* polyenes → β carotene.
→ lycopene.

multiple bond

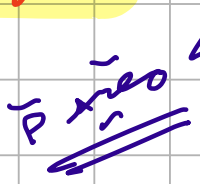
* Conjugated
* non conj
cumulated

C=C–C≡C C=C–C–C≡C C=C=C

* more than double bond
→ diene triene.

C–C–C(C)–C iso

C–C	C=C	C≡C
tetrahedral	trigonal	Linear
relatively free	restricted	180°
109.5°	planar	"Acetylenes"
(sp^3)	120°	(sp)
	(sp^2)	



nucleophilic

Nu^-

$\ddot{N}u$

electrophilic

E^+

$\overset{\delta+}{E}$

* Hydroboration = syn addition

+ H

Alkynes

→ Hydrogenation (+ H)

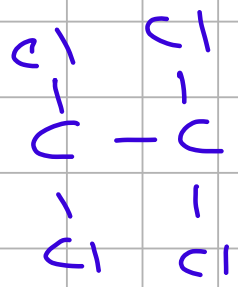
Catalyst Ni / Pt → —

= special palladium (Pd) (Lindlars catalyst) → 1 mol H_2 cis alkene

Na / Li → trans alkene

→ Halogenation (+ X_2)

First trans →



→ Hydrogen Halide

Markovnikov's Rule

H goes to the H

Alkenes

* Electrophilic addition.

- → Hydrogenation (+H)
  - **syn addition** (نفس الاتجاه)
  - cis
- → Halogenation (+ X_2)
  - **Anti addition** (عكس الاتجاه او مضادة)
  - trans
  - Cl ✓ — I ✗ unreactive
  - Br ✓ — F ✗ too reactive
- → Addition of acids
  - HF / HCl / HBr / H–OSO_3H
- → Oxidation → ozonolysis O_3
  - → * two carbonyl group ($\overset{O}{\overset{||}{C}}$—H)
  - → permanganate $KMnO_4$ → purple → brown-black (MnO_2) — cis
    - → aglycol
    - ⇒ cis-cyclopentane-1,2-diol

BH_3 → 2. H_2O_2, OH^-

anti M.V

!! Not stable in H^+

$3^\circ > 2^\circ > 1^\circ >$ Methyl

* more stable

* less stable

Alkanes

physical properties of — = ≡

* physical states
  - $C_1 \rightarrow C_4$ gases
  - $C_5 \rightarrow C_{17}$ liquids
  - $C_{18} \rightarrow$ wax like solids

* Solubility ⇒ "Like dissolve like"

* Alkane / = / ≡) → Soluble in non polar solvent
  - Carbon tetrachloride CCl_4
  - benzene.

Water ✗

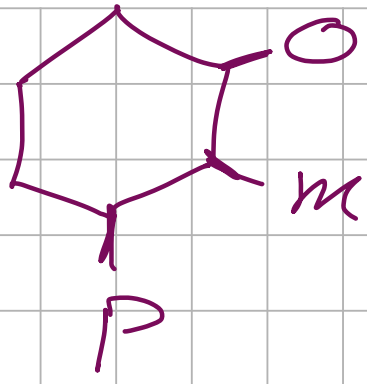
* Boiling points = B.P

→ more branch → less B.P

* Intermolecular interaction

→ H-bond
→ dipole-dipole
→ London.

B.P → ↑ increase — ↑ M.weight
→ ↓ decrease — ↑ branch



* m ⇒ withdraw e⁻ from the ring
  ↳ ring deactivating groups

* substituents withdraw e⁻
  ↳ decrease e⁻ density
  ↳ slow down the reaction.

* o, p ⇒ supply e⁻ to the ring.
  ↳ ring activating

* substituents donate e⁻
  ↳ increase e⁻ density and
  ↳ speed up the reaction

* Halogens → F
→ Cl
→ Br
→ I

→ withdrawing e⁻ (w.d) (and they are strong w.d)

But (X_2) unshared electrons pairs so they are ortho, para – directing

* X_2 → deactivating.

Exception