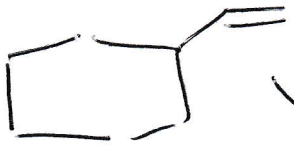
② $CH_2=CH$ is called Vinyl (common name)

$H_2C=CHCl$ Vinyl Chloride

③ $H_2C=C(H)-CH_2$ Allyl

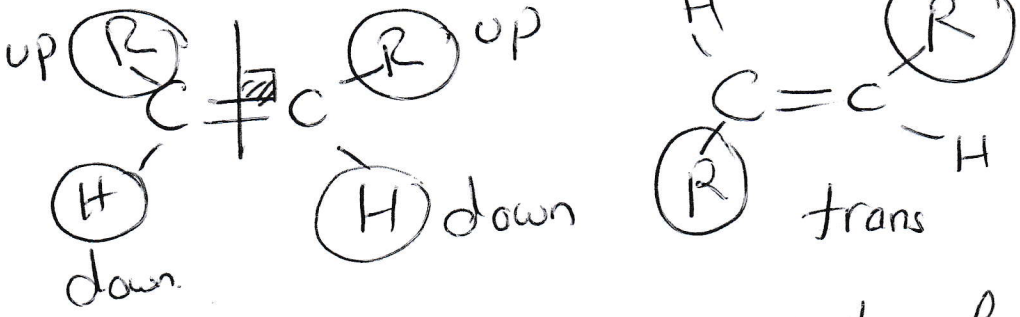
$H_2C=C(H)-CH_2Br$ Allyl bromide

(IUPAC: 3-Bromo propene)



Vinyl Cyclohexane

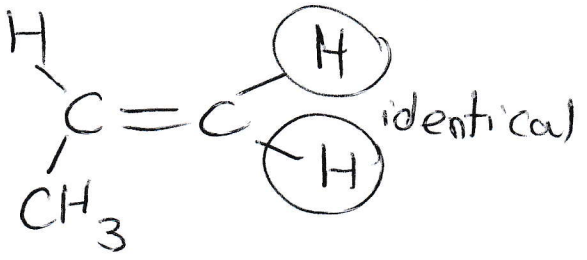
* Cis-Trans isomerism in Alkenes:

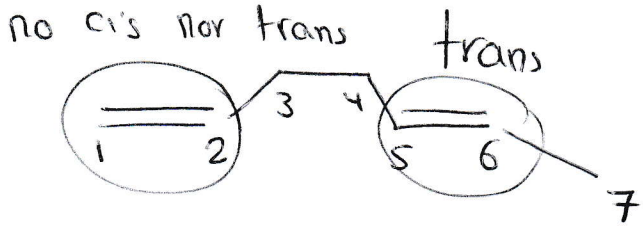


trans

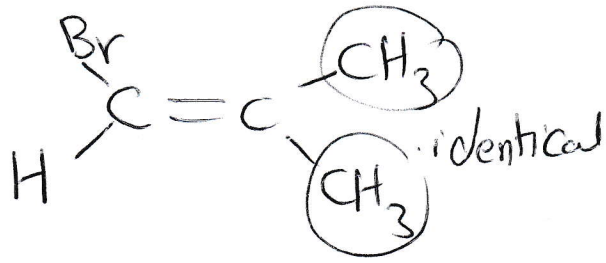
cis and trans are part of IUPAC name and should be written in the beginning.

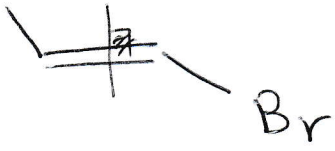
Note: If alkene has identical groups (atoms) on the same carbon of C=C, there is no cis nor trans.





trans-1, 5-heptadiene





trans-1-Bromopropene

Ex: Which one can show cis-trans isomerism ?

1-hexene, 1-pentene, 2-methyl-2-pentene,

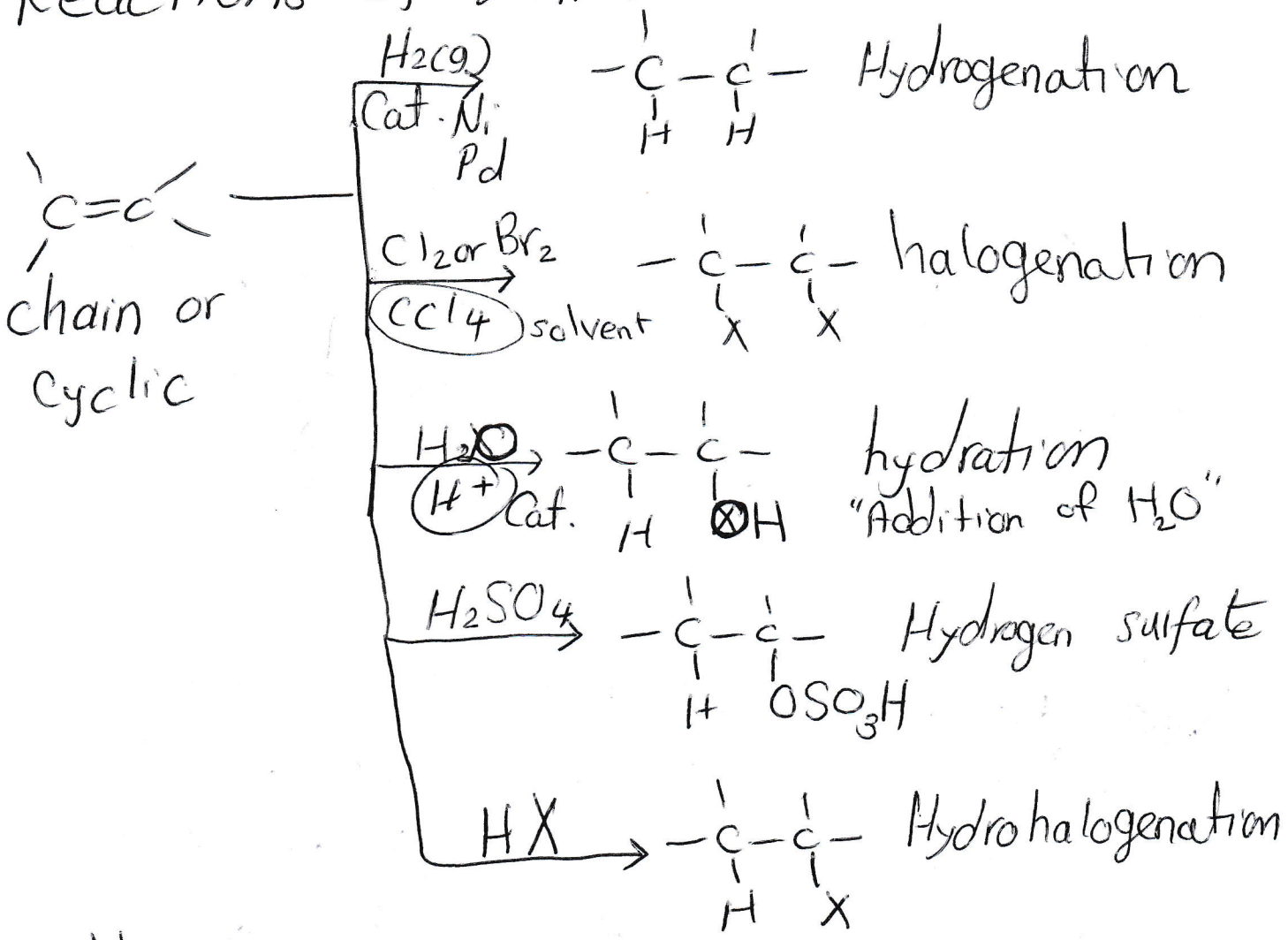
2-hexene, 3-hexene, 2-methyl-2-butene

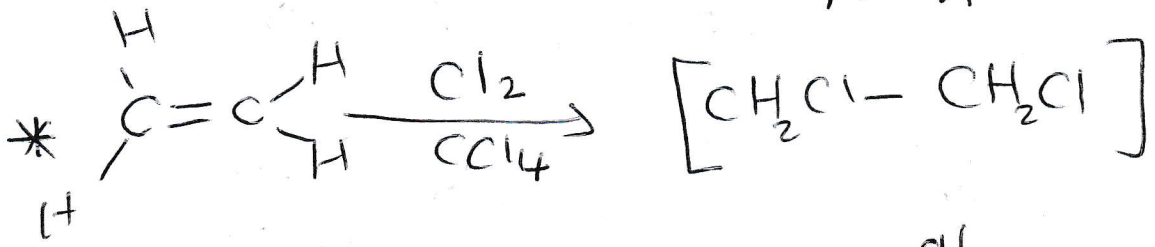
* Reactions of Alkenes and Alkynes:

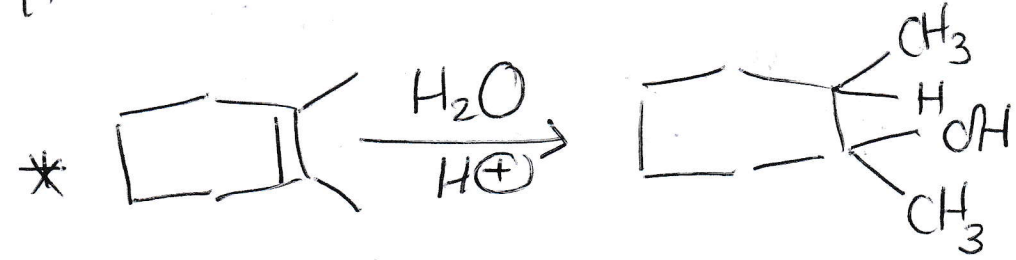
First: For alkenes:

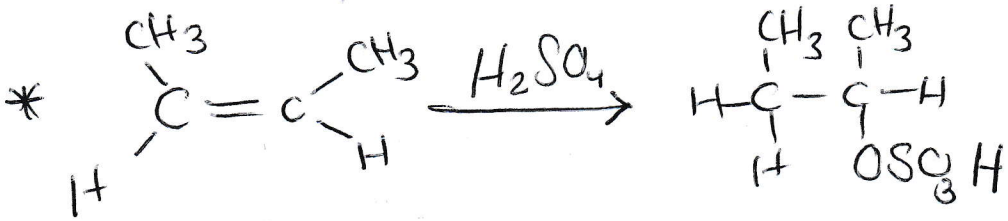
π bond is broken in reactants and new σ bonds are formed in the product $\Longrightarrow$ this type of reaction is called: Addition reaction

Reactions of Alkenes:-







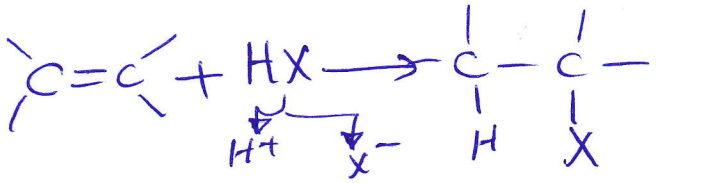


Mechanism of reaction:-

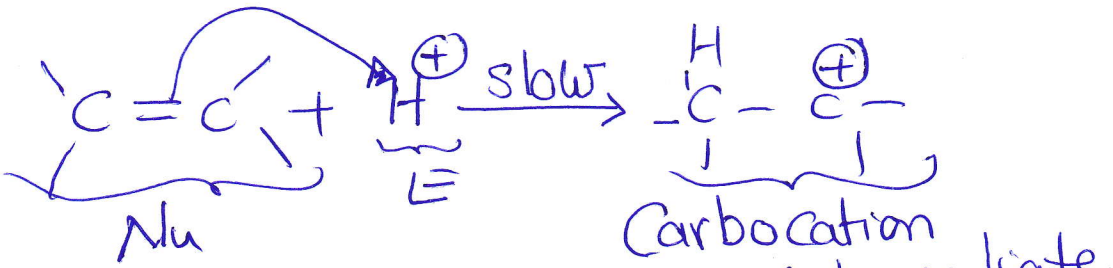
* Electrophile (E):- electron-deficient species, such as: $H^{\oplus}$, $CH_3^{\oplus}$, $Cl-\overset{Cl}{\underset{Cl}{Al}}-Cl$

* Nucleophile (Nu):- electron-rich species such as: π-bonds in alkene or benzene, $H-\ddot{O}-H$, $H-\overset{H}{\underset{H}{N^{+}}}-H$, $X^{\ominus}$

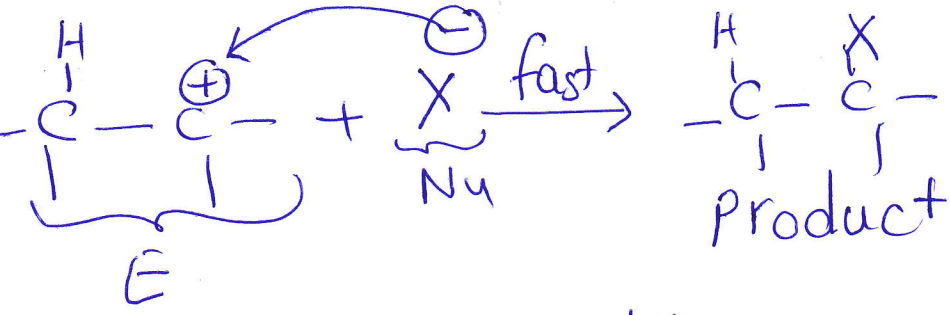
Now, Mechanism of reaction is consisting of 2 steps.



Step 1:

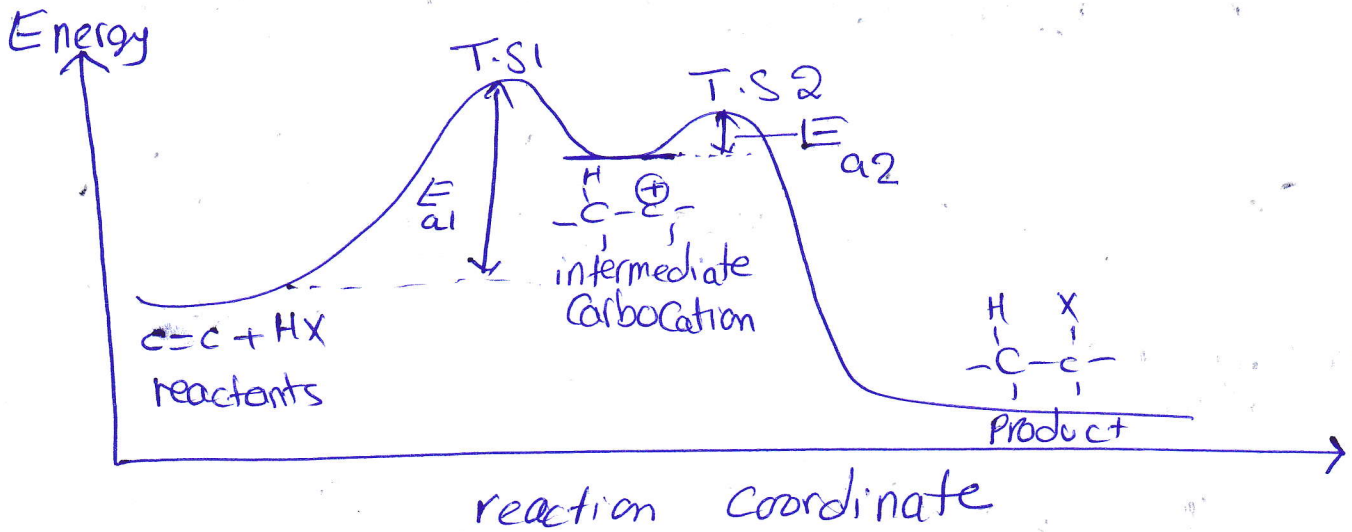


Step 2:



Mechanism: Electrophilic Addition reaction for alkenes and alkynes

Reaction energy diagram:

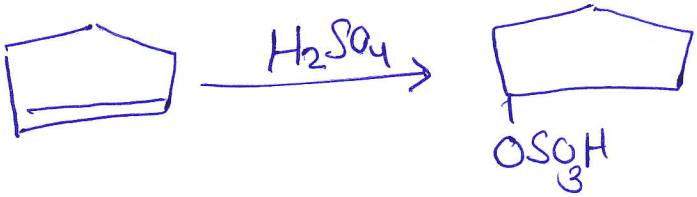


* T.S: Transition state: Bonds are broken and formed at same time.

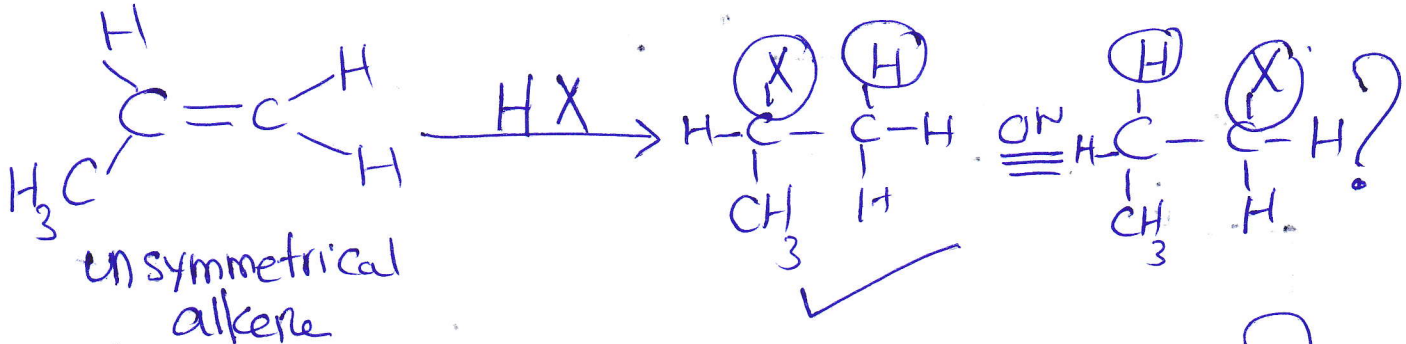
* E_a: Activation energy: Difference in energy between reactant and Transition state or intermediate and transition state.

* Reaction is exothermic ($\Delta H_{rxn} <$ zero).

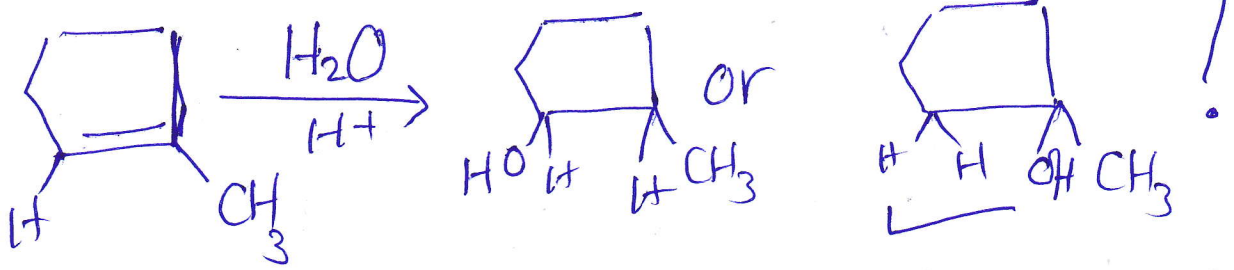
Ex1: Write an intermediate for the following reaction



Markovnikov's rule: It is important if alkene (or alkyne) is not symmetrical.

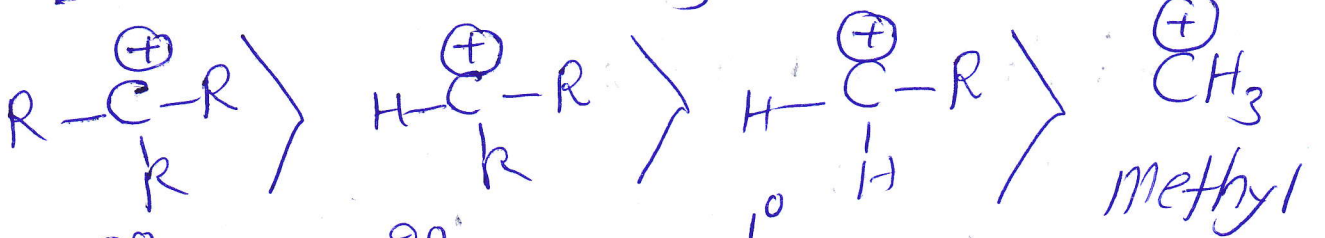


unsymmetrical alkene



* Markovnikov's rule states that: Electrophile (H^+) is added to carbon of C=C that has more hydrogens that are attached directly to the carbon.

* Explain Stability of Carbocation



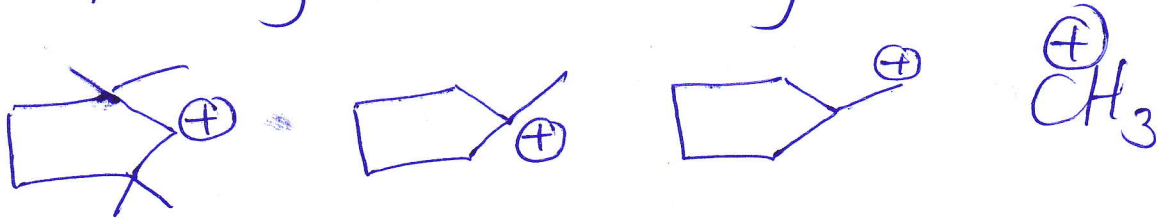
3° Carbocation "the most stable

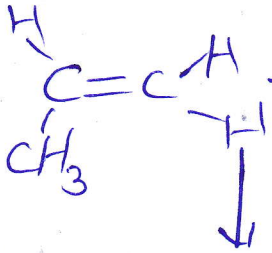
2°

1°

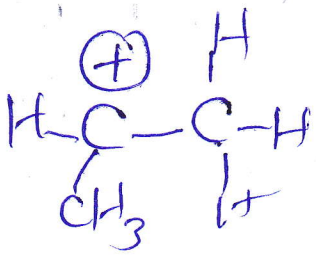
methyl "the least stable"

Ex 1. Arrange the stability of carbocations



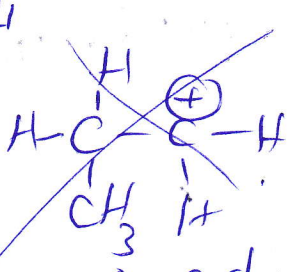
Now, for a reaction  + HX

↓ Step 1: $H^{\oplus}$



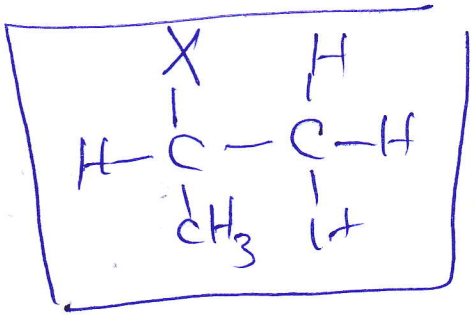
2° Carbocation

or



1° carbocation

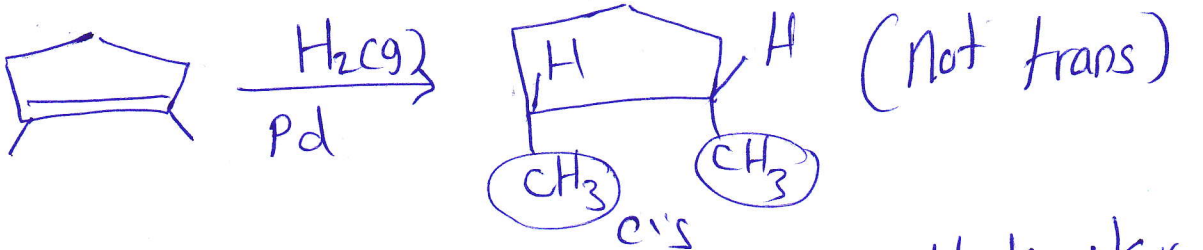
↓ Step 2: $X^{\ominus}$



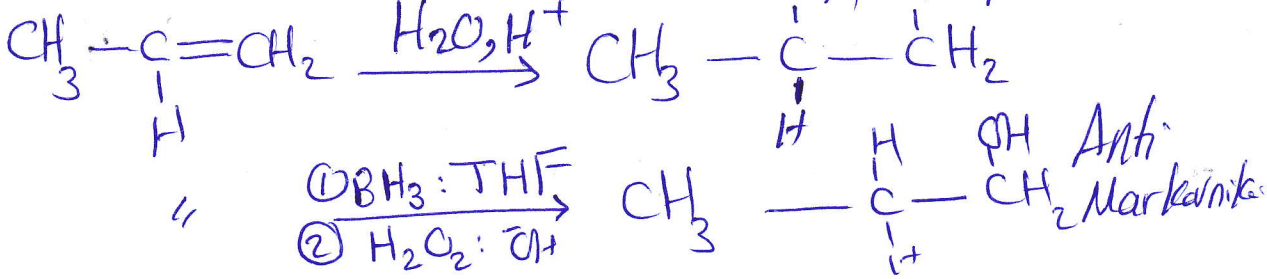
Product.

Notes:

① For cyclic alkenes with substituents



(not trans)

② 

Markovnikov

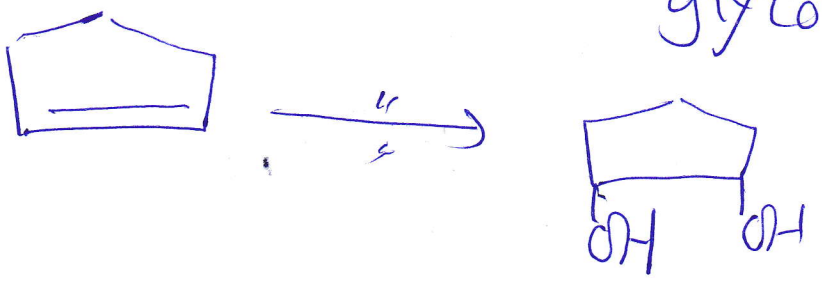
Anti Markovnikov

Last rxn is called: Hydroboration-oxidation of alkenes

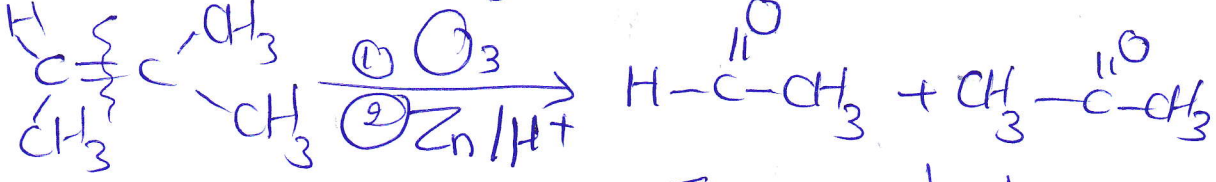
Finally, for reactions of alkenes ⟹ there is an <u>oxidation reaction</u>.

① Oxidation using $KMnO_4$

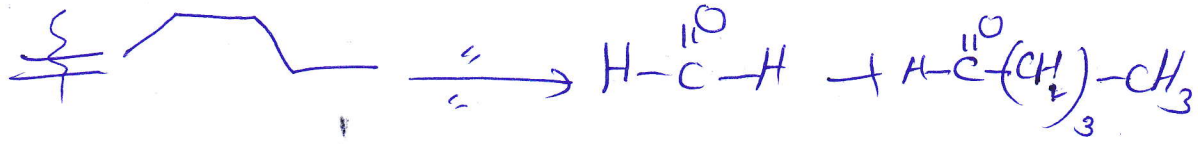
1,2-diol
glycol



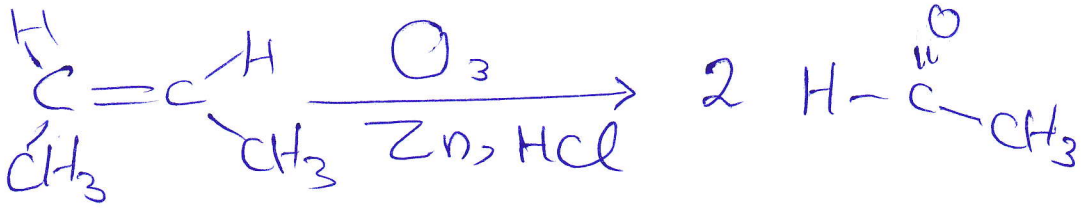
② Ozonolysis using O_3 then Zn/H^+.

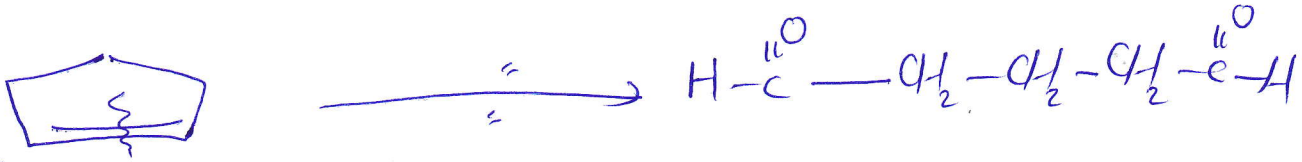
a) 

Two products are obtained

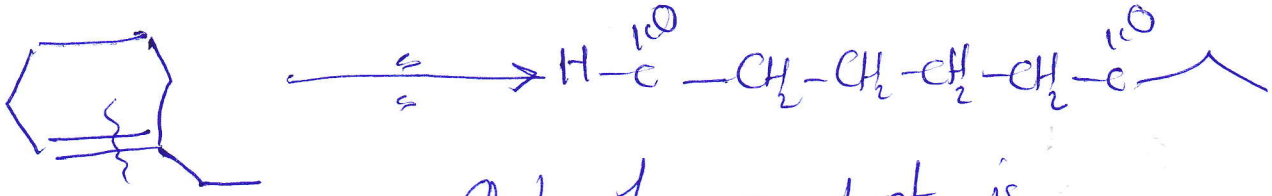
b) 

σ and π bonds are broken of C=C.



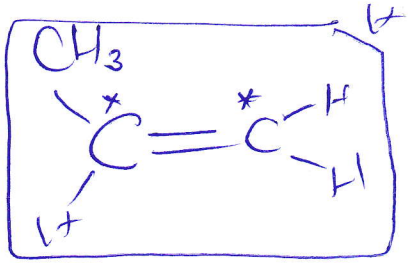


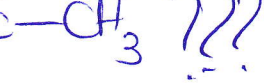
break at σ and π bonds



Only 1 product is consumed.

Ex: Draw an alkene that upon ozonolysis will produce  and

Answer 

Ex: Draw an alkene that upon ozonolysis will produce only  ??