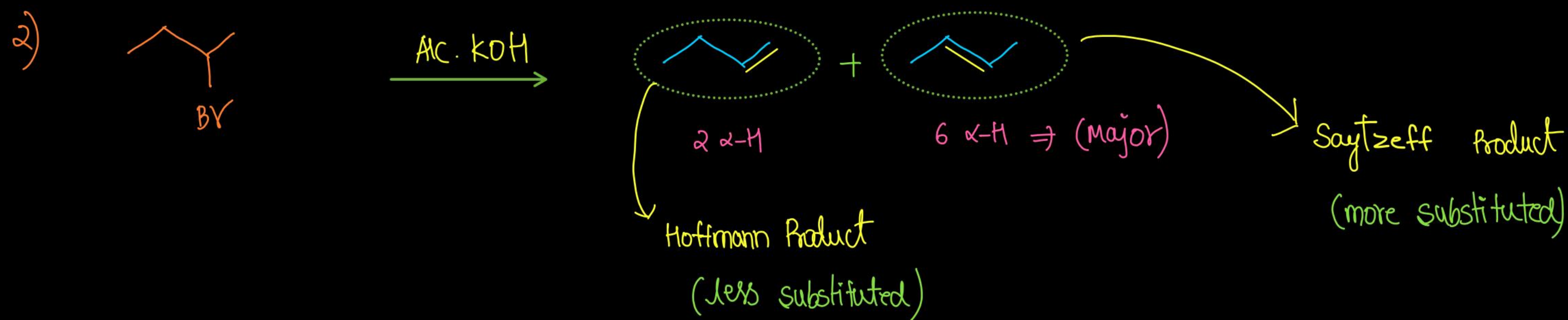
5) Regio selective

$R \longrightarrow (A) + (B)$ } one of the isomer is major

6) Stereoselective

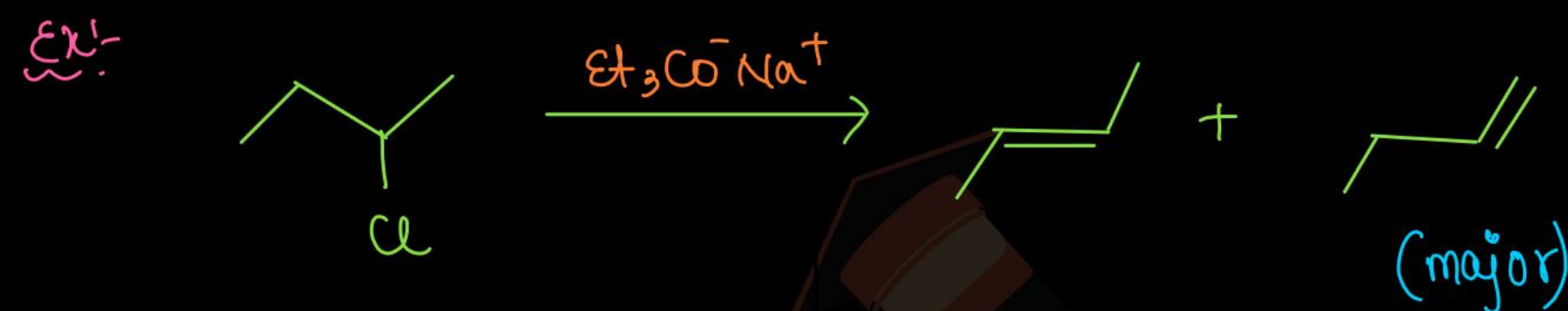
$R \longrightarrow (A) + (B)$ } one of the stereoisomer is major

Practice :-

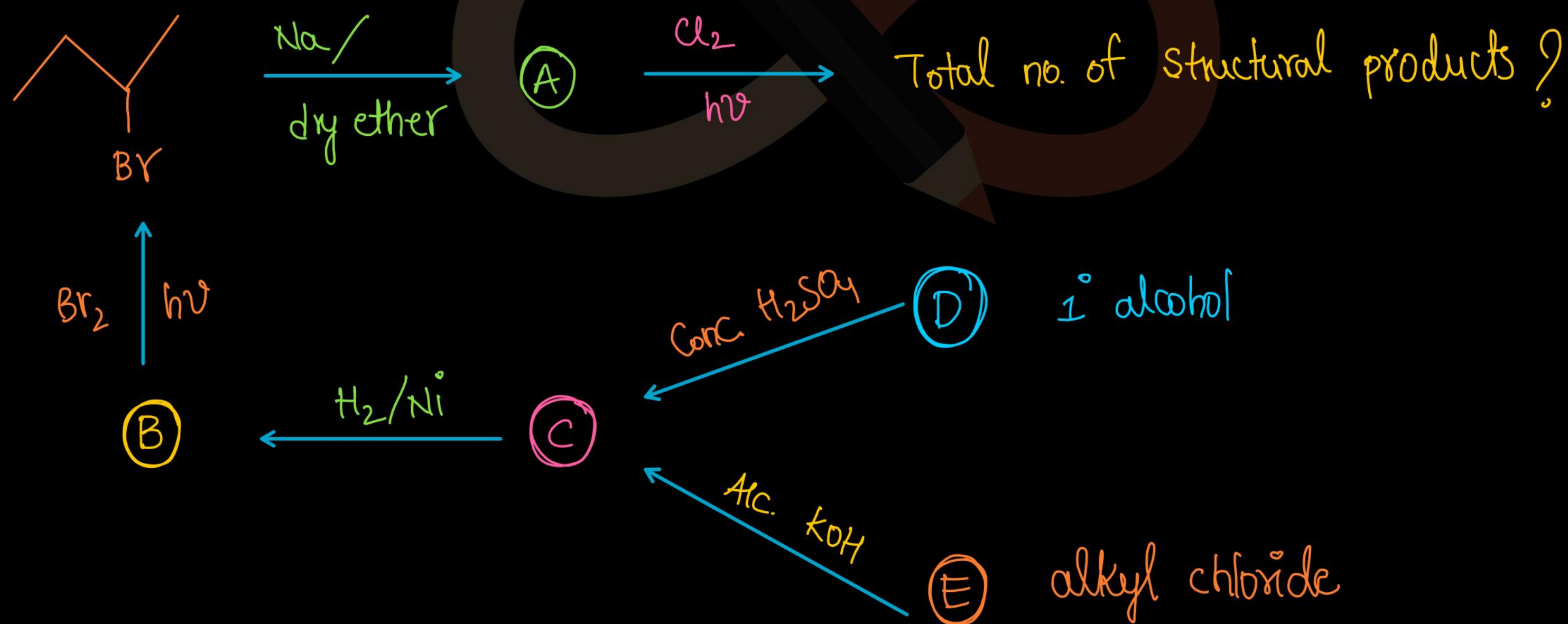


Imp points :-

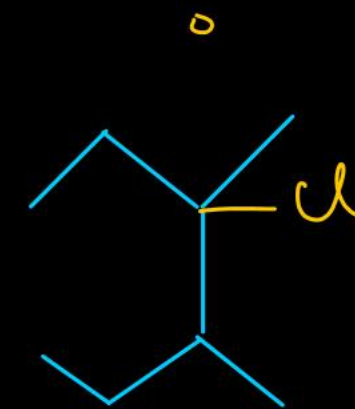
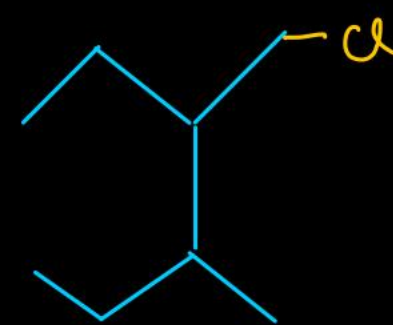
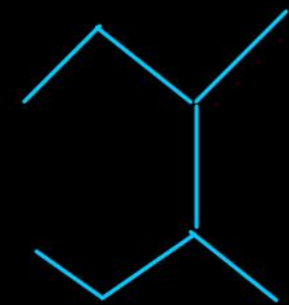
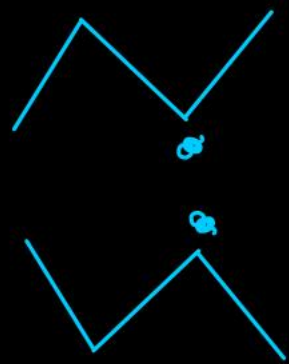
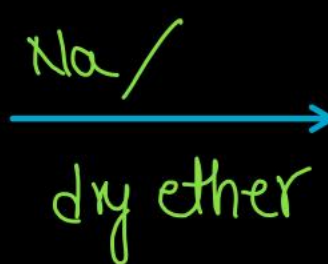
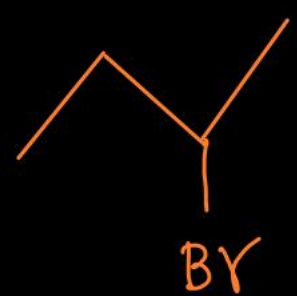
*) If $\text{Et}_3\text{CO}^-\text{Na}^+$ (Bulky base) is used,
less hindered alkene is major product (Hofmann)



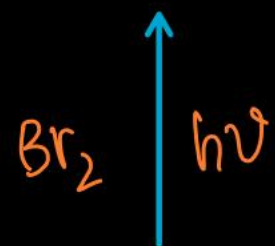
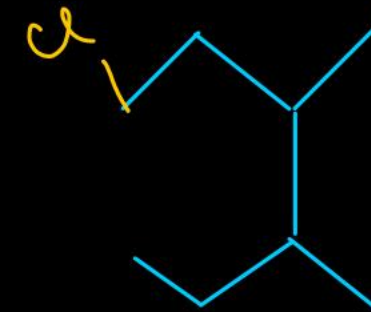
6)



Sol:-



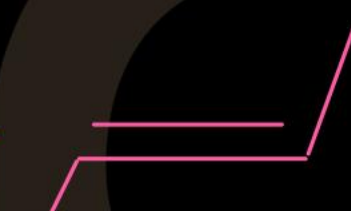
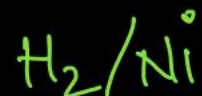
4



(B)



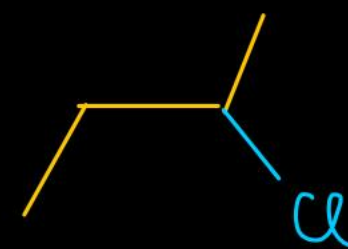
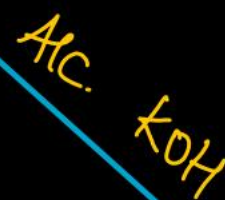
(n-butane)



(but-2-ene)



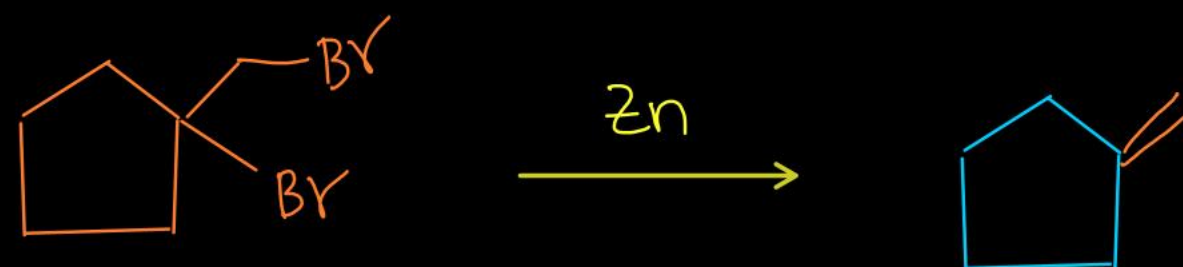
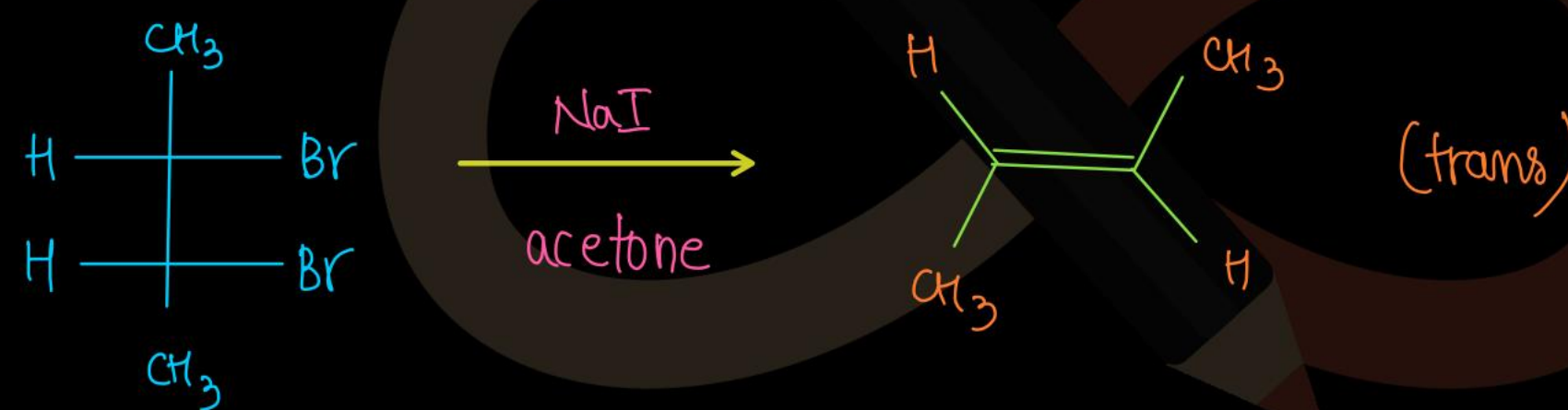
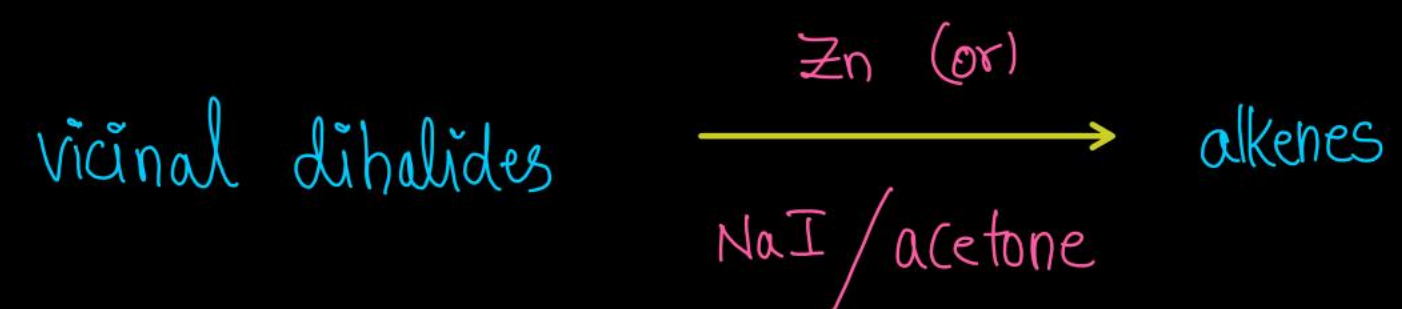
(D) 1° alcohol
(butan-1-ol)


$$\} \text{ (butan-2-ol)}$$


③ alkyl chloride

(2-chloro butane)

④ Dehalogenation :-

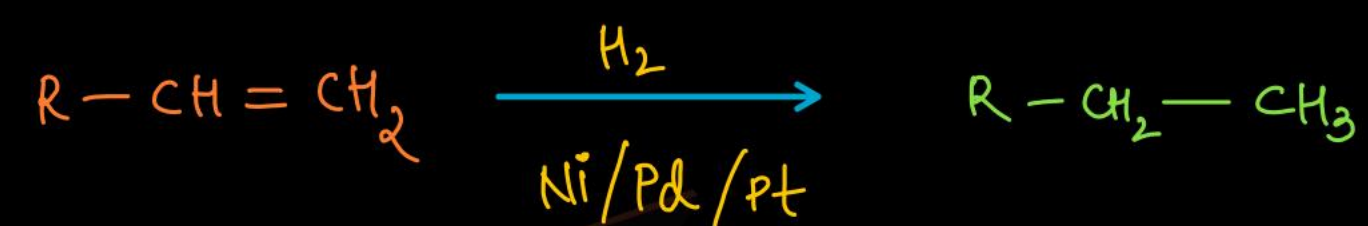


*) Anti Elimination

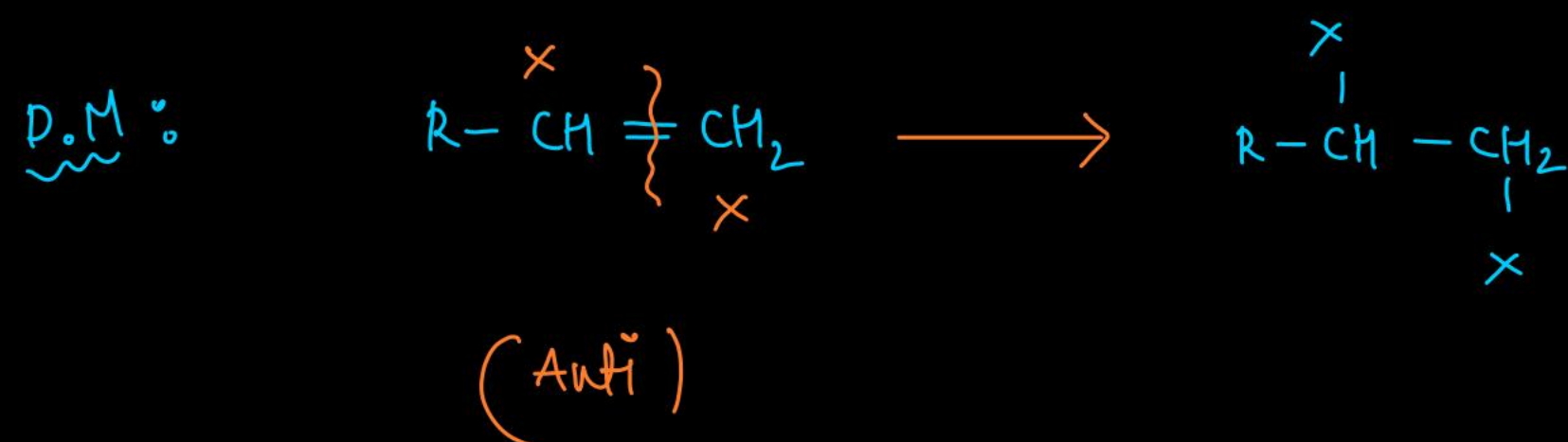
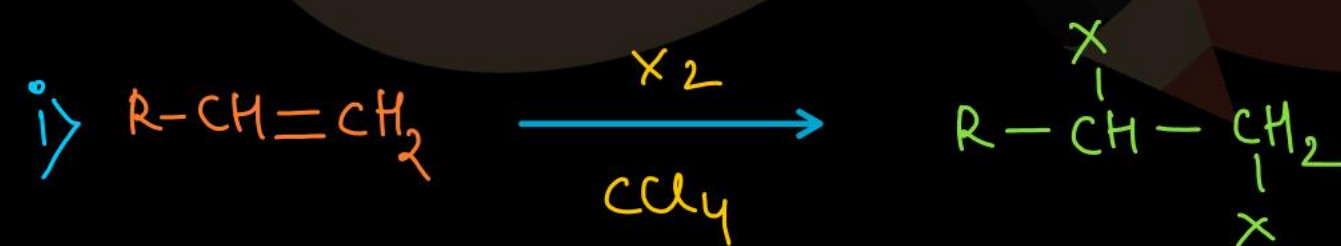
*) Stereo specific reaction

Properties :-

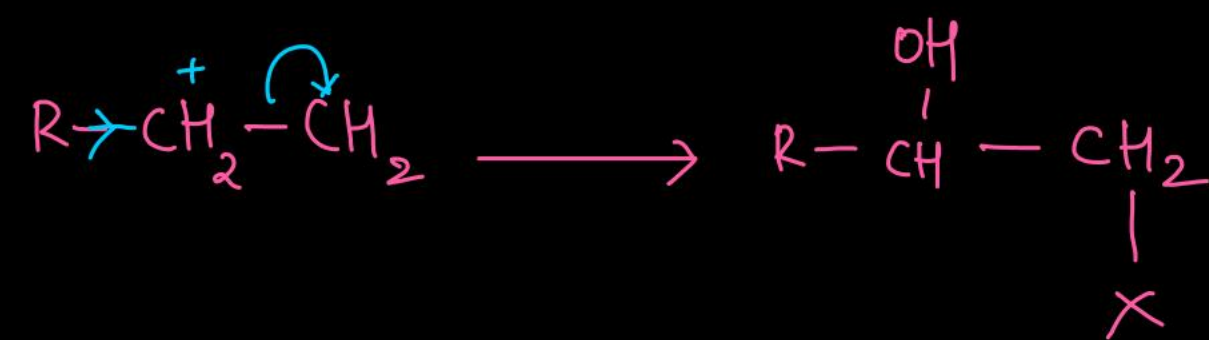
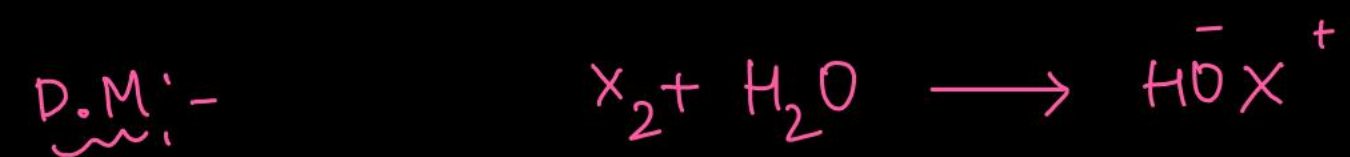
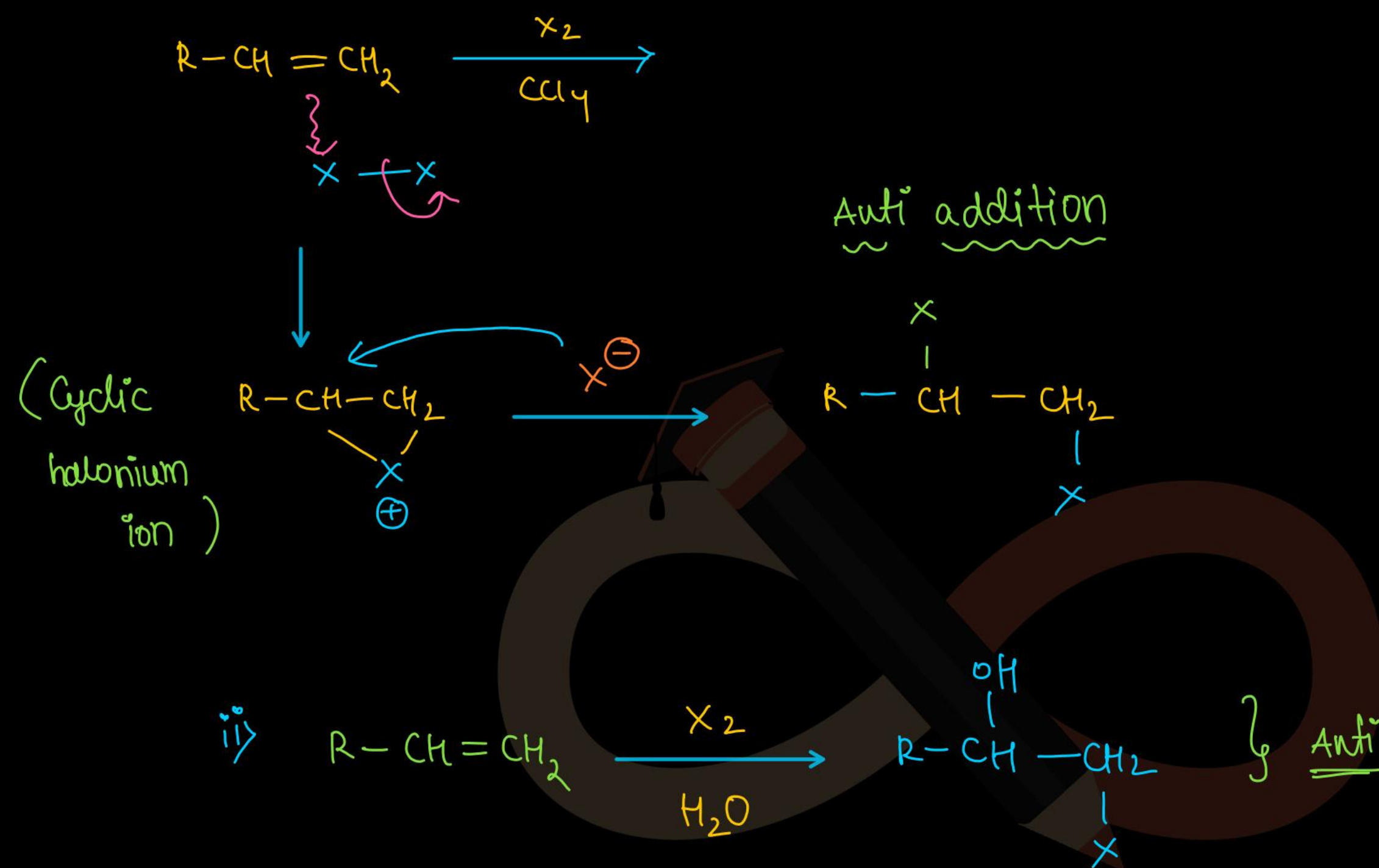
1) Addition of dihydrogen :



2) Addition of Halogen :

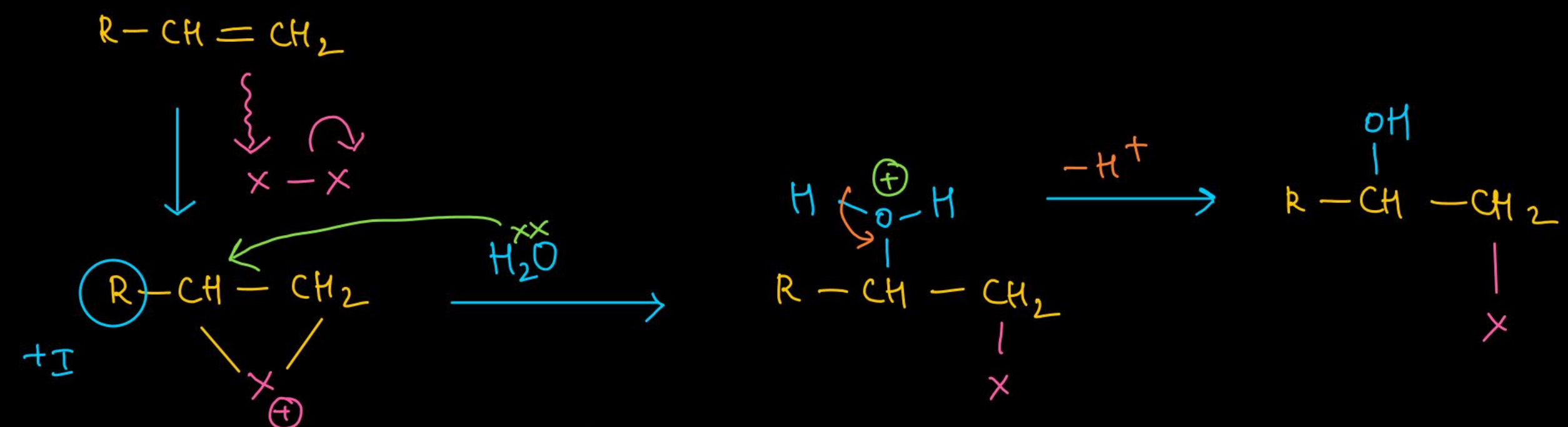


Mechanism :-

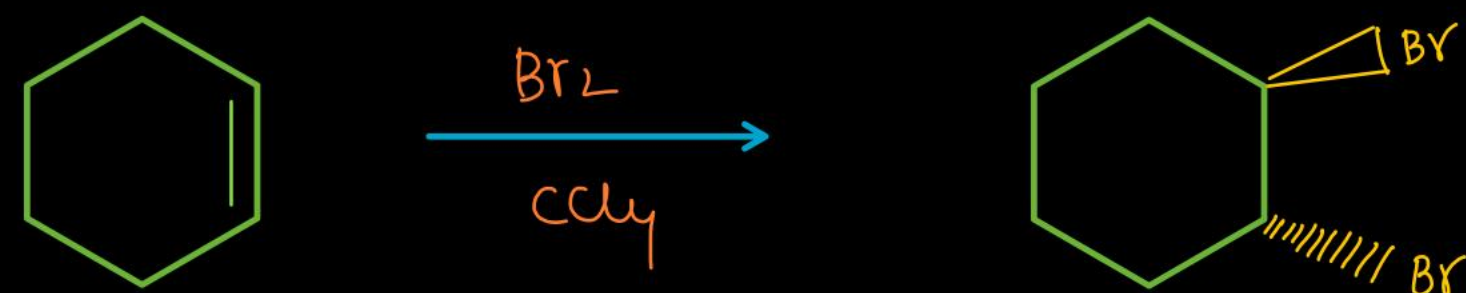
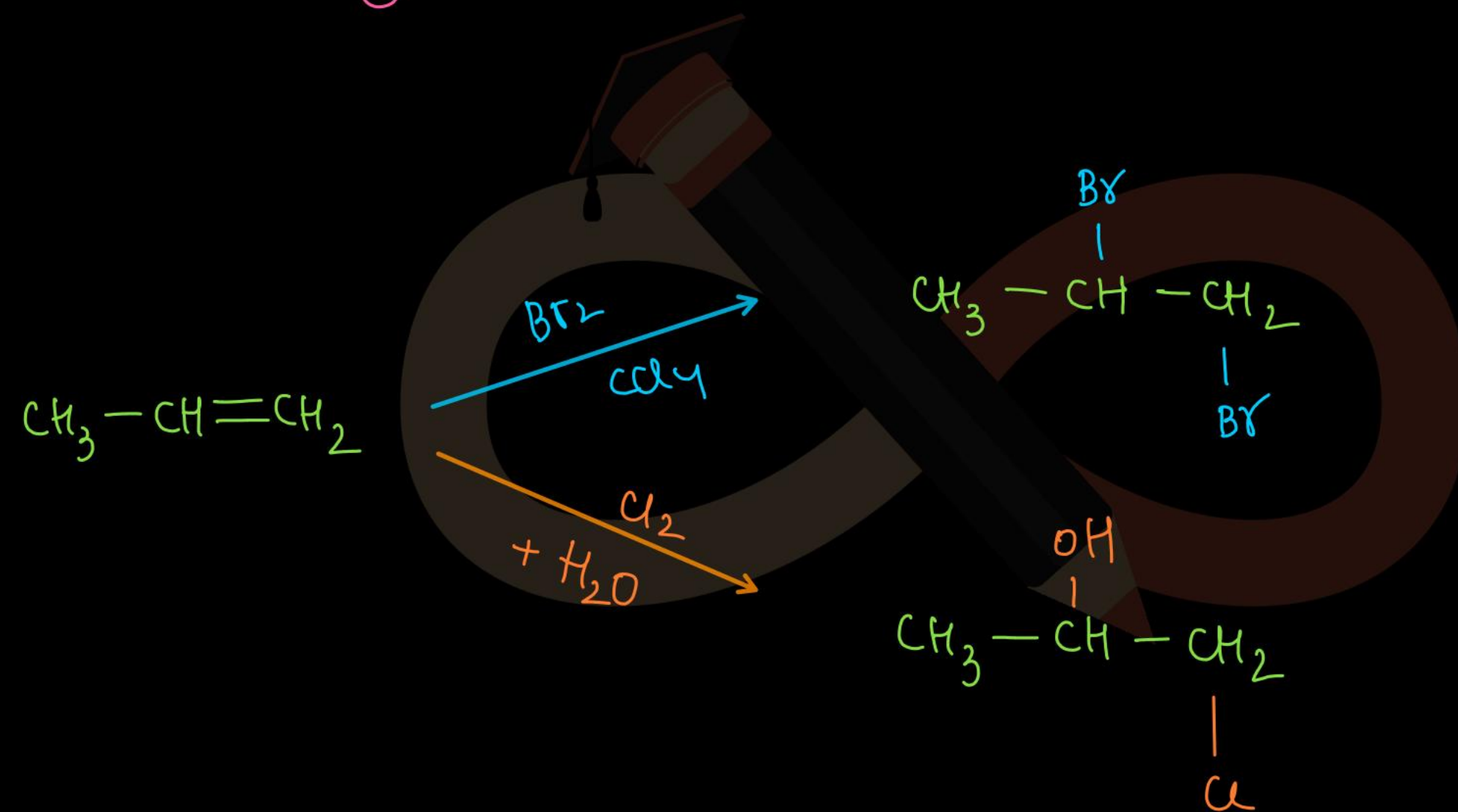


Halo hydrin

Mechanism :-



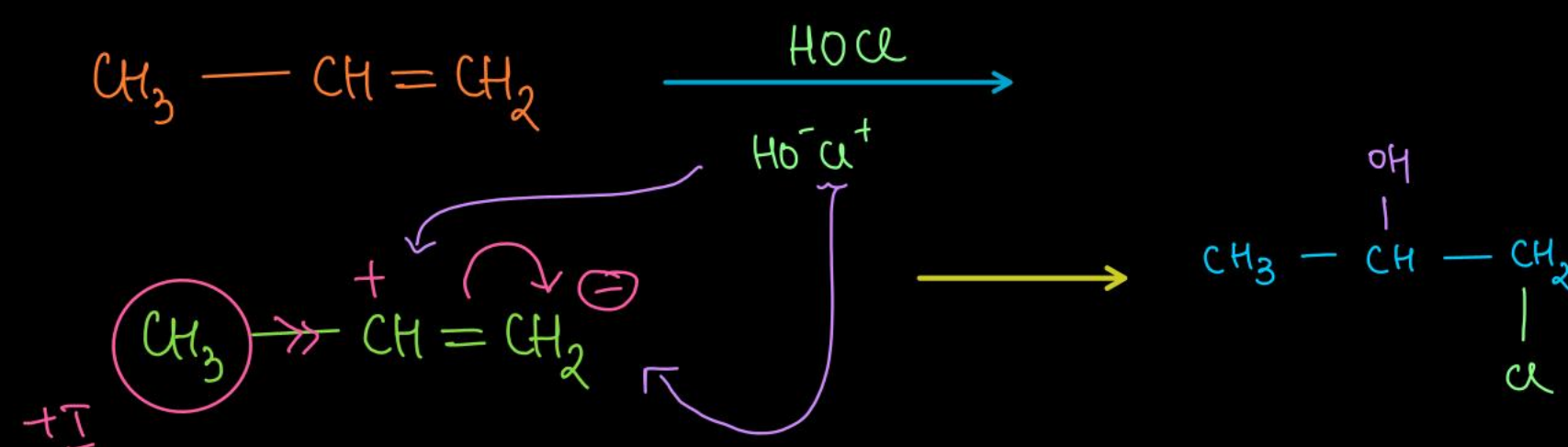
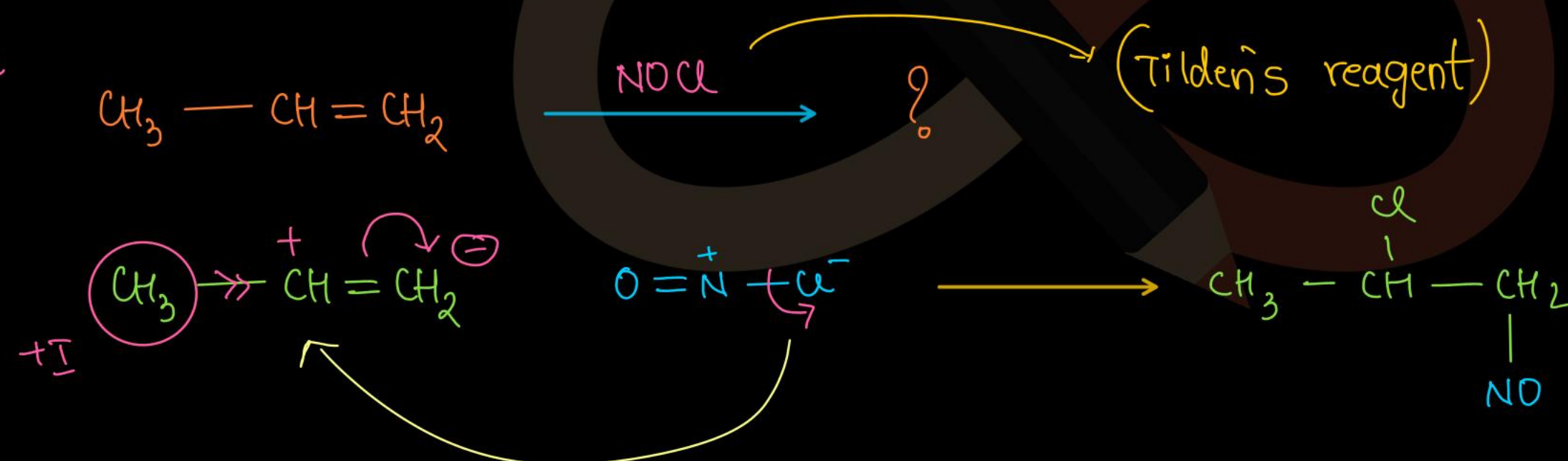
Practice :-



other examples :-

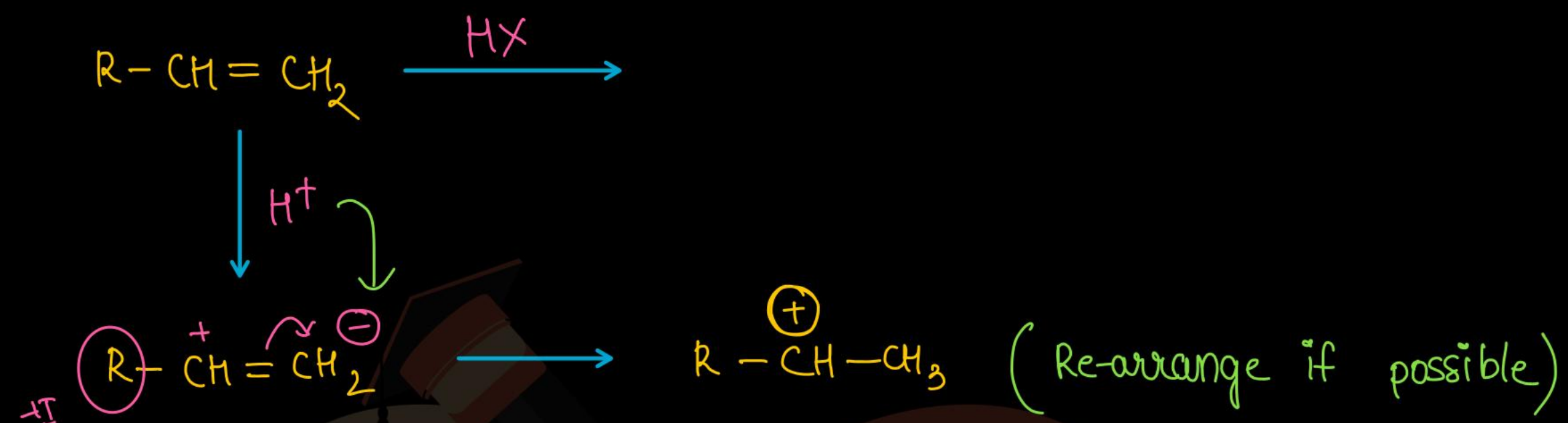


Q) * JEE



③ Addition of hydrogen-halide (HX)

Mechanism :



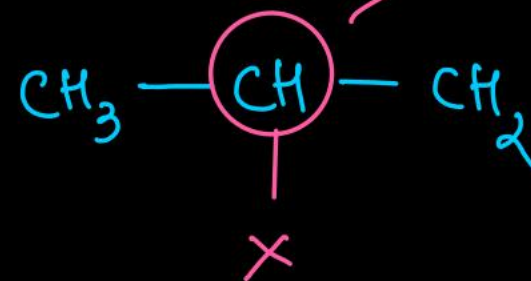
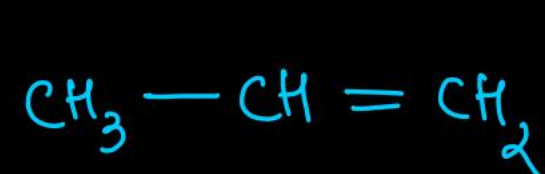
Imp points :-

- ① Rate of reactivity : $\text{HCl} < \text{HBr} < \text{HI}$
- ② formation of C^+ is RDS
- ③ rate $\propto$ stability of C^+
- ④ Electrophilic addition rxn (EAR)
- ⑤ regio selective rxn

Practice :-



NCERT :-



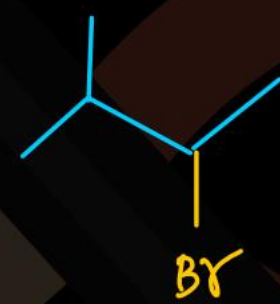
Markonikov's rule

-ve part of reagent is added
to carbon with least hydrogens
[(or) more no. of $\alpha\text{-H}$]

$\Rightarrow$

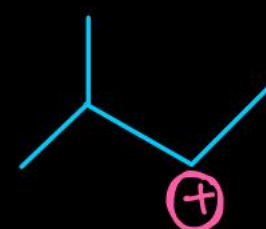
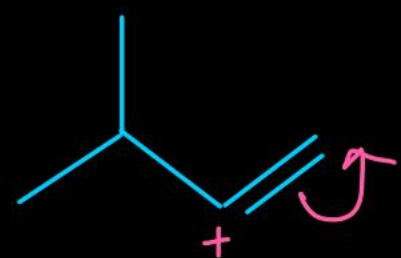


least no. of H

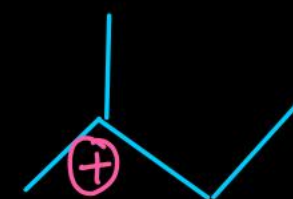


(markonikov's rule) X

Actual mech :

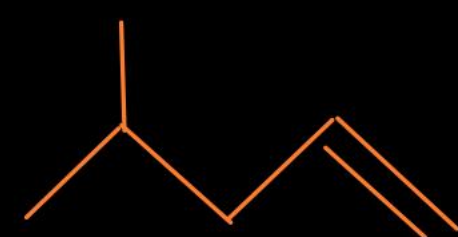


(Re-arrangement is possible)



final product

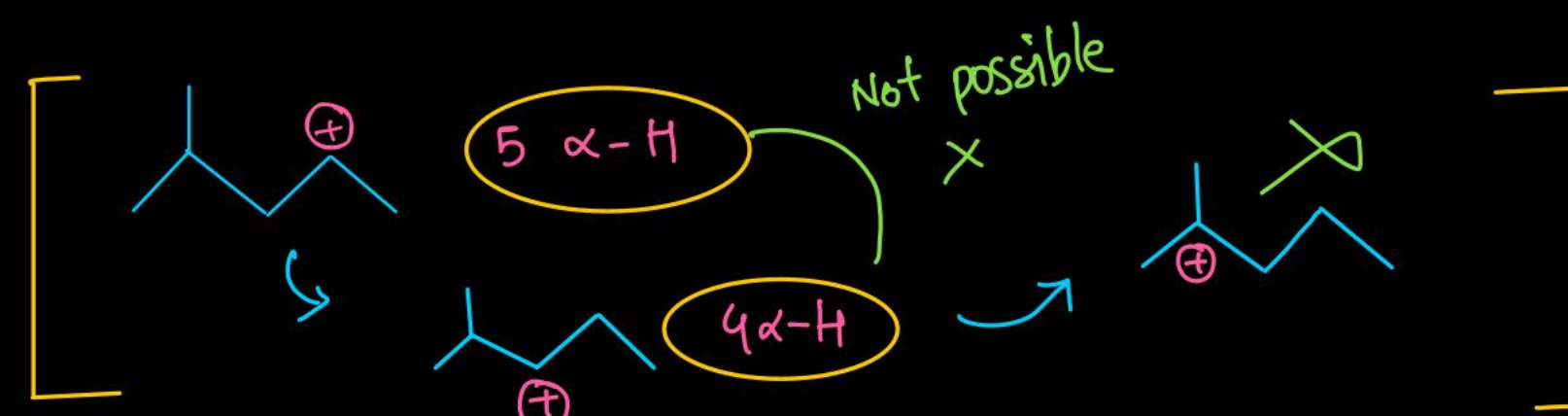
a)



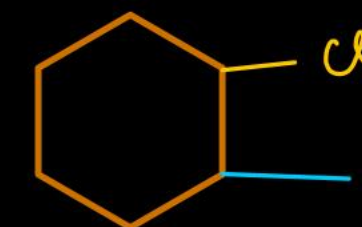
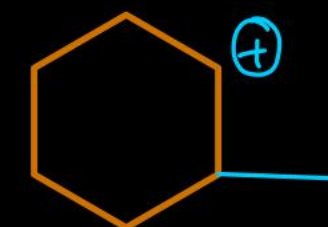
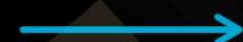
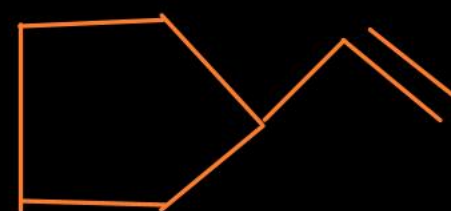
✗ Wrong



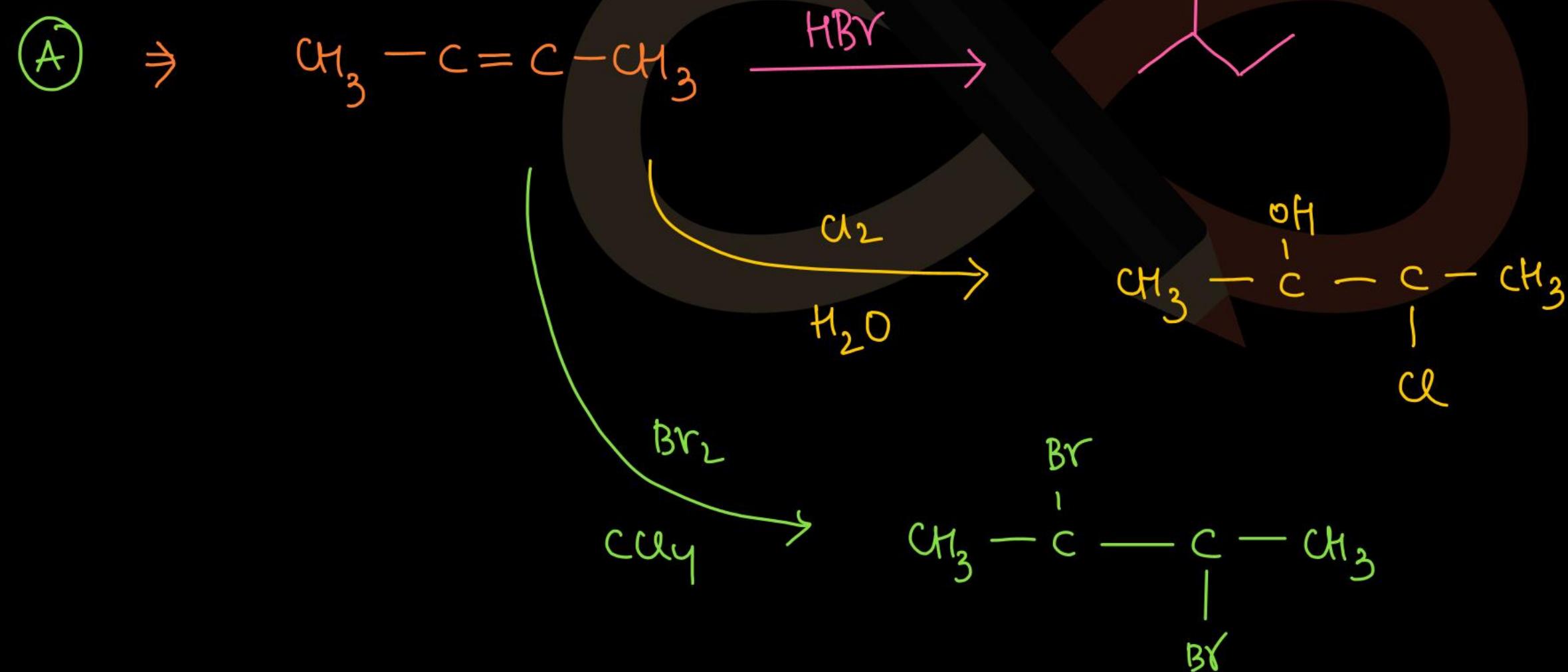
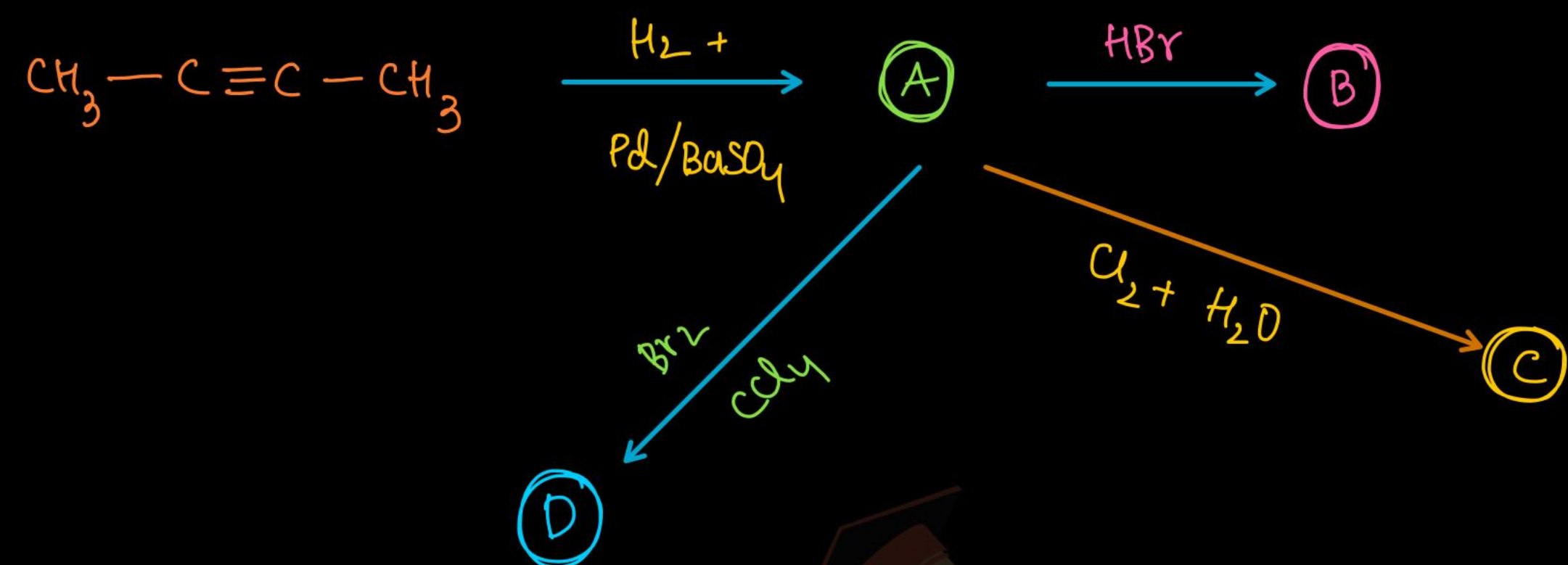
(final)



a)



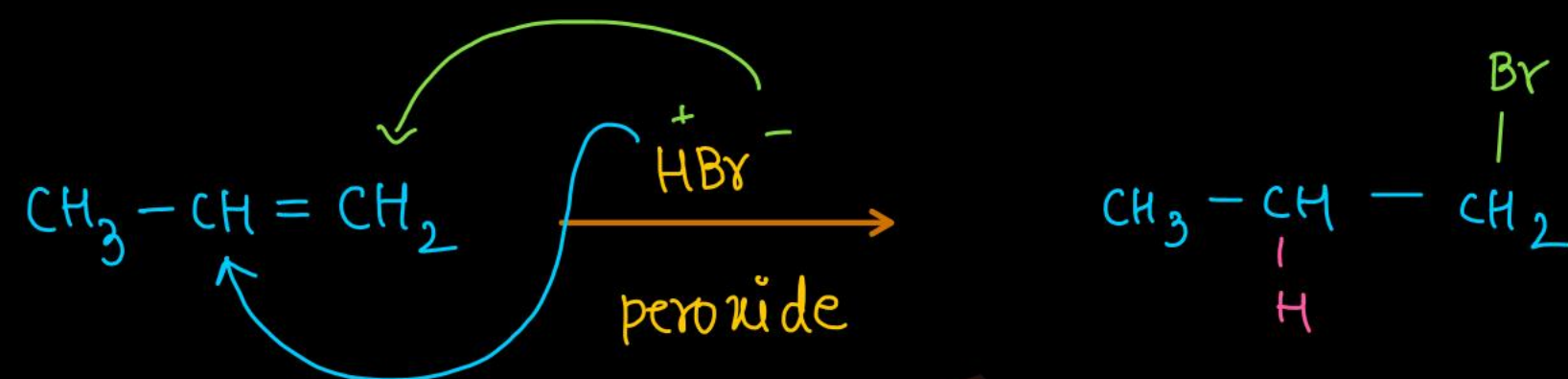
Q)



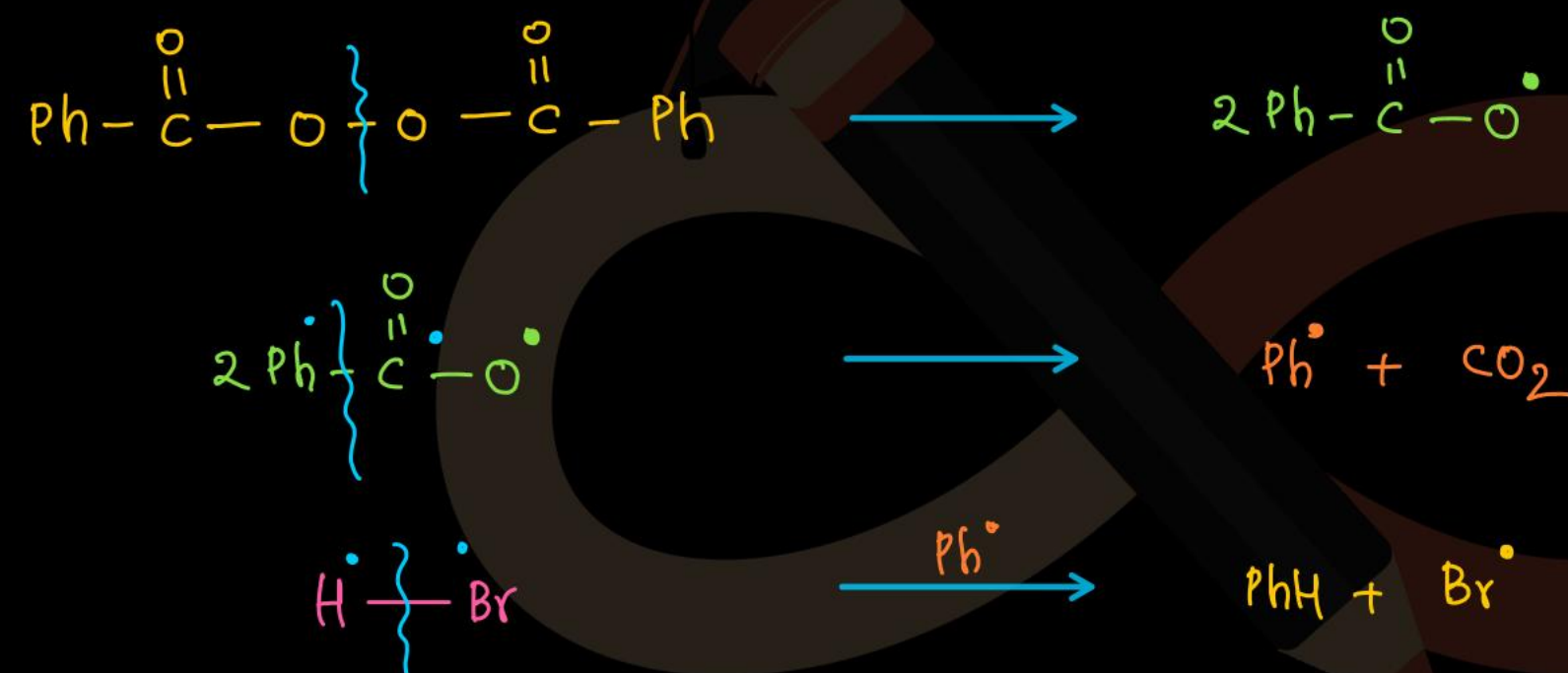
* Kharasch effect : Addition of $\text{HBr} + \text{peroxide}$ } $\rightarrow$ free radical mechanism.

$\hookrightarrow$ (Anti Markovnikov's rule) $\rightarrow$ at carbon with more Hydrogens
[or] least no. of $\alpha\text{-H}$

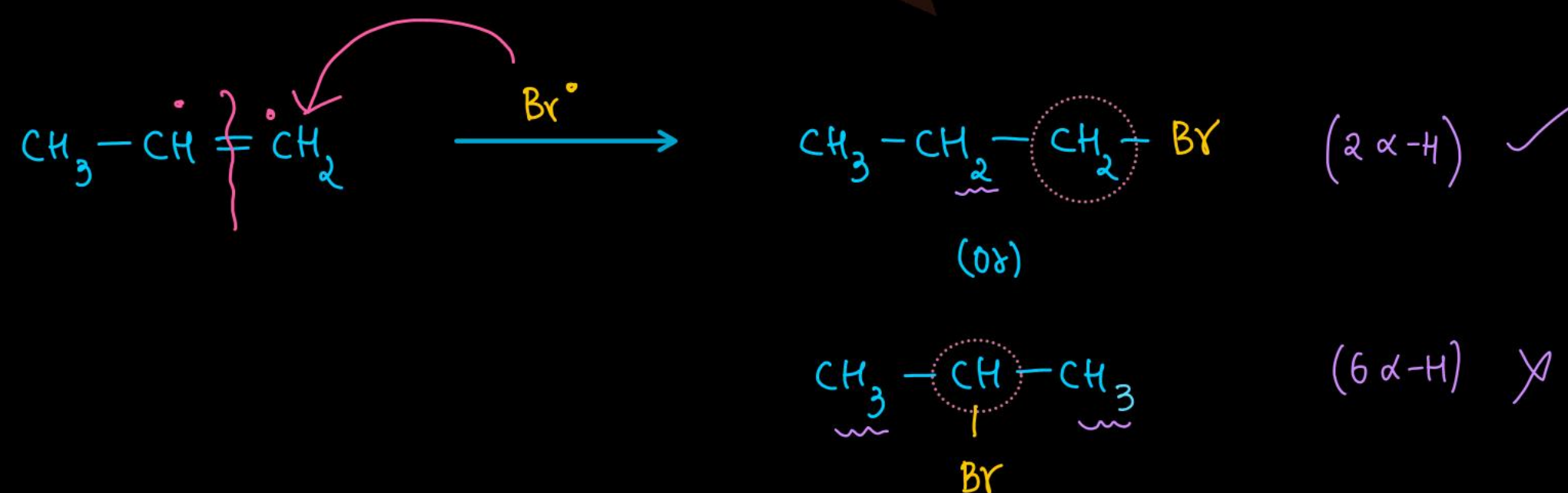
Ex:-

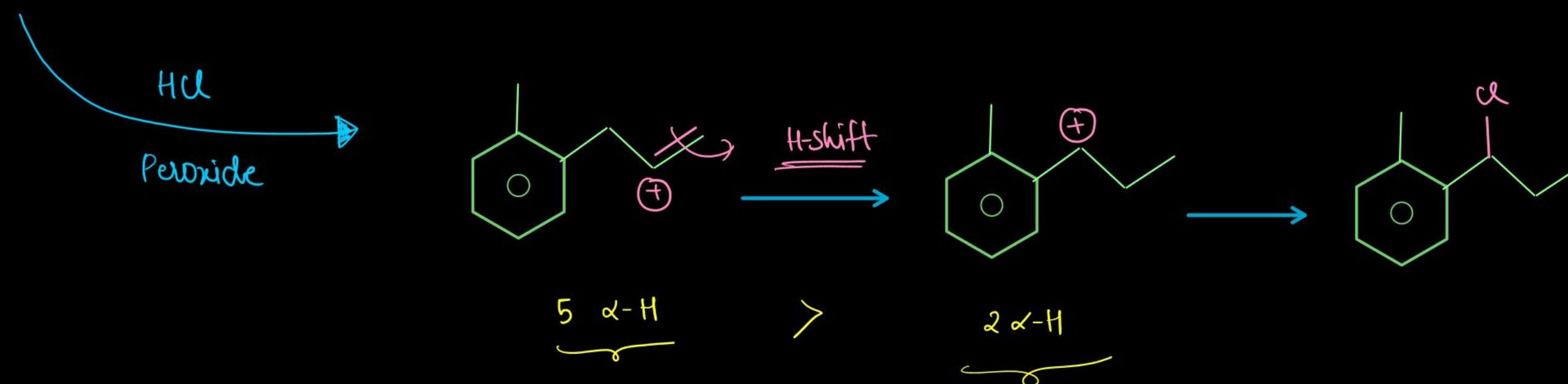
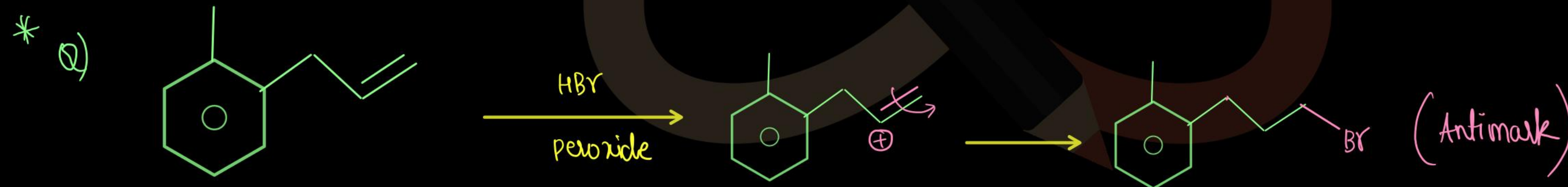
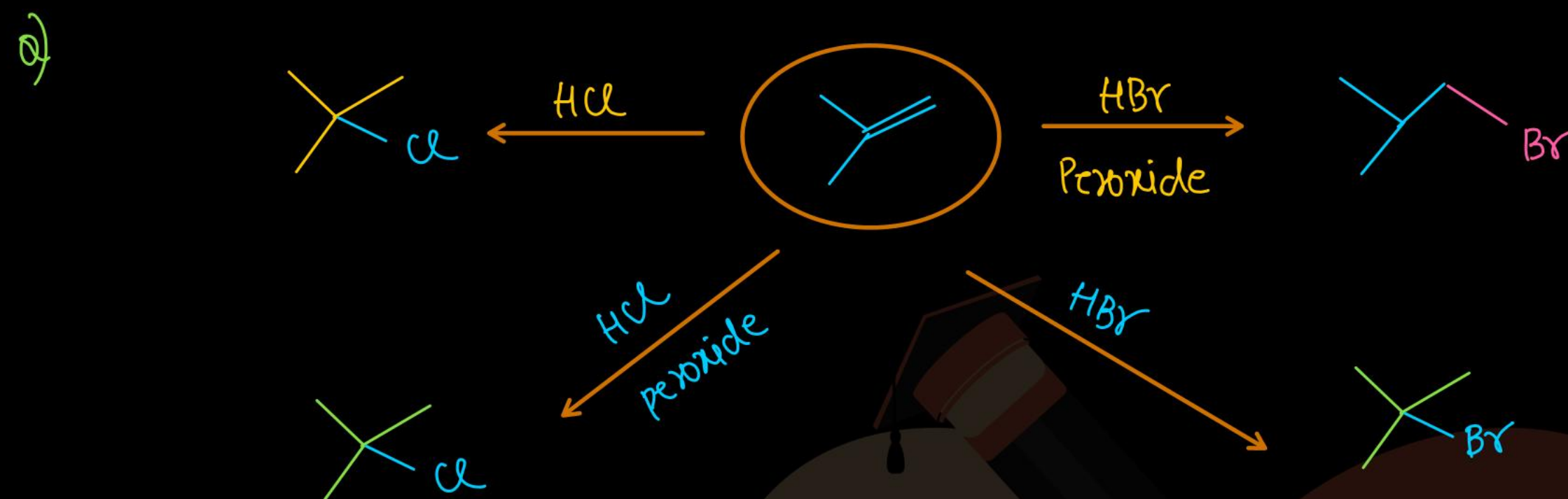


Mechanism:-



Now,





5 α -H

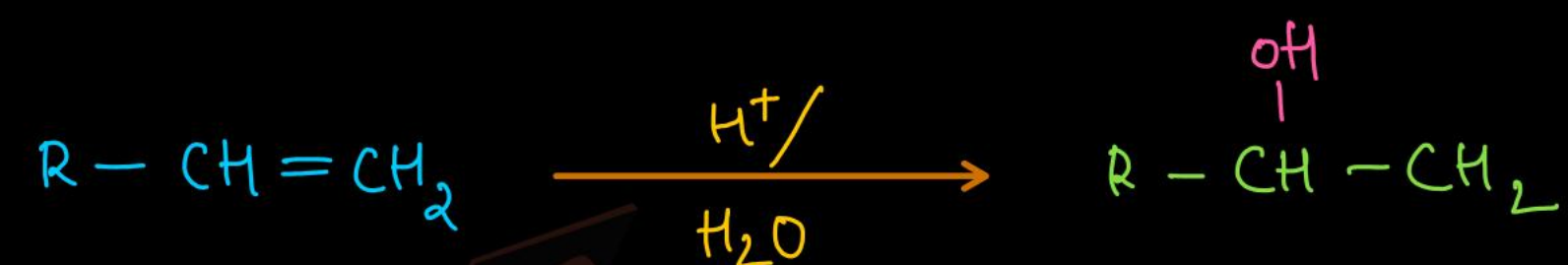
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2 α -H

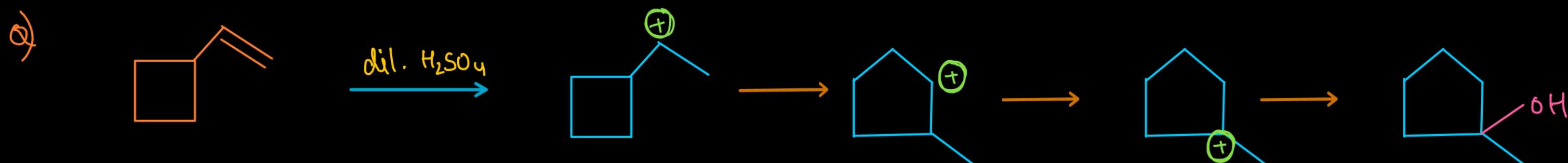
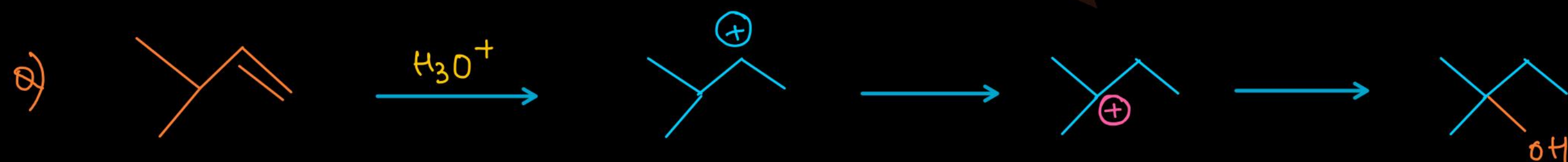
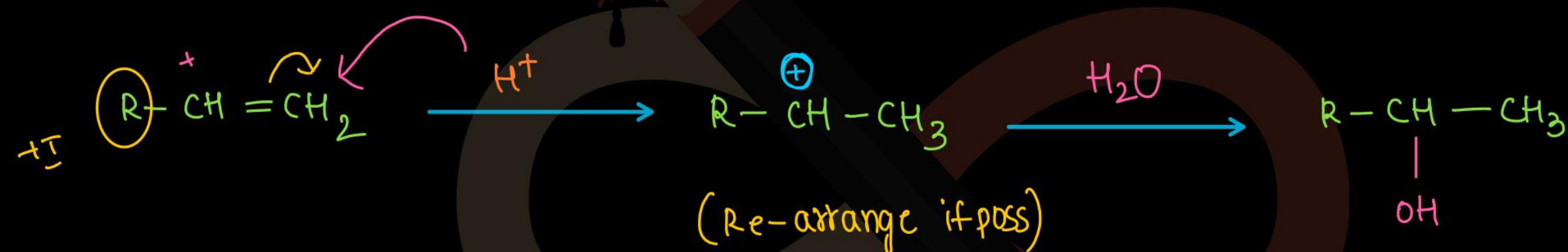
but resonance dominates
hence re-arrangement occurs.

④ Addition of Water :

Reagent : dil H_2SO_4 (or) $\text{H}^+/\text{H}_2\text{O}$ (or) H_3O^+

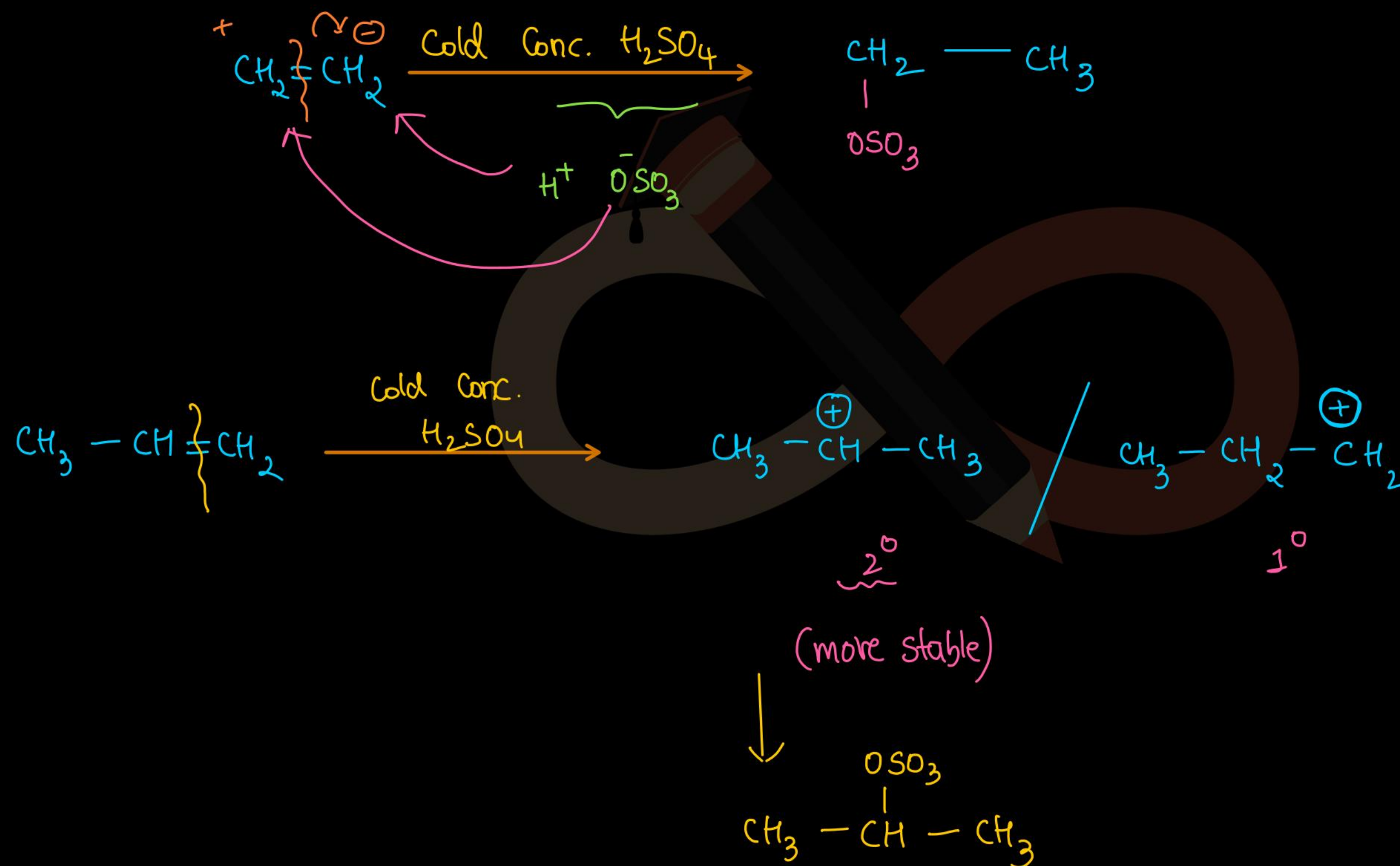


Mechanism :



⑤ Addition of Sulphuric acid

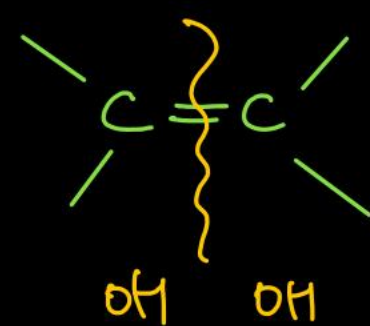
Reagent: Cold Conc. H_2SO_4



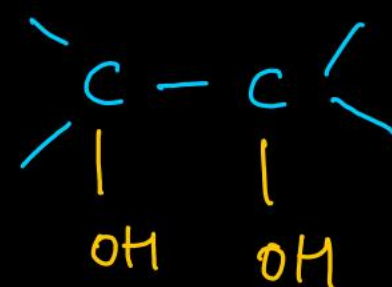
⑥ Hydroxylation

Reagent :- Cold Alk. KMnO_4 } Bayer's reagent

D.M

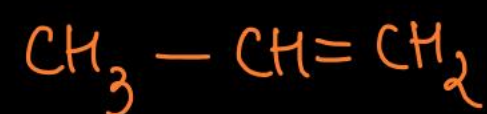


$\xrightarrow{\text{dil Alk KMnO}_4}$

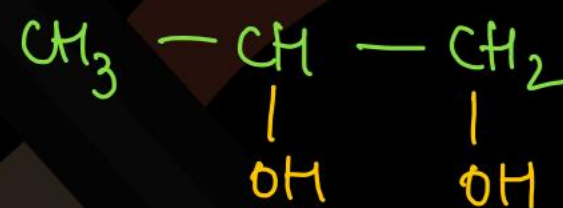


(syn addition)

Q)



$\xrightarrow{\text{Bayer's reagent}}$



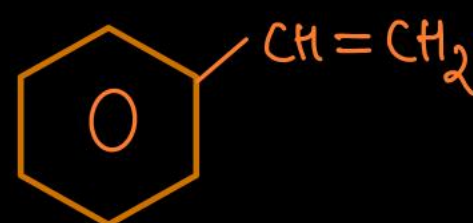
Q)



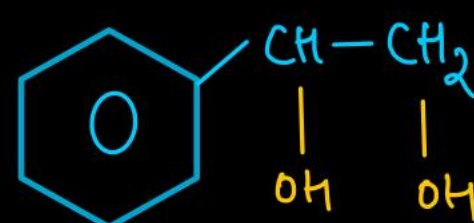
$\xrightarrow{\text{dil + Alk. KMnO}_4}$



Q)



$\xrightarrow{\text{dil + Alk. KMnO}_4}$

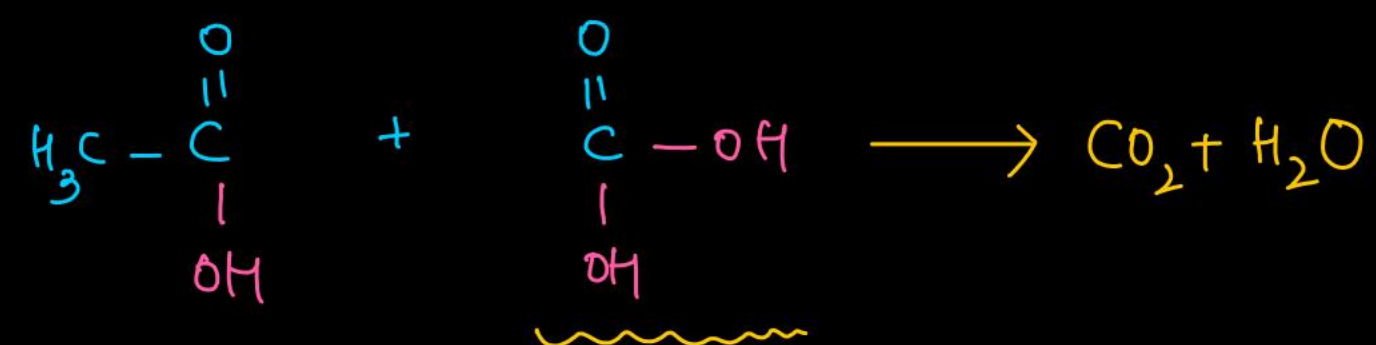
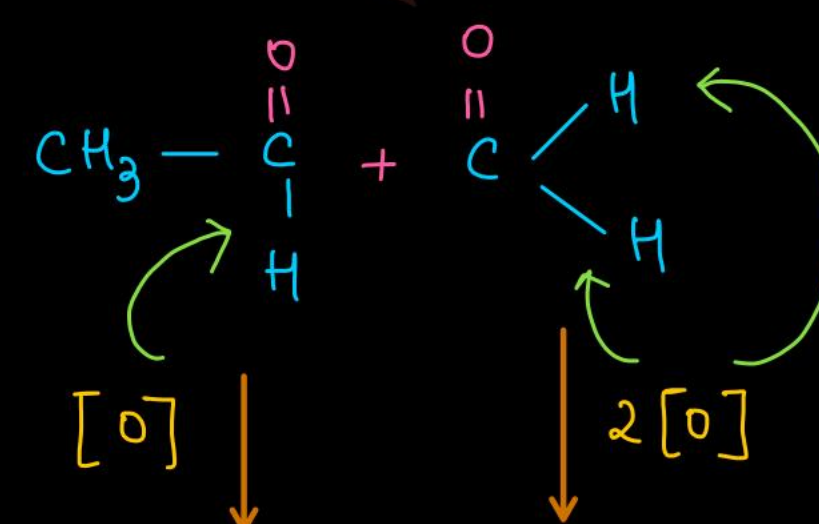
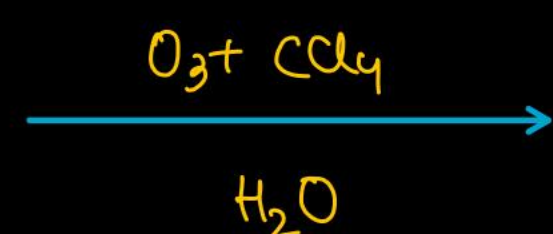
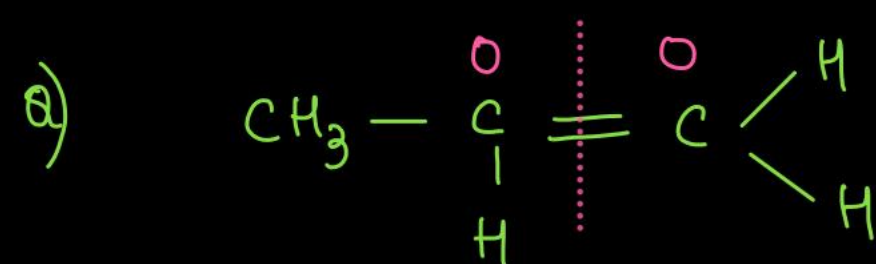
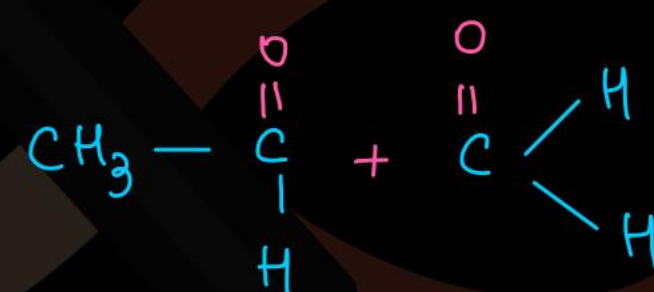
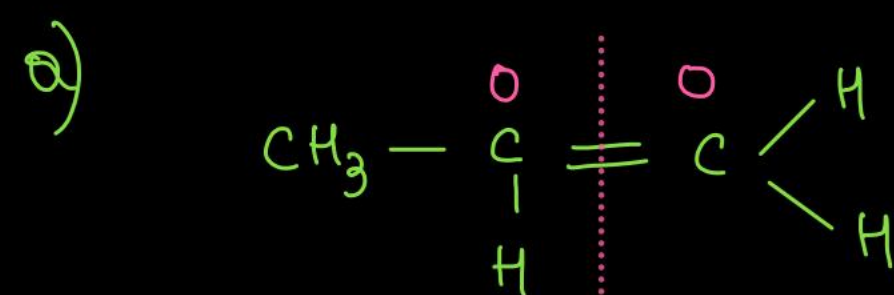
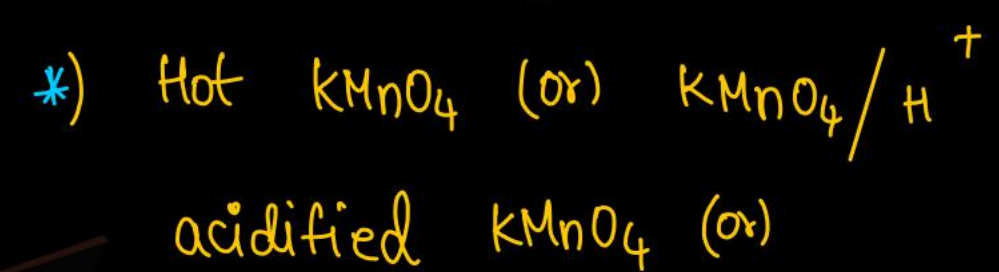
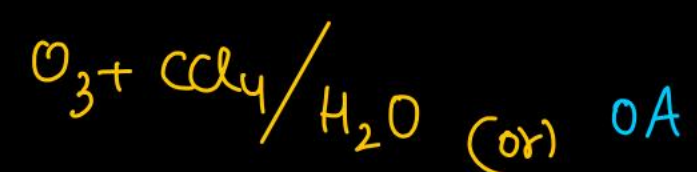


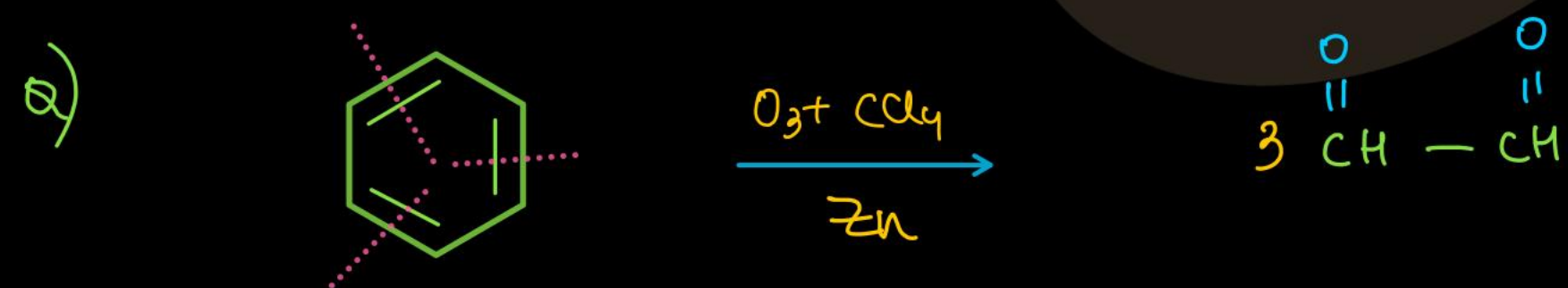
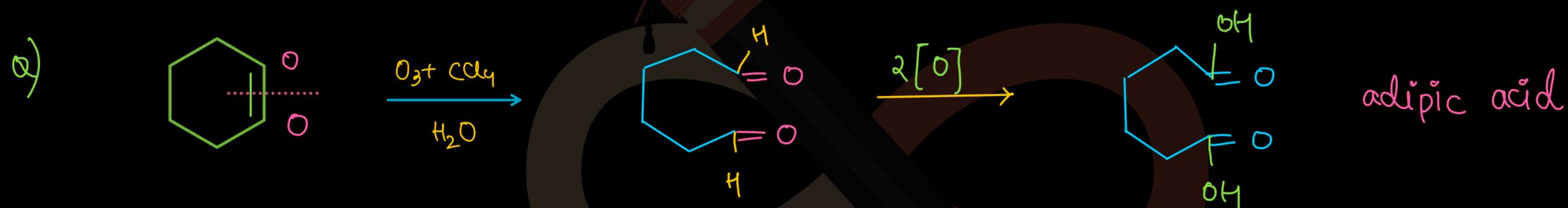
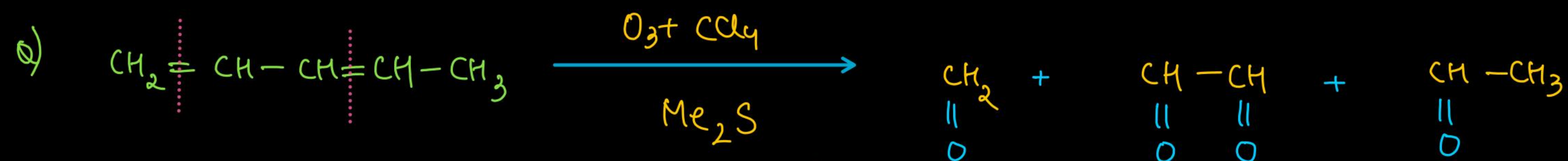
⑦ Ozonolysis : Used for detection of '='

a) Reductive



b) Oxidative

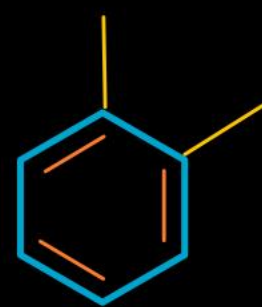




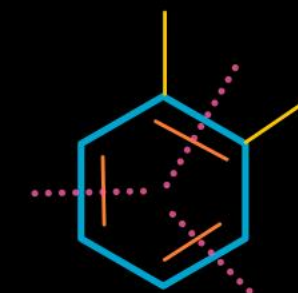
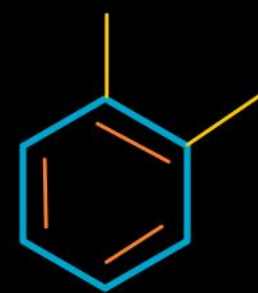
Q) Total no. of diff types of products by reductive ozonolysis of o-xylene?

Sol:-

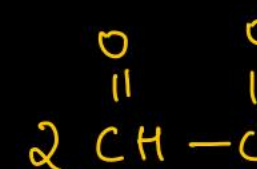
O-xylene



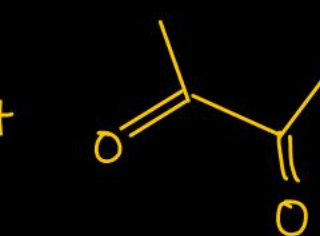
&



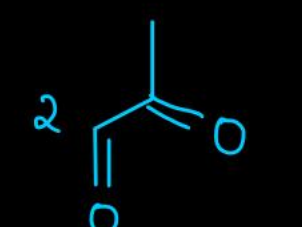
(3)
diff types



Glyoxal



dimethyl
glyoxal

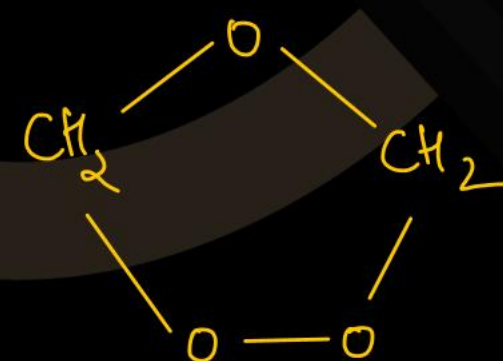


methyl
glyoxal

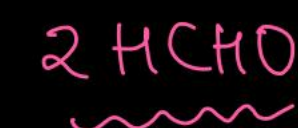
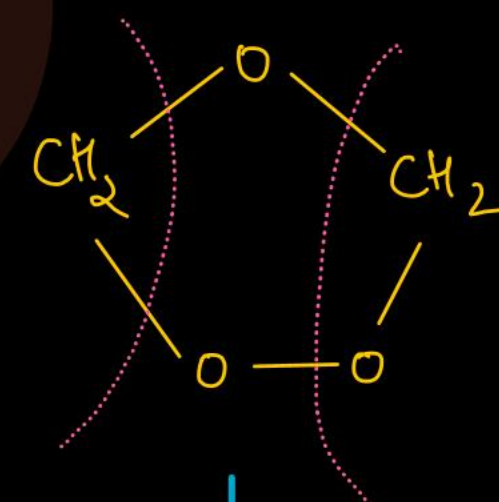


Glyoxal

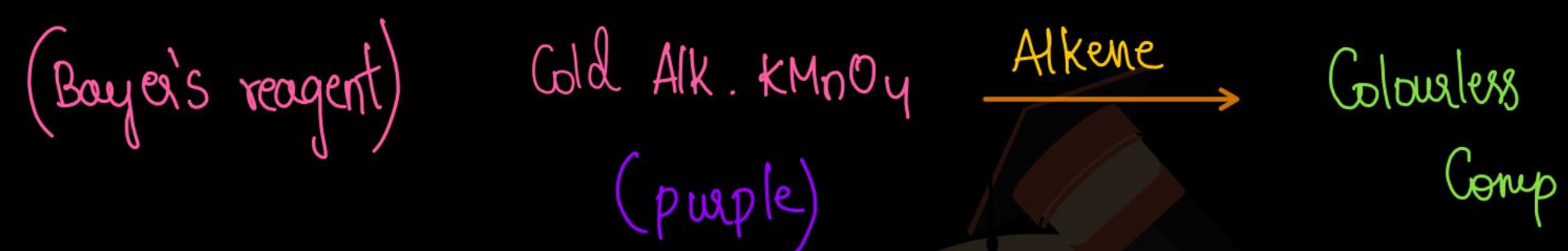
☆



(ozonide)

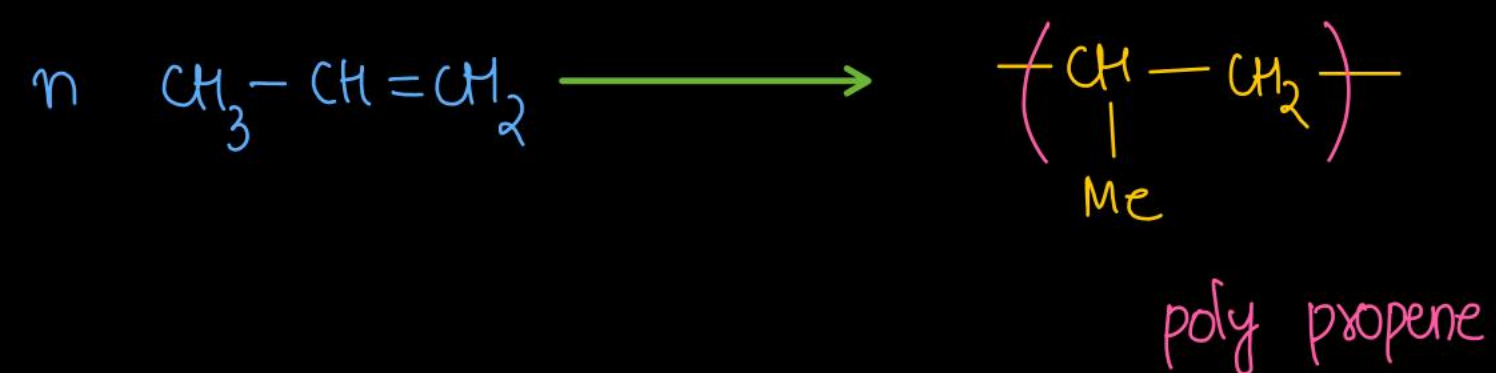
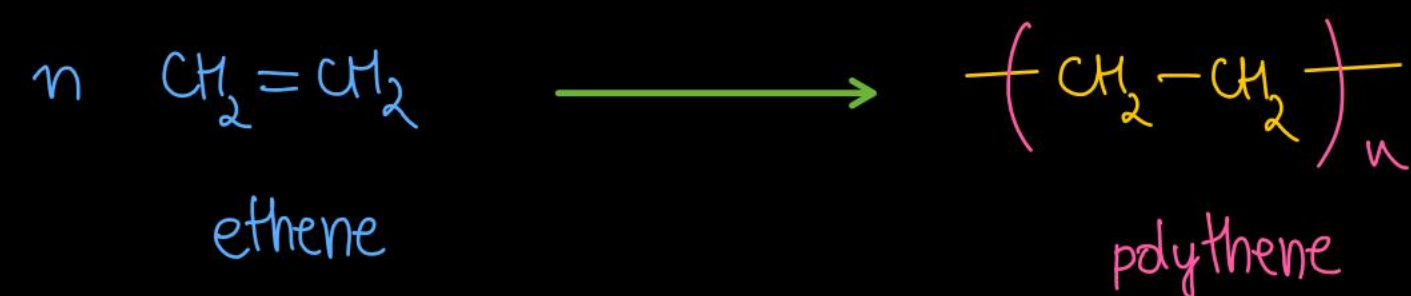


Test for unsaturation :



*) ozonolysis

⑧ Polymerisation



Hydration of alkene

a) HydroBoration oxidation (HBO)

Reagents :- $\frac{\text{B}_2\text{H}_6 / \text{THF}}{\text{H}_2\text{O}_2 / \text{OH}^-}$ ($\text{H}^+ \text{ OH}^-$ Anti Mar)



Note:-

- *) Anti Mar
- *) Syn addition
- *) No carbocation formation
- *) stereospecific
- *) regioselective

b) Oxymercuration - demercuration (OM:DM)

Reagents :-

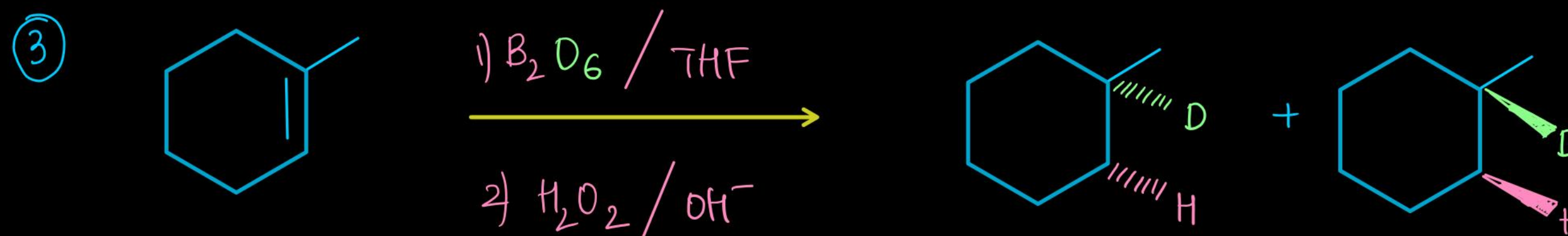
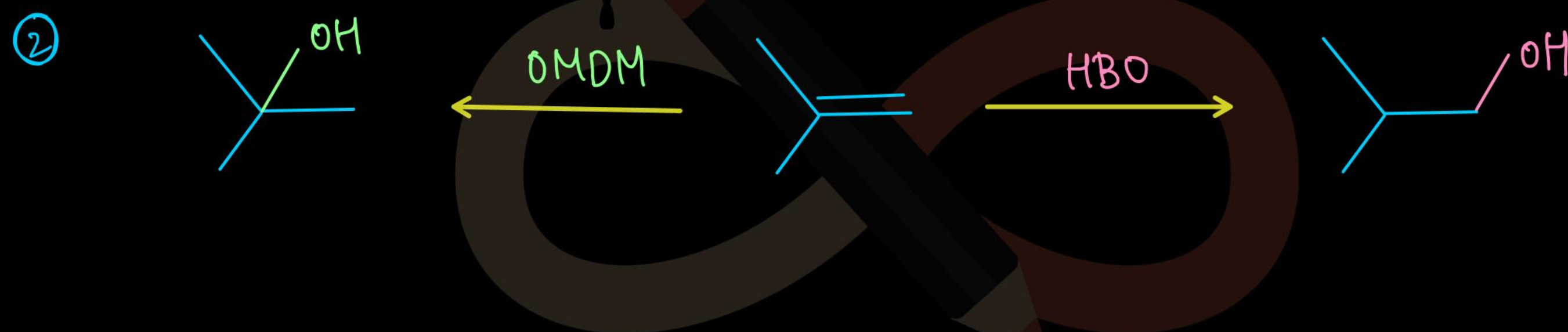
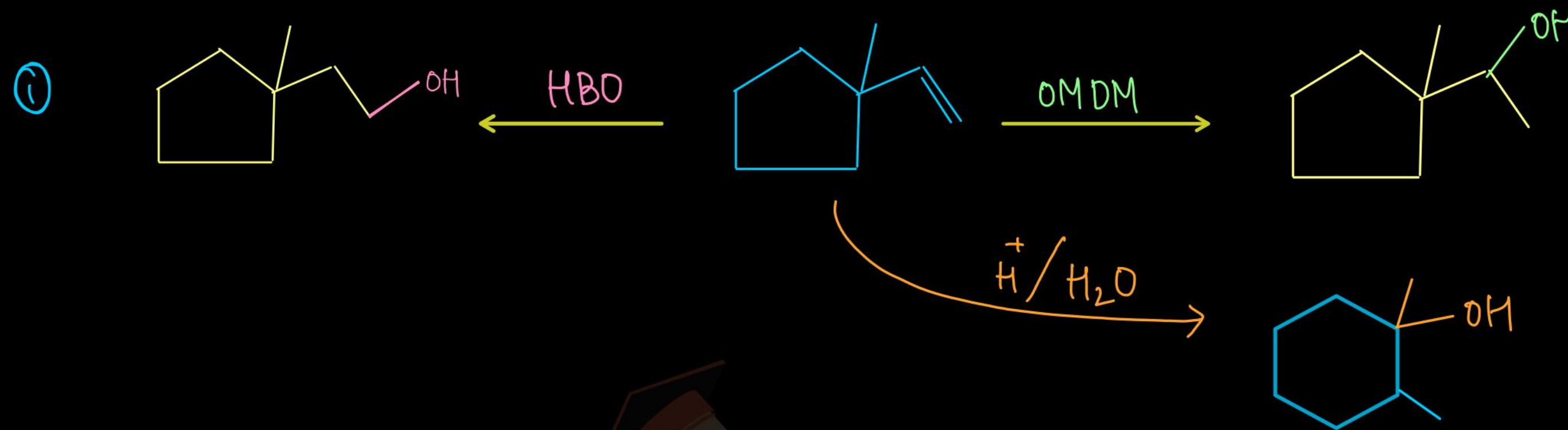
①	$\text{Hg}(\text{OAc})_2$
②	$\text{NaBH}_4 / \text{OH}^-$



Note :-

- * No carbocation is formed
- * Markonikov's rule
- * No - rearrangement
- * Anti - addition
- * Stereospecific

Practice :-



Q

