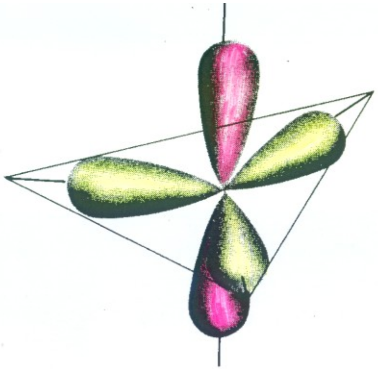
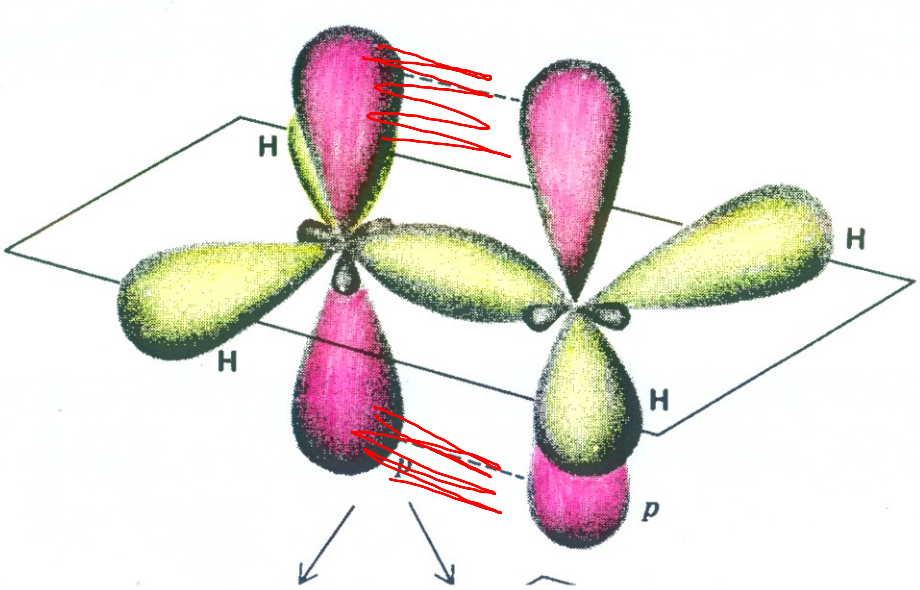
ALKENES AND CYCLOALKENES

Compounds with **C - C** 0,154 nm and **C – H** bonds
C = C 0, 134 nm and **=C-H** bonds

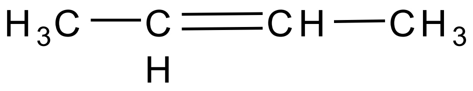
Bonding energy **C – C** 351 kJ/mol σ - bond
C = C 610 kJ/mol **Δ = 259 kJ/mol** π - bond

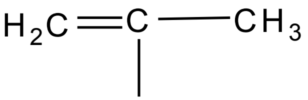




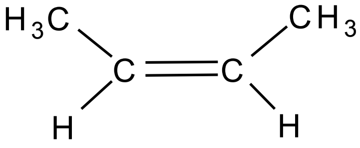
ALKENES AND CYCLOALKENES

Nomenclature

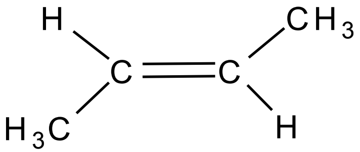
$H_2C{=}CH_2$	ethene, ethylene
$H_2C{=}CH{-}CH_3$	propene, propylene
$H_2C{=}CH{-}CH_2{-}CH_3$	butene
 $H_3C{-}\underset{H}{C}{=}CH{-}CH_3$	but-2-ene

$H_2C{=}CH{-}$	ethenyl- , **vinyl-**
$H_2C{=}CH{-}CH_2{-}$	prop-2-en-1-yl, **allyl-**
$H_3C{-}CH{=}CH{-}$	prop-1-en-1-yl
 $H_2C{=}\underset{\mid}{C}{-}CH_3$	prop-1-en-2-yl

Geometric isomerie



cis-but-2-ene

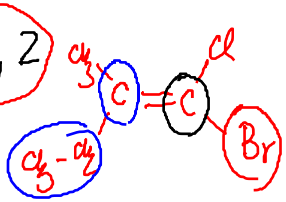


trans-but-2-ene

(E) (Z)

application ***cis-*** and ***trans-*** is suitable only for simple molecules

E, Z

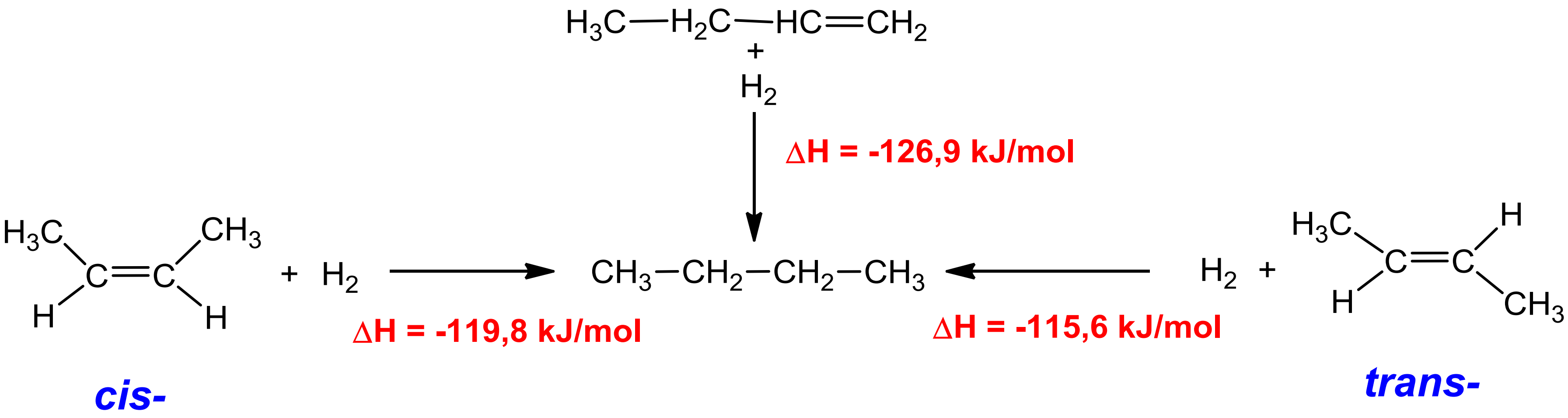


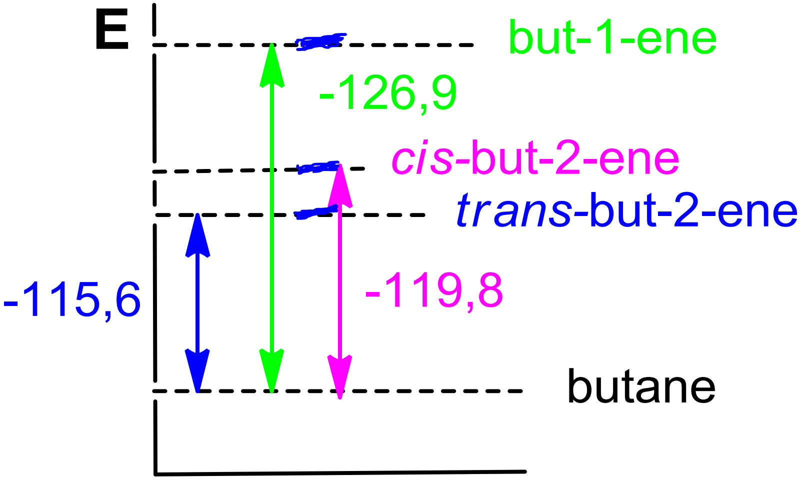
má větší prioritu

(Z) – 1-brom-1-chlor-2-methylbuten

ALKENES AND CYCLOALKENES

STABILITY of alkenes

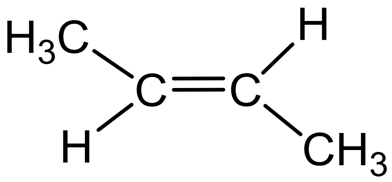




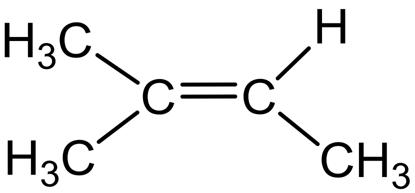
HEAT OF HYDROGENATION

stability of *trans*-isomer is higher

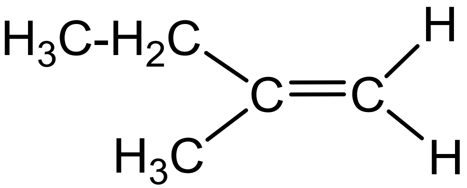
ALKENES AND CYCLOALKENES



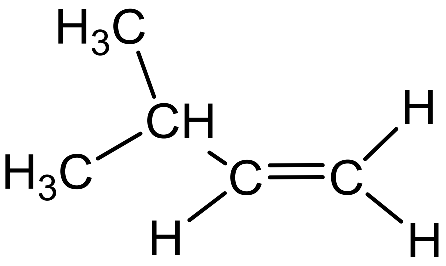
ΔH = -115,6 kJ/mol



ΔH = -112,7 kJ/mol



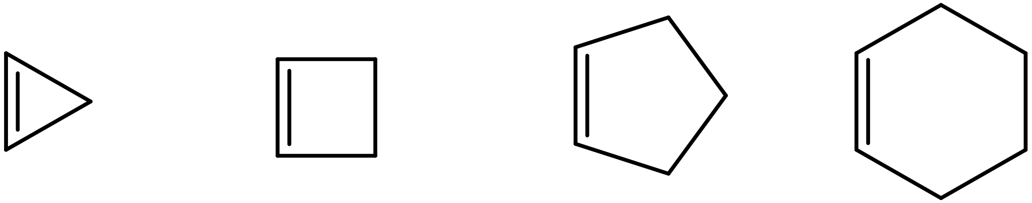
ΔH = -119,4 kJ/mol



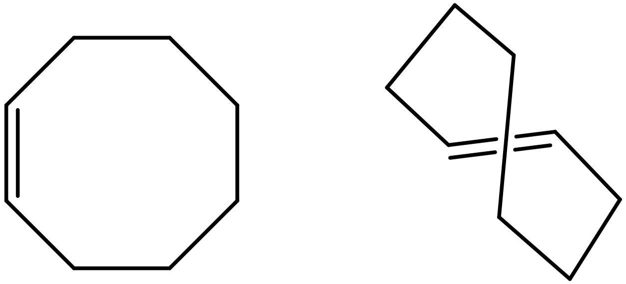
ΔH = -126,9 kJ/mol

the more the systeme at the double bond is branched, the more is stable

ALKENES AND CYCLOALKENES



all cycloalkenes with less than 6 atoms in a ring are only known as *cis-* isomers



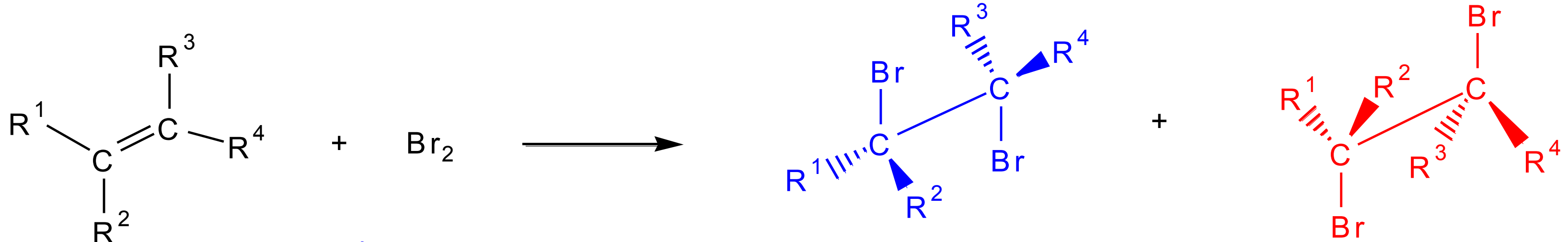
only stable is *trans*-cyclooctene

ALKENES AND CYCLOALKENES

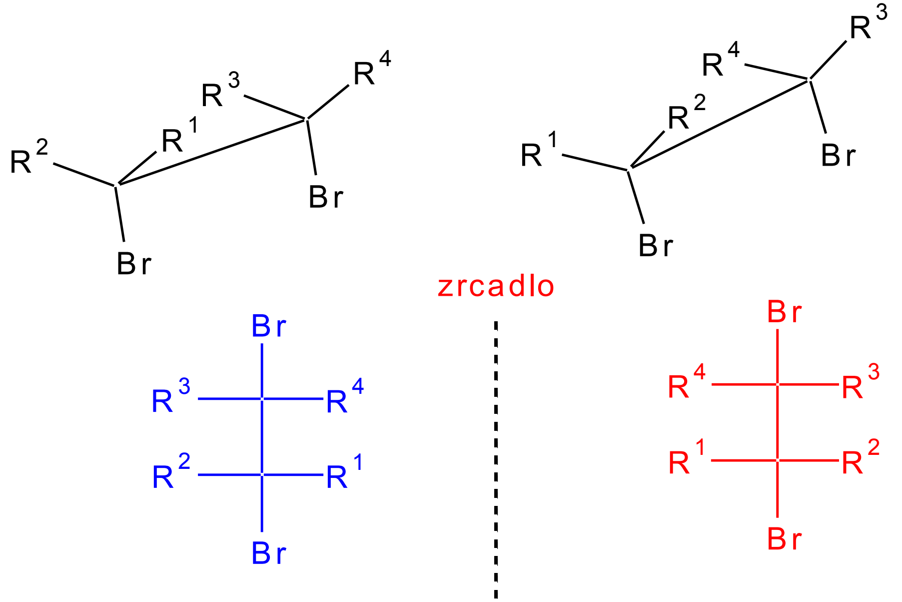
THE MAIN DIRECTION OF ALKENE REACTIVITY

ADDITION REACTION

Reactions are stereospecific



planární



During addition of symmetrical molecule to non-symmetrically substituted olefine enantiomers are created – reaction is stereospecific- *trans- (anti-)* addition

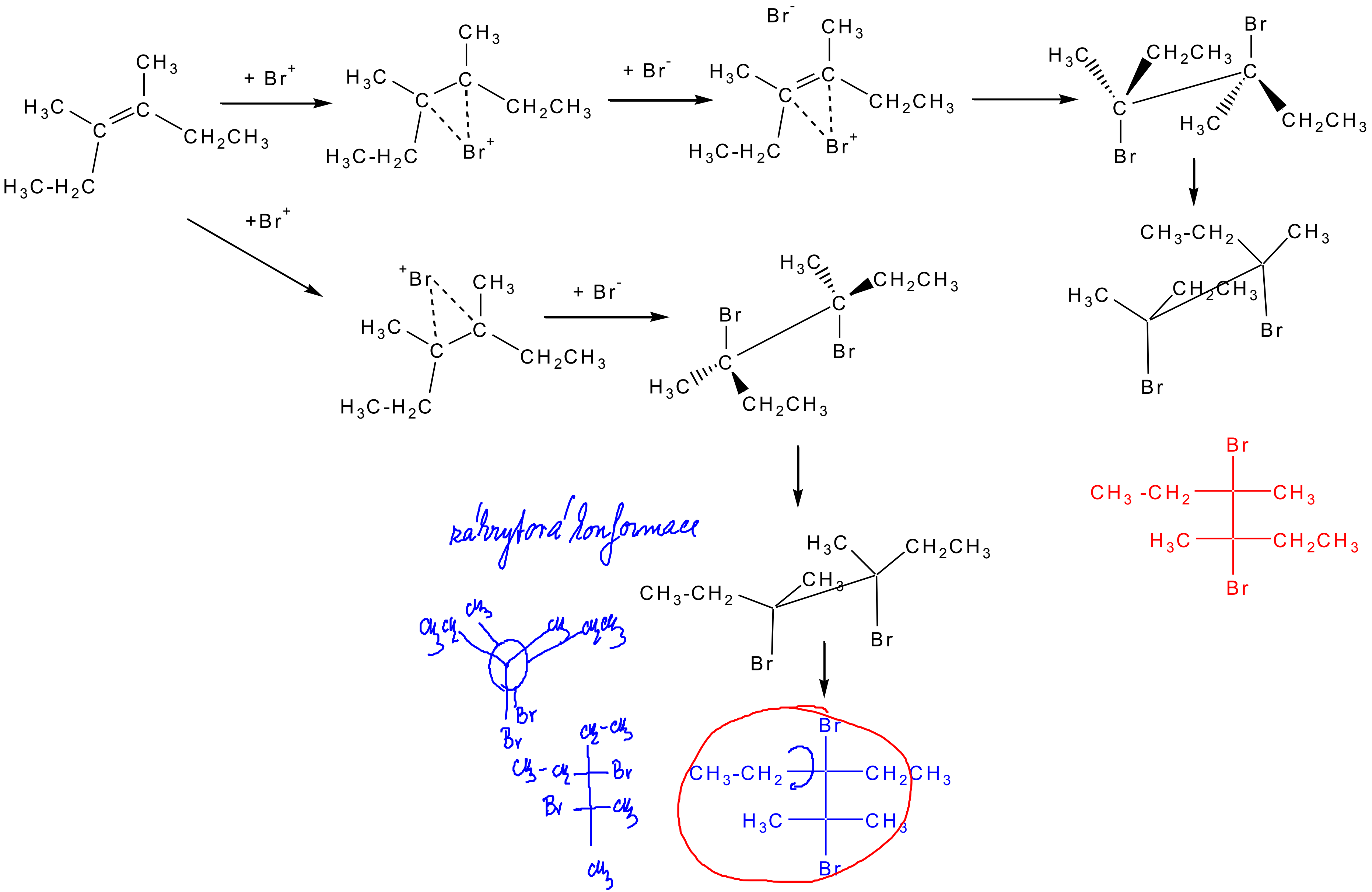
$$Br_2 + Br_2 \longrightarrow Br^+ + Br_3^-$$

$$Br-Br \cdots Br-Br \longrightarrow Br^{\oplus} + Br_3^{\ominus}$$

Stereospecific mechanism of additions

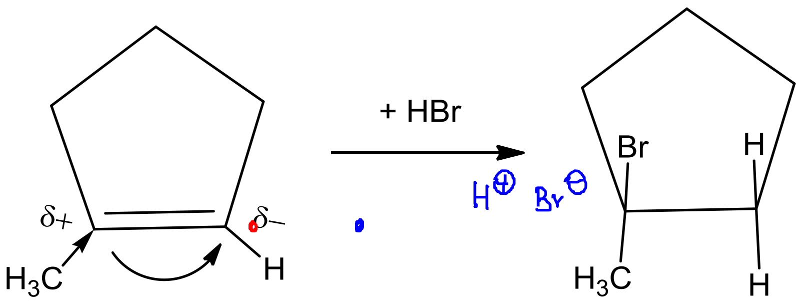
$Br_2 + Br_2 \longrightarrow Br^+ + Br_3^-$

$Br_3^{\ominus} \longrightarrow Br^{\ominus} + Br_2$



zákrytová konformace

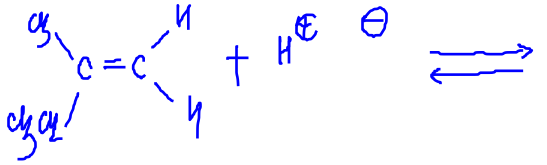
Regiospecific mechanism of additions

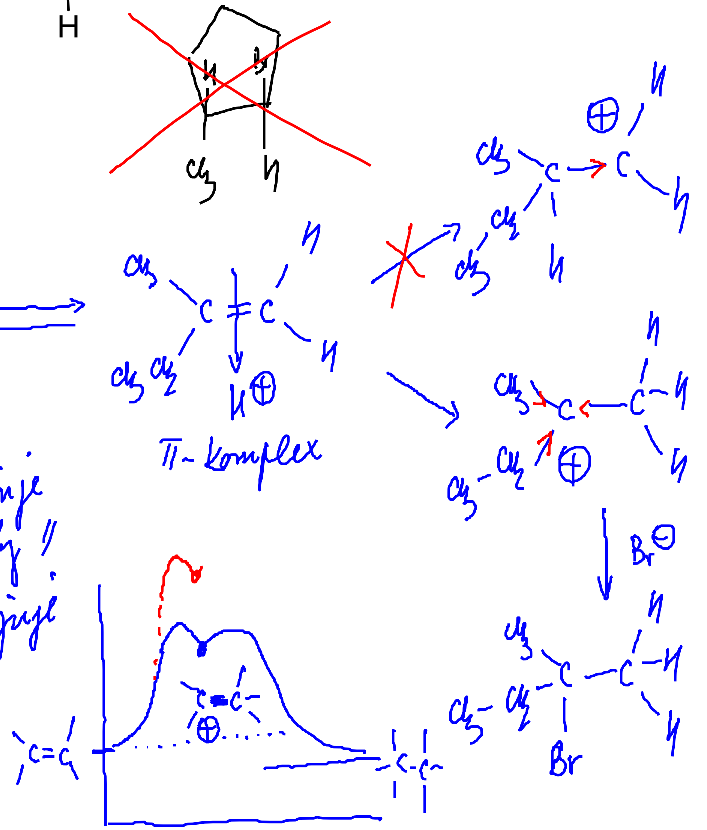


nesymetrický alken

nesym. činidlo molekula, které se aduje

Markovnikovo pravidlo





primární karbokation

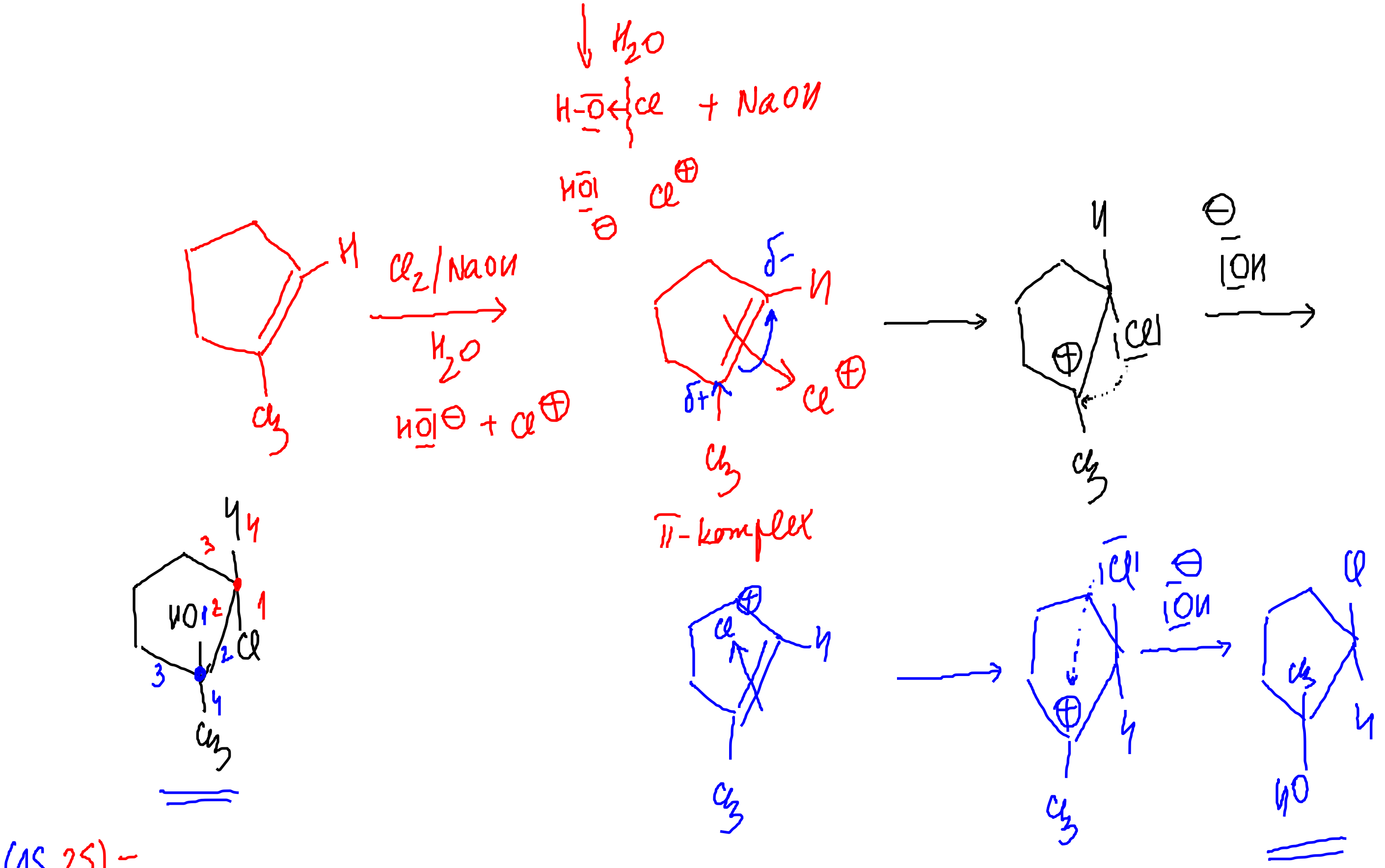
terc. karbokation

"- elektrofilní částice se připojuje na uhlík s více vodíky"

- elektrofilní částice se připojuje k uhlíku tak aby vznikl stabilnější karbokation

Regiospecific mechanism of additions

$$Cl_2 + NaOH \xrightarrow{H_2O} NaCl \quad NaOCl$$



(1S,2S)-

-chlor-1-metylcyklopentanol

Regiospecific mechanism of additions

$Br_2 + Br_2 \longrightarrow Br^+ + Br_3^-$