Ministry of Higher Education and Scientific Research

Al-Muthanna University

Organic chemistry

For the 1st year students of the «faculty of Pharmacy»

Lecture (6)
Dienes Hydrocarbones

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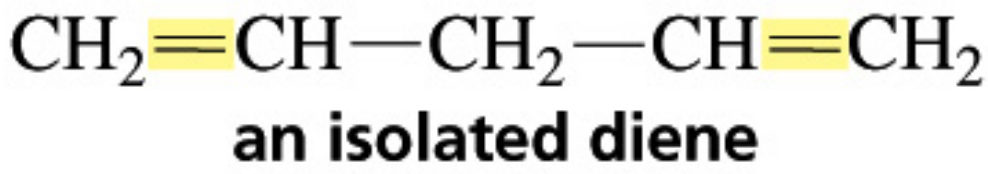
Diene hydrocarbons

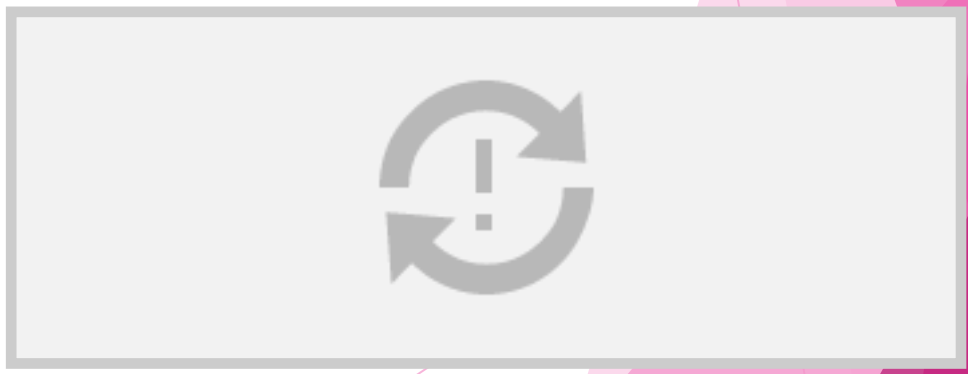
Alkadienes are characterized by the presence of two double bonds. Depending on their relative position, they are divided into the following types:

a) Isolated dienes

- When double bonds are separated by at least two single bond , **isolated diene**



an isolated diene

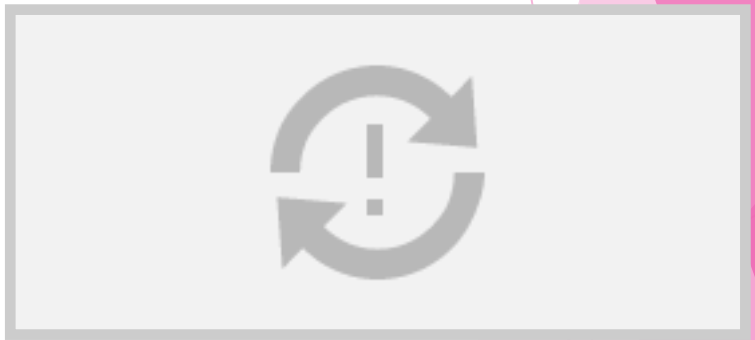


b) Conjugated dienes

- When double bonds are separated by only one single bond, **conjugated diene**

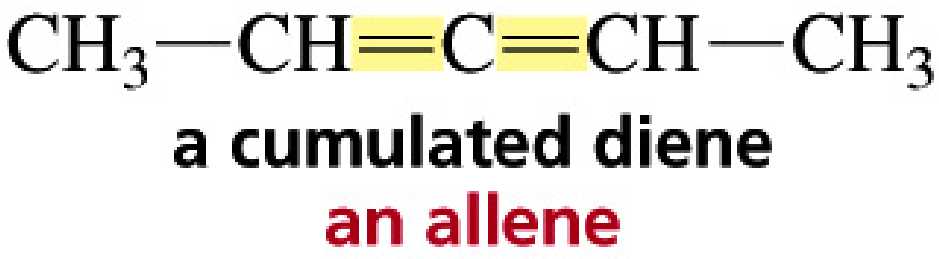
$CH_3CH{=}CH{-}CH{=}CHCH_3$

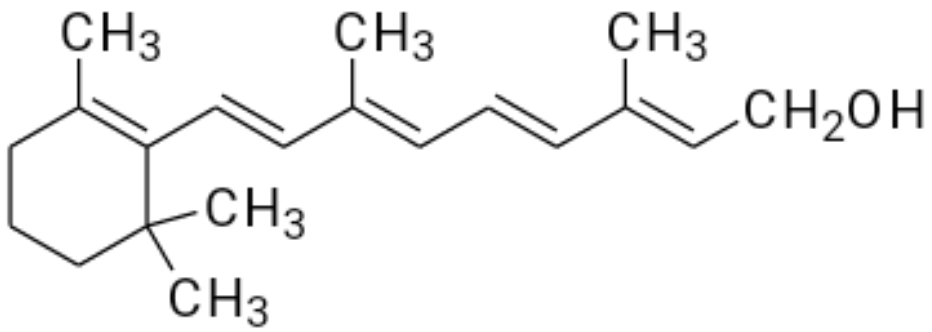
a conjugated diene



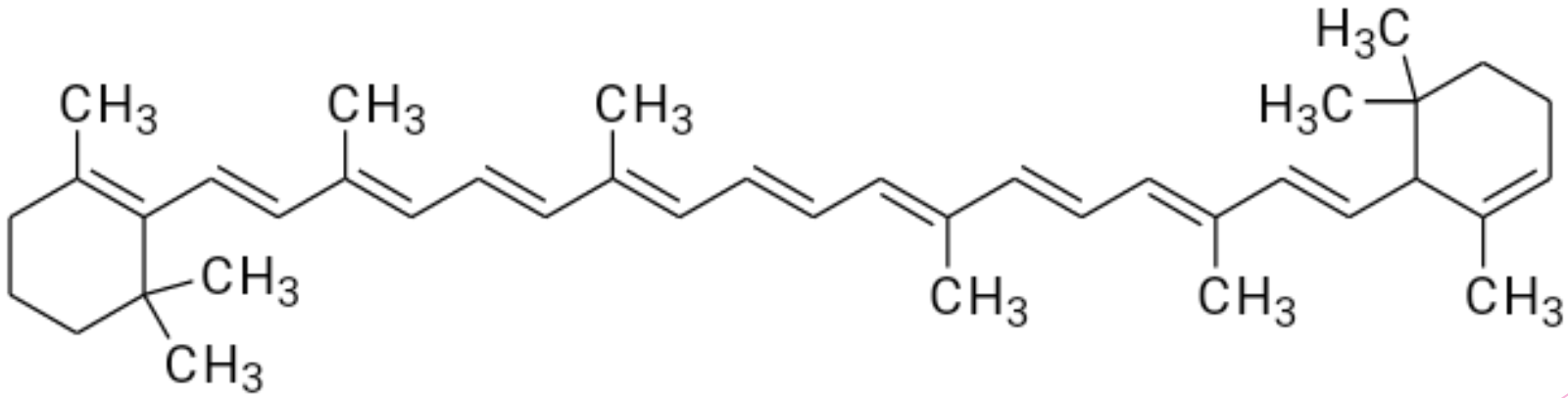
c) cumulated diene

- When both sets of double bonds emanate from the same carbon, **cumulated diene**





Vitamin A



beta-carotene

Stability of alkadienes:

- (**Cumulated dienes** are not stable and are rare)

- **Isolated dienes** are not stable ,they are undergo addition reactions with one or two moles…

- ☆ **Conjugated dienes** :

1) They are more stable.
2) They are the preferred products of substitutions.
3) They give 1,2- + 1,4-addition products

Chemical reactions of isolated dienes

- **<u>isolated</u> dienes:) addition reactions(**

- $CH_2=CHCH_2CH_2CH=CH_2 + H_2, Ni \rightarrow CH_3CH_2CH_2CH_2CH=CH_2$

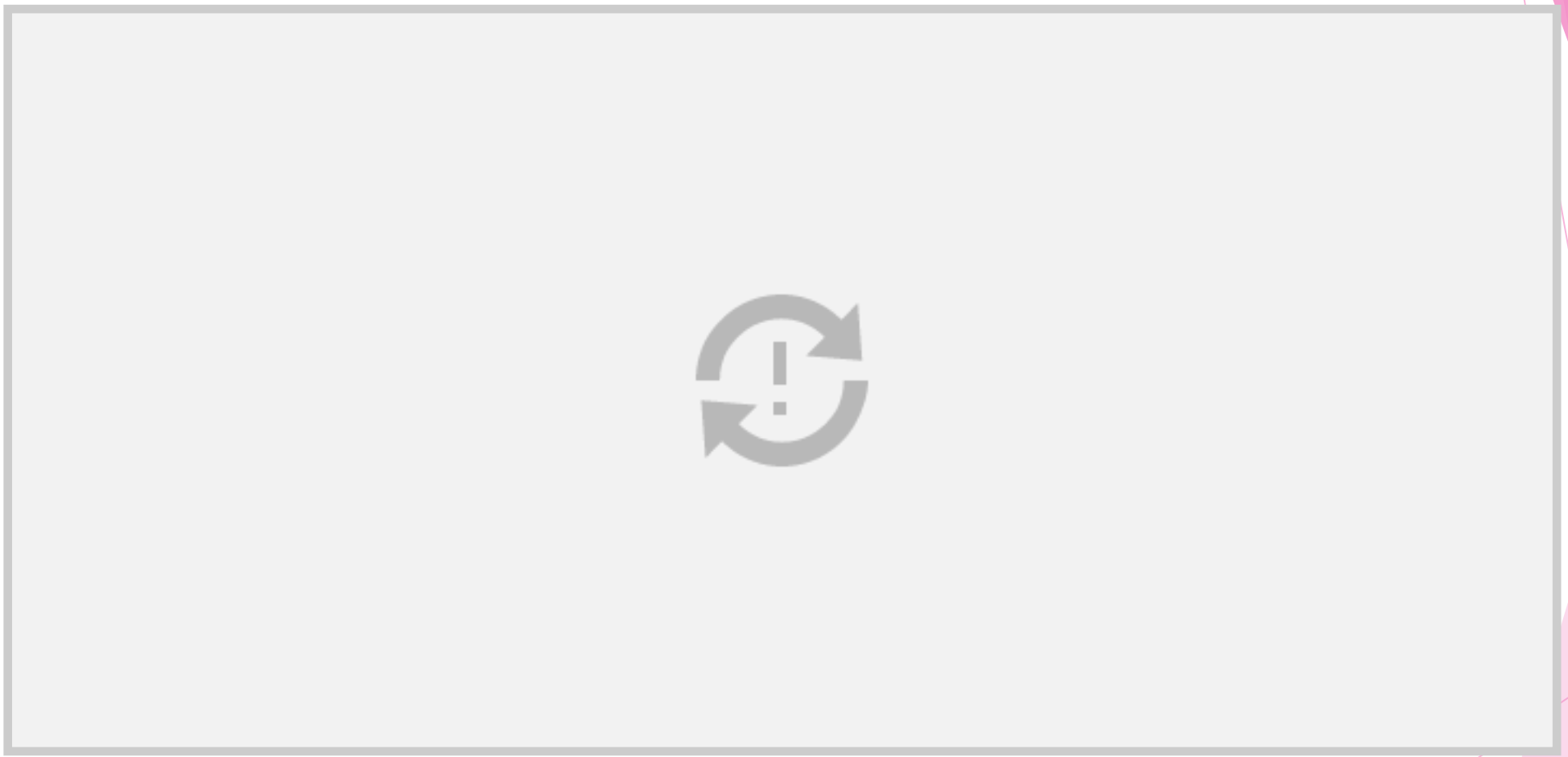
- $CH_2=CHCH_2CH_2CH=CH_2 + 2\,H_2, Ni \rightarrow CH_3CH_2CH_2CH_2CH_2CH_3$

- $CH_2=CHCH_2CH_2CH=CH_2 + Br_2 \rightarrow CH_2CHCH_2CH_2CH=CH_2$ (Br Br)

- $CH_2=CHCH_2CH_2CH=CH_2 + HBr \rightarrow CH_3CHCH_2CH_2CH=CH_2$ (Br)

- $CH_2=CHCH_2CH_2CH=CH_2 + 2\,HBr \rightarrow CH_3CHCH_2CH_2CHCH_3$ (Br Br)

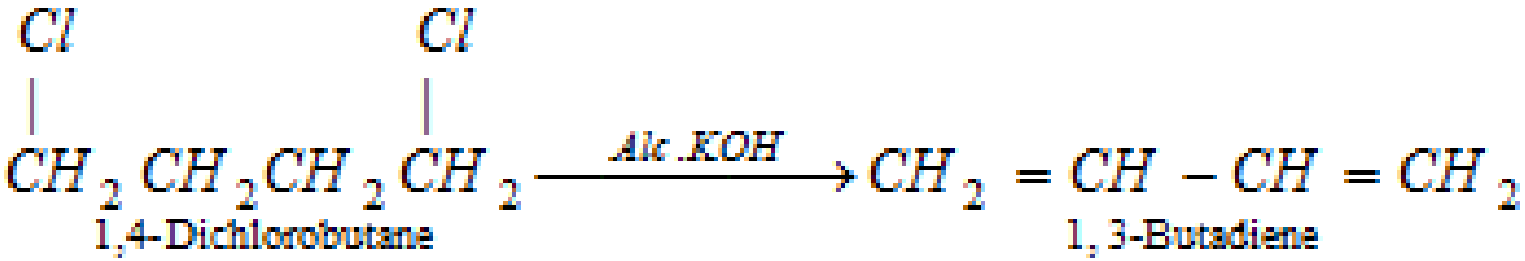
Chemical reactions of conjugated dienes



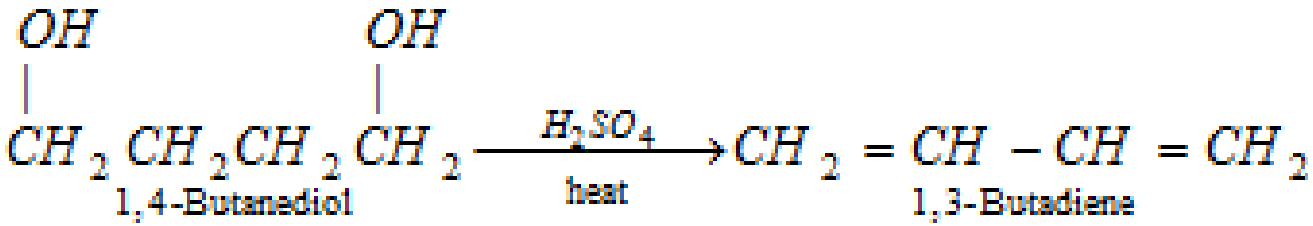
Methods of preparation

(1) ***From acetylene*** :

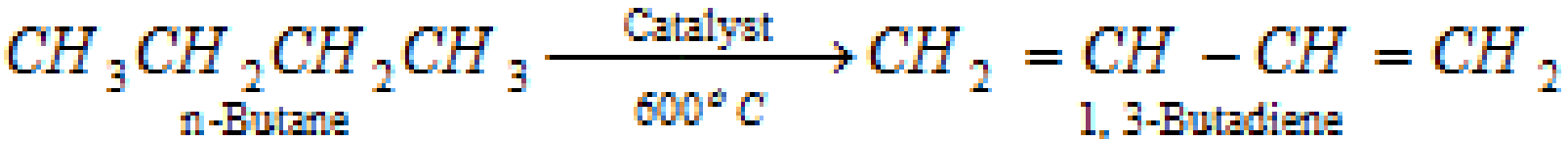
(2) Dehydrohalogenation of dihalides :



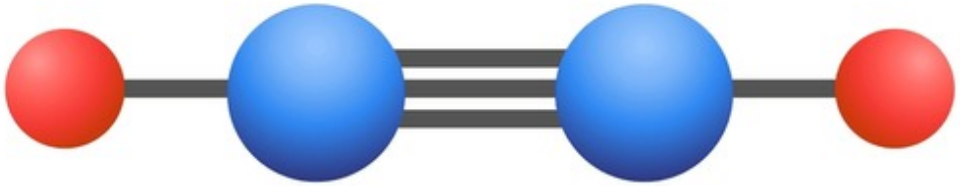
(3) Dehydration of alcohols :



(4) Dehydrogenation of alkanes:



ALKYNE



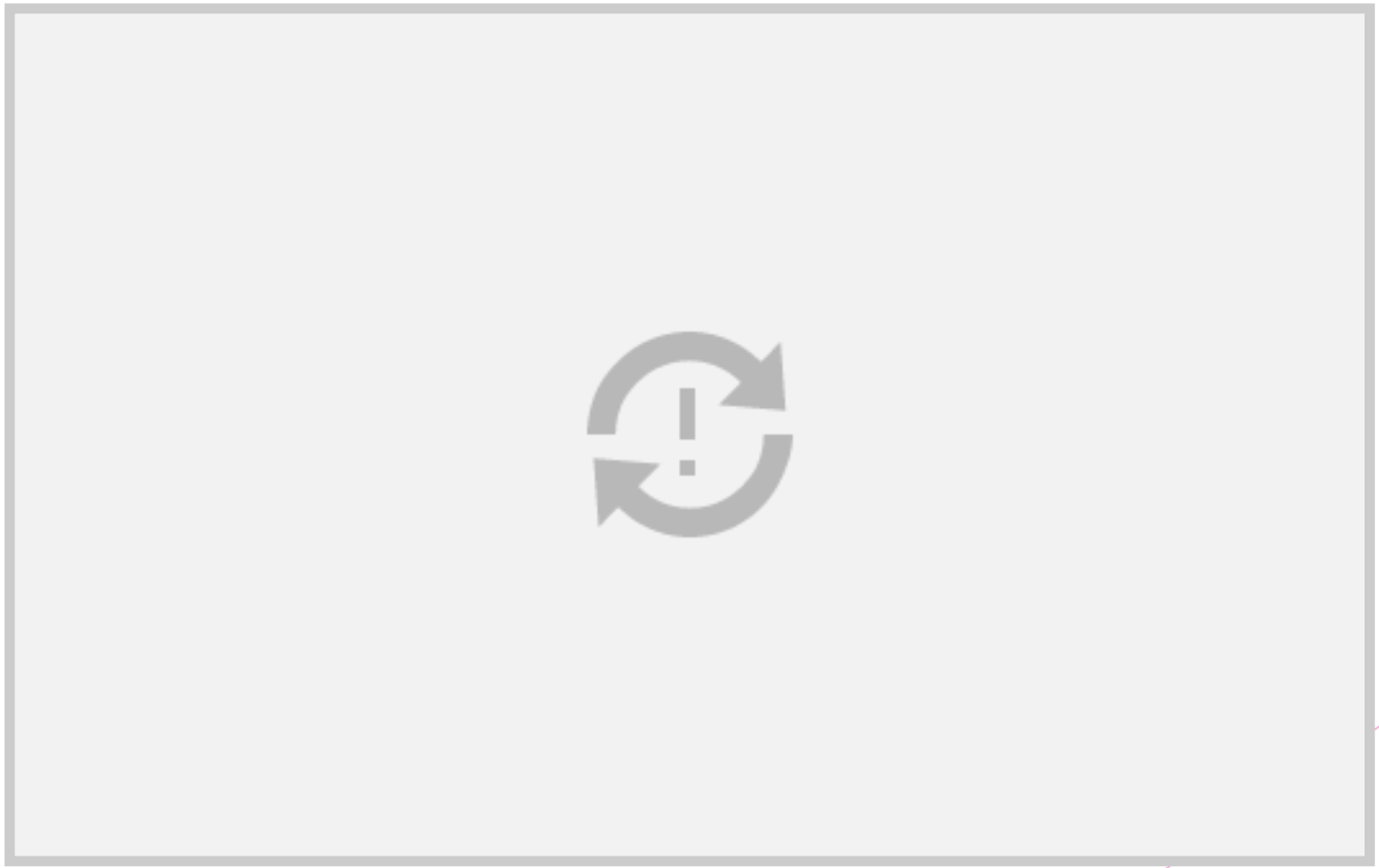
C_nH_{2n-2}

C : Carbon

H : Hydrogen

ALKYNES

- Alkynes (c_nH_{2n-2} chain carbon atoms are in the states sp and sp^3-hybridization within the molecule contains one triple bond).



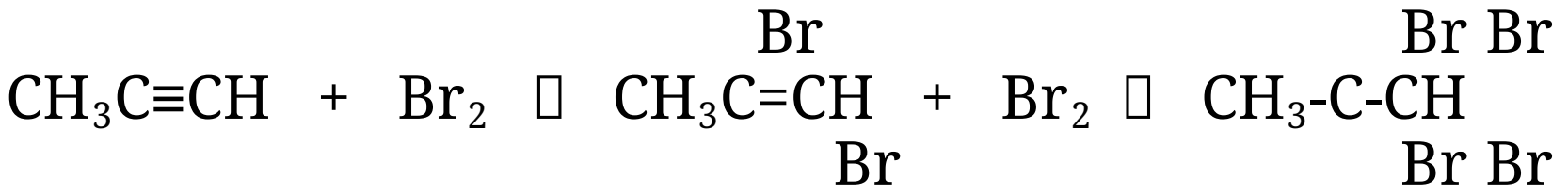
Alkynes can be described as terminal or internal.

Reactions, alkynes:

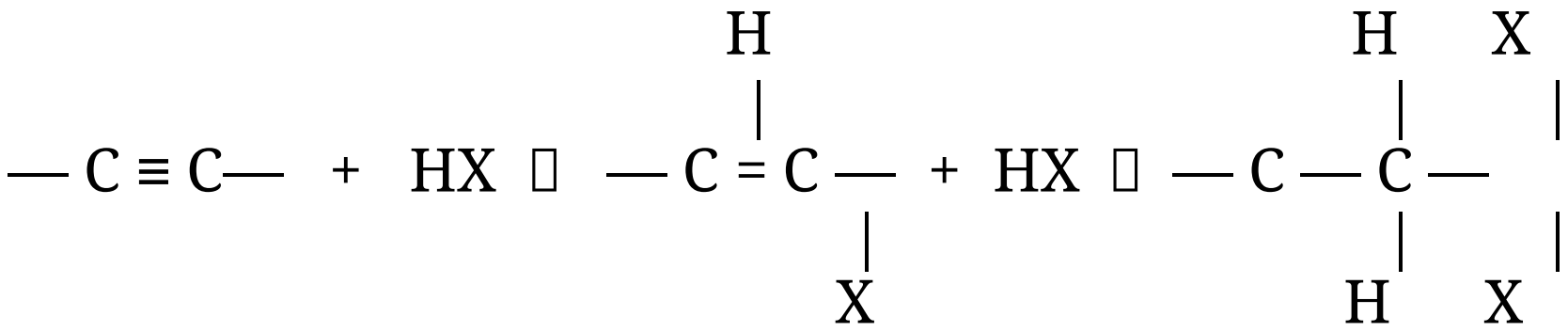
1. addition of H_2 (reduction)
2. addition of X_2
3. addition of HX
4. addition of H_2O, H^+
5. as acids
6. Ag^+
7. oxidation

1. Addition of H_2 (reduction)

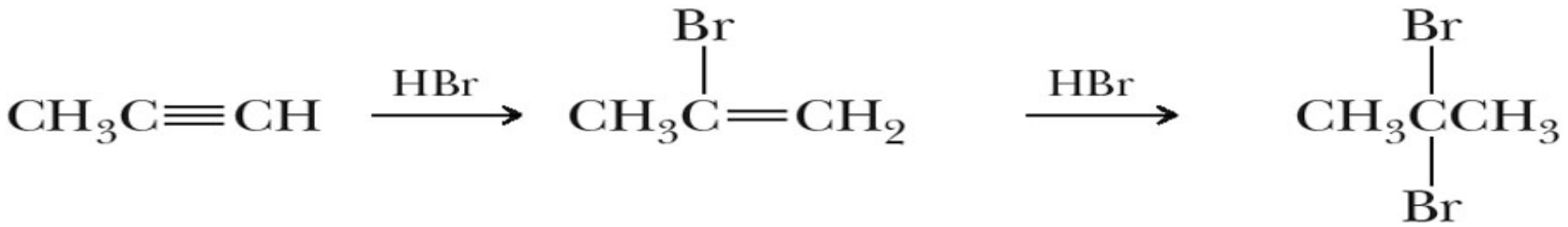
2. Addition of X_2



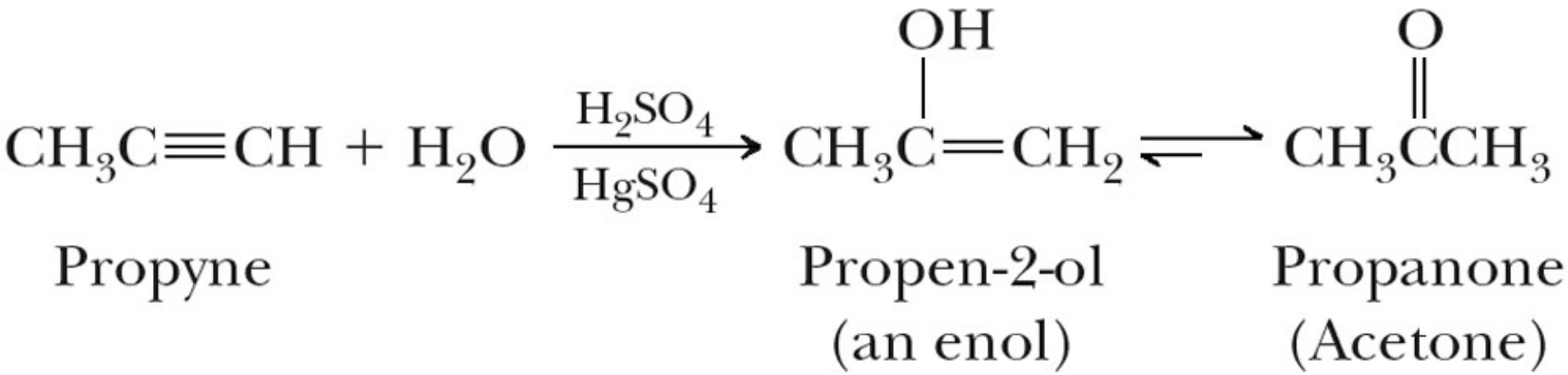
3. Addition of hydrogen halides:



a) HX = HI, HBr, HCl
b) Markovnikov rule



Propyne 2-Bromopropene 2,2-Dibromopropane



Propyne

Propen-2-ol
(an enol)

Propanone
(Acetone)

5. As acids: (Terminal alkynes only!)

with active metals:

$$CH_3C{\equiv}CH + Na \rightarrow CH_3C{\equiv}C^-Na^+ + \tfrac{1}{2} H_2 \uparrow$$

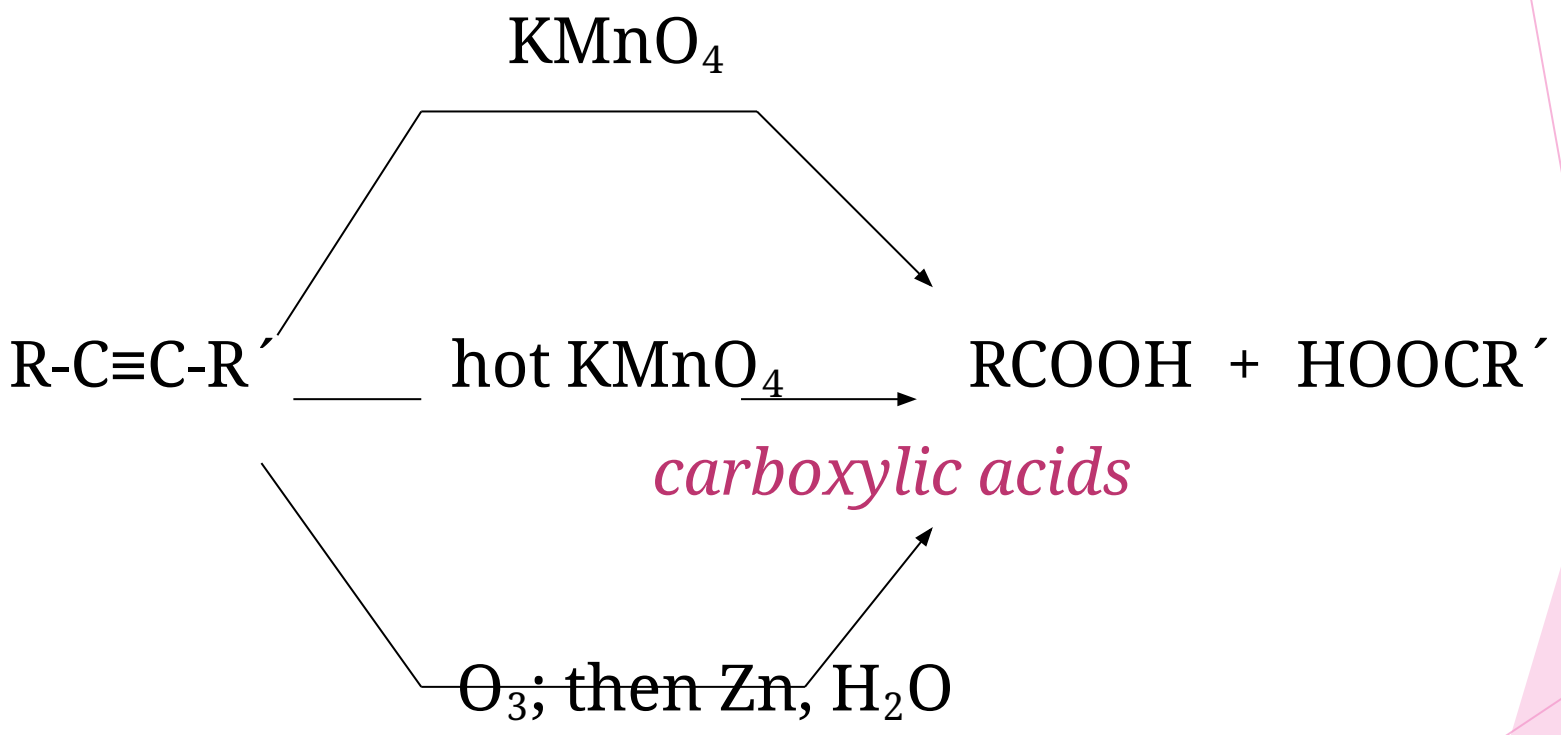
5. Ag^+ (Terminal alkynes only!)

$$CH_3CH_2C{\equiv}CH + AgNO_3 \rightarrow CH_3CH_2C{\equiv}C^-Ag^+ \downarrow$$

$$CH_3C{\equiv}CCH_3 + AgNO_3 \rightarrow \text{N.R} \quad (\underline{\text{not terminal}})$$

formation of a precipitate is a test for terminal alkynes.

7. Oxidation


KMnO4
R-C≡C-R´
hot KMnO4
RCOOH + HOOCR´
carboxylic acids
O3; then Zn, H2O

$CH_3CH_2C{\equiv}CCH_3$ + Cold $KMnO_4$ → CH_3CH_2COOH + $HOOCCH_3$

$CH_3C{\equiv}CH$ + hot $KMnO_4$ → CH_3COOH + CO_2

$CH_3C{\equiv}CCH_3$ + O_3; then Zn, H_2O → 2 CH_3COOH

Methods of preparation

1)

2)

$$2\,CH_4 \xrightarrow[1200°C]{\text{Steam}} HC{\equiv}CH + 3\,H_2$$

Methane **Acetylene**

(3) Dehydrohalogenation of dihalides :


Best Regards!
Thank you!