Poglavlje 12: Reakcije alkena

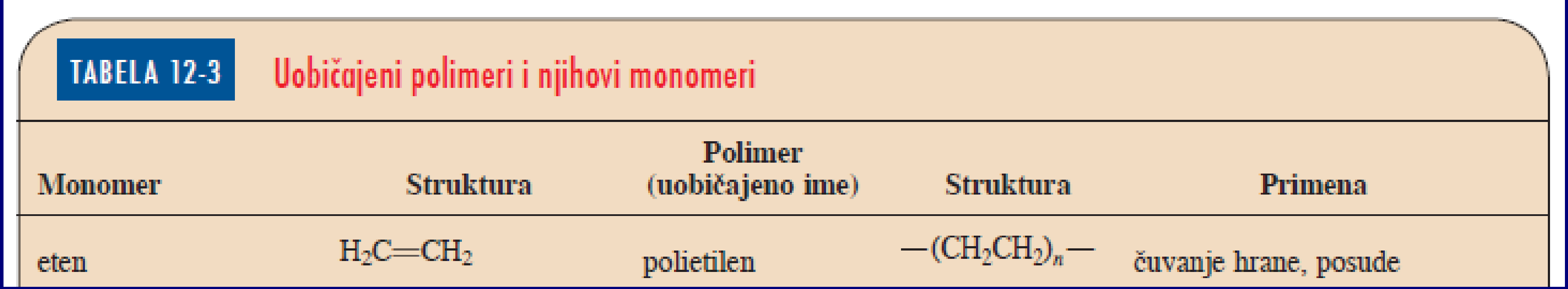
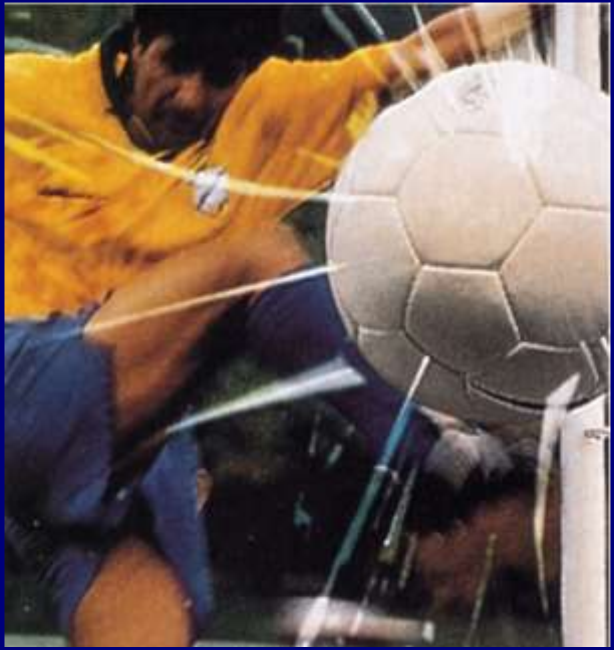


TABELA 12-3 Uobičajeni polimeri i njihovi monomeri

Monomer	Struktura	Polimer (uobičajeno ime)	Struktura	Primena
eten	$H_2C{=}CH_2$	polietilen	$-(CH_2CH_2)_n-$	čuvanje hrane, posude

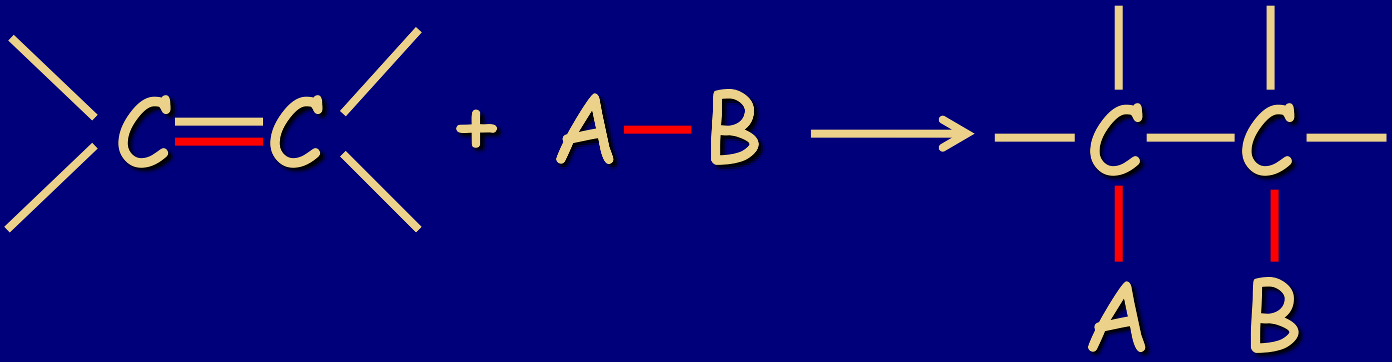
Polietilen



otporna na habanje

Adicione reakcije alkena

π veza je nezasićena, karakteristične reakcije adicije.



egzotermna reakcija

$$\Delta H^\circ = (DH^\circ_{\pi\text{-veza}} + DH^\circ_{A-B}) - (DH^\circ_{C-A} + DH^\circ_{C-B})$$

Vežba 12-1

Izračunajte ΔH° adicije H_2O_2 na eten, pri čemu se dobija 1,2-etandiol (etilen-glikol) ($DH^\circ_{\text{HO-OH}} = 51$ kcal mol^{-1}).

$$\Delta H^\circ = (65 + 51) - (94 + 94)$$

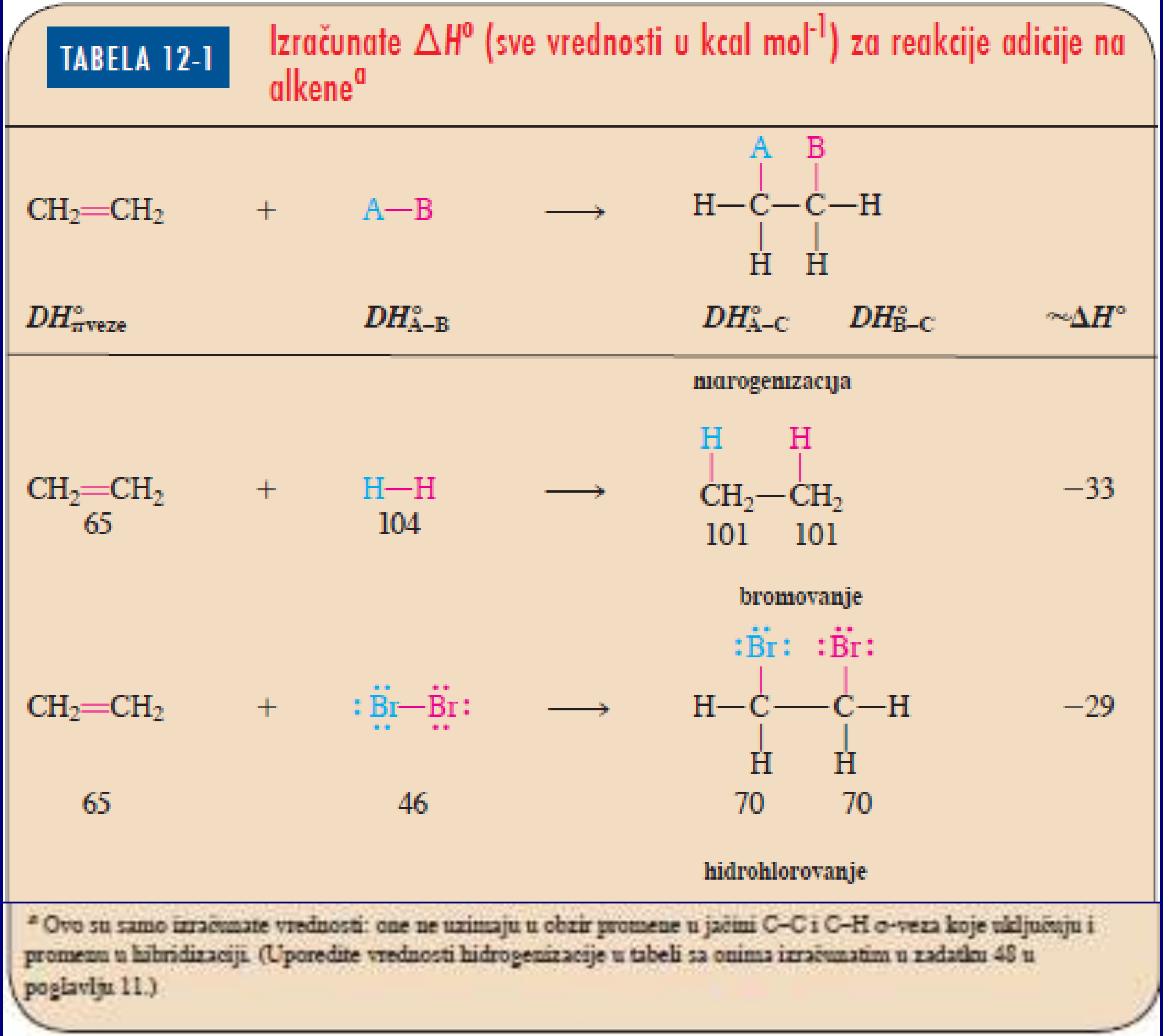


TABELA 12-1 Izračunate ΔH° (sve vrednosti u kcal mol^{-1}) za reakcije adicije na alkene[a]

$$CH_2{=}CH_2 + A{-}B \longrightarrow H{-}\overset{\overset{A}{|}}{\underset{\underset{H}{|}}{C}}{-}\overset{\overset{B}{|}}{\underset{\underset{H}{|}}{C}}{-}H$$

$DH^\circ_{\pi\,veze}$	DH°_{A-B}	DH°_{A-C}	DH°_{B-C}	$\sim\Delta H^\circ$

hidrogenizacija

$$CH_2{=}CH_2 + H{-}H \longrightarrow \overset{H}{\overset{|}{CH_2}}{-}\overset{H}{\overset{|}{CH_2}}$$

$DH^\circ_{\pi\,veze}$	DH°_{A-B}	DH°_{A-C}	DH°_{B-C}	$\sim\Delta H^\circ$
65	104	101	101	−33

bromovanje

$$CH_2{=}CH_2 + :\ddot{Br}{-}\ddot{Br}: \longrightarrow H{-}\overset{\overset{:\ddot{Br}:}{|}}{\underset{\underset{H}{|}}{C}}{-}\overset{\overset{:\ddot{Br}:}{|}}{\underset{\underset{H}{|}}{C}}{-}H$$

$DH^\circ_{\pi\,veze}$	DH°_{A-B}	DH°_{A-C}	DH°_{B-C}	$\sim\Delta H^\circ$
65	46	70	70	−29

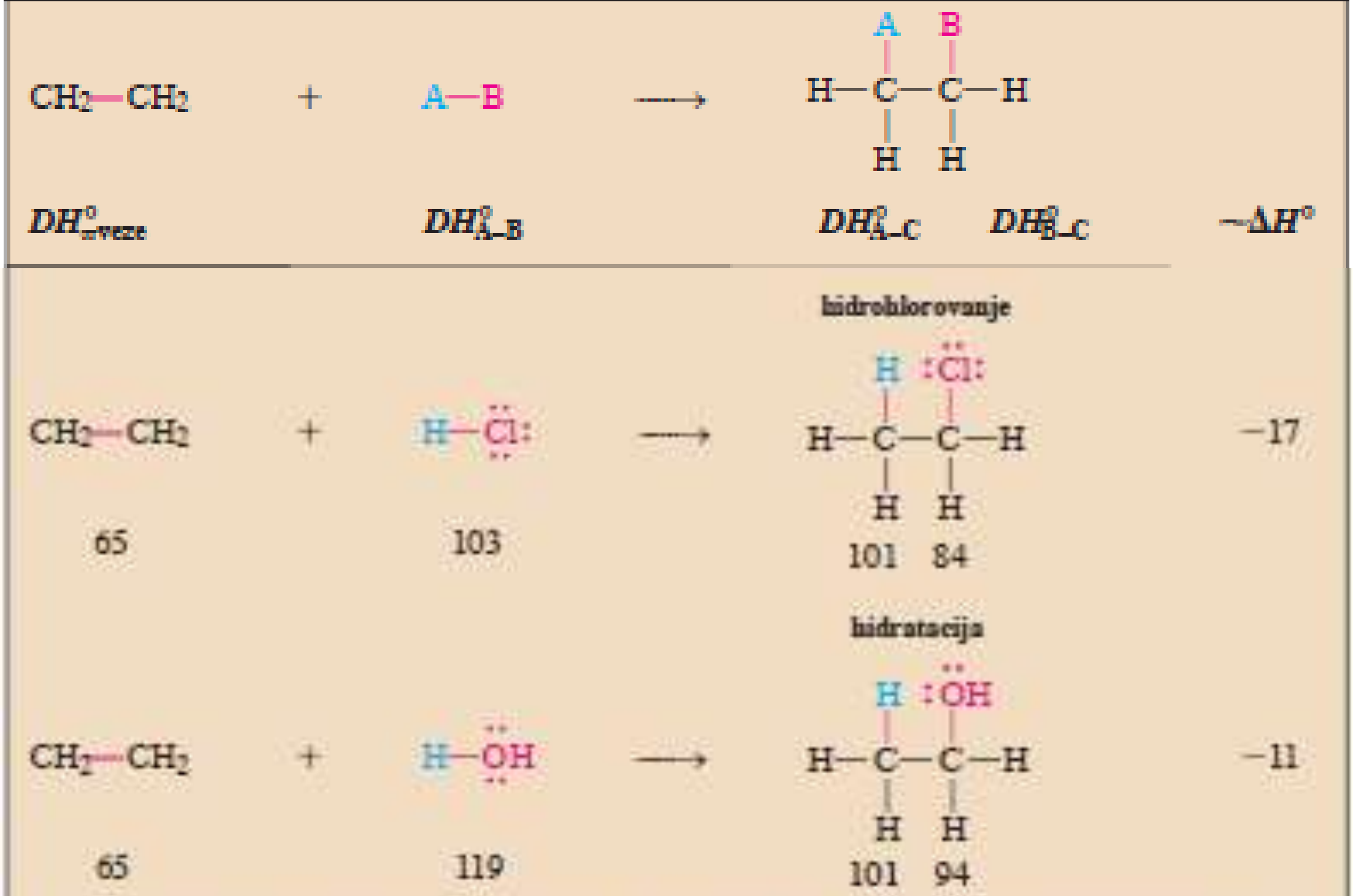
hidrohlorovanje

---

[a] Ovo su samo izračunate vrednosti: one ne uzimaju u obzir promene u jačini C–C i C–H σ-veza koje uključuju i promenu u hibridizaciji. (Uporedite vrednosti hidrogenizacije u tabeli sa onima izračunatim u zadatku 48 u poglavlju 11.)

TABELA 12-1

Izračunate ΔH° (sve vrednosti u kcal mol^{-1}) za reakcije adicije na alkene[a]



$$CH_2-CH_2 + A-B \longrightarrow H-\underset{H}{\overset{A}{C}}-\underset{H}{\overset{B}{C}}-H$$

hidrohlorovanje

$$CH_2-CH_2 + H-\ddot{\underset{..}{Cl}}: \longrightarrow H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{:\ddot{Cl}:}{C}}-H$$

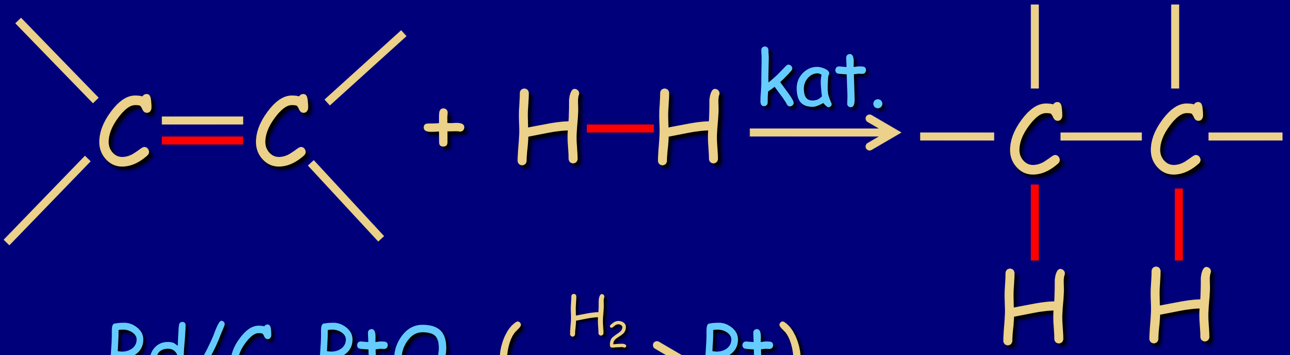
hidratacija

$$CH_2-CH_2 + H-\ddot{\underset{..}{O}}H \longrightarrow H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{:\ddot{O}H}{C}}-H$$

	$DH^\circ_{\pi veze}$	DH°_{A-B}	DH°_{A-C}	DH°_{B-C}	$-\Delta H^\circ$
hidrohlorovanje	65	103	101	84	−17
hidratacija	65	119	101	94	−11

[a] Ovo su samo izračunate vrednosti: one ne uzimaju u obzir promene u jačini C–C i C–H σ-veza koje uključuju i promenu u hibridizaciji. (Uporedite vrednosti hidrogenizacije u tabeli sa onima izračunatim u zadatku 48 u poglavlju 11.)

1. Katalitička hidrogenizacija: H_2 + katalizator

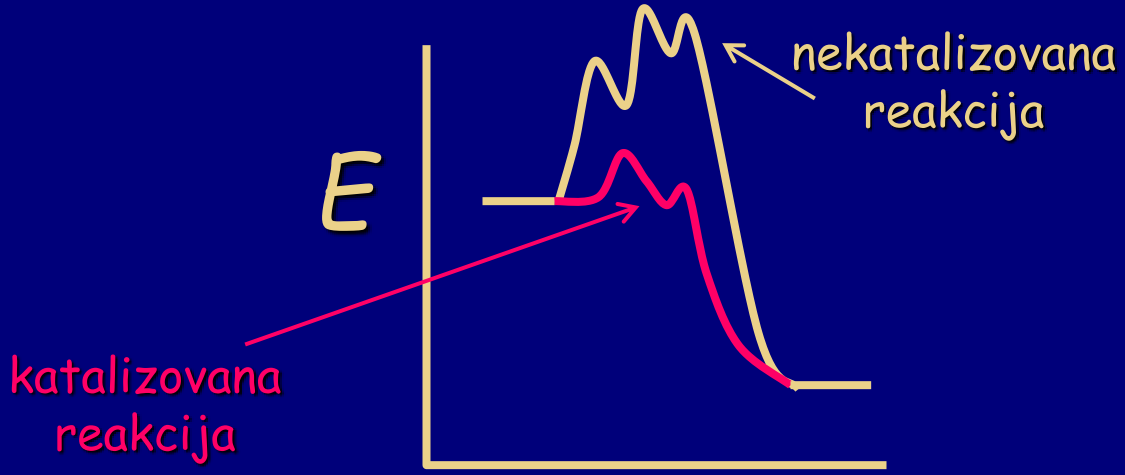


Heterogena
kataliza

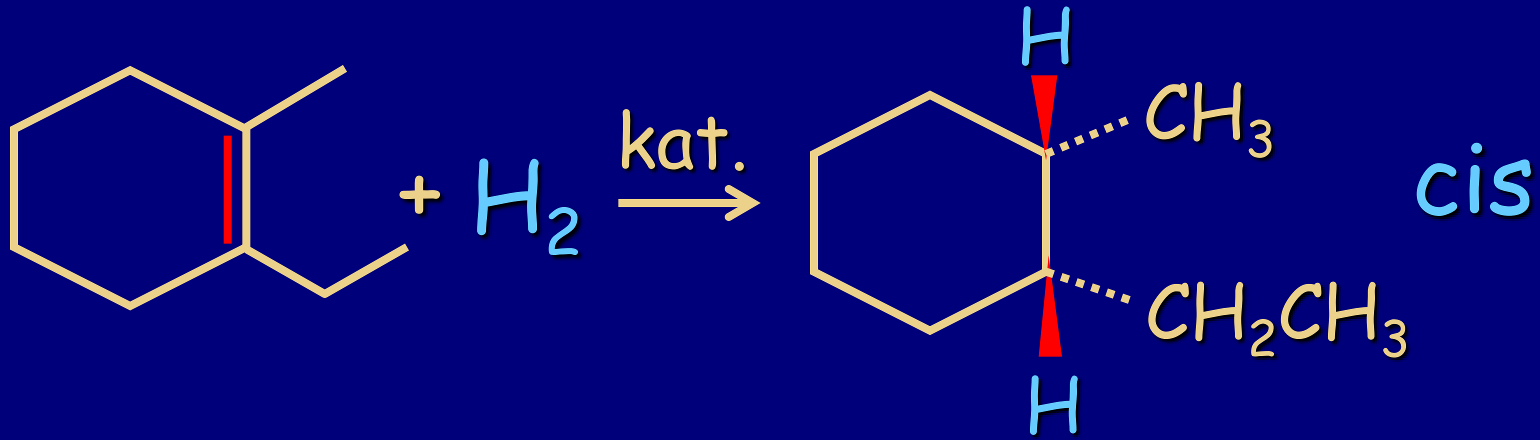
Pd/C, PtO_2 ($\xrightarrow{H_2}$ Pt)

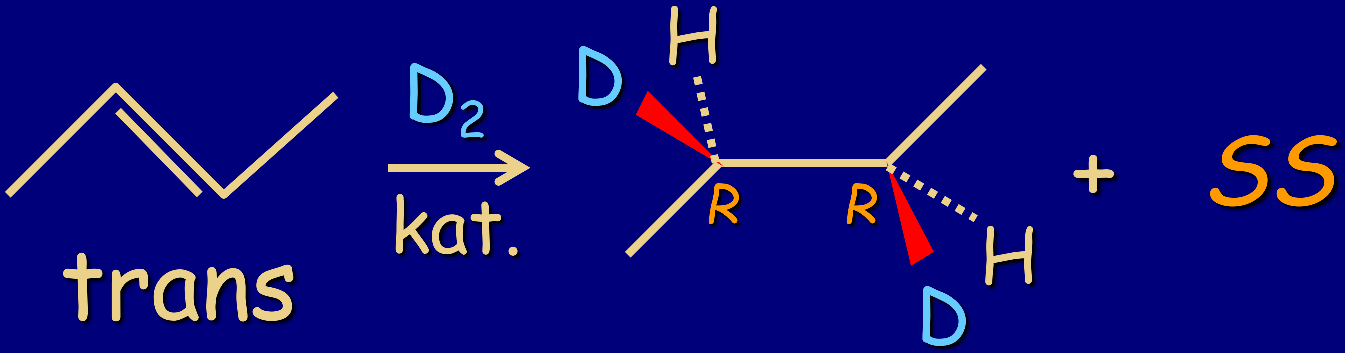
Zašto kataliza? Mehanizam snižavanj Ea

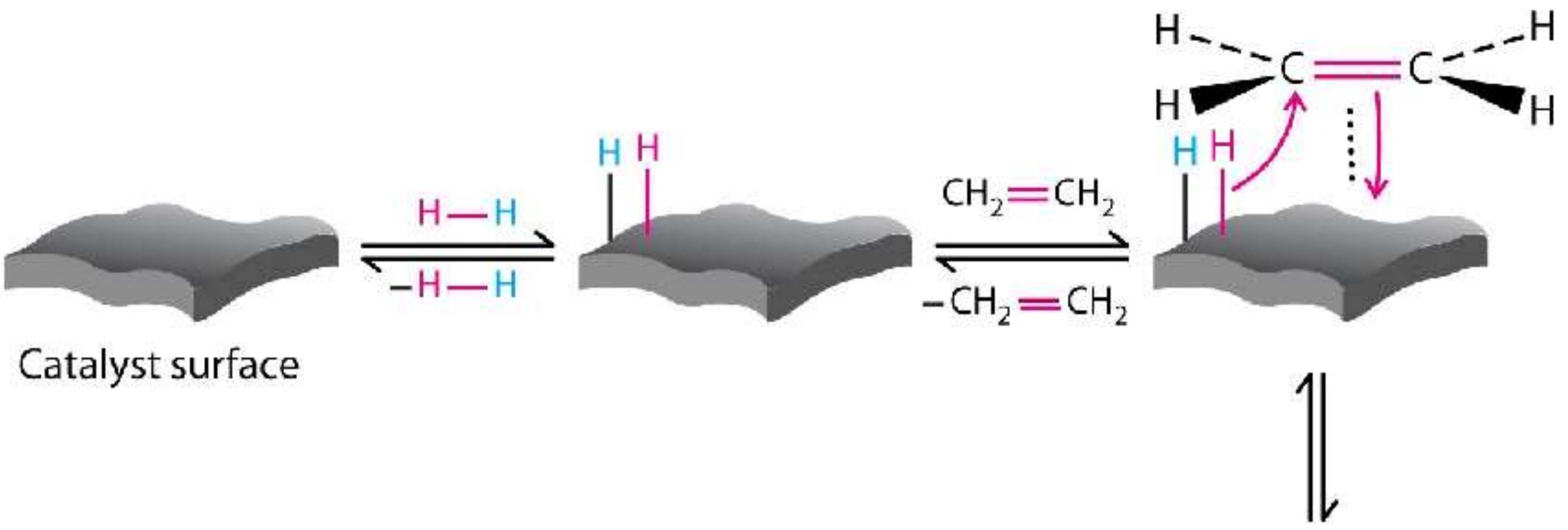
Alkeni + H_2 $\not\rightarrow$
nema reakcije
bez katalizatora

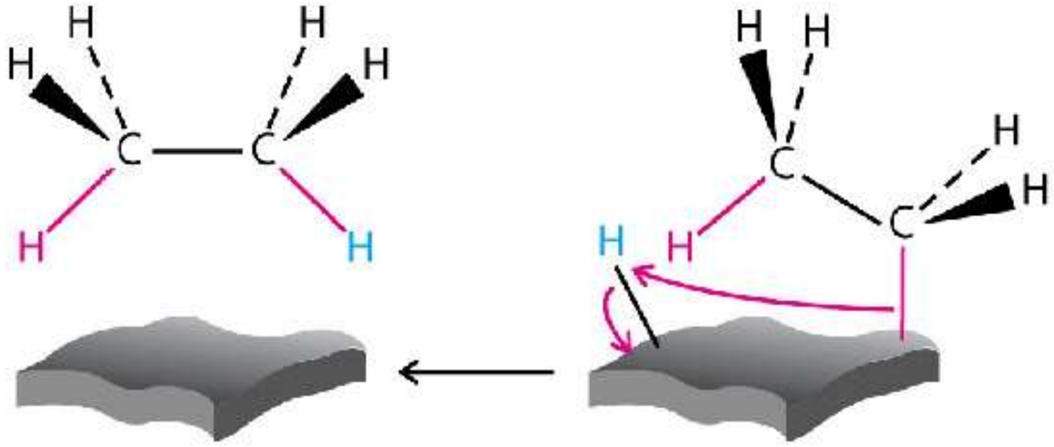


Mehanizam hidrogenizacije: do reakcije dolazi na površini katalizatora. Dolazi do stereospecifične adicije sa iste strane dvostruke veze (sin adicija).









Vežba 12-2

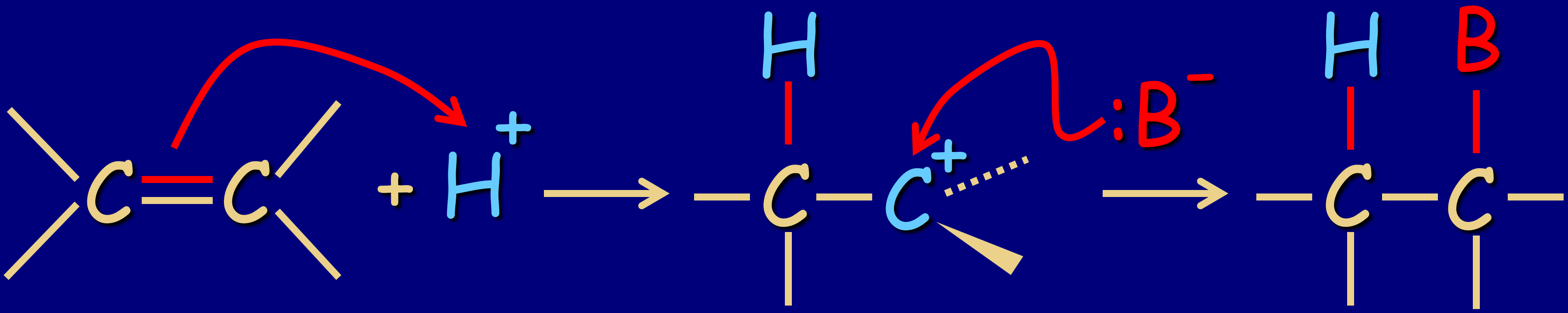
Katalitička hidrogenizacija (S)-2,3-dimetil-1-pentena daje samo jedan optički aktivni proizvod. Nacrtajte proizvod i objasnite rezultat. [**Pomoć:** da li adicija H_2 (1) stvara novi stereocentar ili (2) utiče na neku od veza u okolini već postojećeg stereocentra?]

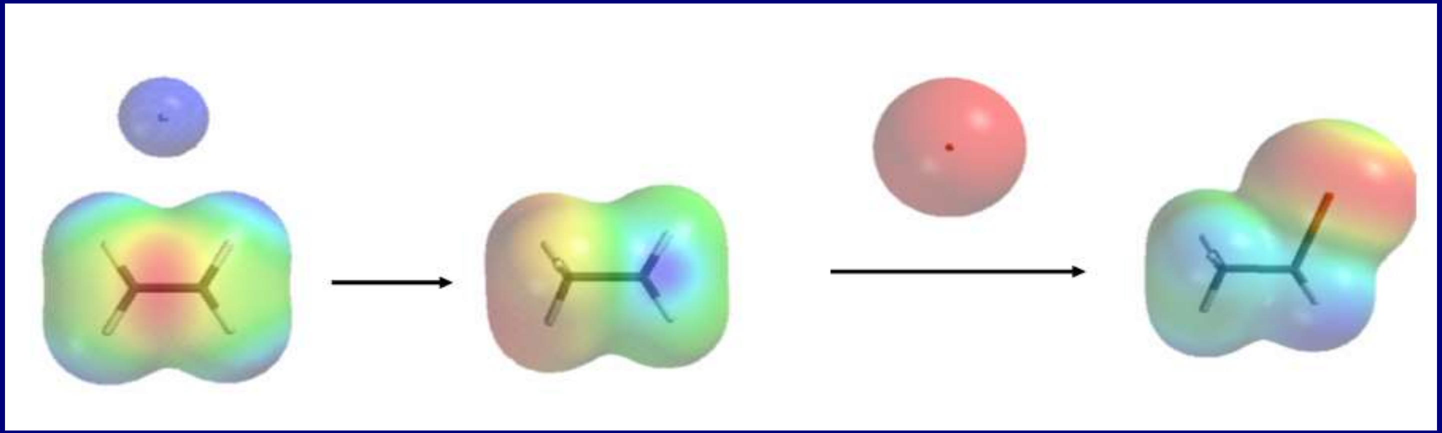
Biljna ulja, margarine, i buter: “očvršćavanje” nakon hidrogenizacije

Elektrofilne adicije

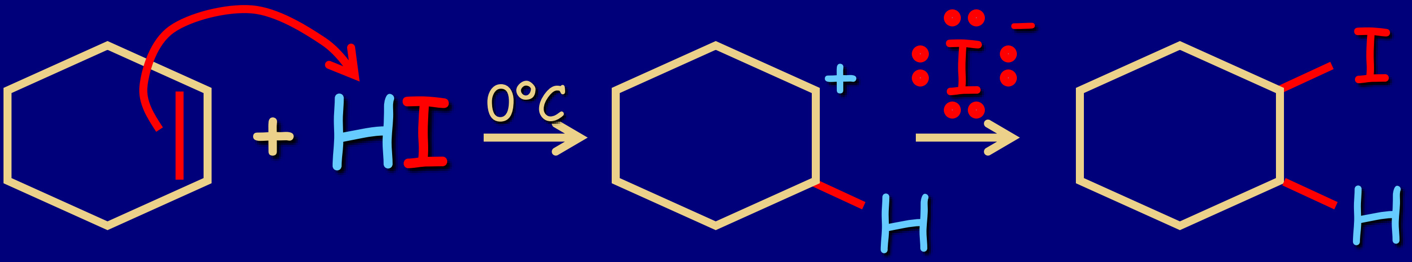
π veza je elektron-bogata. Adicija polarnih reagenasa $\overset{\delta+}{A}$-$\overset{\delta-}{B}$.

Mehanizam za $A^{\delta+} = H^{+}$: Obrnuto od E1!



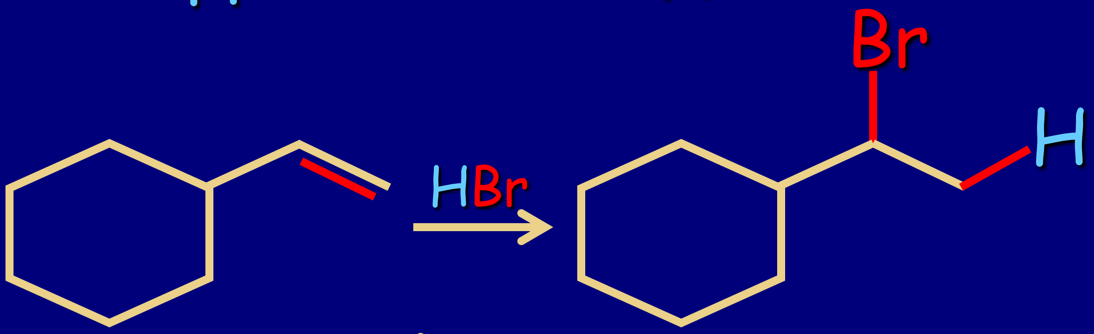


Hidrohalogenovanje $H^+ :X:^-$

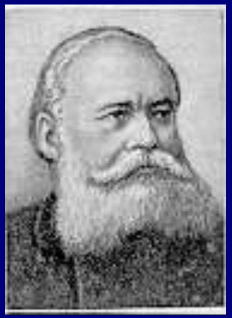


Obrnuto u odnosu na eliminaciju

Regioselektivna reakcija:



Markovnikov-ljevo pravilo

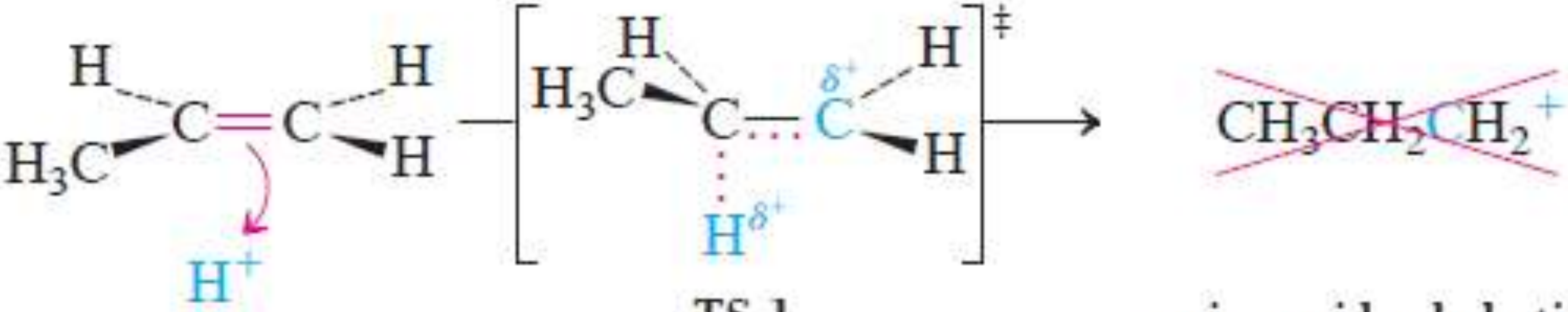


1838-1904

H^+ ($A^{\delta+}$) se adira na manje supstituisan ugljenik

Zašto? Protonovanjem nastaje više supstituisani katjon

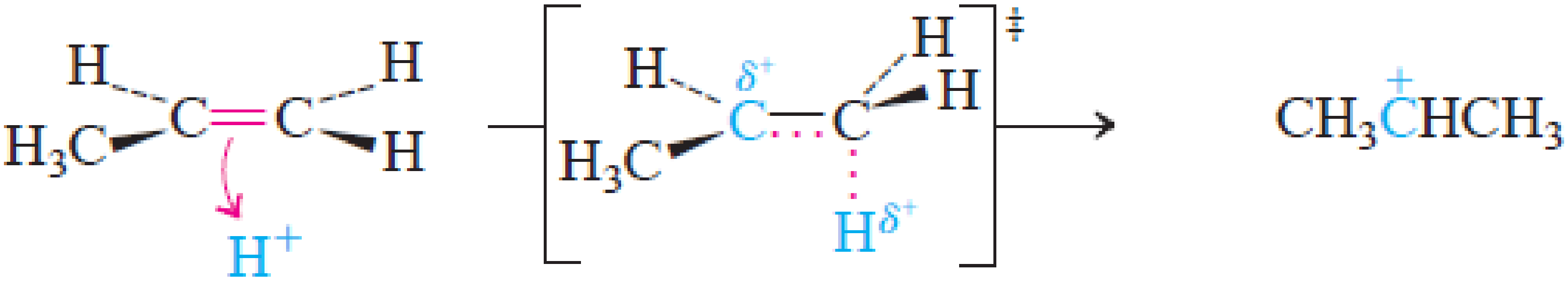
Protonovanje propena na C2



TS-1

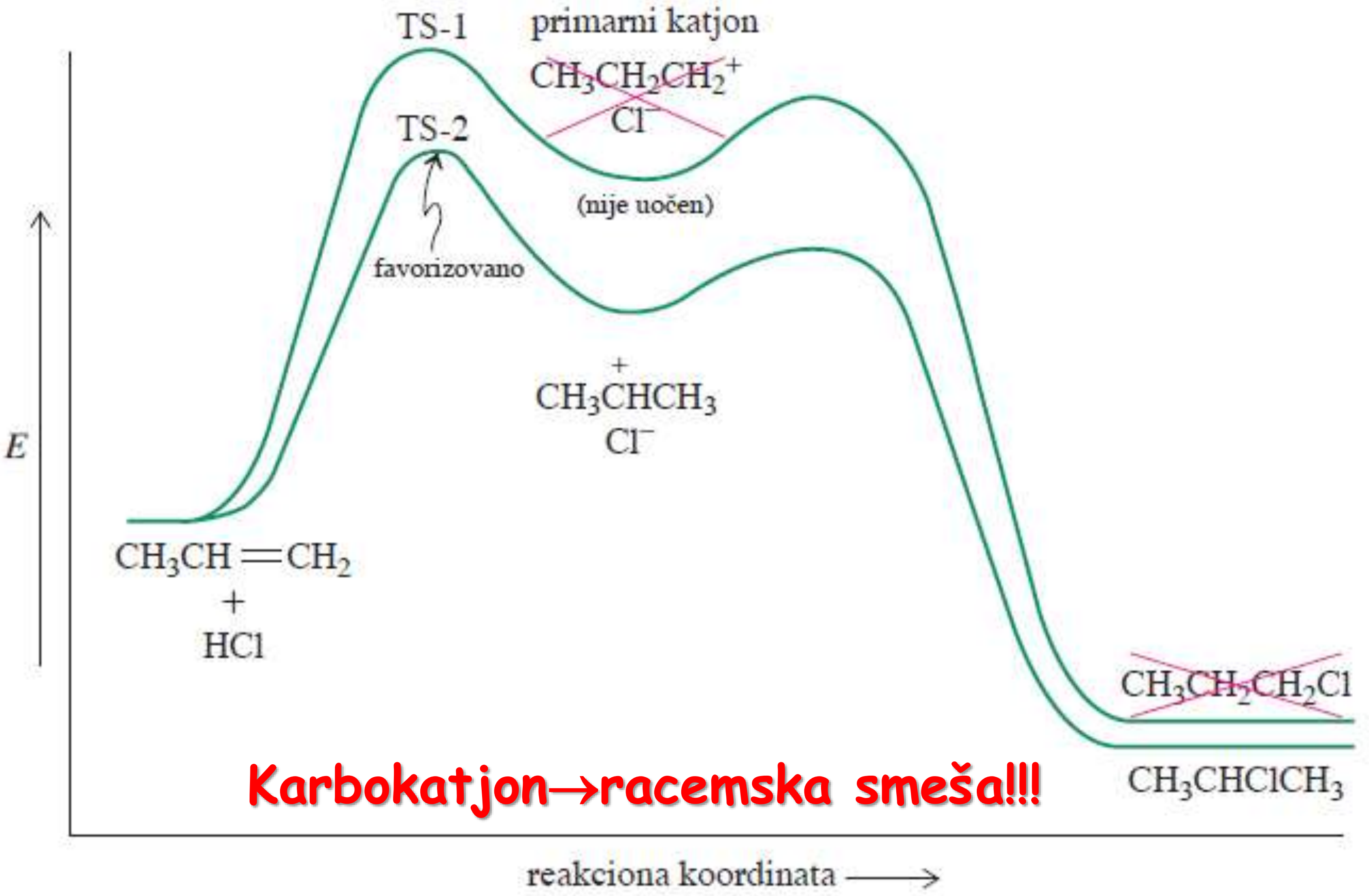
primarni karbokatjon
(nije detektovan)

Protonovanje propena na C1



TS-2

sekundarni karbokatjon
(favorizovan)

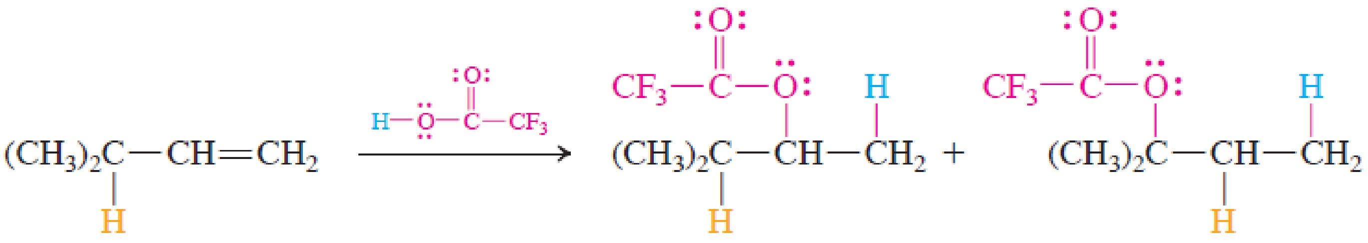


Karbokatjon→racemska smeša!!!

Vežba 12-3

Predvidite ishod adicije HBr na: **(a)** 1-heksen; **(b)** *trans*-2-penten; **(c)** 2-metil-2-buten; **(d)** 4-metilcikloheksen. Koliko se izomera gradi u svakom pojedinačnom slučaju?

U toku elektrofilne adicije može doći do premeštanja karbokatjona



43%

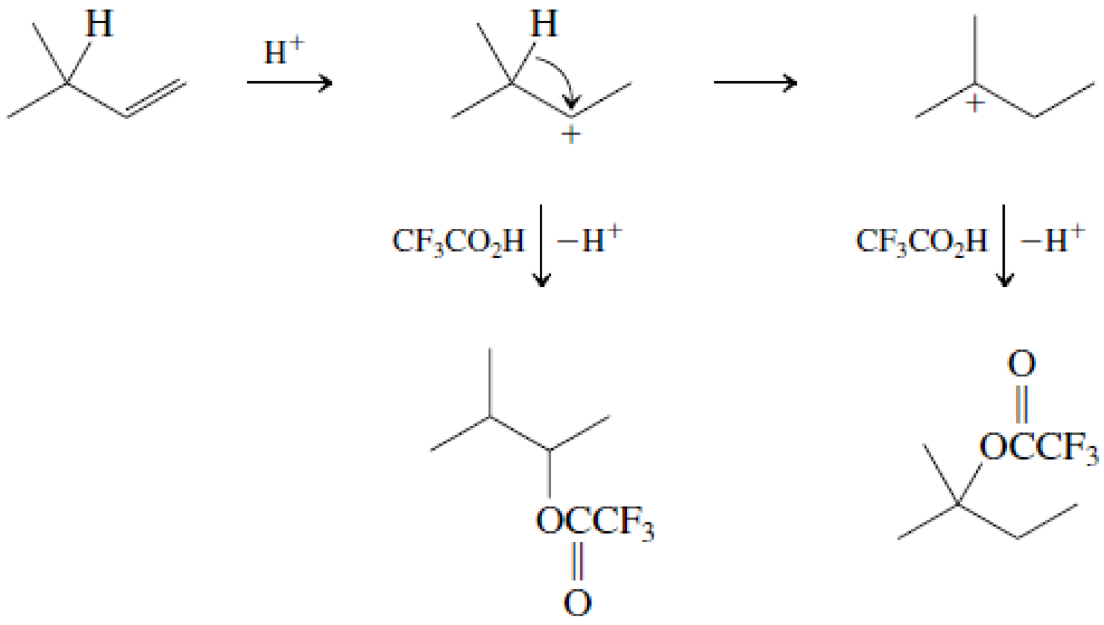
3-metil-2-butil-trifluoracetat

(proizvod normalne Markovnikov-ljeve adicije)

57%

2-metill-2-butil-trifluoracetat

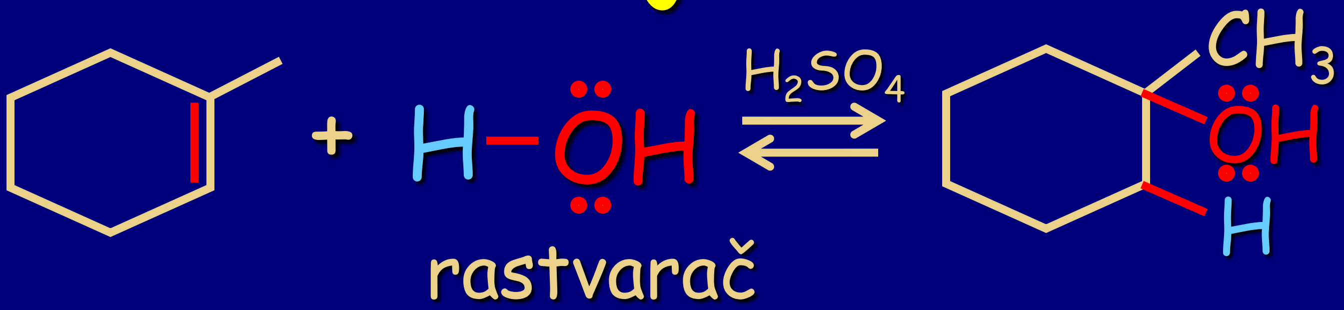
(proizvod nastao nakon premeštanja karbokatjona)



Uslovi za premeštanje: jaka kiselina + slab nukleofil

Markovnikov-ljeva hidratacija

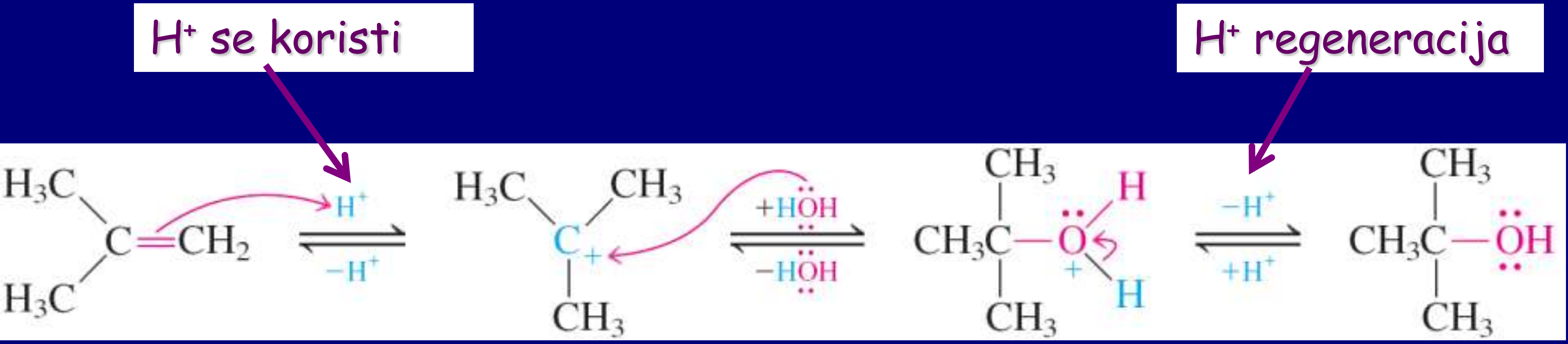
H_2O, H^+ katalizator



Ravnoteža !

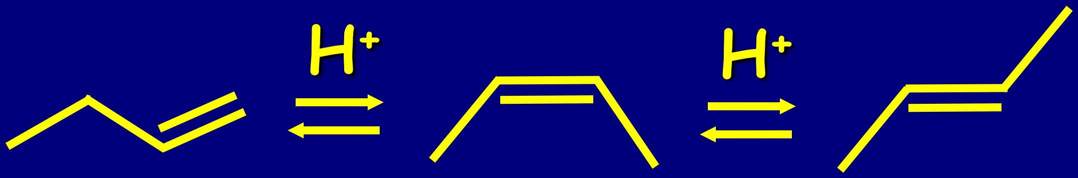
Reverzibilna hidratacija 2-metilpropena:

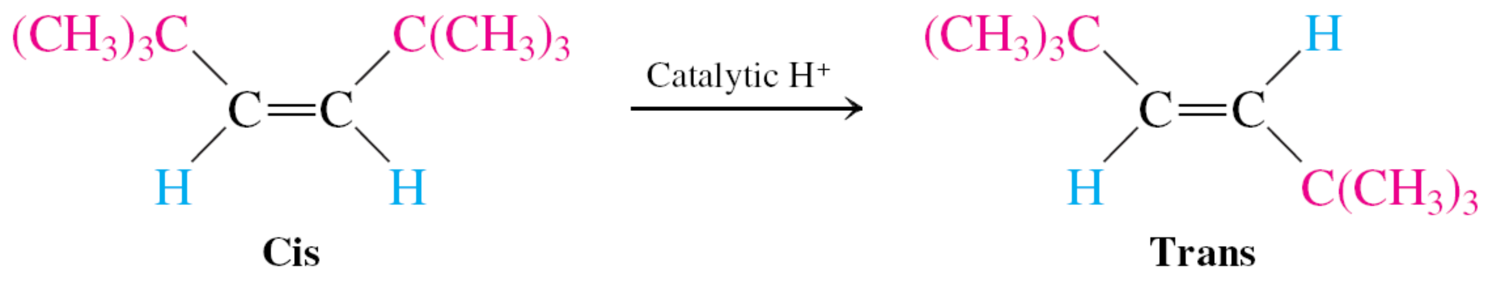
$$\text{alkohol} \underset{H_2SO_4,\ \text{višak } H_2O,\ \text{niska temperatura}}{\overset{\text{konc. } H_2SO_4,\ \text{visoka temperatura}}{\rightleftharpoons}} \text{alken} + H_2O$$

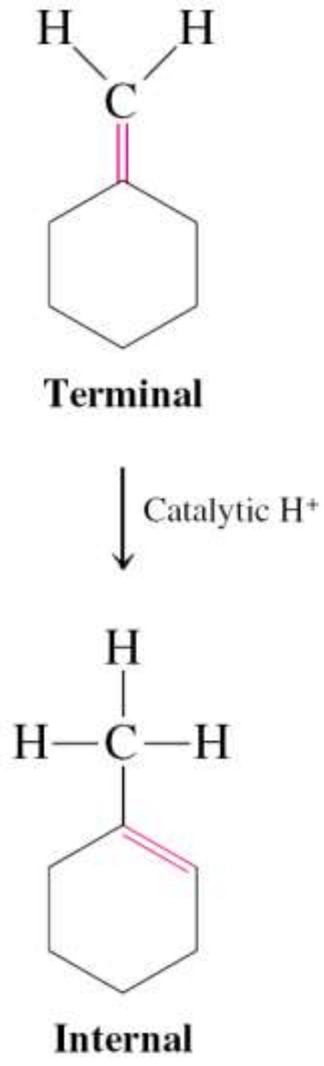


Posledice reverzibilnosti E1

Izomerizacija alkena







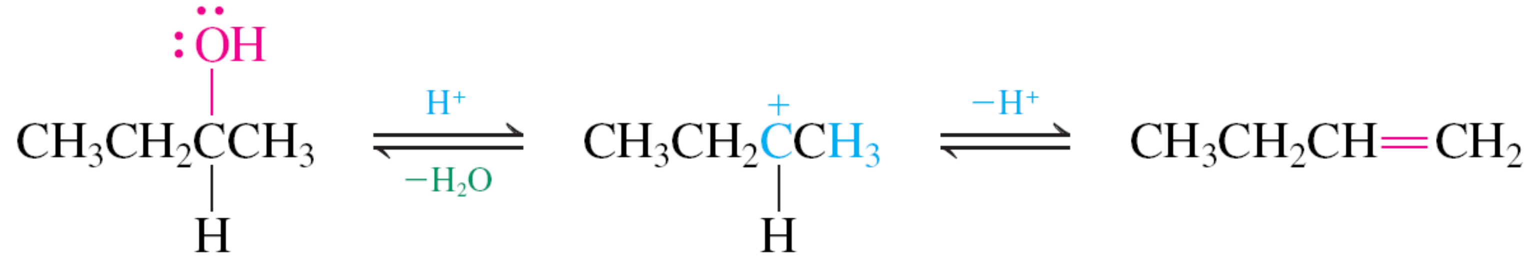
ravnoteža = termodinamička kontrola

Vežba 12-6

Dejstvo katalitičke količine deuterisane sumporne kiseline na 2-metilpropen u D_2O daje $(CD_3)_3COD$. Objasnite mehanizam.

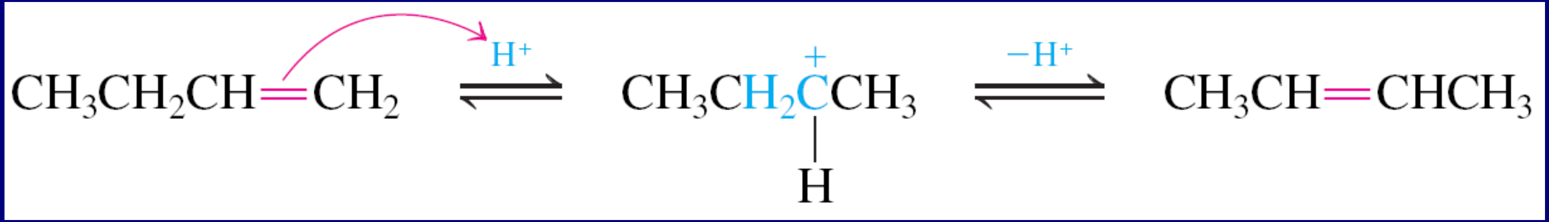
Mehanizam termodinamičke kontrole

Faza 1



$$\mathrm{CH_3CH_2\overset{:\ddot{O}H}{\underset{H}{C}}CH_3 \underset{-H_2O}{\overset{H^+}{\rightleftharpoons}} CH_3CH_2\overset{+}{\underset{H}{C}}CH_3 \overset{-H^+}{\rightleftharpoons} CH_3CH_2CH{=}CH_2}$$

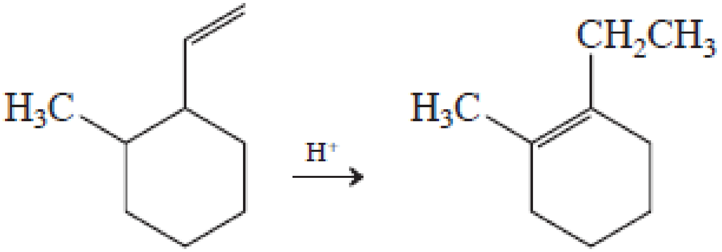
Faza 2



$$\mathrm{CH_3CH_2CH{=}CH_2 \overset{H^+}{\rightleftharpoons} CH_3CH_2\overset{+}{\underset{H}{C}}CH_3 \overset{-H^+}{\rightleftharpoons} CH_3CH{=}CHCH_3}$$

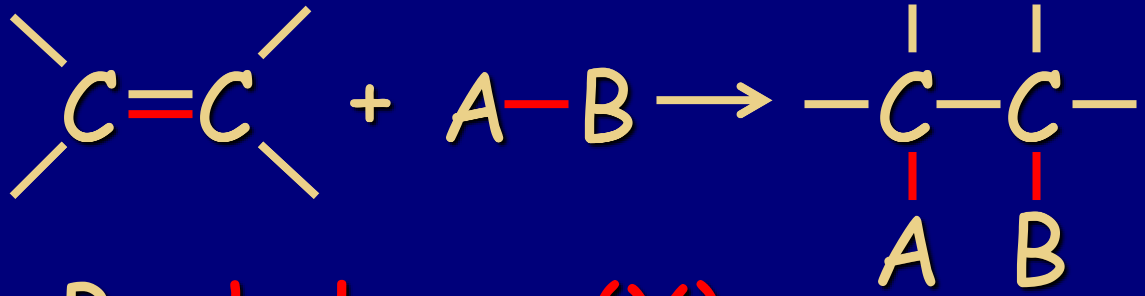
Vežba 12-7

Napišite mehanizam predstavljenog premeštanja. Zbog čega se ova reakcija vrši?

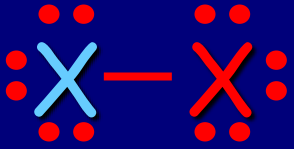


HALOGENIVANJE

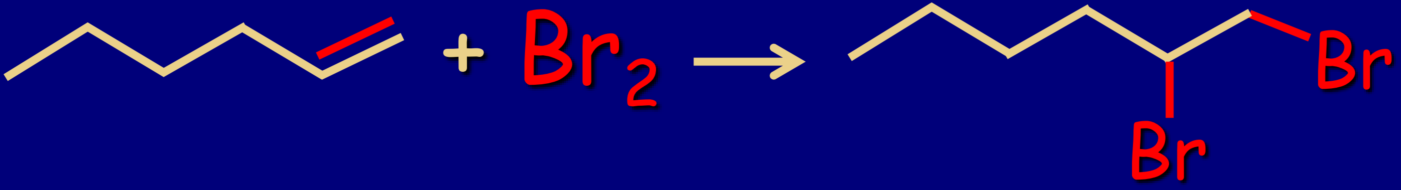
podsećanje:



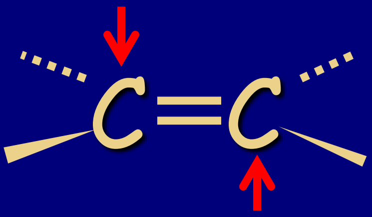
A = B = halogen (X)



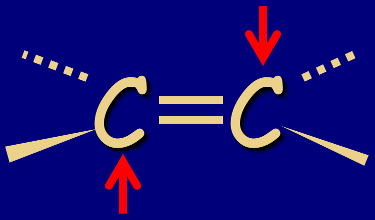
polarizacija veze



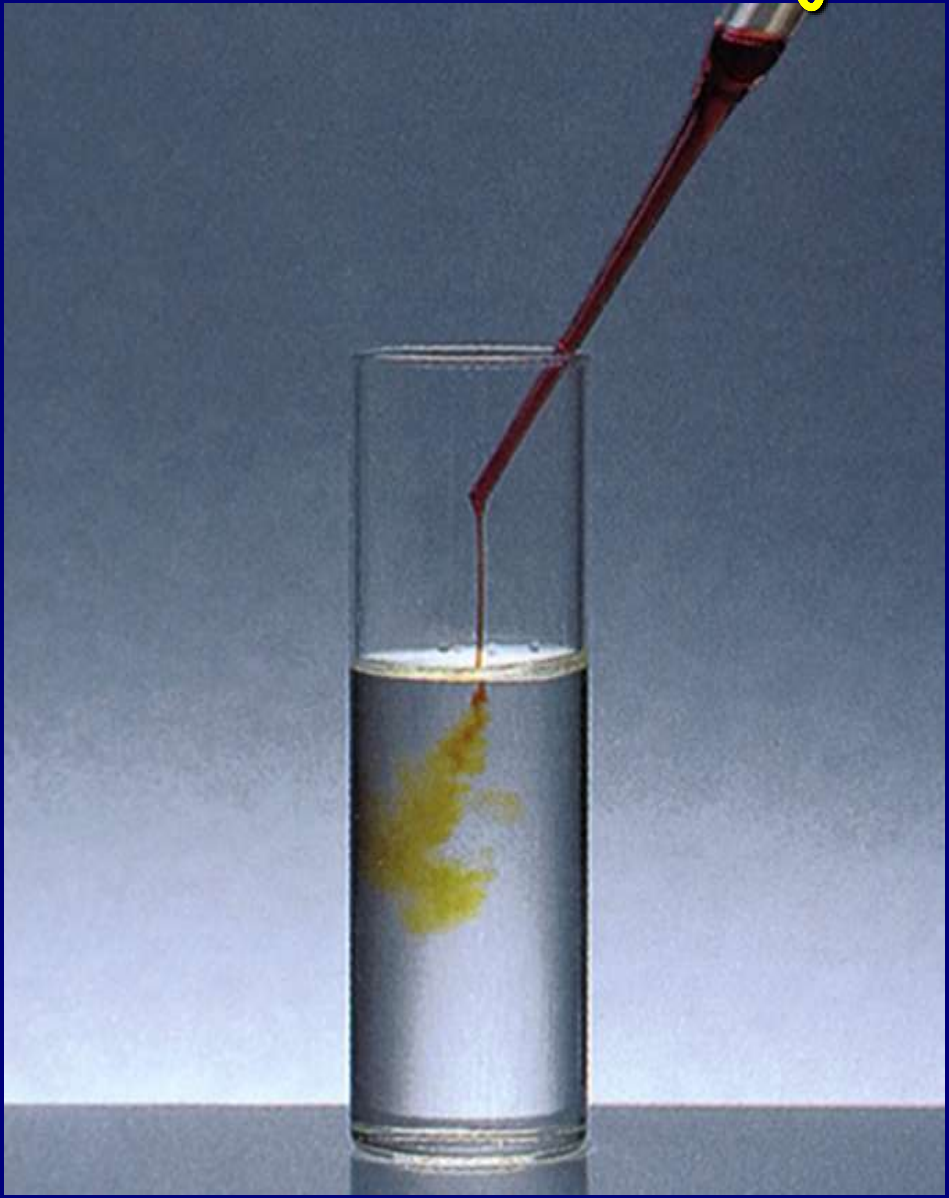
Stereospecifična adicija: anti (nije sin)



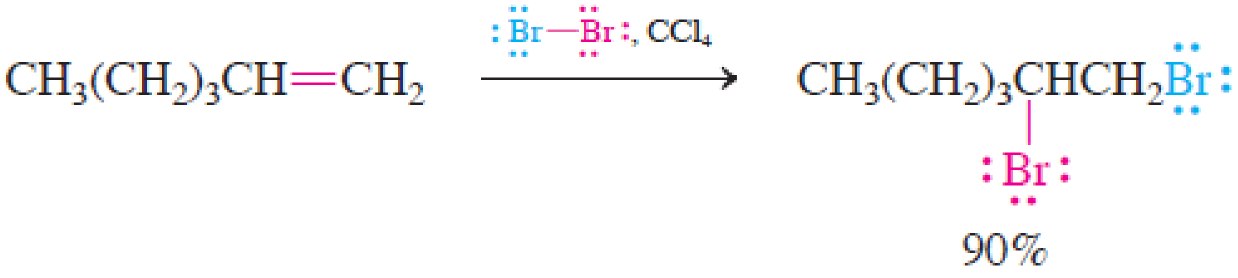
ili



Bromovanje: moguća “titracija” test za nezasićenje



Elektrofilna adicija Br_2 na 1-heksen



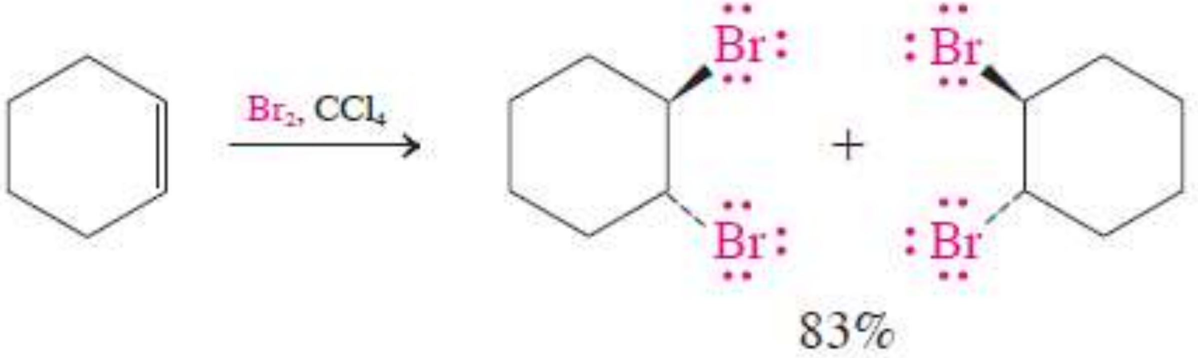
$$CH_3(CH_2)_3CH{=}CH_2 \xrightarrow{Br{-}Br,\ CCl_4} CH_3(CH_2)_3CH(Br)CH_2Br$$

1-heksen

1,2-dibromheksan

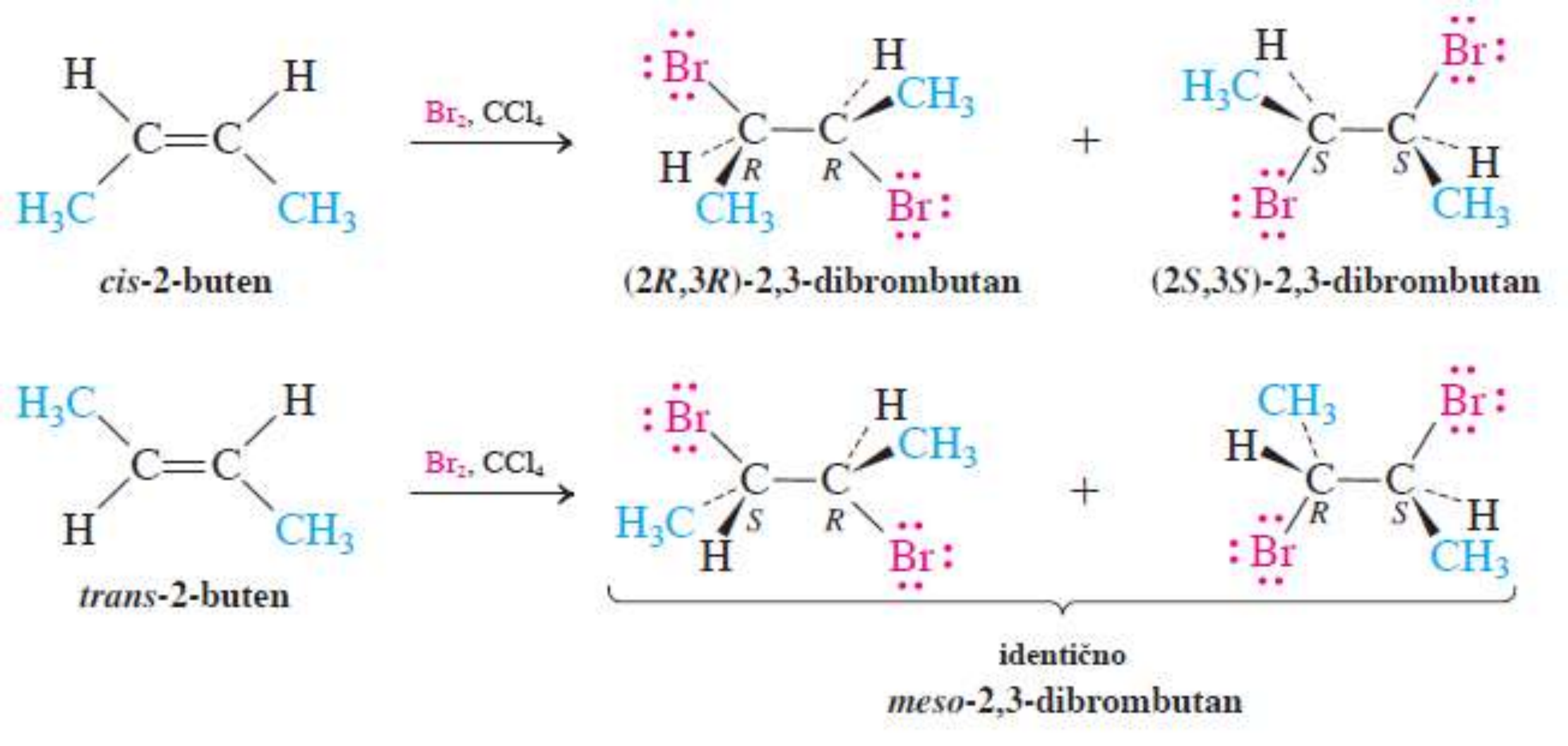
Bromovanje je anti adicija

anti-bromovanje cikloheksena

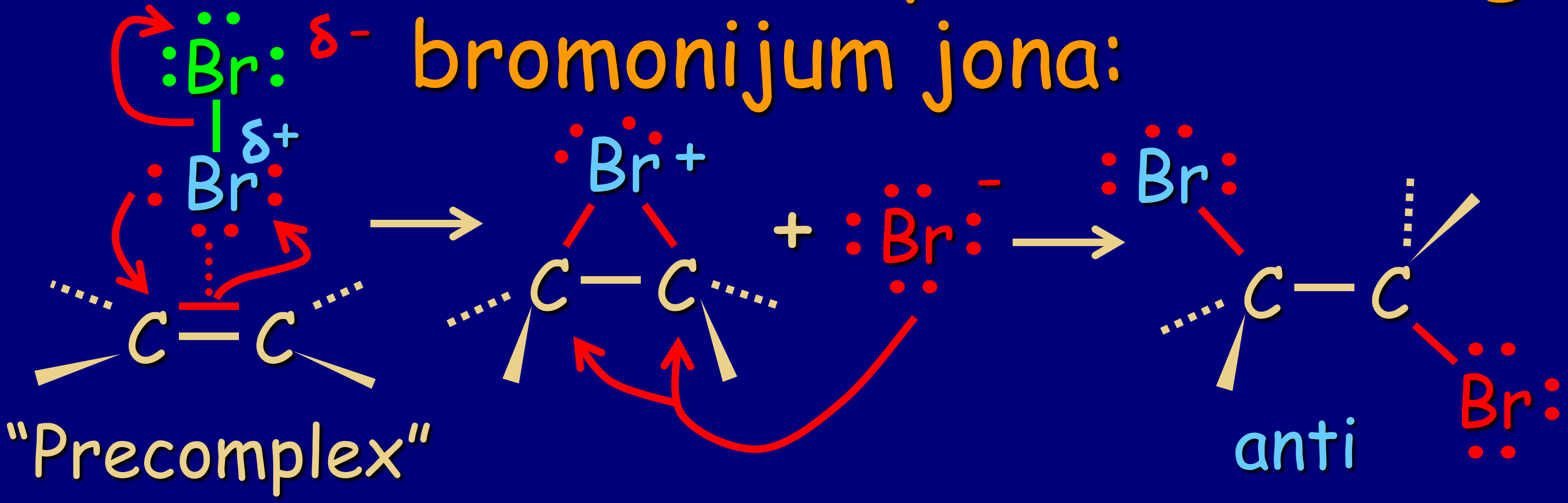


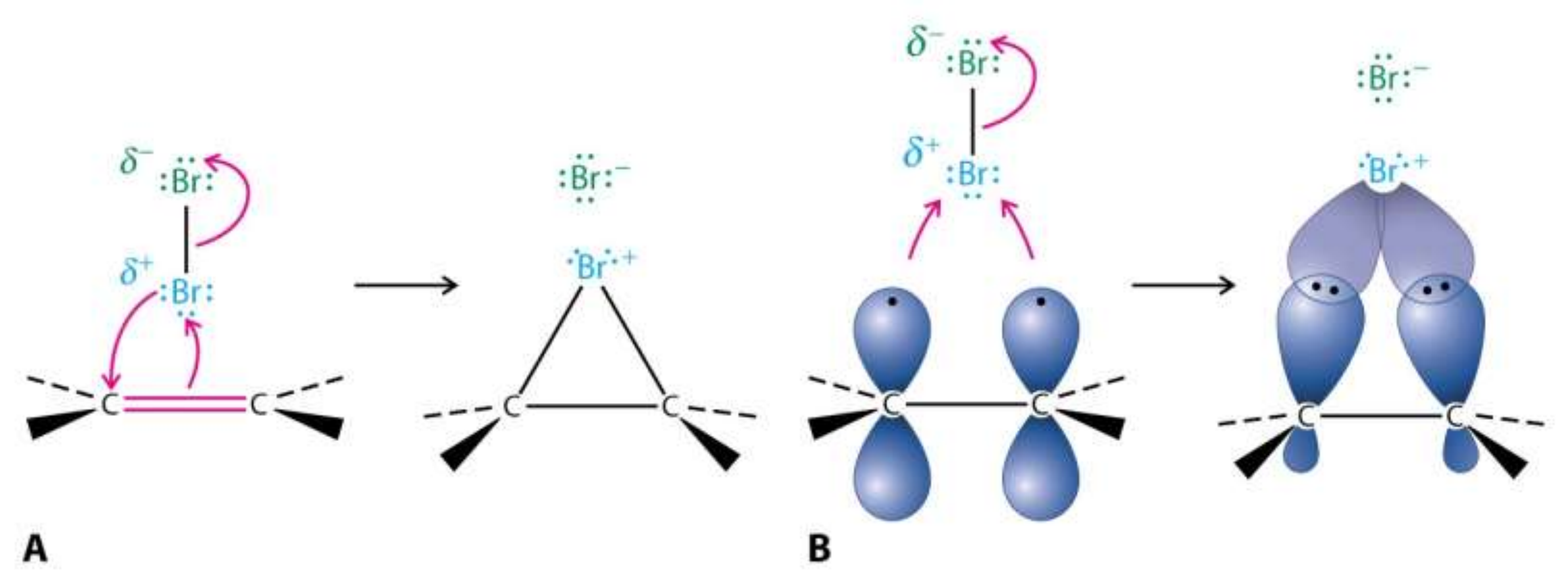
racemski *trans*-1,2-dibromcikloheksan

Stereospecifično bromovanje 2-butena

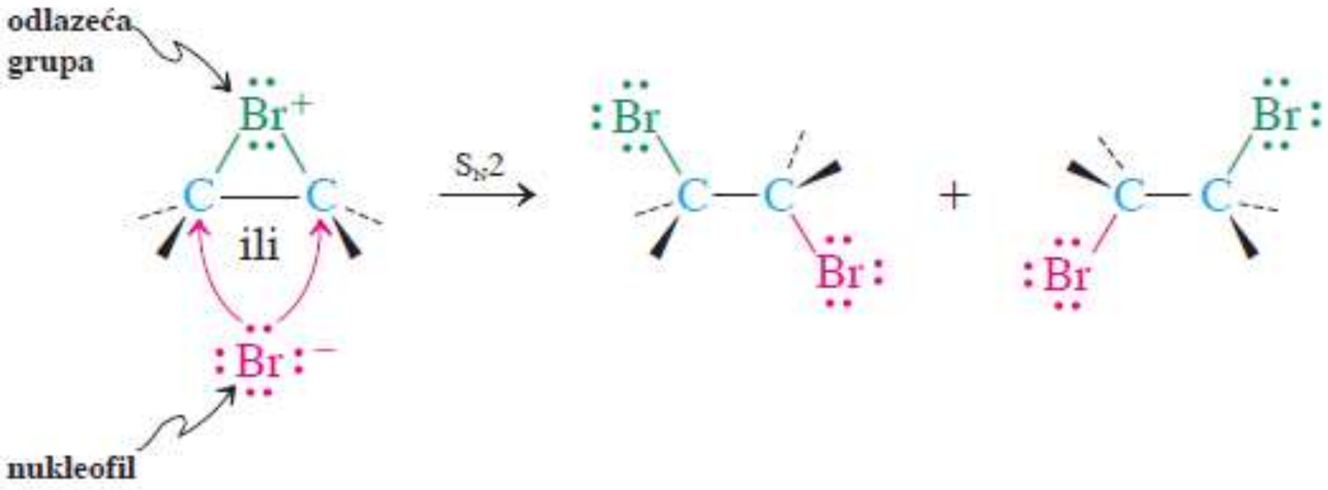


Mehanizam preko cikličnog bromonijum jona:



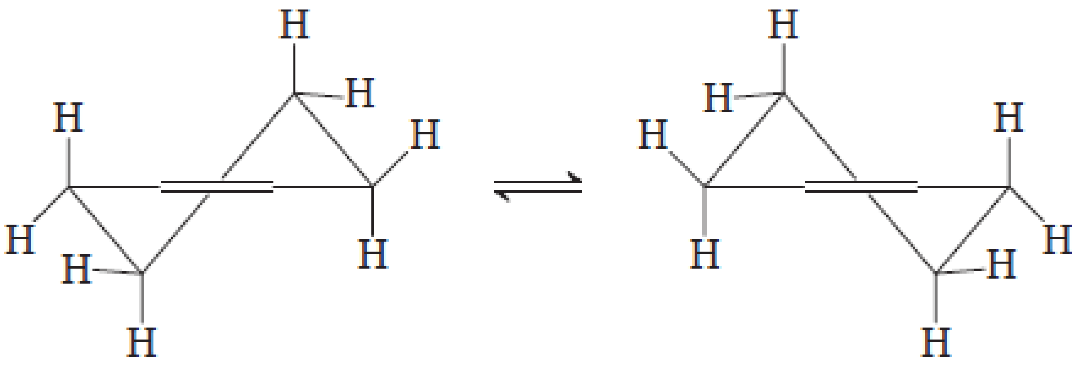


Nukleofilno otvaranje cikličnog bromonijum jona



Vežba 12-9

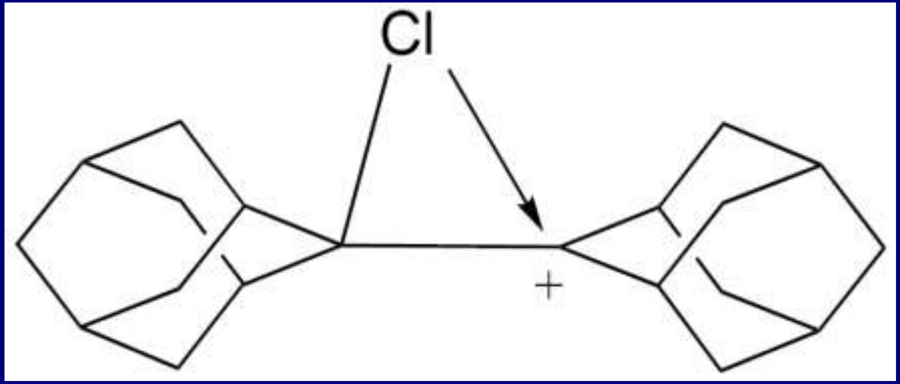
Nacrtajte intermedijer koji nastaje bromovanjem cikloheksena, koristeći dole date konformacije. Pokažite zašto se dobija racemski proizvod. Šta možete reći o početnoj konformaciji proizvoda?

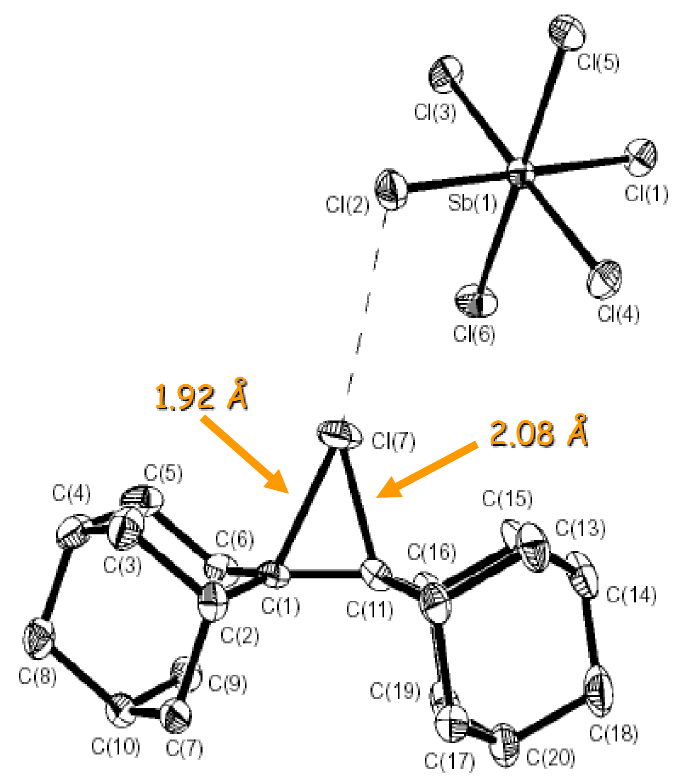


konformaciona ravnoteža cikloheksena

Struktura hloronijum jona

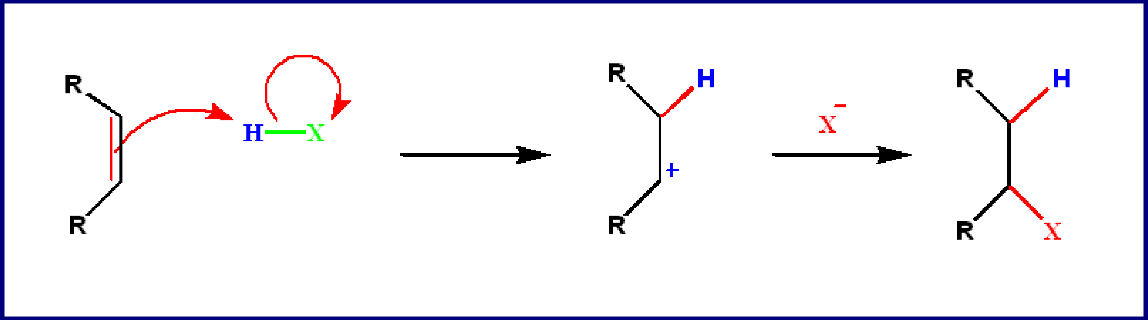
Kochi, *Chem. Commun.* 1998



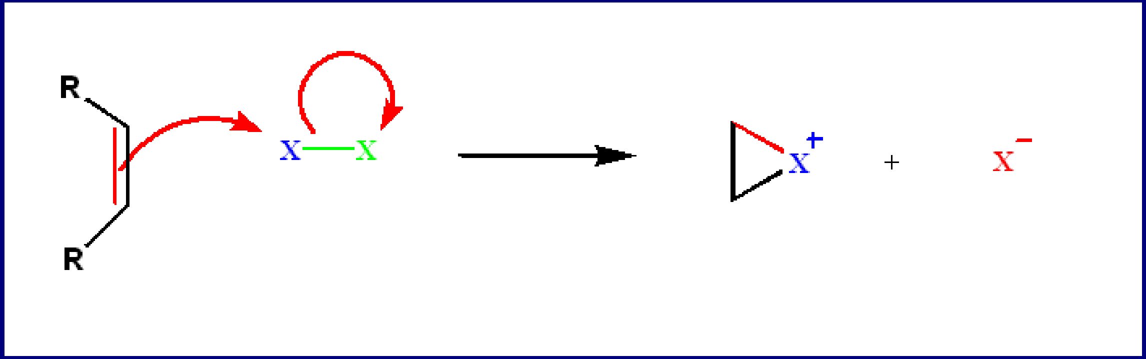


Alkeni kao nukleofili/baze

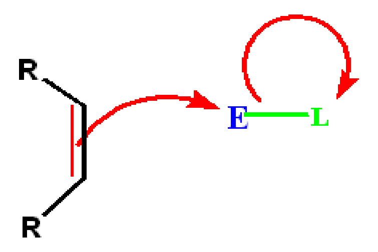
Baze:



Nukleofili:

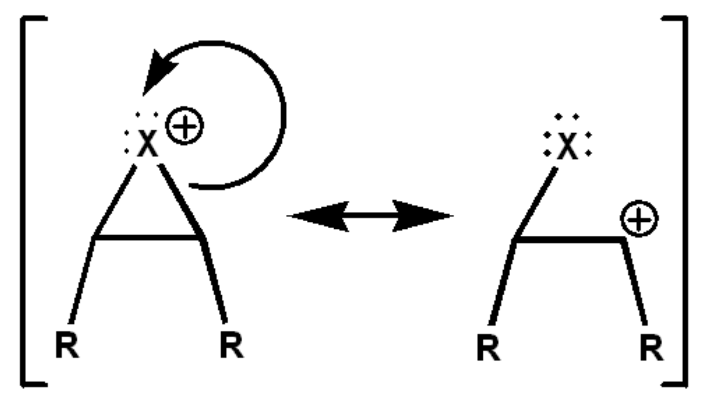


Generalno:

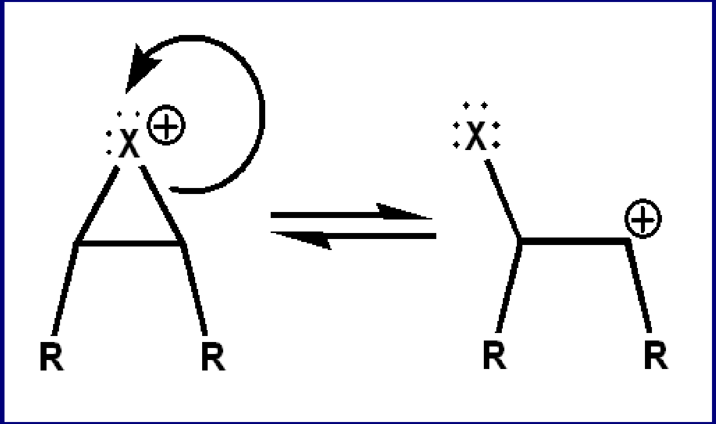


Ciklični halonijum joni: rezonancija naspram ravnoteže

Rezonancija:

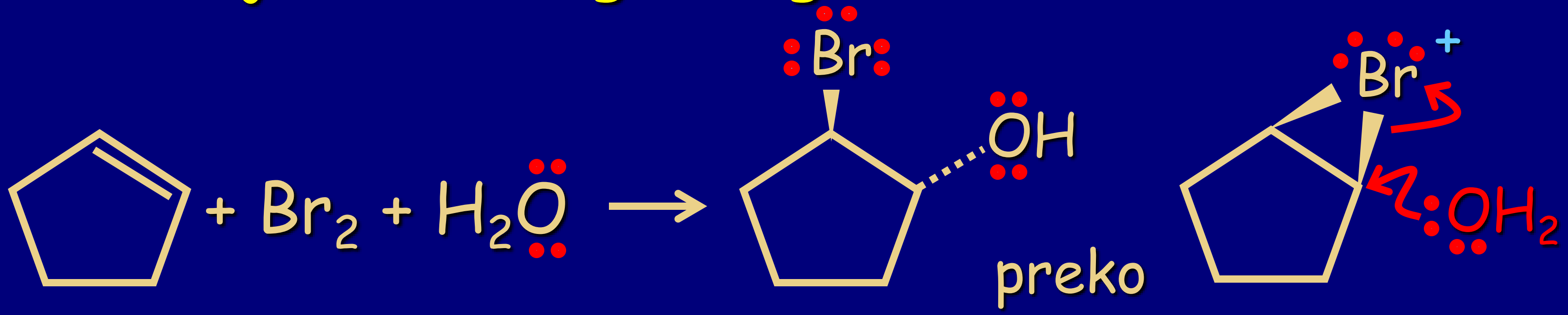


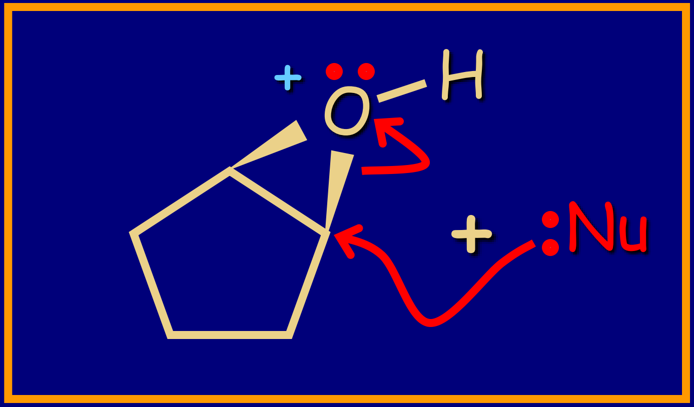
Ravnoteža:



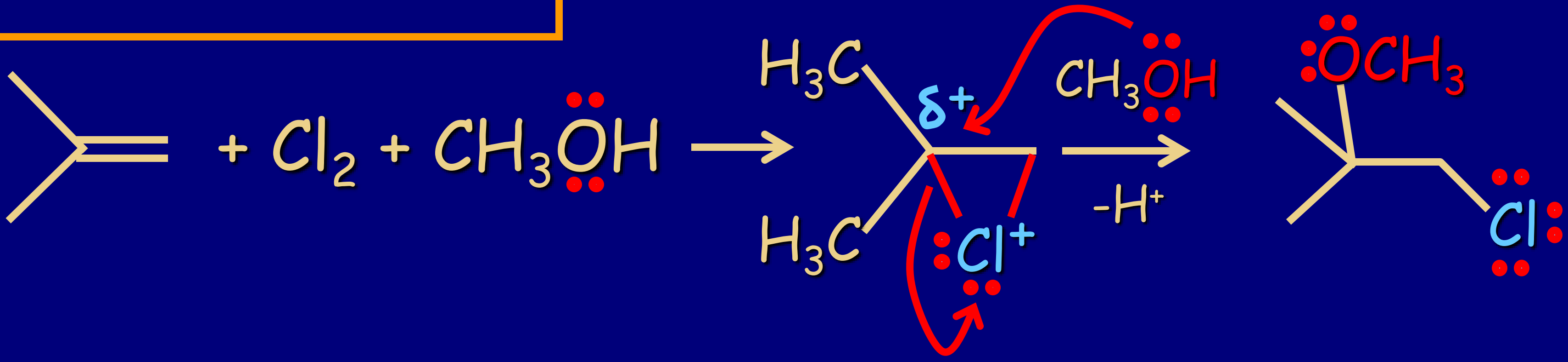
Opšti karakter elektrofilne adicije

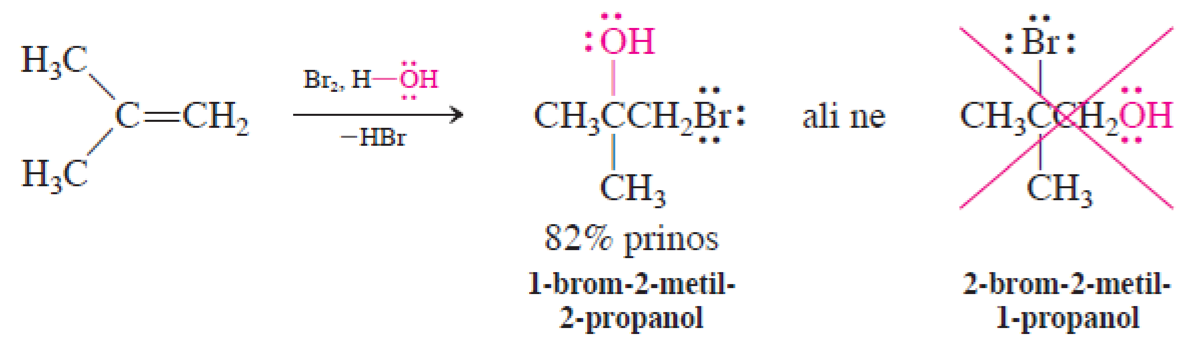
Halonijum ioni mogu reagovati sa različitim Nu



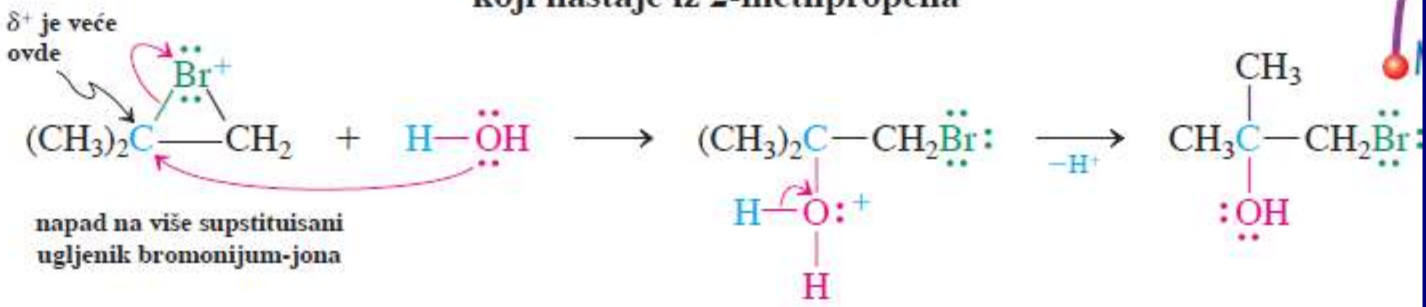


ili X_2, ROH → haloetri
(anti adicija +
Markovnikov-ljevo pravili)





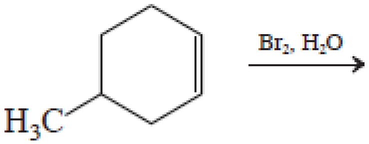
Regioselektivno otvaranje bromonijum-jona koji nastaje iz 2-metilpropena



Vežba 12-11

Šta su proizvodi datih reakcija?

(a) $CH_3CH{=}CH_2 \xrightarrow{Cl_2,\ CH_3OH}$ (b)



Vežba 12-13

Koji je dobar prekursor za dobijanje racemske smese (2*R*,3*R*)- i (2*S*,3*S*)-2-brom-3-metoksipentana? Koje biste druge izomerne proizvode mogli očekivati na osnovu predloženih reakcija?

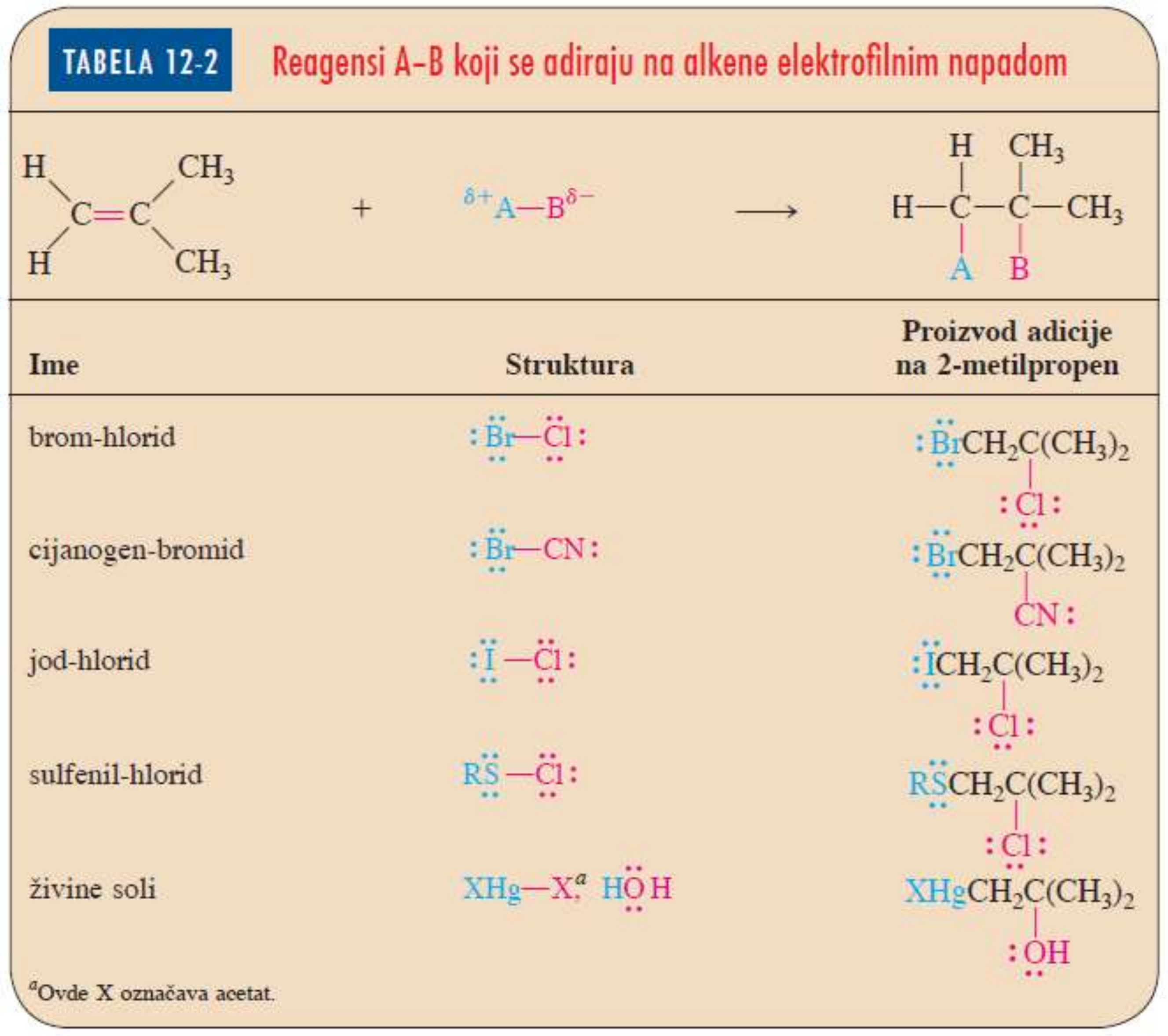


TABELA 12-2 Reagensi A–B koji se adiraju na alkene elektrofilnim napadom

$$\underset{H}{\overset{H}{}}\!\!>\!C=C\!<\!\underset{CH_3}{\overset{CH_3}{}} \quad + \quad {}^{\delta+}A-B^{\delta-} \longrightarrow H-\underset{A}{\overset{H}{C}}-\underset{B}{\overset{CH_3}{C}}-CH_3$$

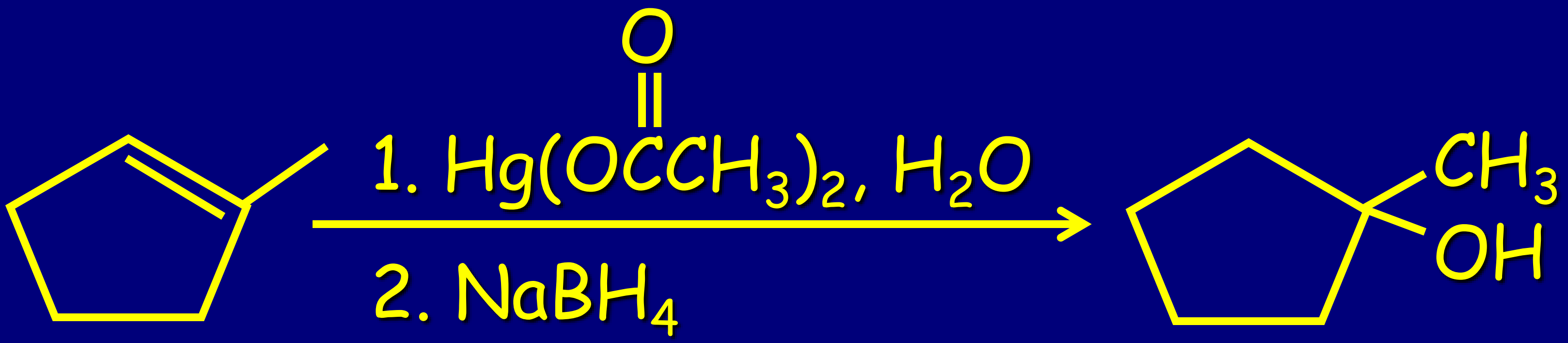
Ime	Struktura	Proizvod adicije na 2-metilpropen
brom-hlorid	$:\ddot{\underset{..}{Br}}-\ddot{\underset{..}{Cl}}:$	$:\ddot{\underset{..}{Br}}CH_2\underset{:\underset{..}{Cl}:}{C}(CH_3)_2$
cijanogen-bromid	$:\ddot{\underset{..}{Br}}-CN:$	$:\ddot{\underset{..}{Br}}CH_2\underset{CN:}{C}(CH_3)_2$
jod-hlorid	$:\ddot{\underset{..}{I}}-\ddot{\underset{..}{Cl}}:$	$:\ddot{\underset{..}{I}}CH_2\underset{:\underset{..}{Cl}:}{C}(CH_3)_2$
sulfenil-hlorid	$R\ddot{\underset{..}{S}}-\ddot{\underset{..}{Cl}}:$	$R\ddot{\underset{..}{S}}CH_2\underset{:\underset{..}{Cl}:}{C}(CH_3)_2$
živine soli	$XHg-X^{a}_{.}\quad H\ddot{\underset{..}{O}}H$	$XHgCH_2\underset{:\underset{..}{O}H}{C}(CH_3)_2$

[a] Ovde X označava acetat.

Sintetički korisna reakcija: oksimerkurovanje-demerkurovanje

Oksimerkurovanje-demerkurovanje

Markovnikov-ljeva hidratacija bez karbokatjona



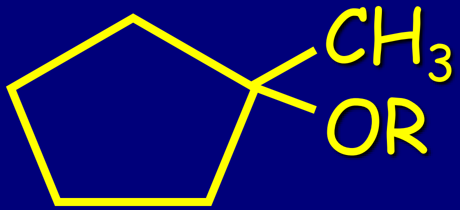
1. $Hg(O\overset{\overset{O}{\|}}{C}CH_3)_2, H_2O$

2. $NaBH_4$

ili

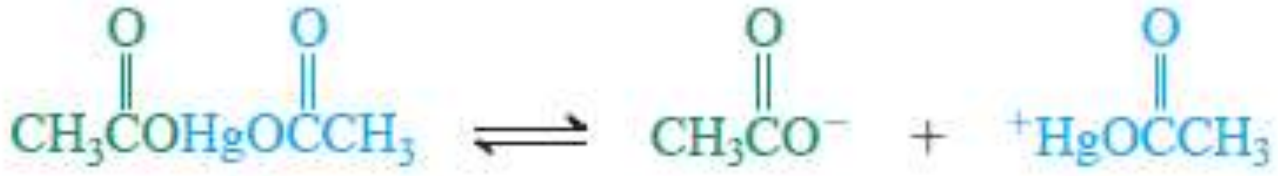
1. $Hg(O\overset{\overset{O}{\|}}{C}CH_3)_2$,

2. ROH: dobijanje etara



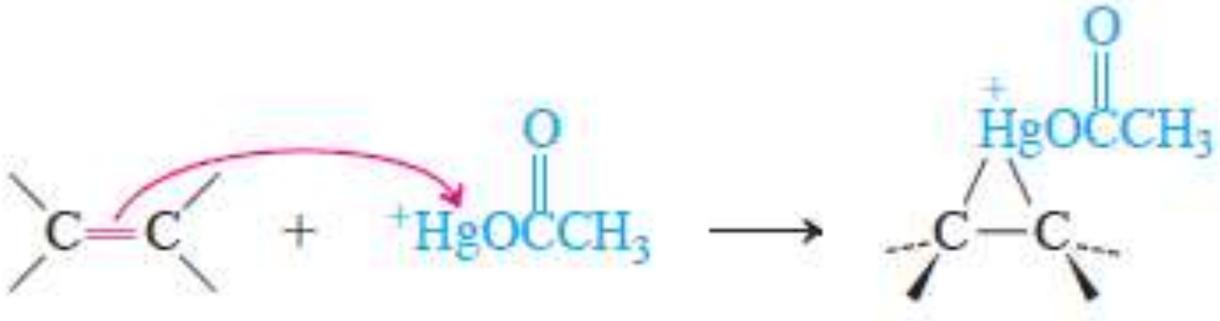
Mehanizam oksimerkurovanja-demerkurovanja

FAZA 1. Disocijacija



$$CH_3\overset{O}{\overset{\|}{C}}OHgO\overset{O}{\overset{\|}{C}}CH_3 \rightleftharpoons CH_3\overset{O}{\overset{\|}{C}}O^- + {}^+HgO\overset{O}{\overset{\|}{C}}CH_3$$

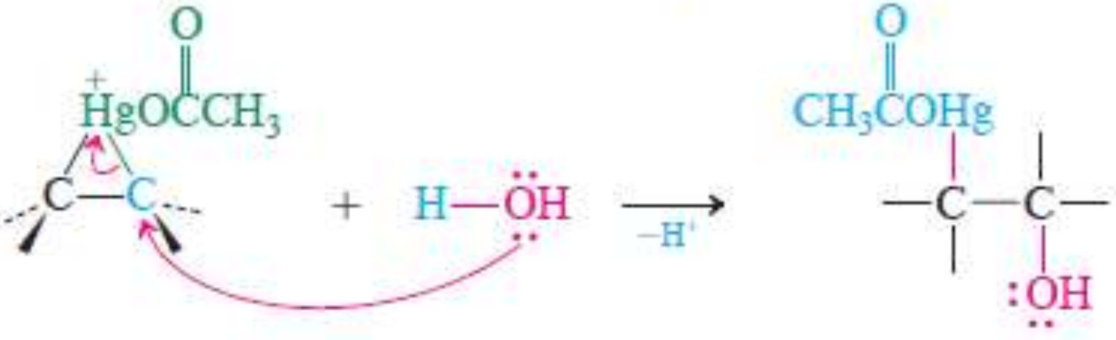
FAZA 2. Elektrofilni napad



merkurinijum-jon

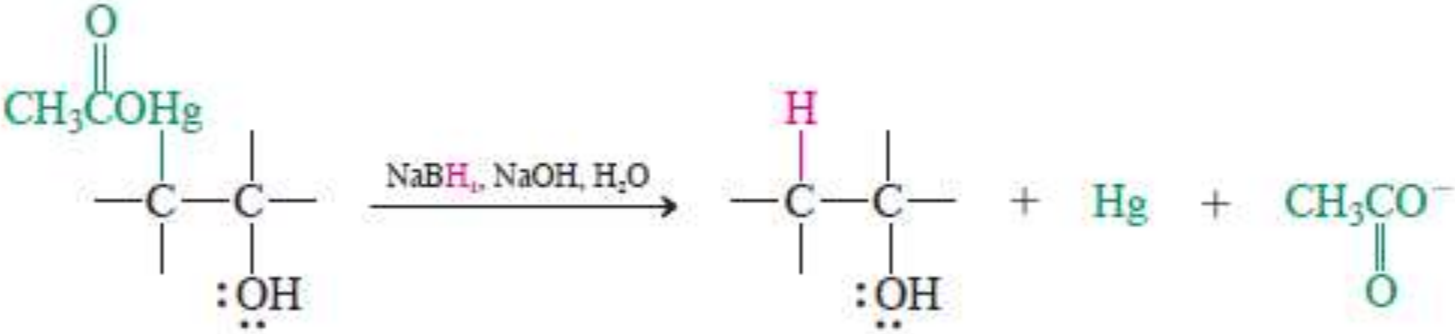
Mehanizam oksimerkurovanja-demerkurovanja

FAZA 3. Nukleofilno otvaranje (Markovnikov-ljeva regioselektivnost)



alkilmerkuri-acetat

FAZA 4. Redukcija



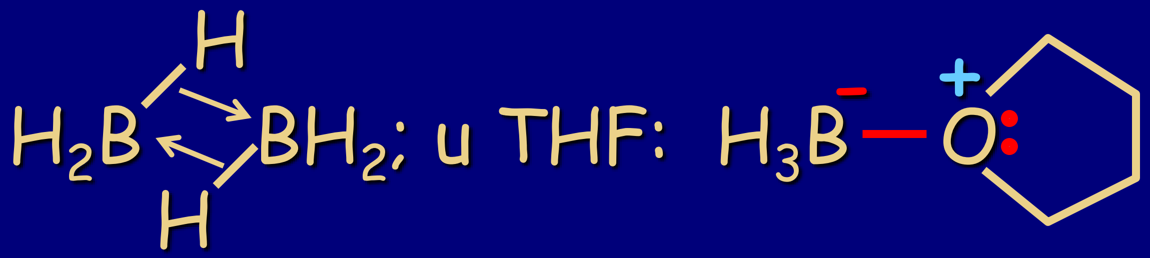
Hidroborovanje-oksidacija

anti-Markovnikov-ljeva hidratacija

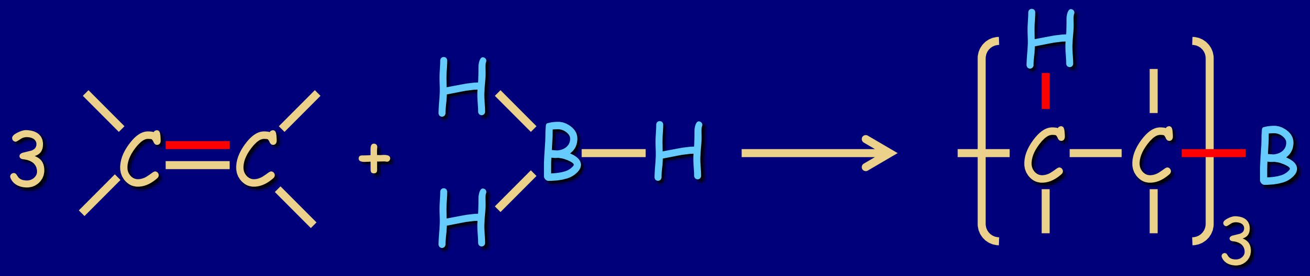
$$RCH = CH_2 + H_2O \longrightarrow RCH_2CH_2OH$$

Ključna reakcija: adicija $>B-H$ na π-veze.

Boran, BH_3, postoji kao dimer

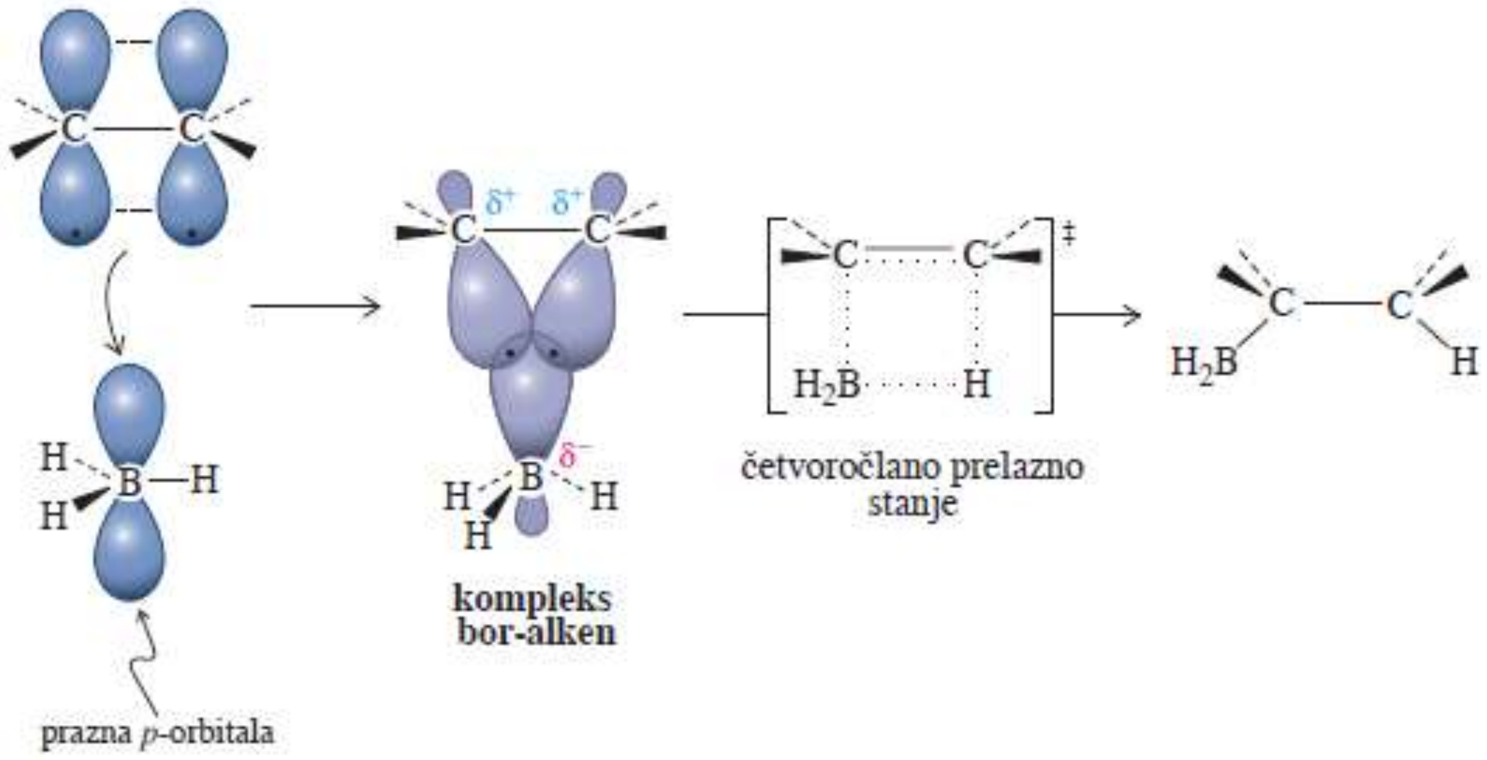


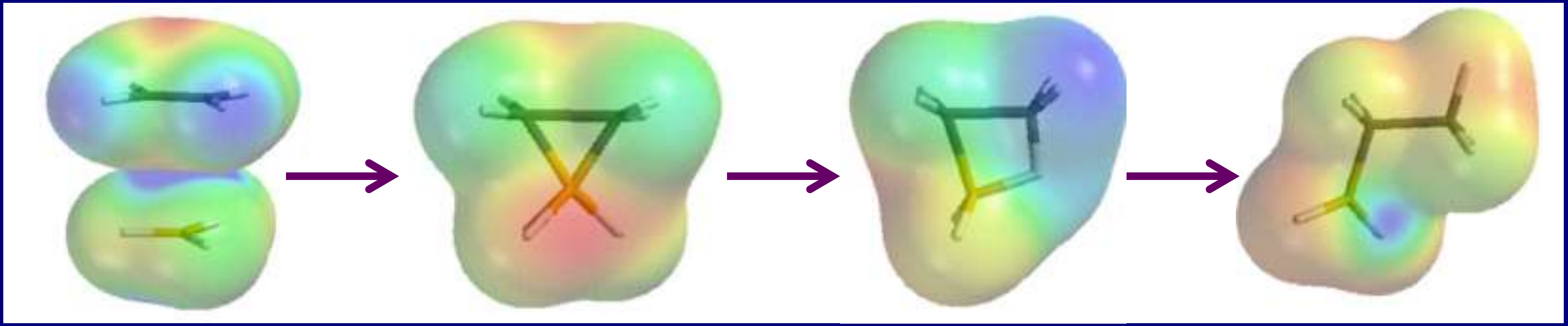
Sve tri B-H veze reaguju:



Alkilboran

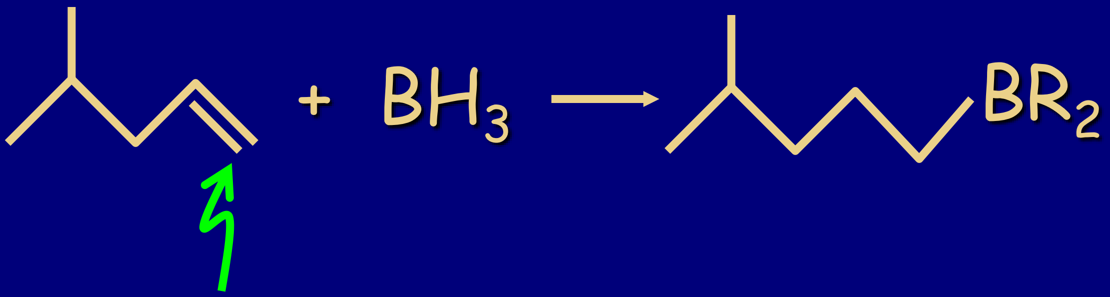
Mehanizam hidroborovanja





Hidroborovanje je regioselektivno:

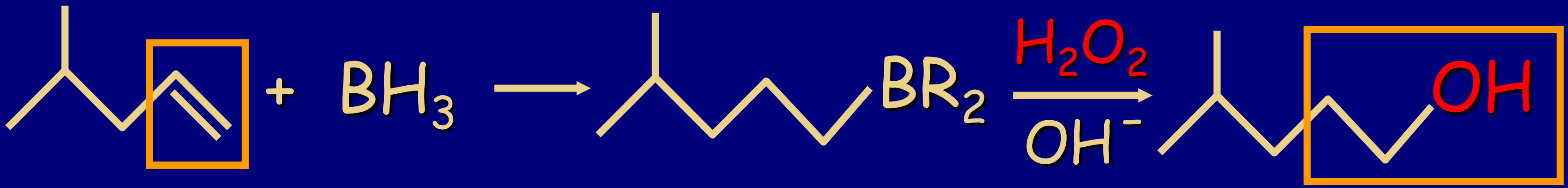
Sterni činioci kontrolišu adiciju B-H

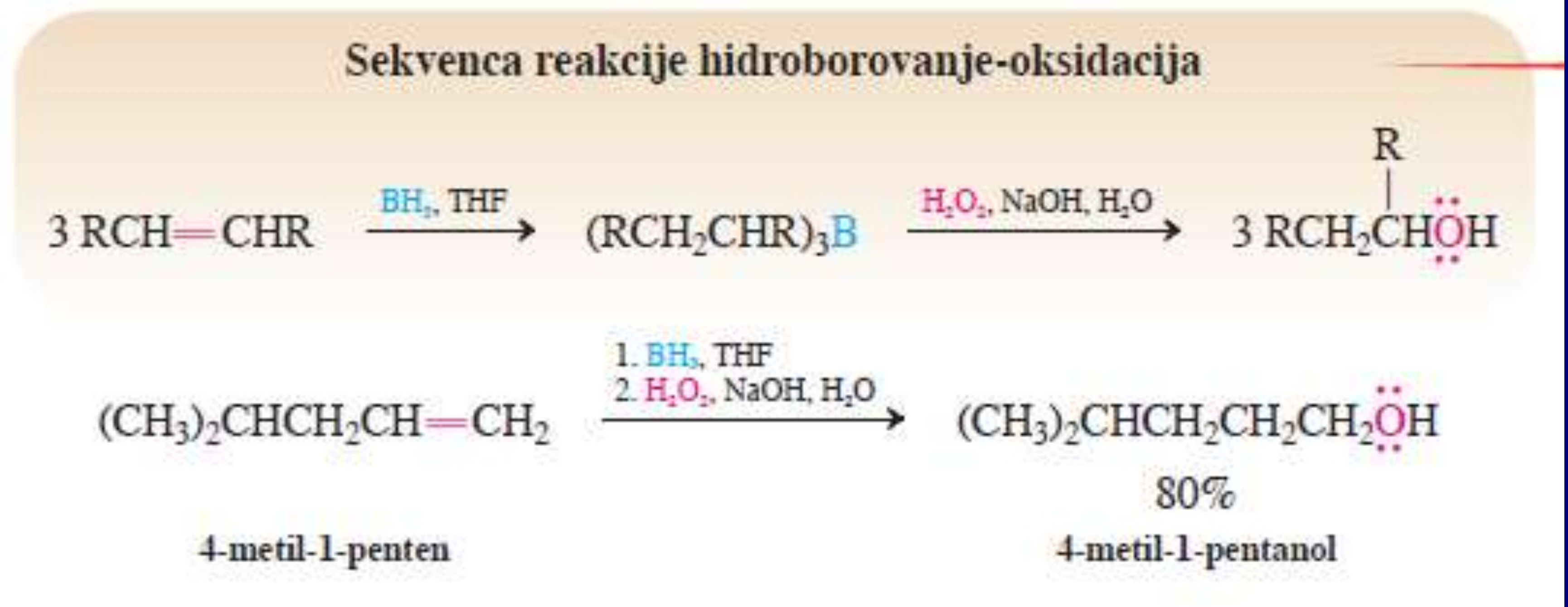


manje zaklonjen
ugljenik

Primena hidroborovanja?

Oksidacijom alkilborana dobijaju se alkoholi!!!





Sekvenca reakcije hidroborovanje-oksidacija

$$3\,RCH{=}CHR \xrightarrow{BH_3,\ THF} (RCH_2CHR)_3B \xrightarrow{H_2O_2,\ NaOH,\ H_2O} 3\,RCH_2\overset{\overset{R}{|}}{C}H\underset{\cdot\cdot}{\ddot{O}}H$$

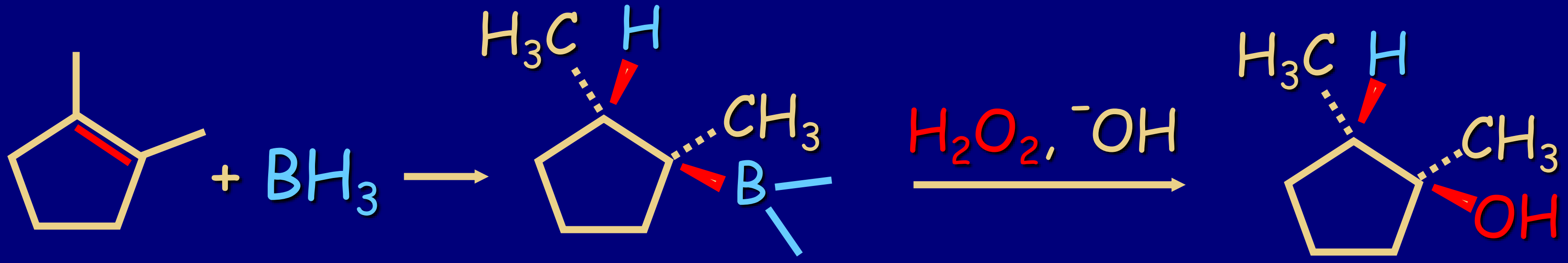
$$(CH_3)_2CHCH_2CH{=}CH_2 \xrightarrow{\substack{1.\ BH_3,\ THF\\ 2.\ H_2O_2,\ NaOH,\ H_2O}} (CH_3)_2CHCH_2CH_2CH_2\underset{\cdot\cdot}{\ddot{O}}H$$

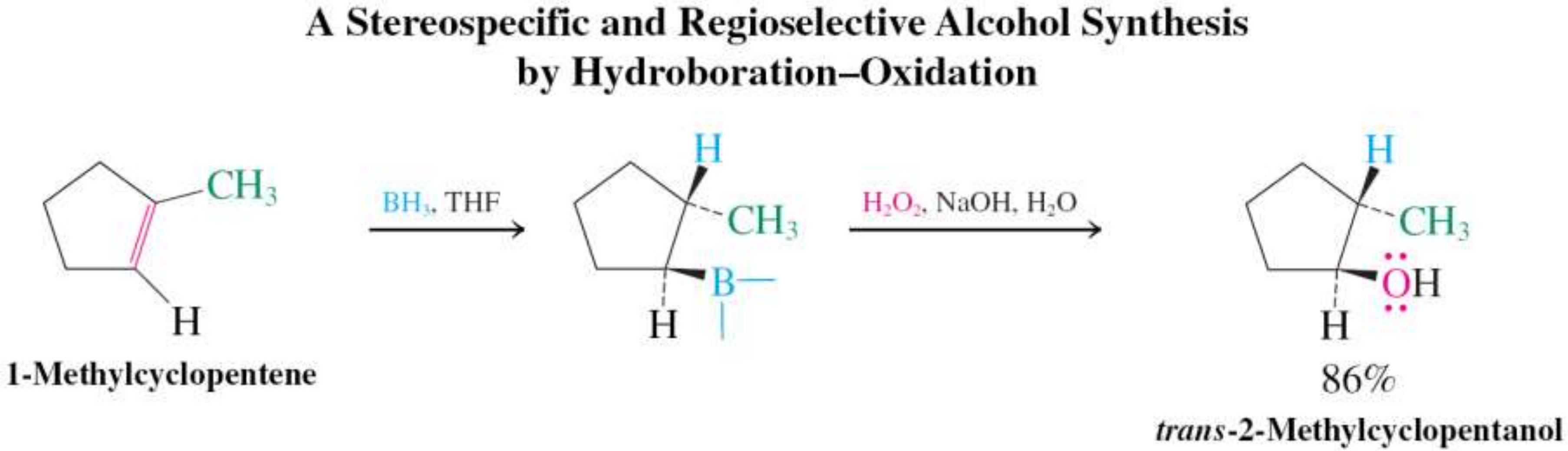
80%

4-metil-1-penten

4-metil-1-pentanol

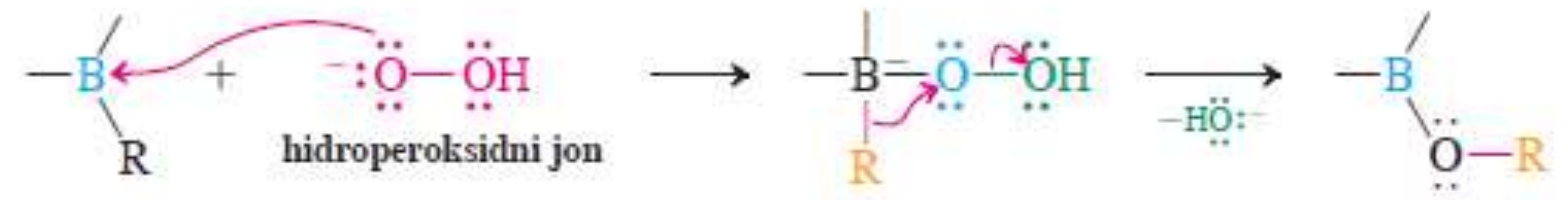
Hidroborovanje je stereospecifično:
sin adicija B—H





A Stereospecific and Regioselective Alcohol Synthesis by Hydroboration–Oxidation

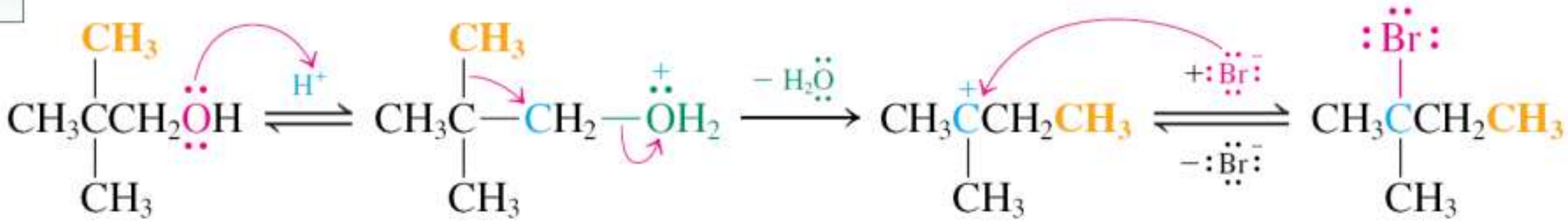
Mehanizam oksidacije alkilborana



$$(RO)_3B \quad + \quad 3\ NaOH \xrightarrow{H_2O} Na_3BO_3 \quad + \quad 3\ ROH$$

Sličnost sa premeštanjem alkil-grupa?

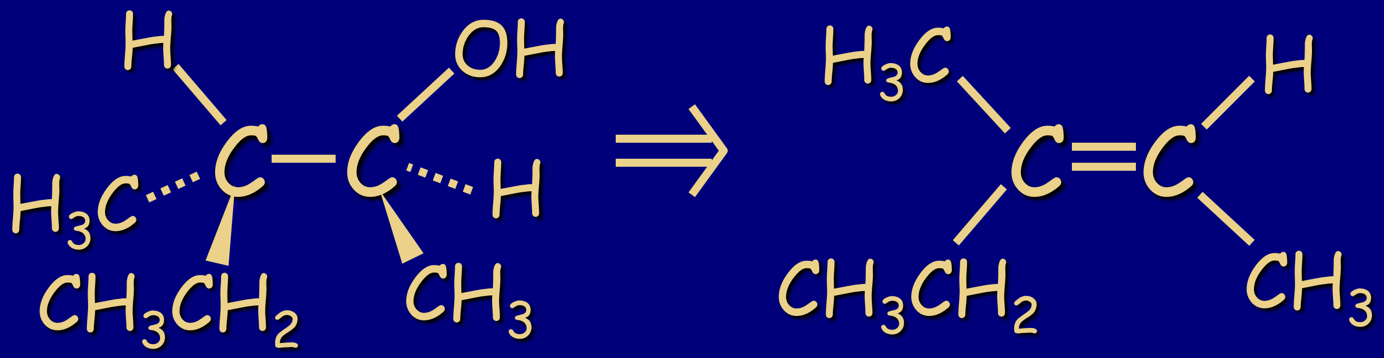
Mechanism of Concerted Alkyl Shift

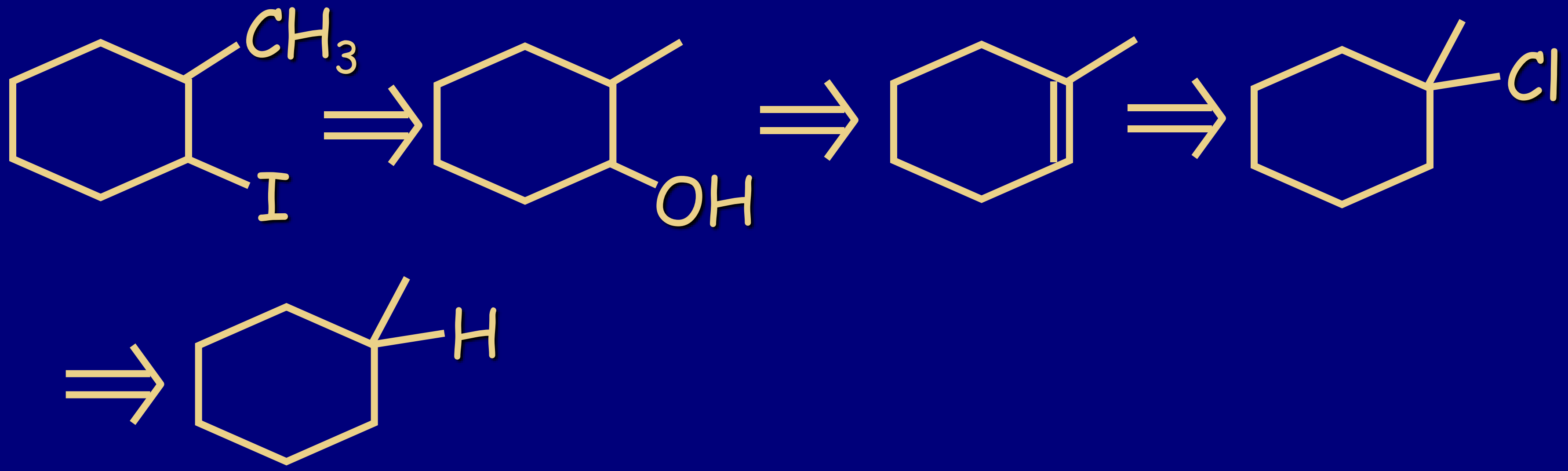


Vežba 12-15

Napišite proizvode sekvence reakcija hidroborovanje-oksidacija (a) propena i (b) (*E*)-3-metil-2-pentena. Naznačite jasno stereohemiju.

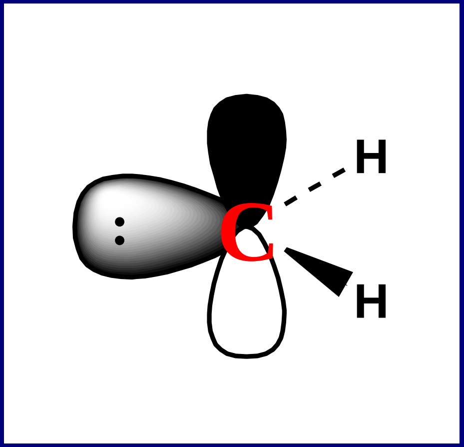
Primena u sintezi retrosinteza:





Elektrofilna adicija karbena
Sinteze ciklopropana

karbeni,
$:CR_2$, vrste sa 6-elektrona,
prvi član je metilen $:CH_2$.
Možemo zamisliti da nastaje deprotonovanjem karbokatjona:
$CH_3^+ \Rightarrow :CH_2 + H^+$.

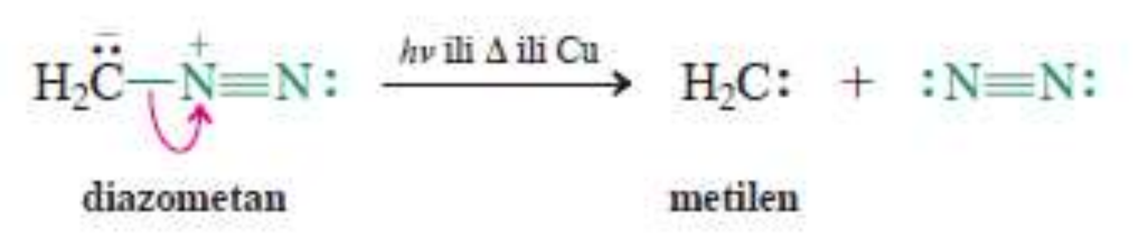


Metilene

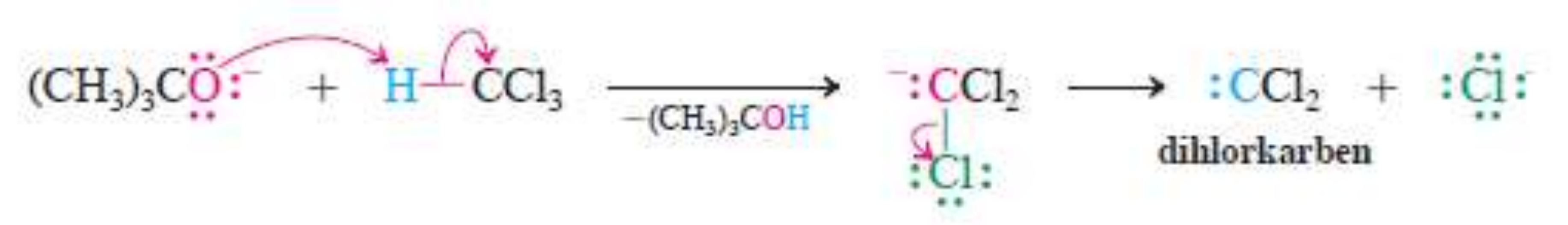
Karbeni su elektron-deficitarni, ponašaju se prema alkenima kao elektrofili.

Dobijanje

a. Metilen iz diazometana CH_2N_2



b. Dihlorkarben iz hloroforma



c. Simmons-Smith-ov reagens

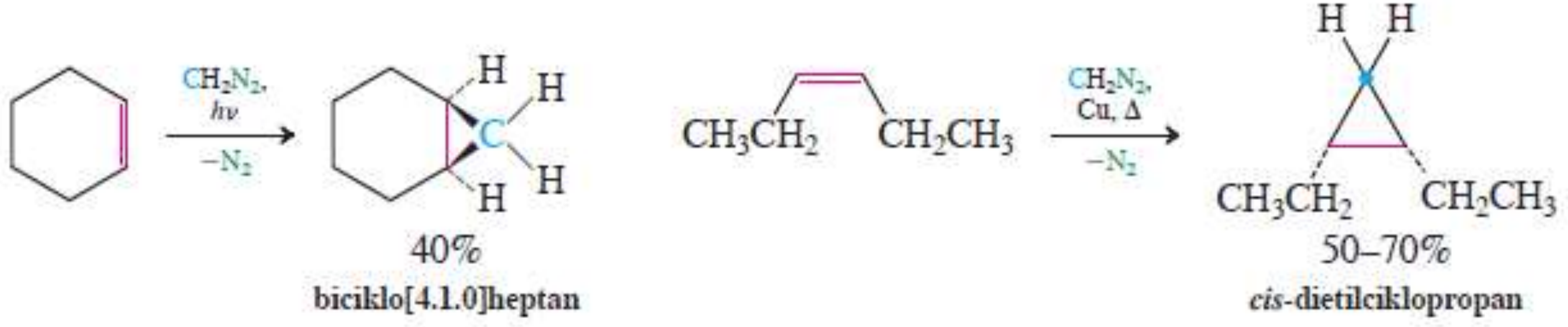
$$CH_2I_2 + Zn\text{-}Cu \Rightarrow \text{“}CH_2\text{”}$$

Karbeni uzimaju dva π elektrona iz alkena i formiraju ciklopropane

Karbeni uzimaju dva π elektrona iz alkena i formiraju ciklopropane

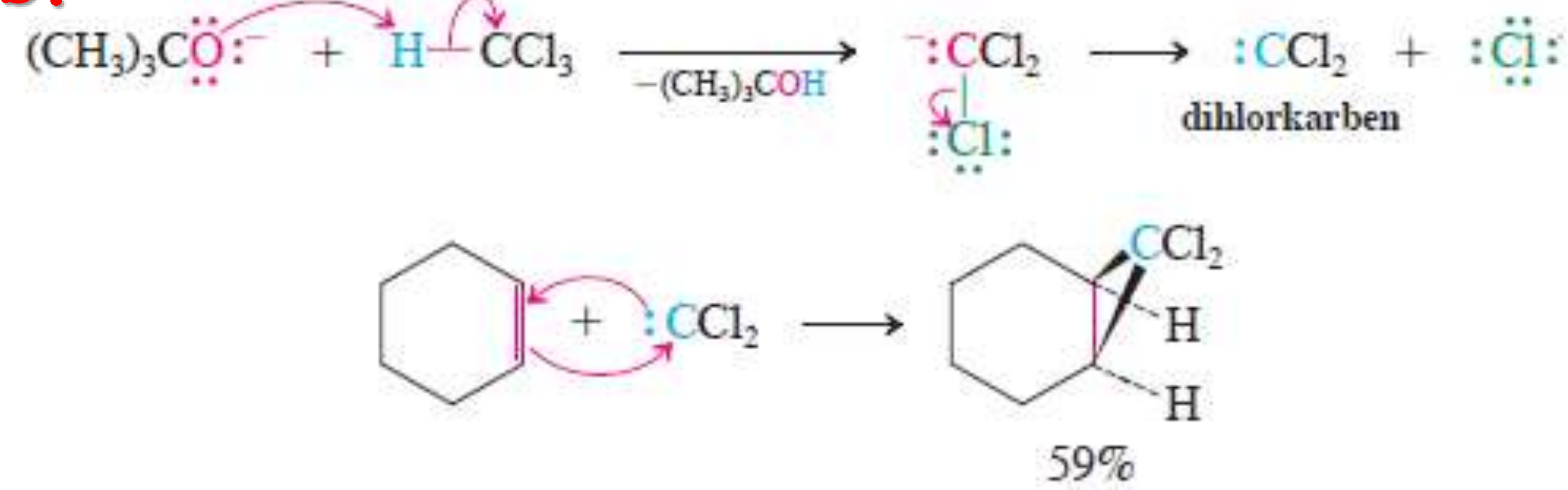
a.

Adicija metilena na dvostruke veze

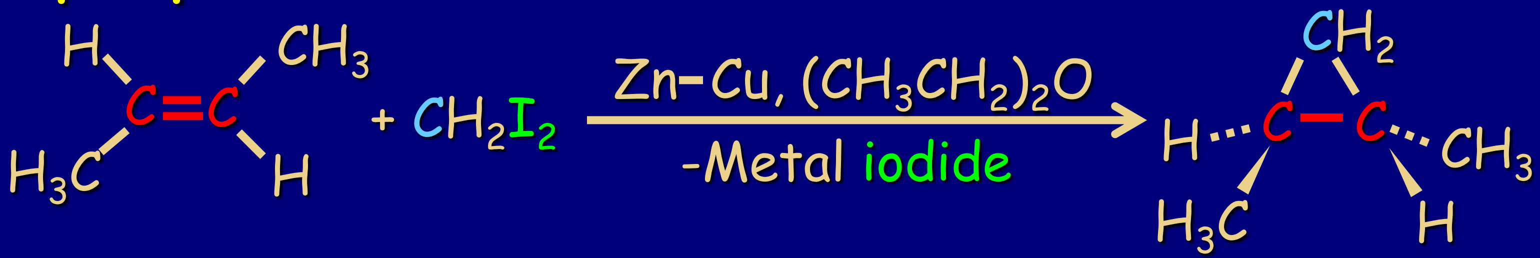


b.

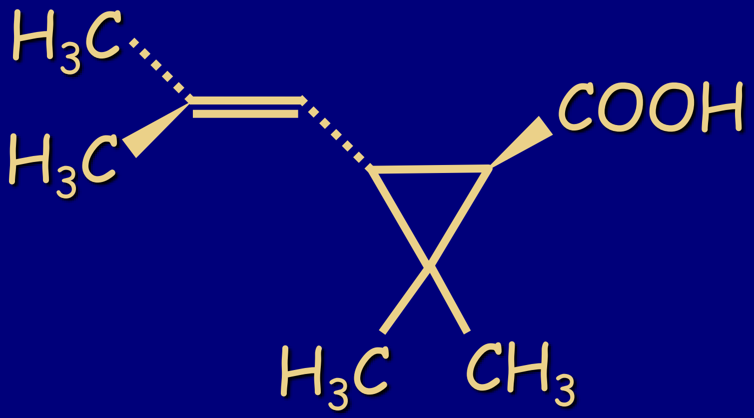
Dobijanje dihlorkarbena iz hloroforma i njegova reakcija sa cikloheksenom



c. Simmons-Smith-ov reagens za dobijanje ciklopropana

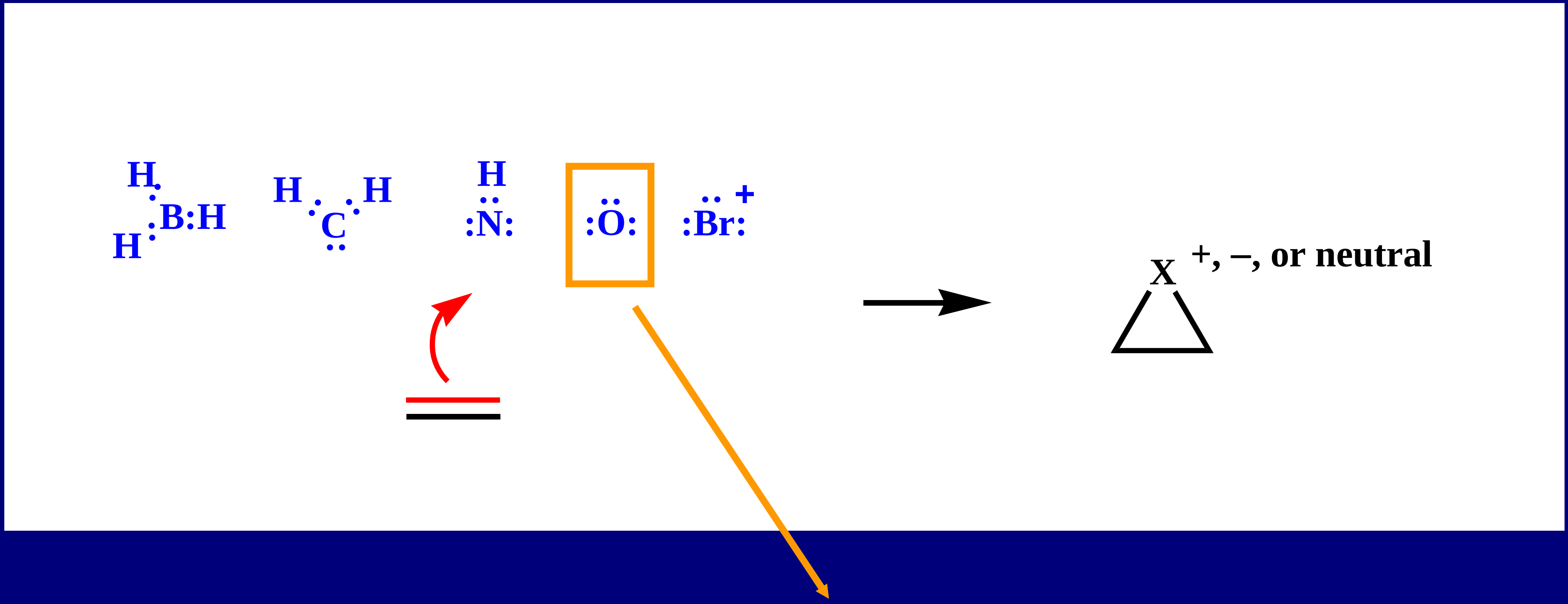


Ciklopropani-prirodni proizvodi:



(+)- hrizantemna kiselina (protiv insekata); rodonačelnik piretroida. US : 1.5 milijarda $!!

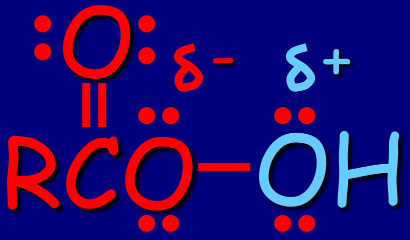
Adicija vrsta sa šest elektrona na π-vezu

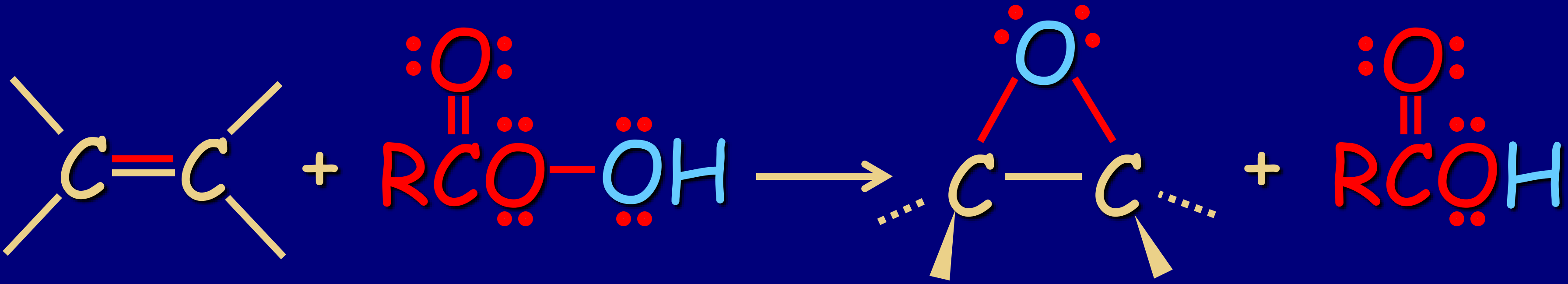


Oksidacija?

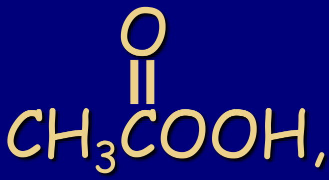
EPOKSIDACIJA

Oksidacija alkena
peroksikarboksilnim kiselinama



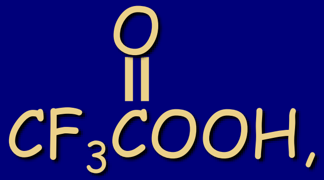


Najčešće korišćene peroksikarboksilne kiseline



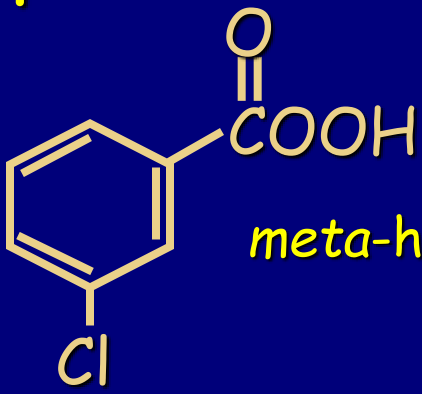
$CH_3\overset{\overset{\displaystyle O}{\|}}{C}OOH$,

Persirćetna
kiselina



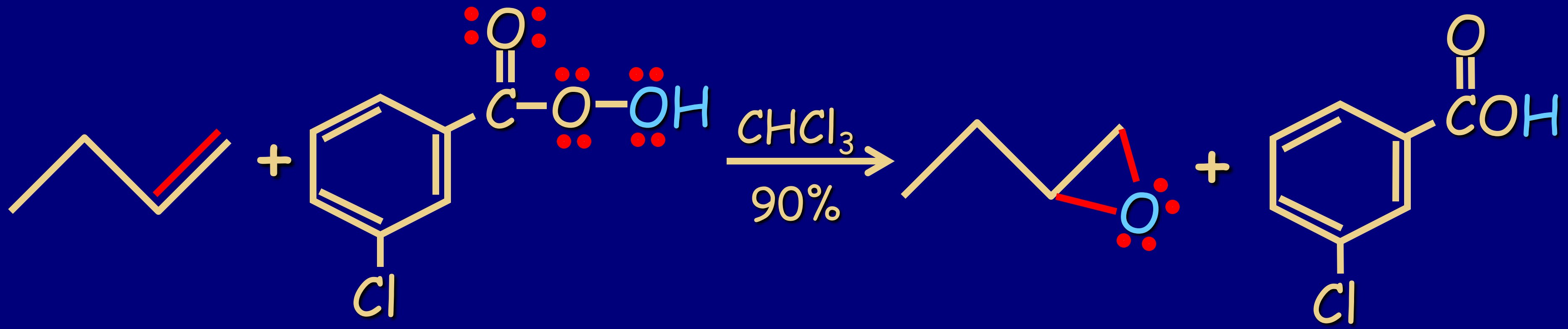
$CF_3\overset{\overset{\displaystyle O}{\|}}{C}OOH$,

Trifluor-
persirćetna
kiselina

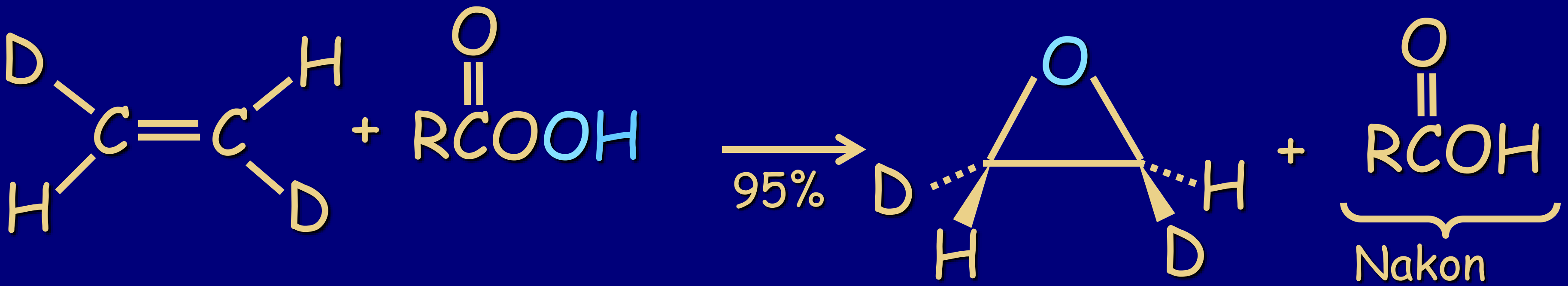


meta-hlorperbenzoeva kiselina

"MCPBA"



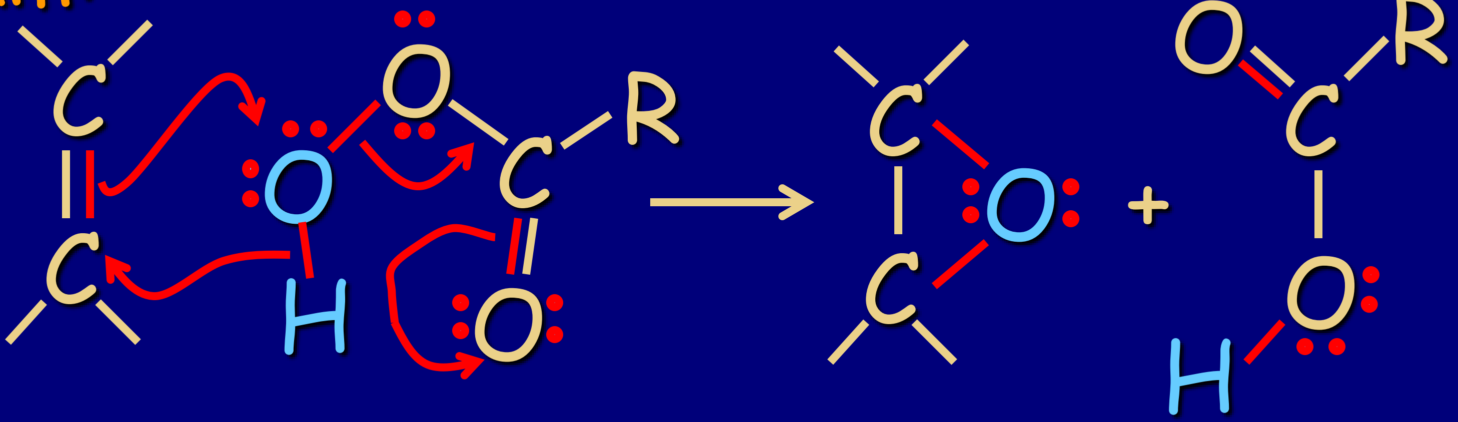
Stereospecifična sin adicija



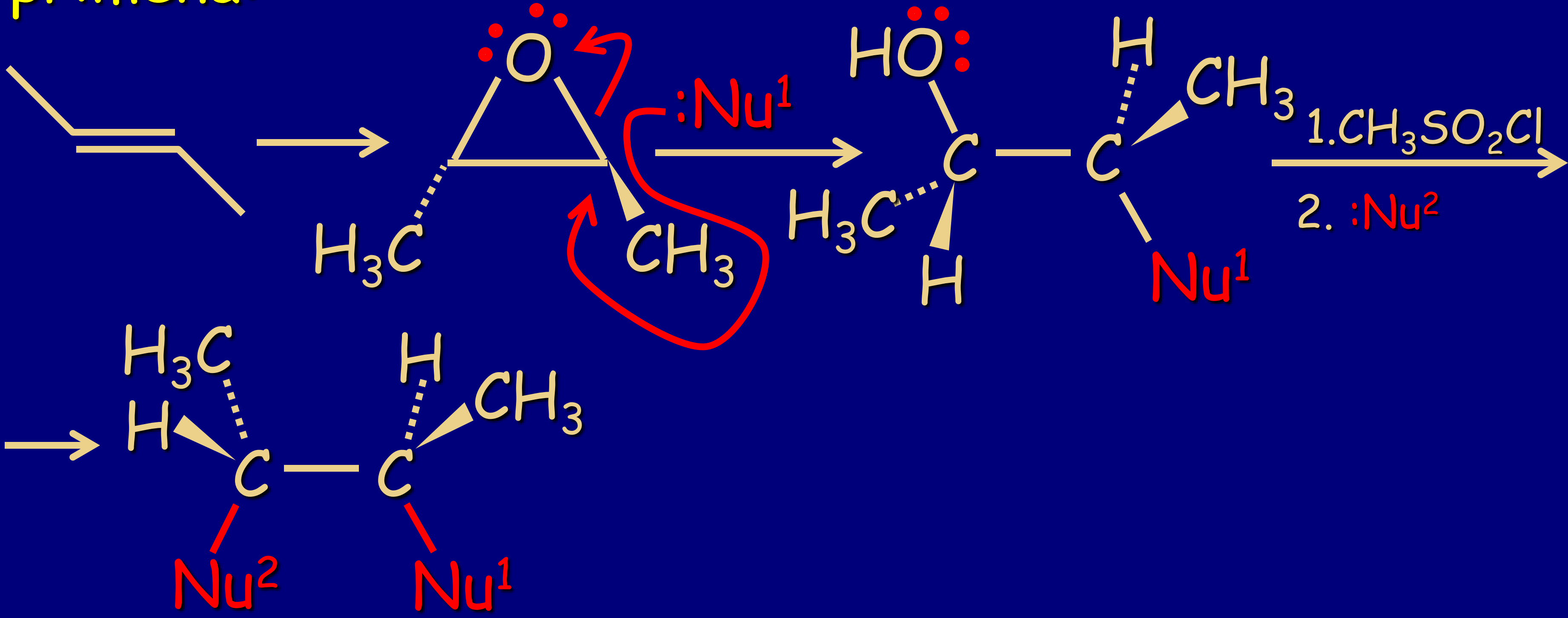
Trans-2,3-di-deuterooksa ciklopropan

Nakon obrade vodom

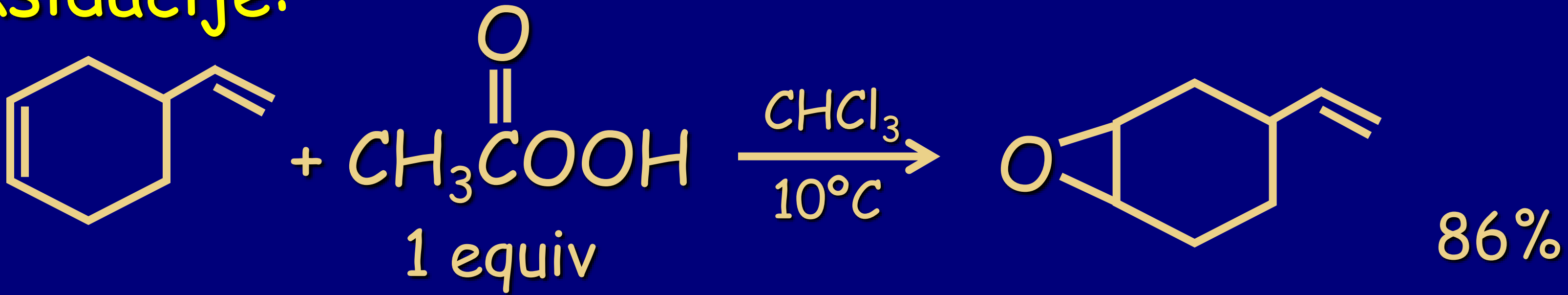
Mehanizam:



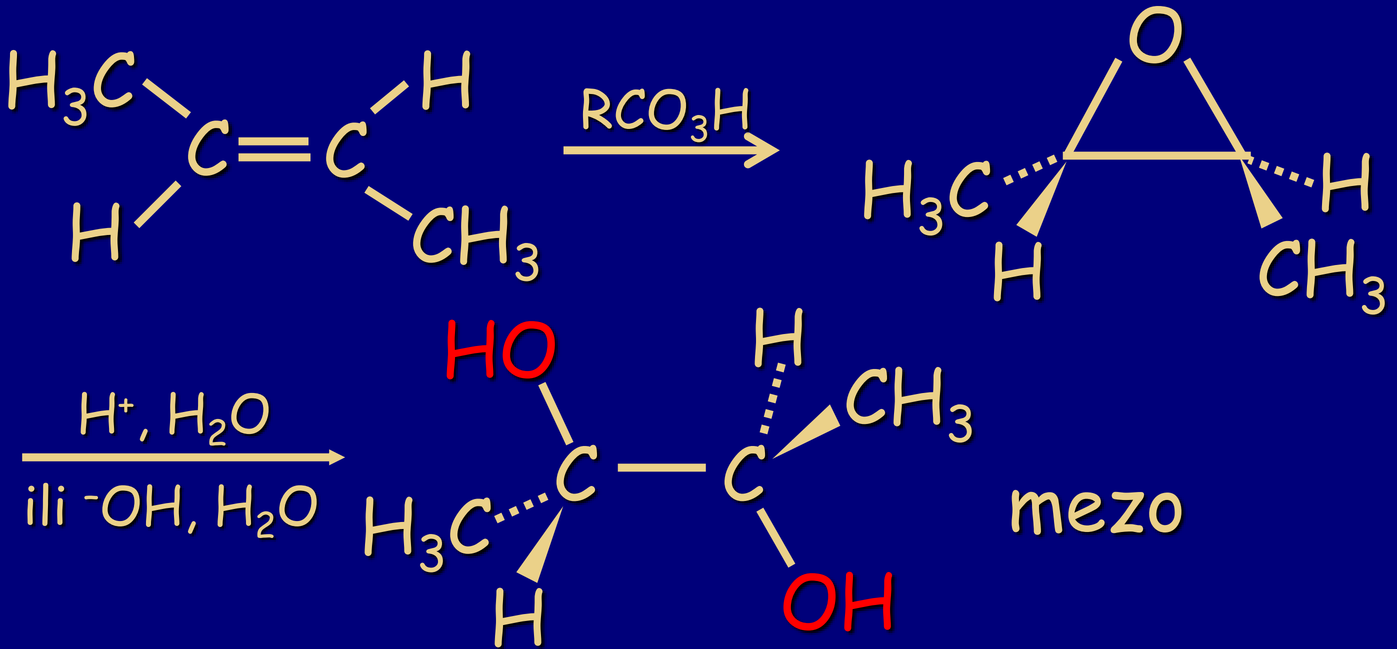
primena:



Reaktivnost alkena prema perkiselinama povećava se sa alkil-supstitucijom, što omogućava selektivne oksidacije:



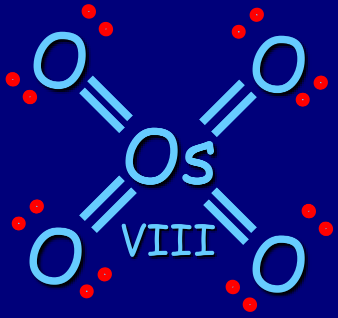
Ukupan rezultat sekvence oksidacije hidrolize anti-dihidroksilovanje alkena:



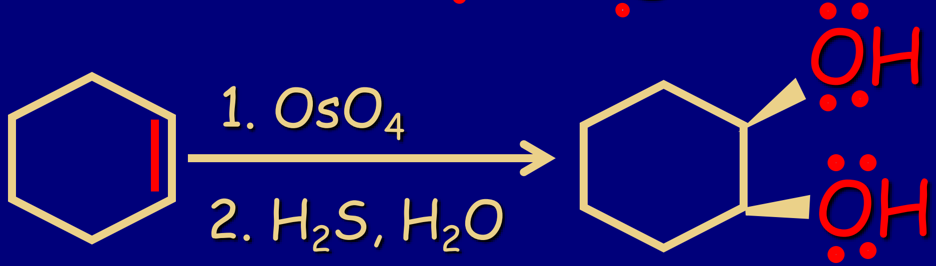
Vicinalno sin-dihidroksilovanje

Reagensi : $KMnO_4$, ^{-}OH, ali je bolje sa:

OsO_4



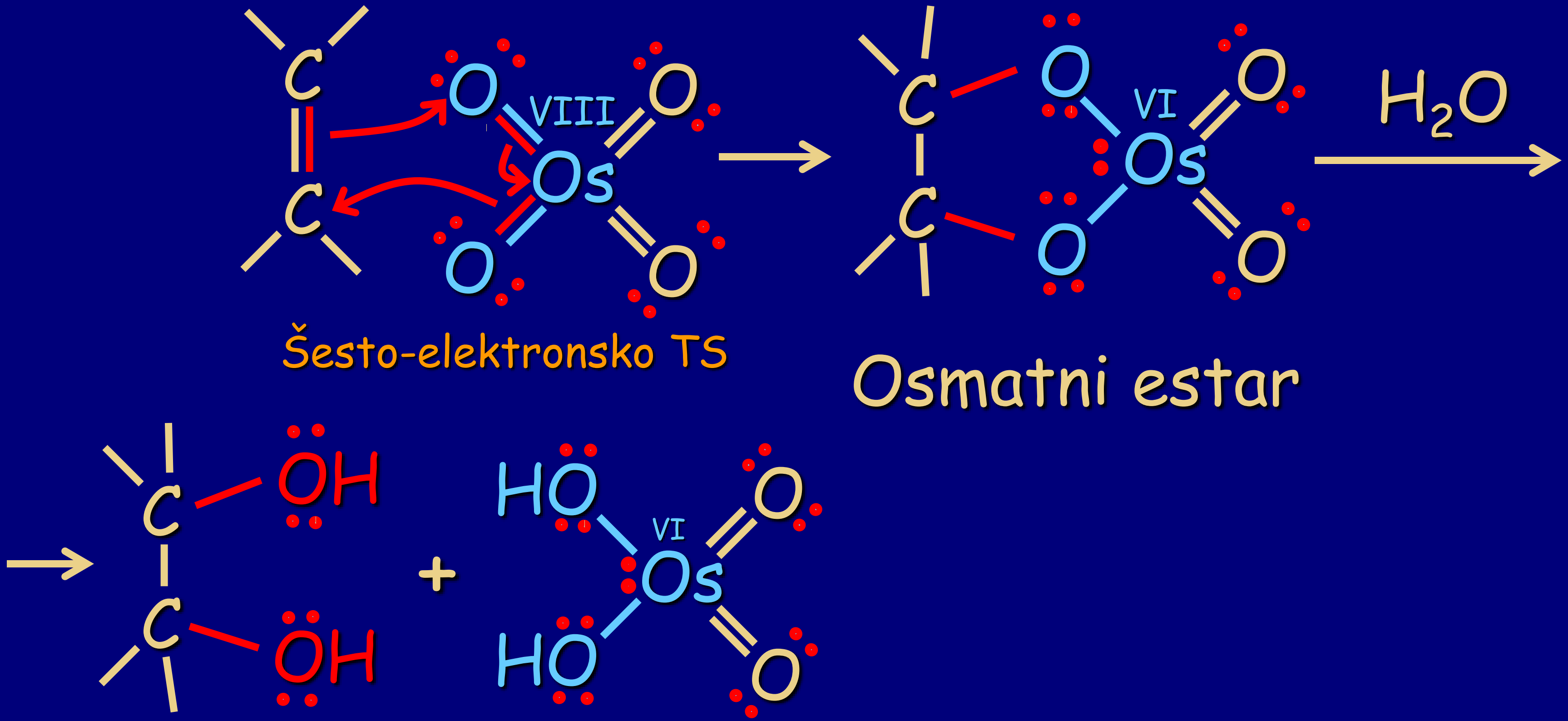
redukcija do Os^{VI}.



cis-1,2-cikloheksandiol

Komplementarna stereohemija anti-dihidroksilaciji

Mehanizam:

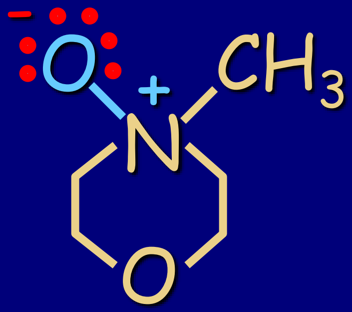


Šesto-elektronsko TS

Osmatni estar

Zbog toga što je OsO_4 skup i vrlo toksičan, on se veoma često koristi u katalitičkim količinama, a u stehiometrijskim količinama koristi se drugo oksidaciono sredstvo, koje ima ulogu da vrši ponovnu oksidaciju redukovanog osmijuma

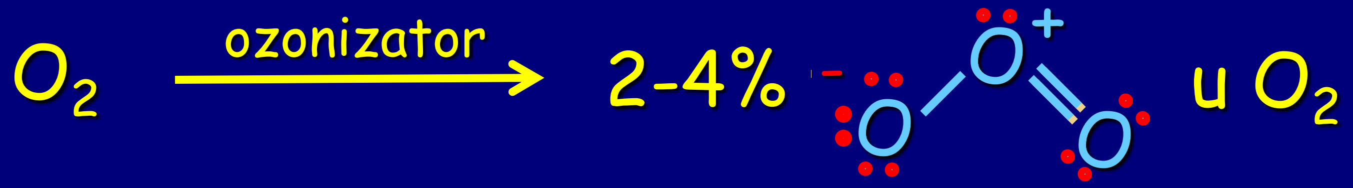
H_2O_2; Fe^{3+};

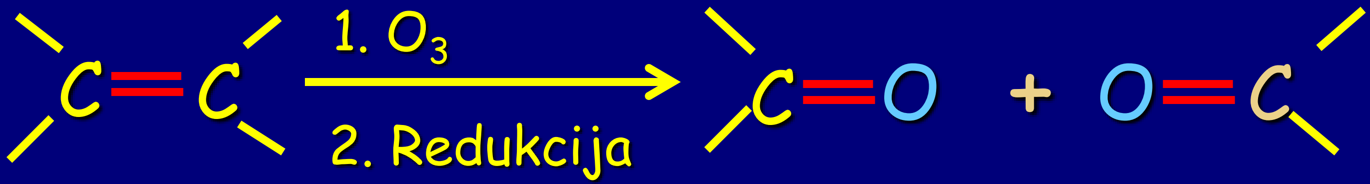


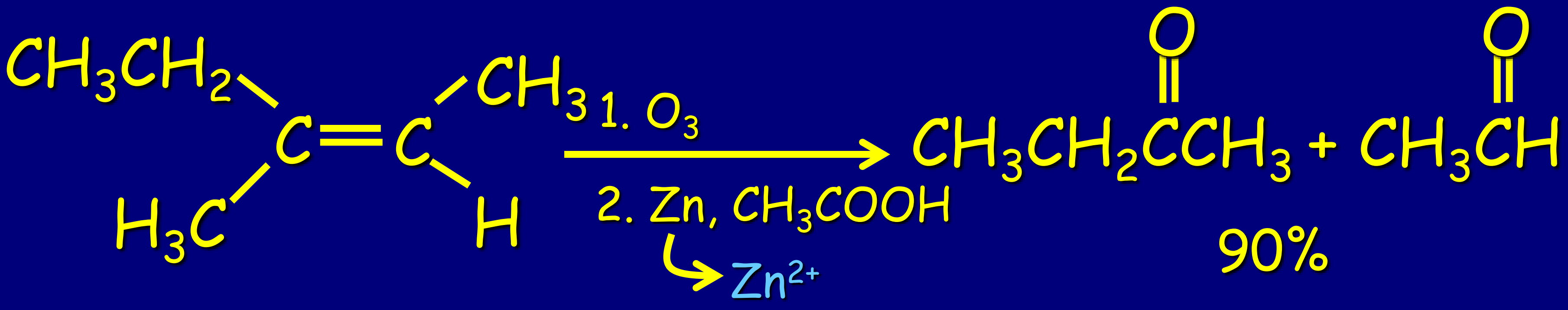
Ozonoliza

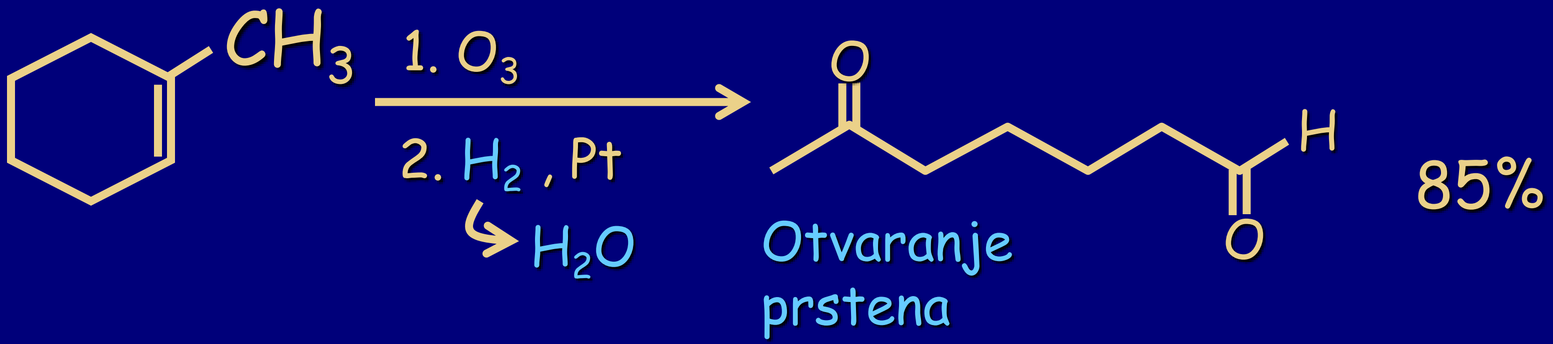
Oksidativno raskidanje C=C veze

1. O_3, 2. Redukcija "ozonide"







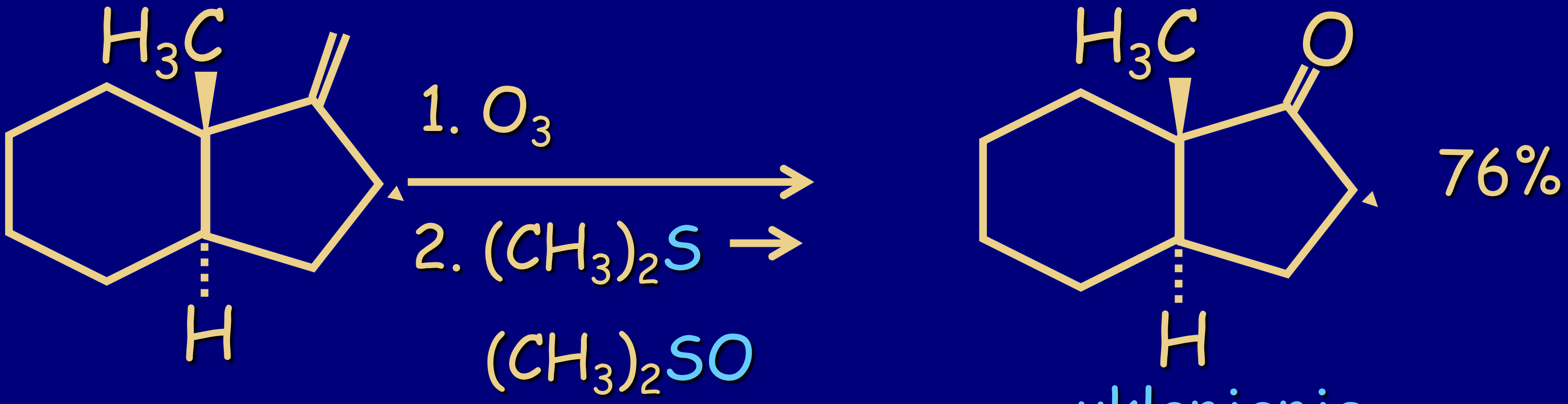


1. O_3

2. H_2, Pt ↳ H_2O

Otvaranje prstena

85%



1. O_3

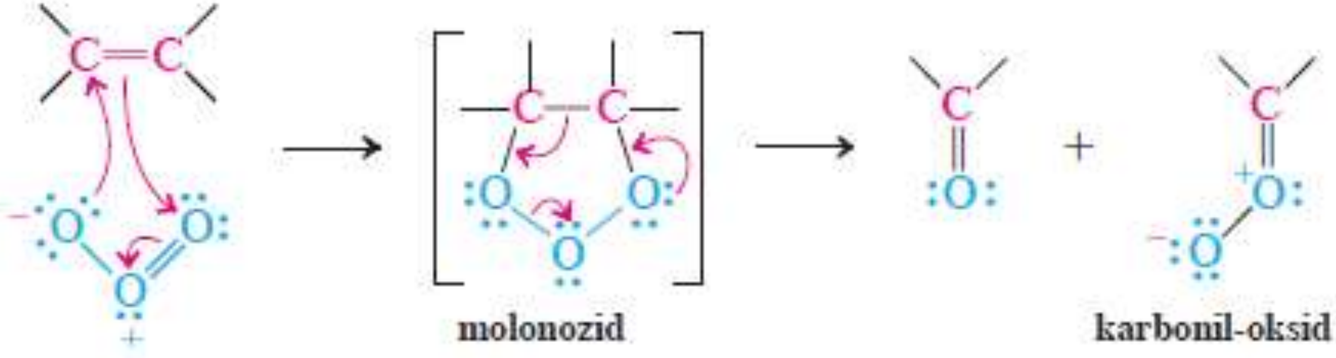
2. $(CH_3)_2S \rightarrow (CH_3)_2SO$

76%

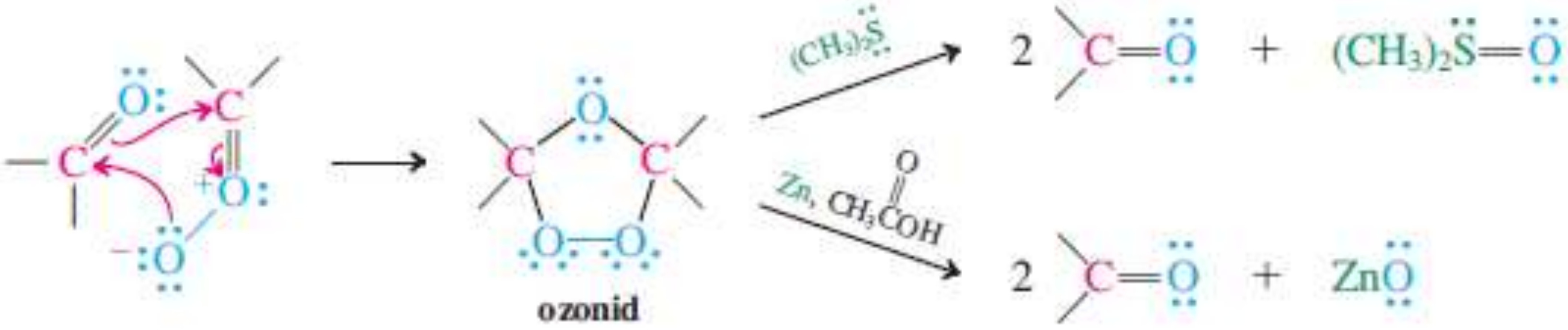
uklanjanje atoma ugljenika

Mehanizam ozonolize

FAZA 1. Nastajanje i raskidanje molonozida



FAZA 2. Nastajanje i redukcija ozonida

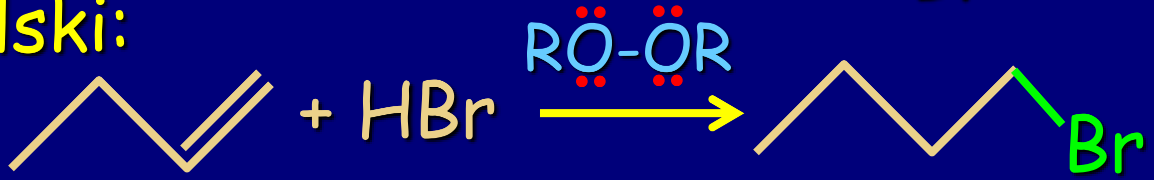


Radikalske adicije
hidrobromovanje alkena

jonski:

Markovnikov

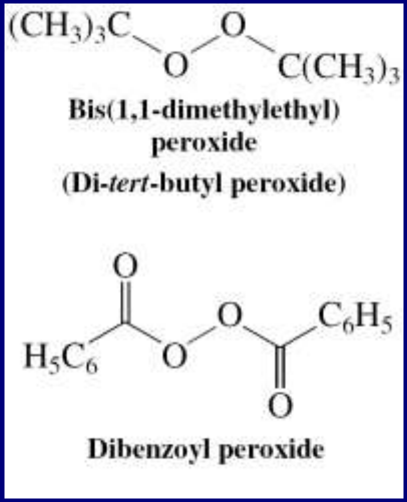
radikalski:



Anti-Markovnikov!

Dva potpuno različita mehanizma!!!!

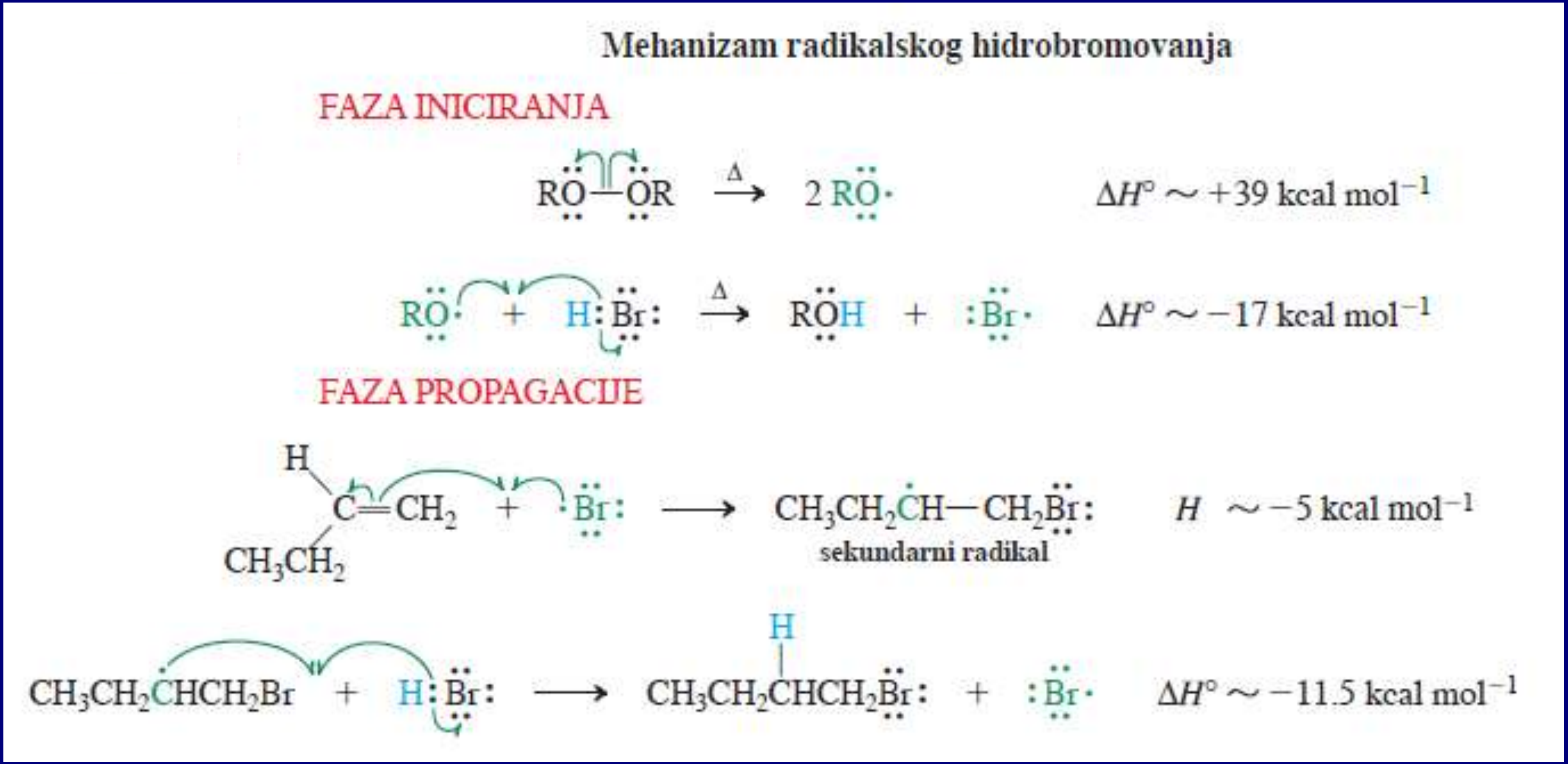
Peroksidi kao radikaski inicijatori



Bis(1,1-dimethylethyl) peroxide
(Di-*tert*-butyl peroxide)

Dibenzoyl peroxide

Poređenje sa radikalskim halogenovanjem ugljovodonika:



Mehanizam radikalskog hidrobromovanja

FAZA INICIRANJA

$$R\ddot{O}{-}\ddot{O}R \xrightarrow{\Delta} 2\,R\ddot{O}\cdot \qquad \Delta H^\circ \sim +39\ \text{kcal mol}^{-1}$$

$$R\ddot{O}\cdot + H{:}\ddot{Br}{:} \xrightarrow{\Delta} R\ddot{O}H + {:}\ddot{Br}\cdot \qquad \Delta H^\circ \sim -17\ \text{kcal mol}^{-1}$$

FAZA PROPAGACIJE

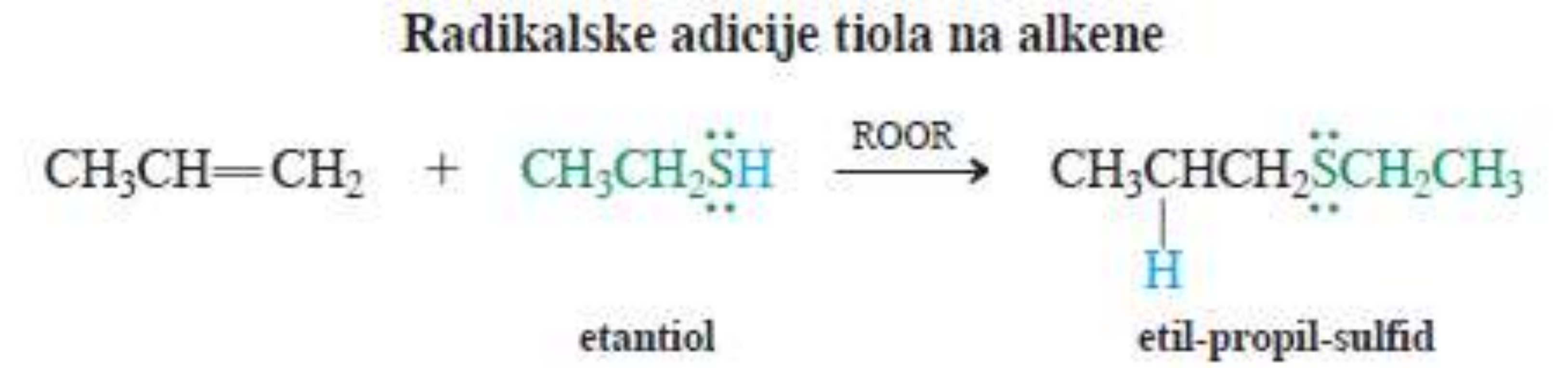
$$(CH_3CH_2)(H)C{=}CH_2 + \cdot\ddot{Br}{:} \longrightarrow CH_3CH_2\dot{C}H{-}CH_2\ddot{Br}{:} \qquad H \sim -5\ \text{kcal mol}^{-1}$$

sekundarni radikal

$$CH_3CH_2\dot{C}HCH_2Br + H{:}\ddot{Br}{:} \longrightarrow CH_3CH_2CH(H)CH_2\ddot{Br}{:} + {:}\ddot{Br}\cdot \qquad \Delta H^\circ \sim -11.5\ \text{kcal mol}^{-1}$$

HCl i HI zbog nepovoljne kinetike ne daju anti-Markovnikov-ljeve adicione proizvode, jer je jedna od faza propagacije endotermna.adicija HCl i HI se vrši isključivo jonskim mehanizmom.

Tioli uspešno podležu anti-Markovnikov-ljevoj adiciji na alkene



Radikalske adicije tiola na alkene

$$CH_3CH{=}CH_2 + \underset{\text{etantiol}}{CH_3CH_2\ddot{\underset{..}{S}}H} \xrightarrow{ROOR} \underset{\text{etil-propil-sulfid}}{CH_3\underset{\substack{|\\H}}{C}HCH_2\ddot{\underset{..}{S}}CH_2CH_3}$$

$$RO\cdot + HSCH_2CH_3 \rightarrow ROH + \cdot SCH_2CH_3$$

Tiil radikal

Adicija hloroforma

$$CH_3(CH_2)_5CH{=}CH_2 + HCCl_3 \xrightarrow{ROOR} CH_3(CH_2)_5\overset{\overset{H}{|}}{C}HCH_2CCl_3$$

24%

1,1,1-Trichlorononane

Mehanizam:

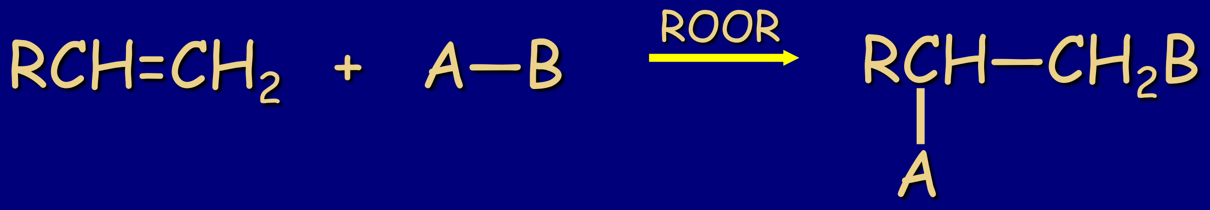
$$RO\cdot + CHCl_3 \longrightarrow ROH + \cdot CCl_3$$

za lančani mehanizam

Nema reakcije:

$$RO\cdot + Cl{-}CHCl_2 \longrightarrow ROCl + \cdot CHCl_2$$

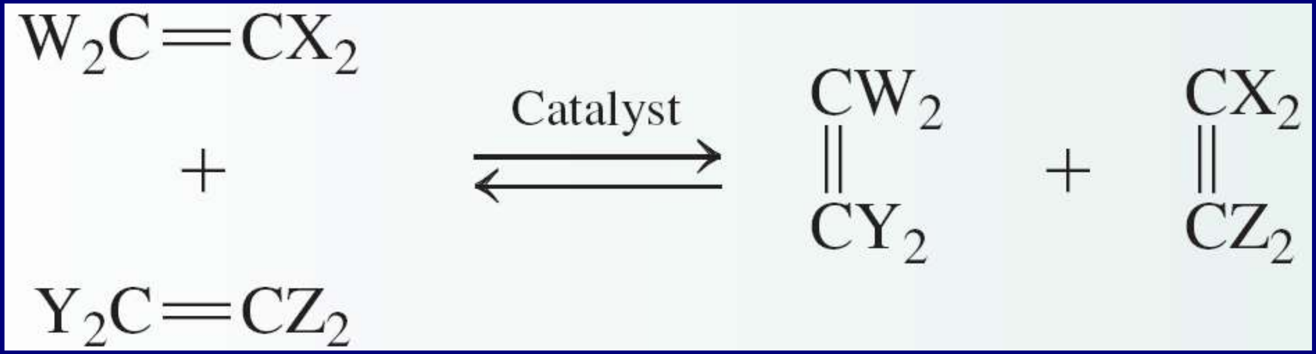
Generalno:



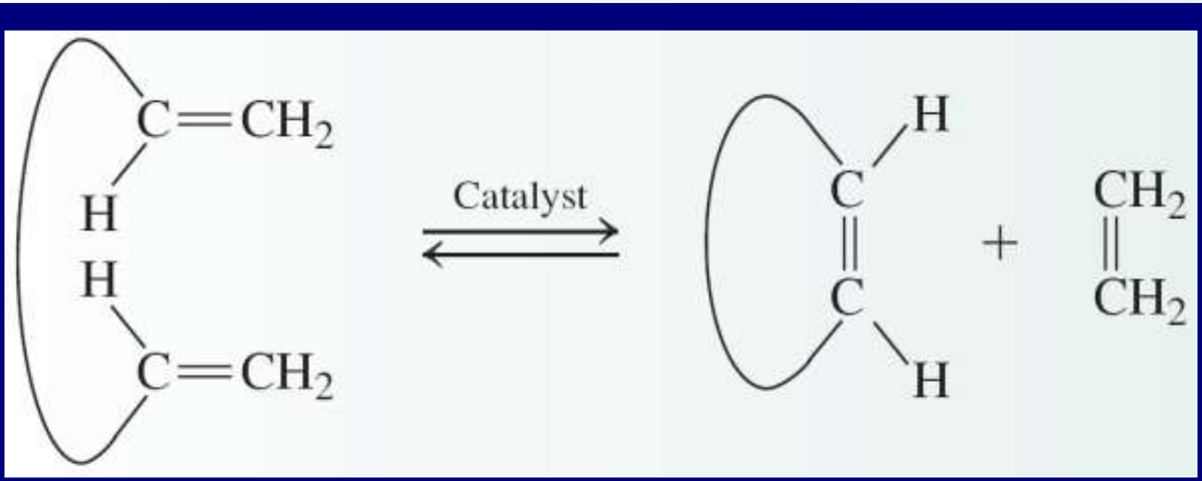
$$RCH{=}CH_2 + A{-}B \xrightarrow{ROOR} R\underset{\underset{A}{}}{\underset{|}{C}}H{-}CH_2B$$

Nobel-ova nagrada za hemiju
2005

Metateza alkena:

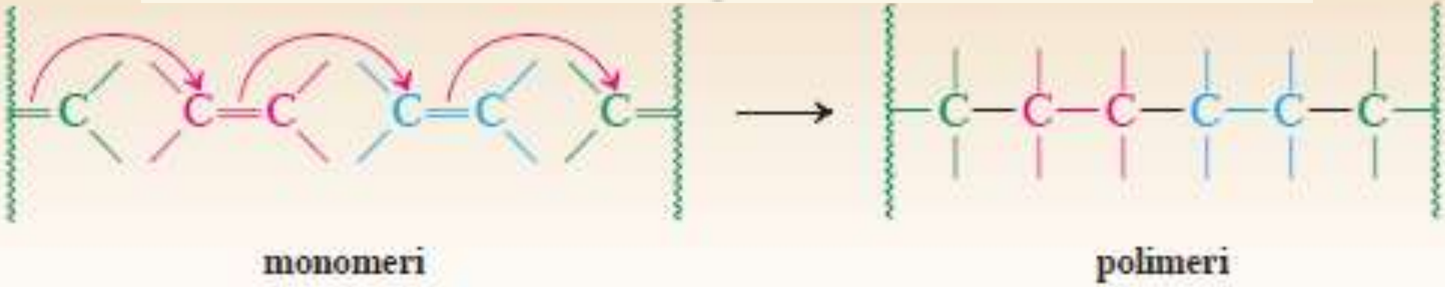


$$W_2C{=}CX_2 + Y_2C{=}CZ_2 \xrightleftharpoons{\text{Catalyst}} CW_2{=}CY_2 + CX_2{=}CZ_2$$



Chauvin, Schrock, Grubbs

Polimerizacija alkena



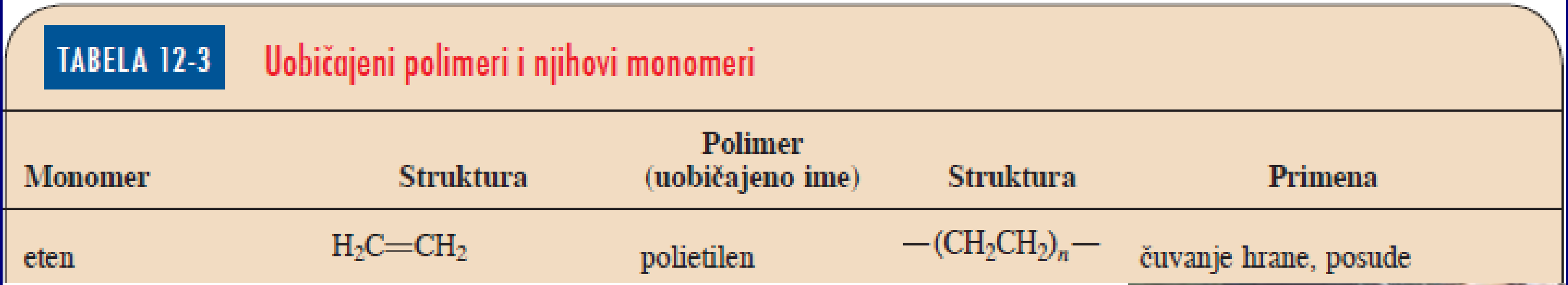
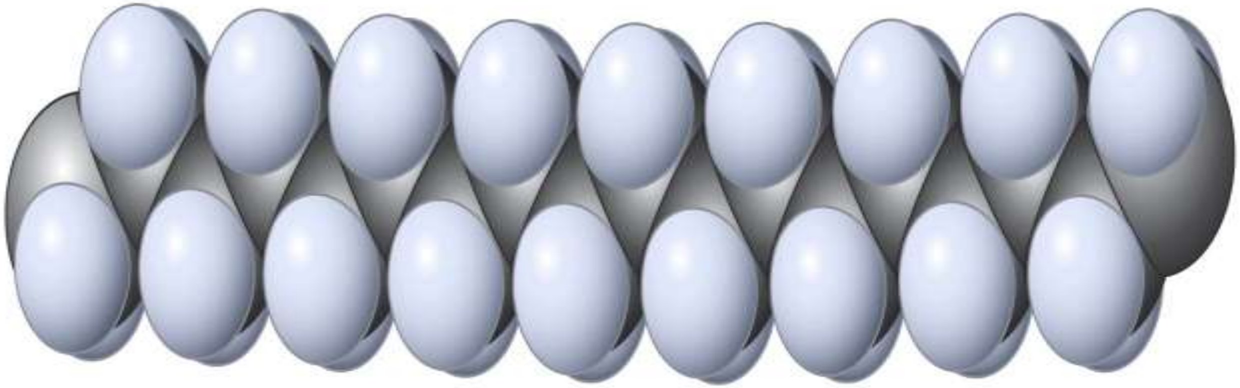
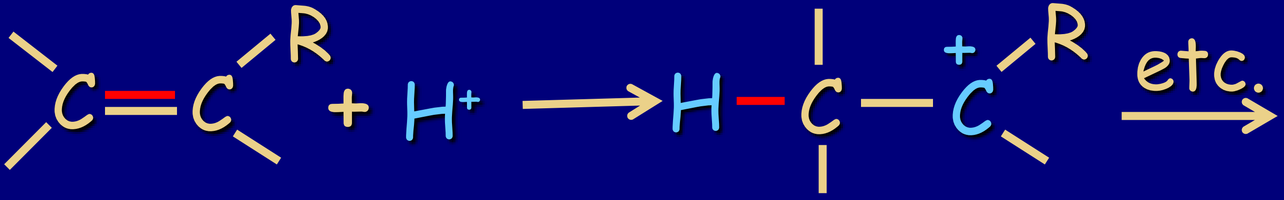


TABELA 12-3 Uobičajeni polimeri i njihovi monomeri

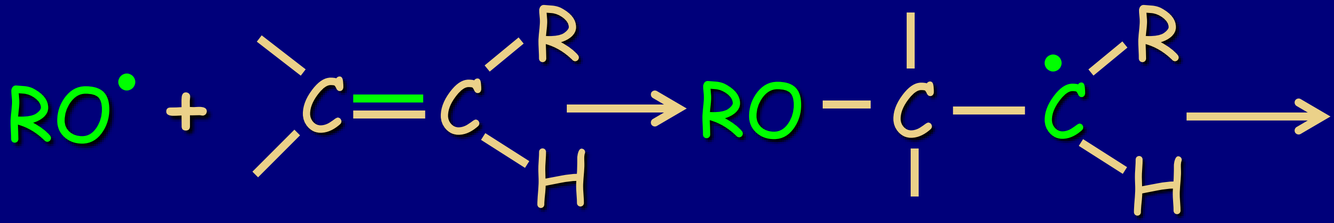
Monomer	Struktura	Polimer (uobičajeno ime)	Struktura	Primena
eten	$H_2C{=}CH_2$	polietilen	$-(CH_2CH_2)_n-$	čuvanje hrane, posude



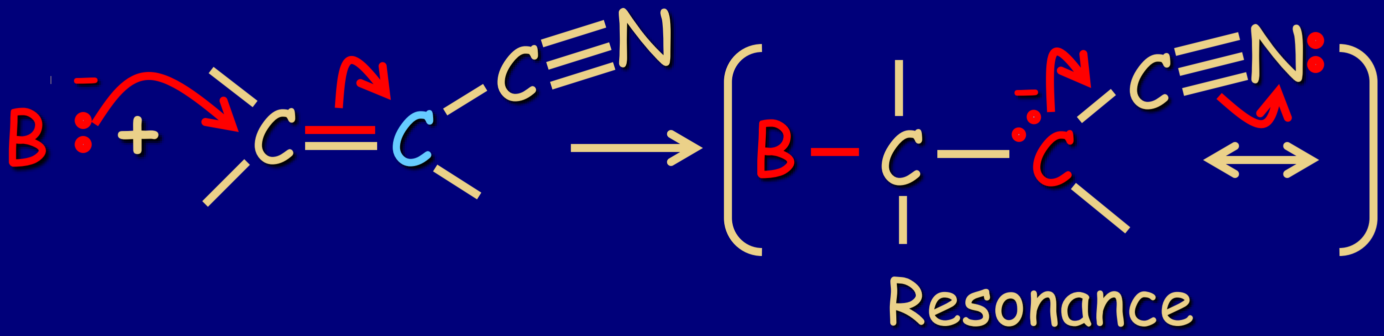
katjonska



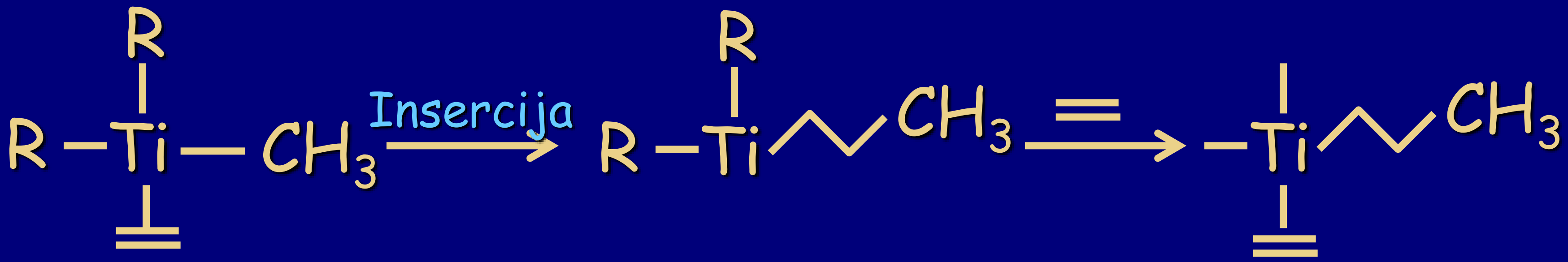
radikalska



anjonska



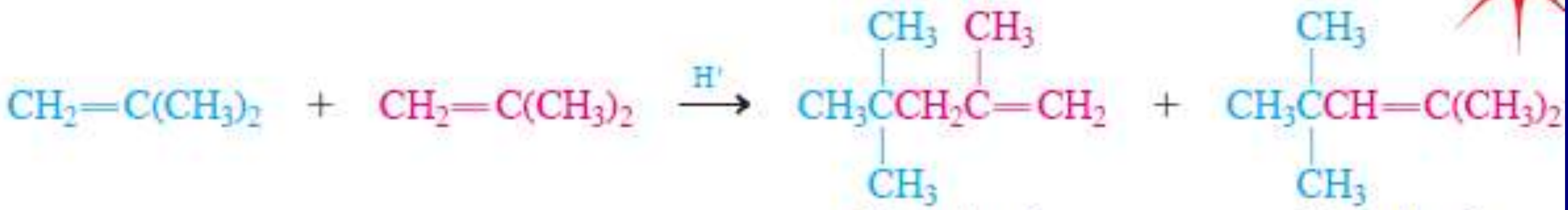
Metali (Ti, Zr, lanthanidi): Ziegler-Natta;
mehanizam preko organometala



Kiselo-katalizovana reakcija

Reakcija preko karbokatjona.

Dimerizacija 2-metilpropena

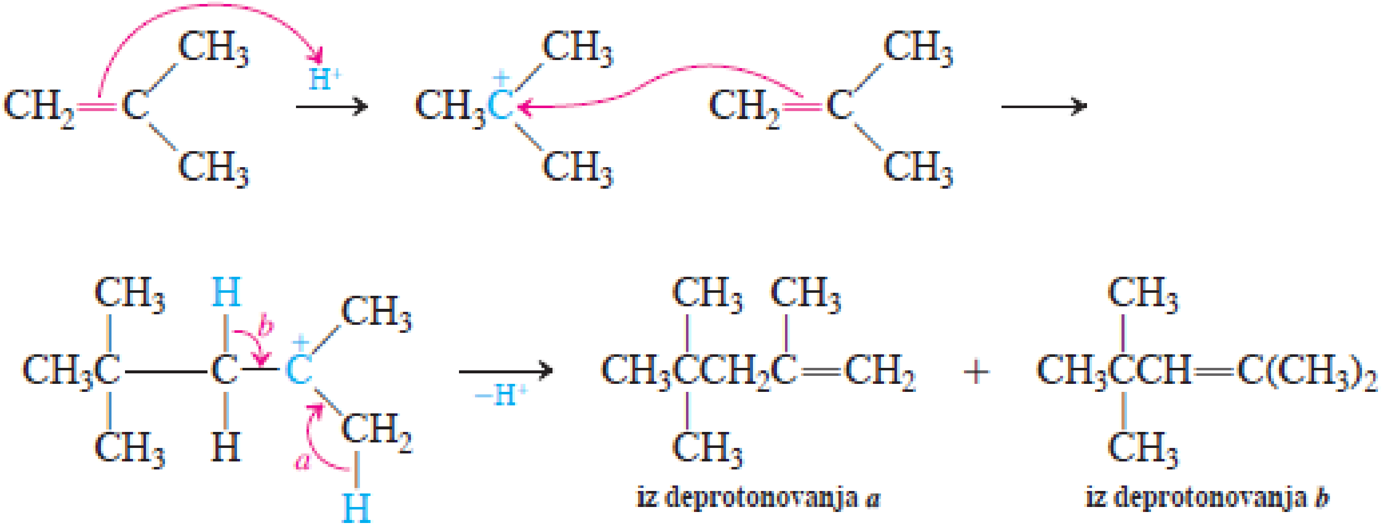


$$CH_2{=}C(CH_3)_2 + CH_2{=}C(CH_3)_2 \xrightarrow{H^+} CH_3\overset{CH_3}{\underset{CH_3}{C}}CH_2\overset{CH_3}{C}{=}CH_2 + CH_3\overset{CH_3}{\underset{CH_3}{C}}CH{=}C(CH_3)_2$$

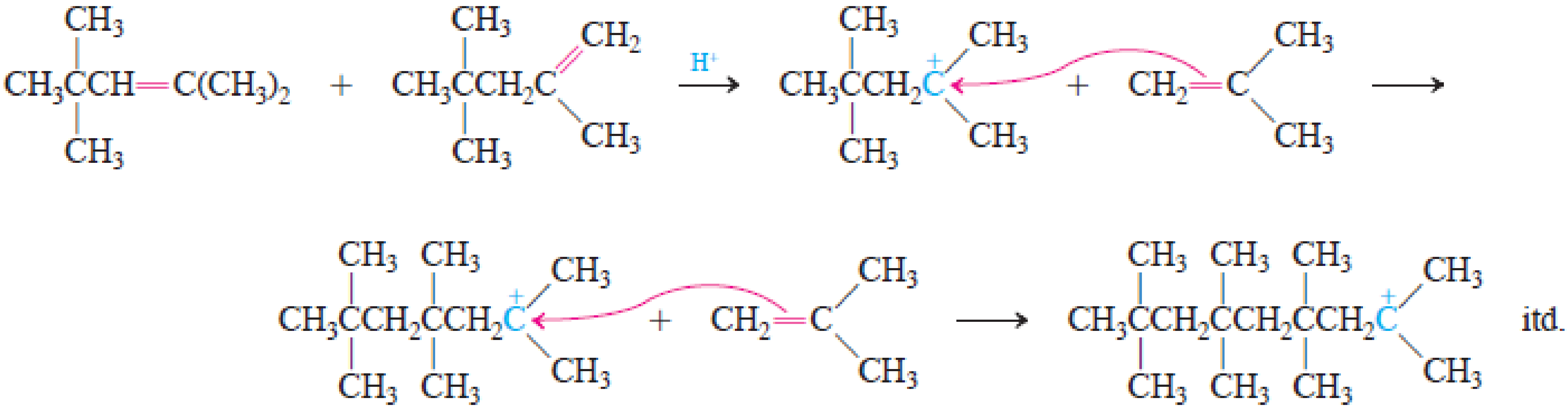
2,4,4-trimetil- -1-penten

2,4,4-trimetil- -2-penten

Mehanizam dimerizacije 2-metilpropena



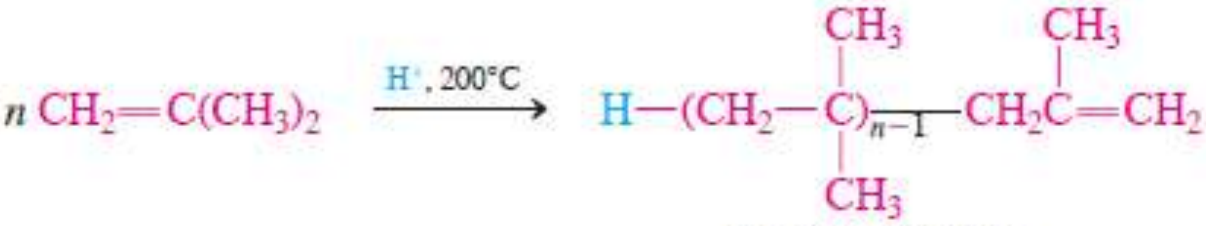
Oligomerizacija dimera 2-metilpropena



$$(CH_3)_3CCH{=}C(CH_3)_2 + (CH_3)_3CCH_2C(CH_3){=}CH_2 \xrightarrow{H^+} (CH_3)_3CCH_2\overset{+}{C}(CH_3)_2 + CH_2{=}C(CH_3)_2 \longrightarrow$$

$$(CH_3)_3CCH_2C(CH_3)_2CH_2\overset{+}{C}(CH_3)_2 + CH_2{=}C(CH_3)_2 \longrightarrow (CH_3)_3CCH_2C(CH_3)_2CH_2C(CH_3)_2CH_2\overset{+}{C}(CH_3)_2 \text{ itd.}$$

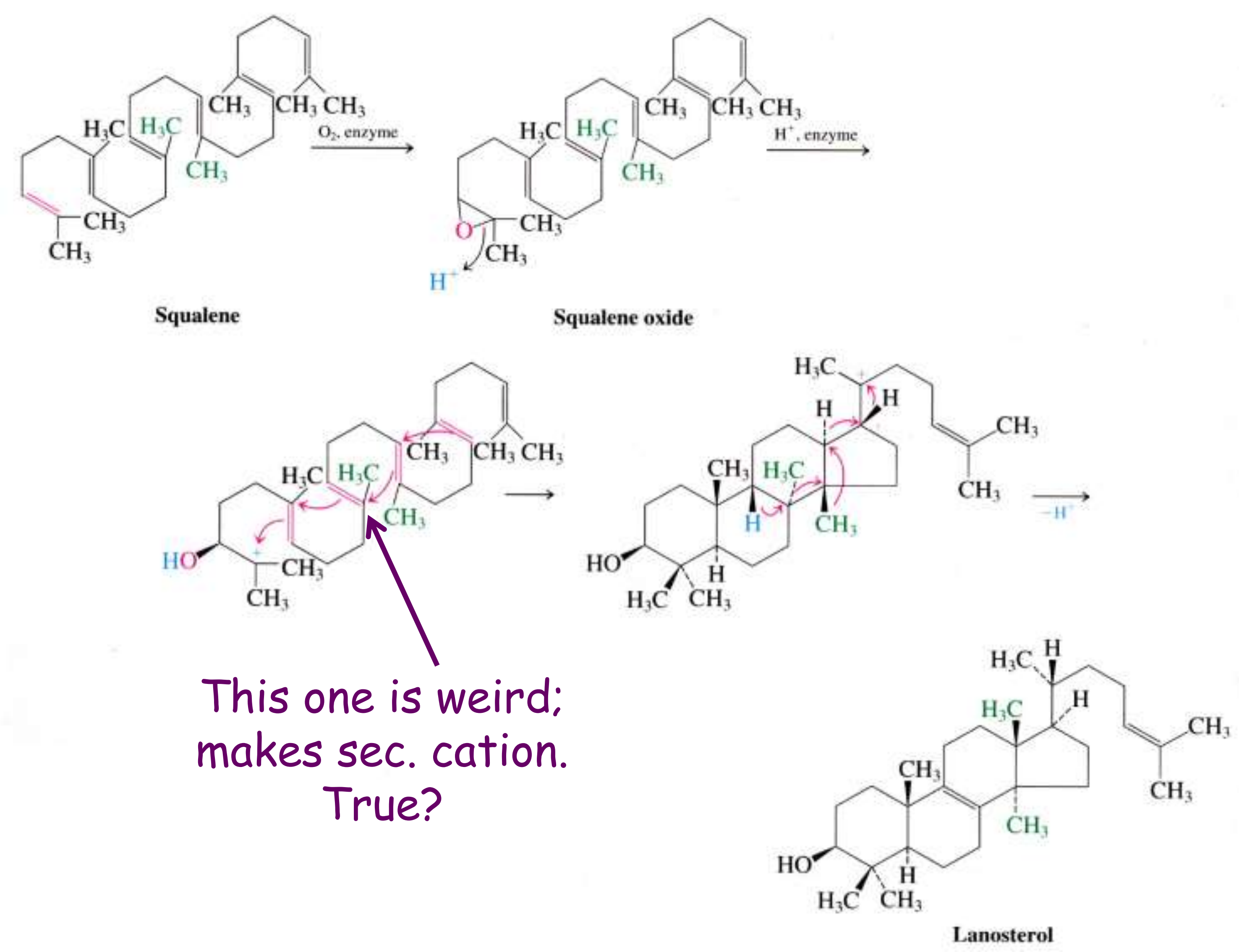
Polimerizacija 2-metilpropena



$$n\,CH_2{=}C(CH_3)_2 \xrightarrow{H^+,\,200°C} H{-}(CH_2{-}C(CH_3)_2)_{n-1}{-}CH_2C(CH_3){=}CH_2$$

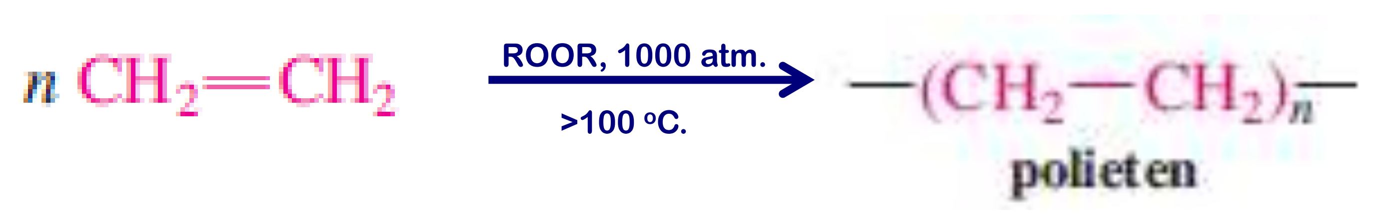
poli(2-metilpropen)
(poliizobutilen)

Kontrolisana oligomerizacija u prirodi: kiselo-katalizovana sinteza steroida (postupna)



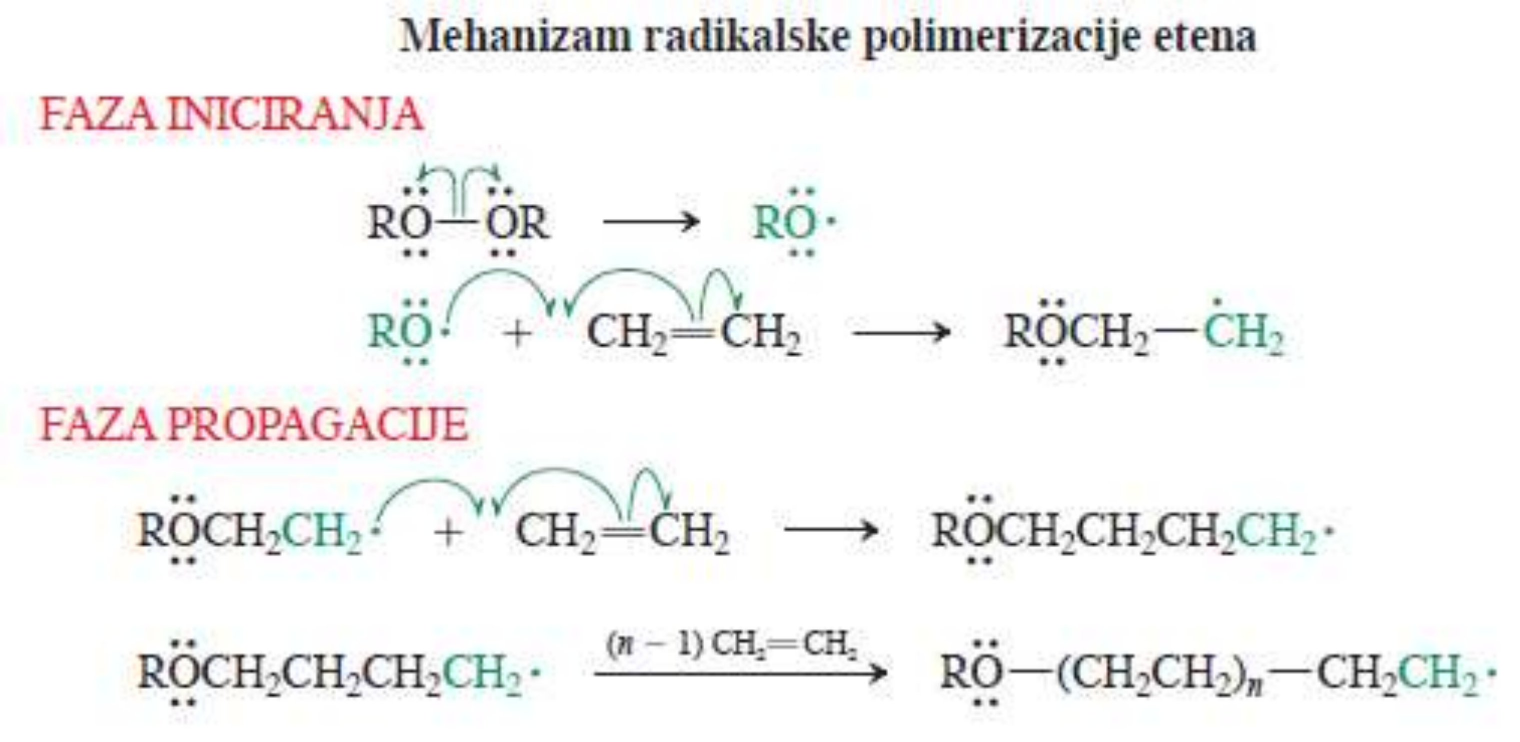
This one is weird; makes sec. cation. True?

Radikalska polimerizacija



$$n\,CH_2{=}CH_2 \xrightarrow[>100\ ^{o}C.]{ROOR,\ 1000\ atm.} -(CH_2-CH_2)_n-$$

polieten



Mehanizam radikalske polimerizacije etena

FAZA INICIRANJA

$$R\ddot{O}-\ddot{O}R \longrightarrow R\ddot{O}\cdot$$

$$R\ddot{O}\cdot + CH_2{=}CH_2 \longrightarrow R\ddot{O}CH_2-\dot{C}H_2$$

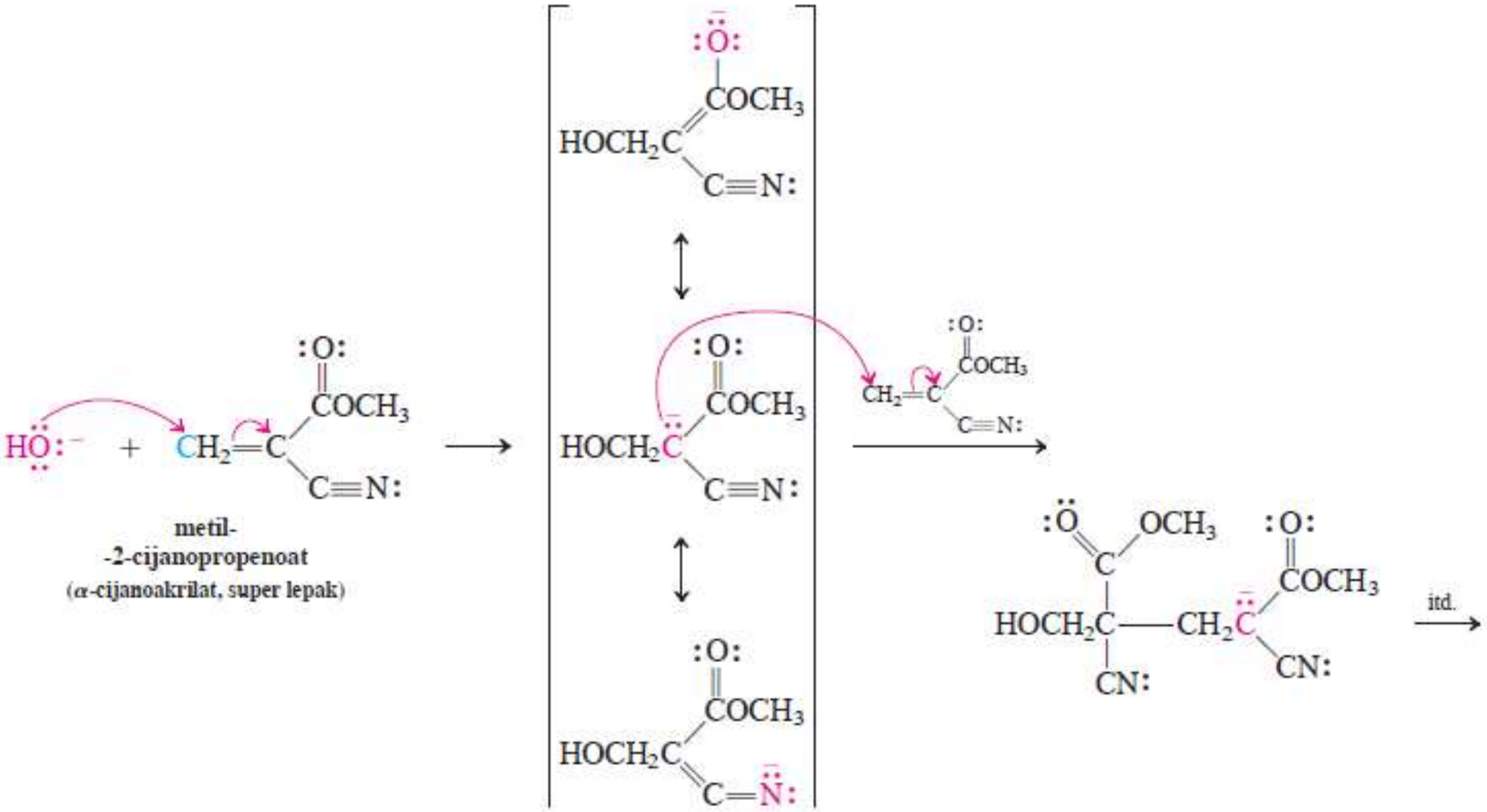
FAZA PROPAGACIJE

$$R\ddot{O}CH_2CH_2\cdot + CH_2{=}CH_2 \longrightarrow R\ddot{O}CH_2CH_2CH_2CH_2\cdot$$

$$R\ddot{O}CH_2CH_2CH_2CH_2\cdot \xrightarrow{(n-1)\ CH_2{=}CH_2} R\ddot{O}-(CH_2CH_2)_n-CH_2CH_2\cdot$$

Anjonska polimerizacija

Anjonska polimerizacija superlepka (metil α-cijanoakrilat)



metil-
-2-cijanopropenoat
(α-cijanoakrilat, super lepak)

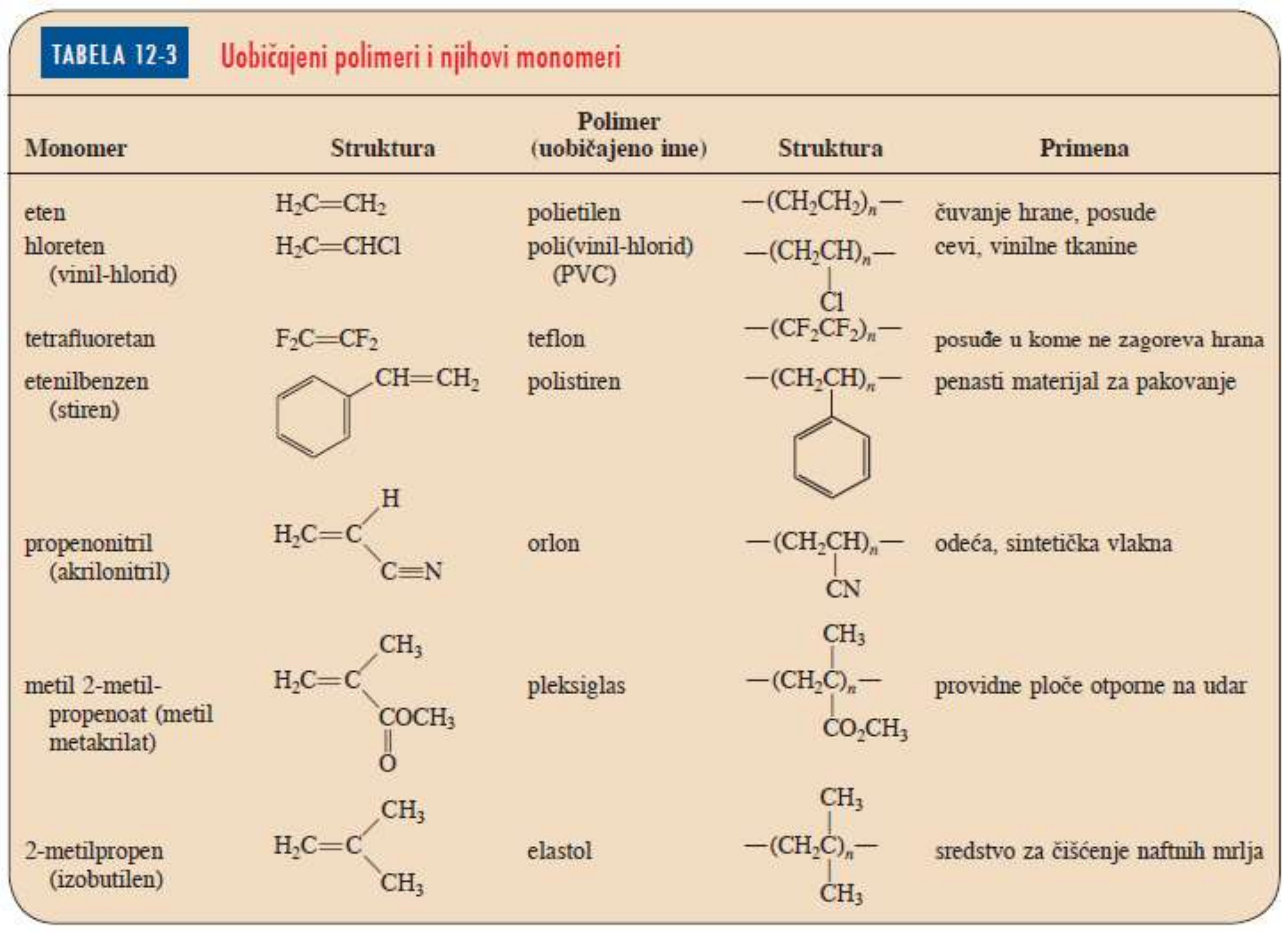


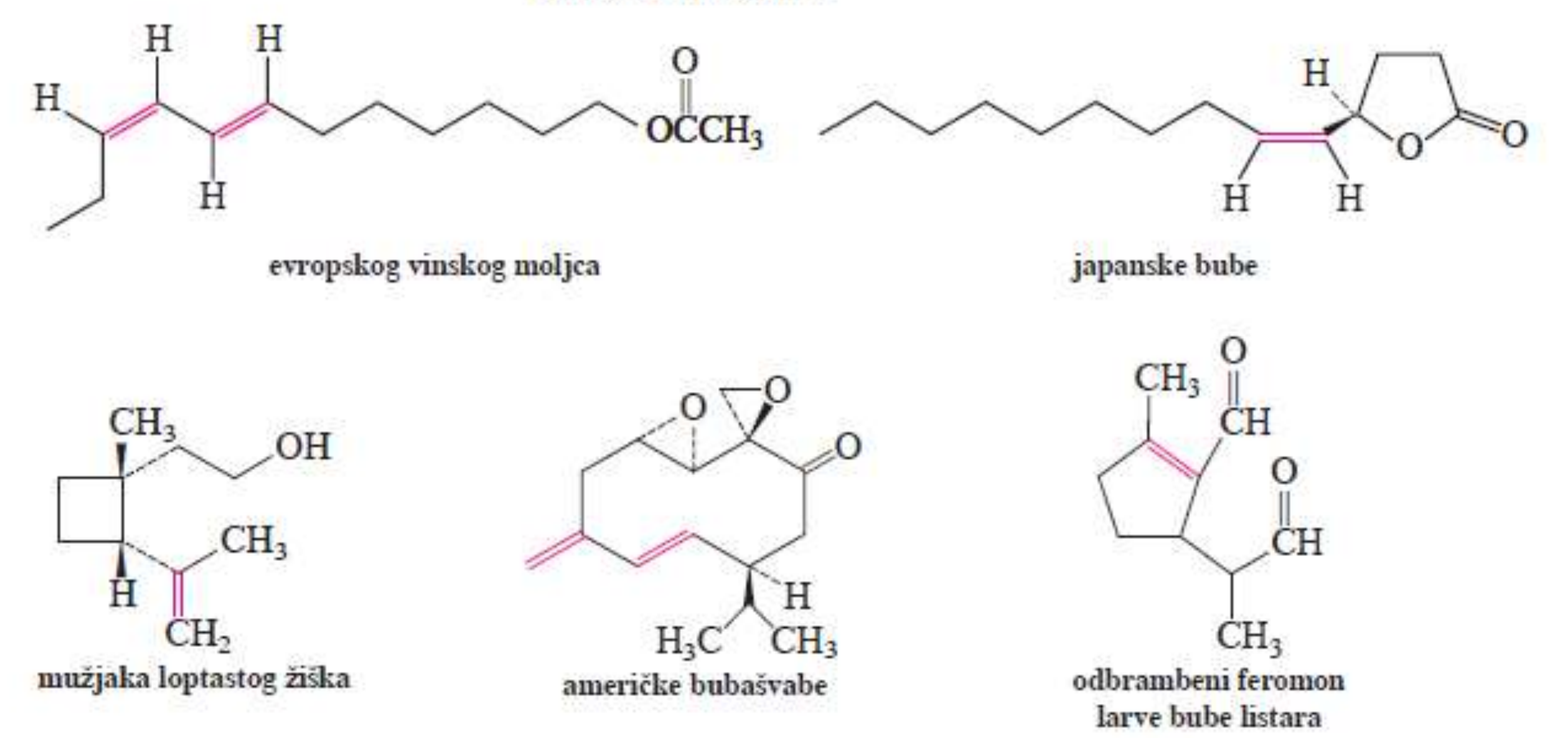
TABELA 12-3 Uobičajeni polimeri i njihovi monomeri

Monomer	Struktura	Polimer (uobičajeno ime)	Struktura	Primena
eten	$H_2C{=}CH_2$	polietilen	$-(CH_2CH_2)_n-$	čuvanje hrane, posude
hloreten (vinil-hlorid)	$H_2C{=}CHCl$	poli(vinil-hlorid) (PVC)	$-(CH_2\underset{Cl}{\underset{\lvert}{CH}})_n-$	cevi, vinilne tkanine
tetrafluoretan	$F_2C{=}CF_2$	teflon	$-(CF_2CF_2)_n-$	posuđe u kome ne zagoreva hrana
etenilbenzen (stiren)	$CH{=}CH_2$	polistiren	$-(CH_2CH)_n-$	penasti materijal za pakovanje
propenonitril (akrilonitril)	$H_2C{=}C\begin{smallmatrix}H\\ C\equiv N\end{smallmatrix}$	orlon	$-(CH_2\underset{CN}{\underset{\lvert}{CH}})_n-$	odeća, sintetička vlakna
metil 2-metil-propenoat (metil metakrilat)	$H_2C{=}C\begin{smallmatrix}CH_3\\ \underset{\underset{O}{\Vert}}{C}OCH_3\end{smallmatrix}$	pleksiglas	$-(CH_2\overset{CH_3}{\overset{\lvert}{\underset{CO_2CH_3}{\underset{\lvert}{C}}}})_n-$	providne ploče otporne na udar
2-metilpropen (izobutilen)	$H_2C{=}C\begin{smallmatrix}CH_3\\ CH_3\end{smallmatrix}$	elastol	$-(CH_2\overset{CH_3}{\overset{\lvert}{\underset{CH_3}{\underset{\lvert}{C}}}})_n-$	sredstvo za čišćenje naftnih mrlja

Alkeni u prirodi: feromoni

Feromoni su hemijske supstance koje služe za komunikaciju u okviru vrste. Postoje seksualni feromoni, feromoni za obeleđavanje kretanja, feromoni upozoravnja, odbrambeni feromoni

Feromoni insekata



evropskog vinskog moljca

japanske bube

mužjaka loptastog žiška

američke bubašvabe

odbrambeni feromon larve bube listara