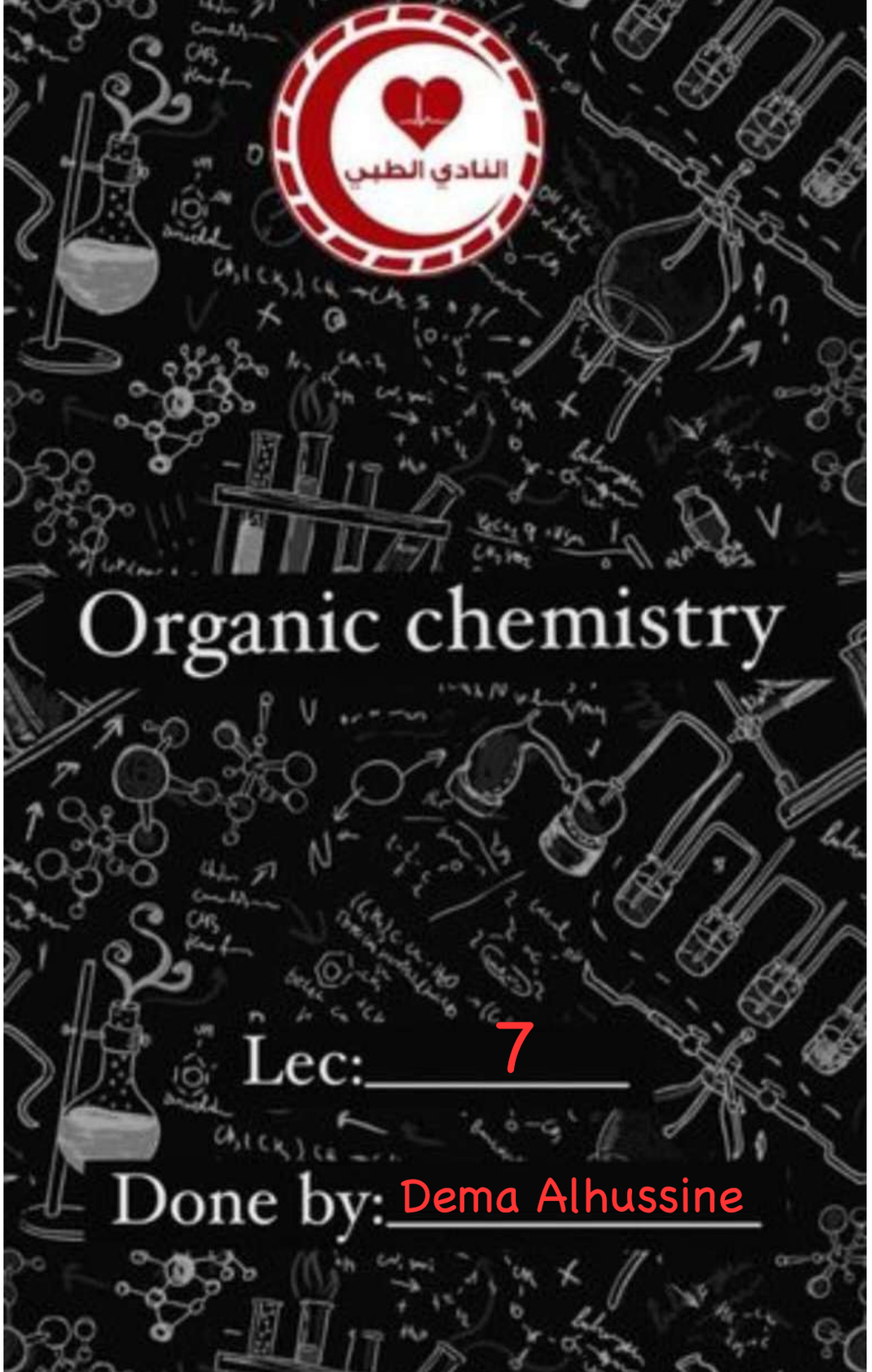
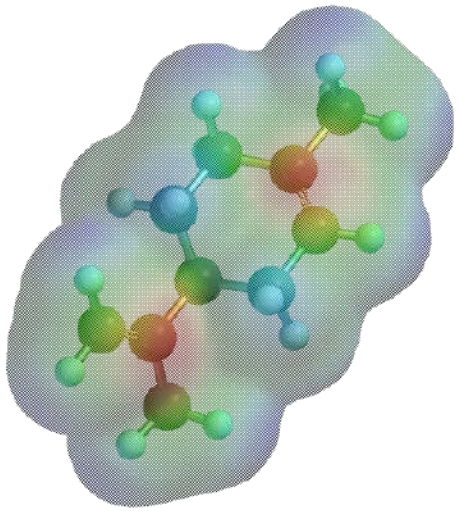
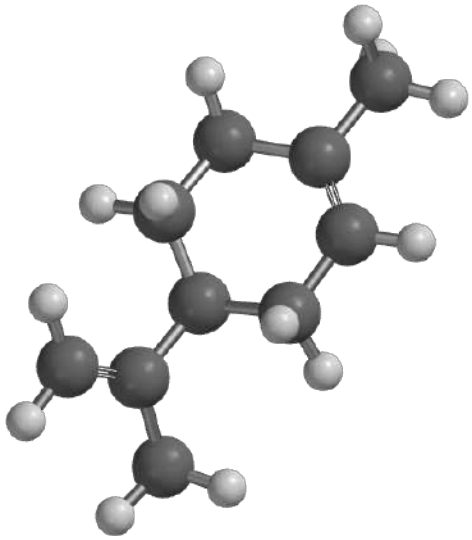
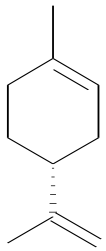

النادي الطبي
Organic chemistry
Lec: 7
Done by: Dema Alhussine





Chapter 3: Alkenes and Alkynes

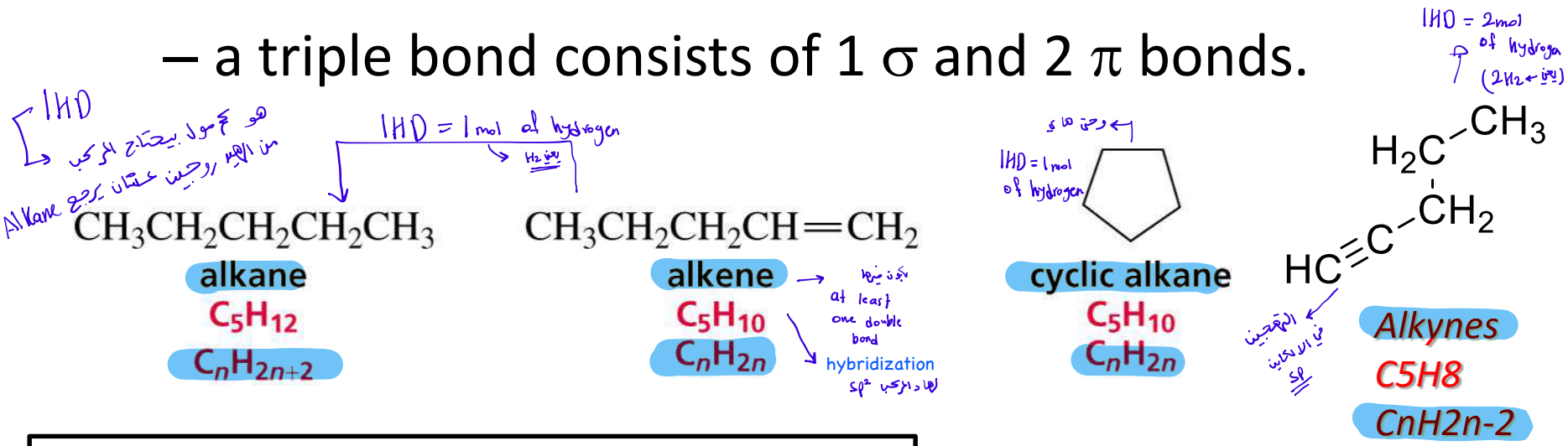


General Properties

Alkenes contain double bonds and alkynes triple bonds. Both classes of compounds are hydrocarbons, containing only C and H atoms.

– a double bond consists of 1 σ and 1 π bond,

– a triple bond consists of 1 σ and 2 π bonds.



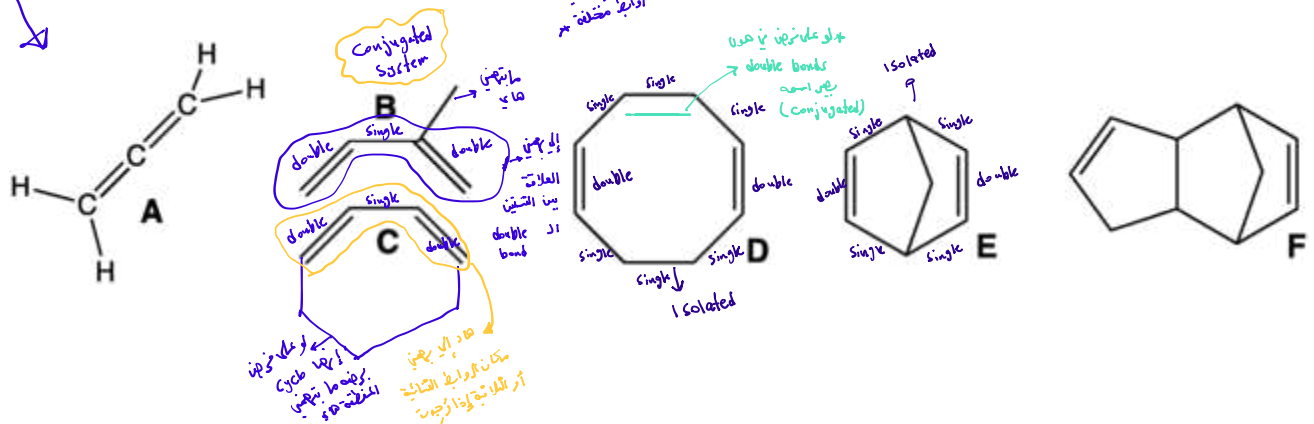
Every π bond results in the loss of a pair of H atoms.

General Properties (cont'd)

The Index of Hydrogen Deficiency (IHD) can give an idea of possible structures based on the ratio of C to H. This is a count of the number of H_2 molecules needed to obtain the corresponding saturated acyclic structure. The IHD is also equal to the number of rings and π bonds in the molecule.

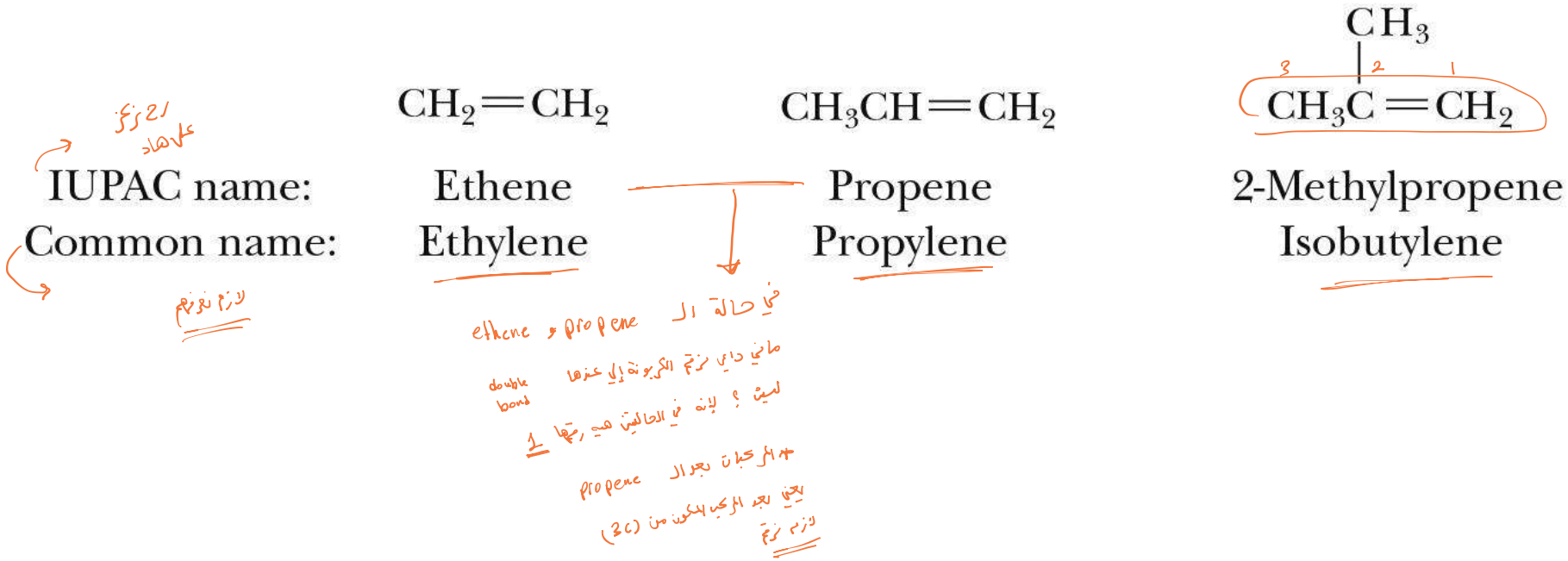
With multiple double (or triple) bonds three possible arrangements arise: cumulated, conjugated or isolated (non-conjugated). Conjugated are especially important as the π bonds can interact.

Cumulated	Conjugated	Isolated (Nonconjugated system)
C=C=C	C=C-C=C	C=C-C-C=C
C=C=C=C	C≡C-C≡C	C≡C-C-C-C≡C

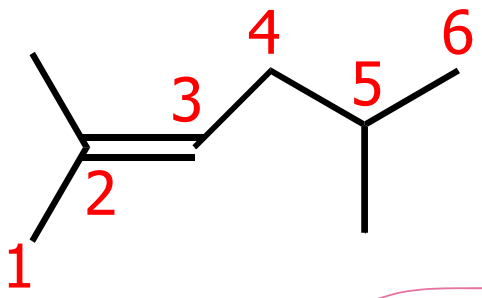


- IUPAC Nomenclature of alkenes
  - Use the Suffix **-ene** to show the presence of a carbon-carbon double bond.
  - Number the parent chain to give the 1st carbon of the double bond the lower number.
  - Follow IUPAC rules for numbering and naming substituents.
  - For a cycloalkene, the numbering of the atoms of the ring the must begin with the two carbons of the double bond.

- Some alkenes, particularly low-molecular-weight ones, are known **almost** exclusively by their common names.



Number the chain in the direction that gives the functional group the lowest number.



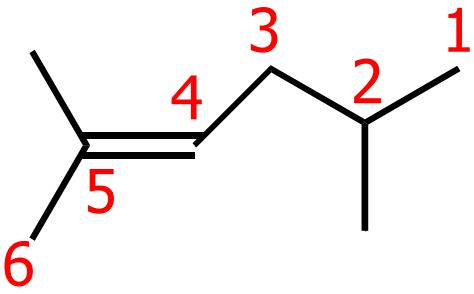
2,5-Dimethyl-2-hexene

6c

ممكن في بعض المراجع يكونوا كاتبين hex-2-ene هيلغي برضه صح ✓

لبس هيلغي بتكتب في الغالب

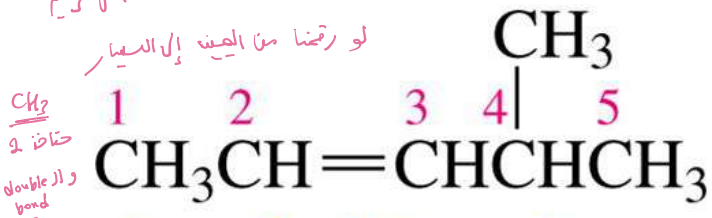
NOT



2,5-Dimethyl-4-hexene

* نركز على إعطاء أقل ترقيم ← double bond

لو رقمنا من اليمين إلى اليسار



CH3 حتاخد 1 والـ double bond 3

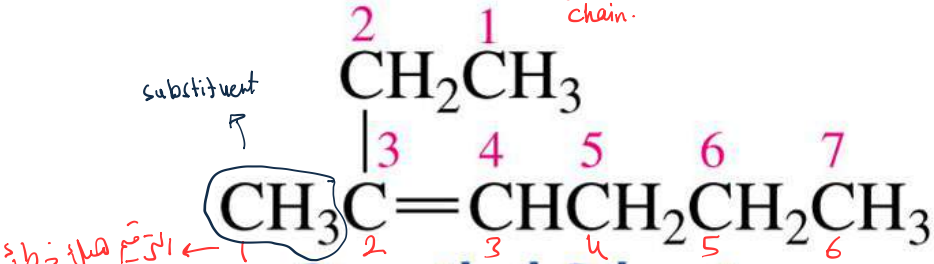
4-methyl-2-pentene

5c

* نهدف لازم نرقم من اليسار إلى اليمين

* خطأ ممكن نقع فيه لو رقمنا بشكل أفقي

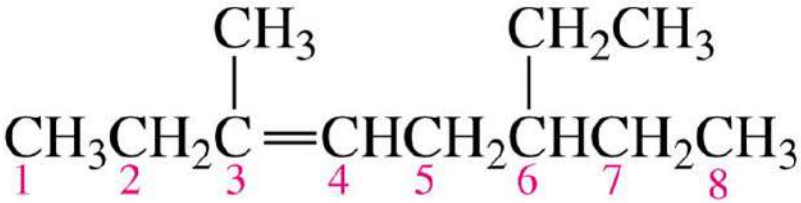
لازم يطلع 7c وهو مش longest chain.



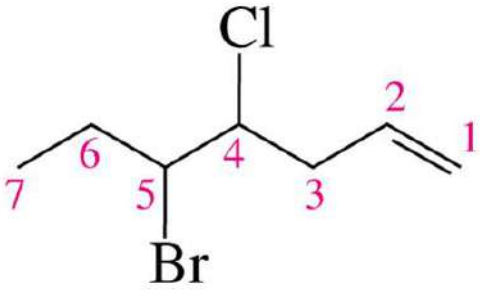
الترقيم هيلغي خطأ

3-methyl-3-heptene

Substituents are stated in alphabetical order.

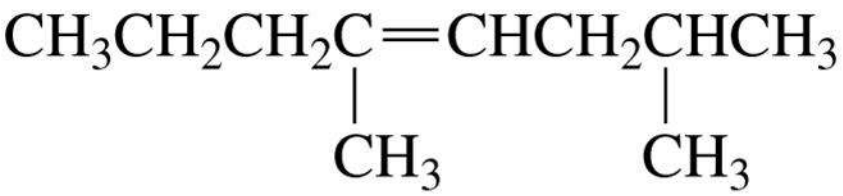


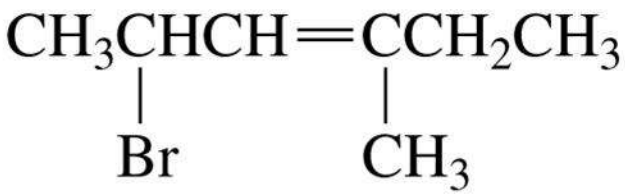
6-ethyl-3-methyl-3-octene

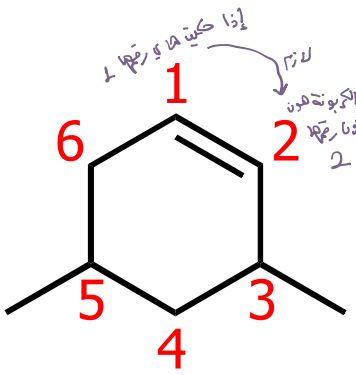


5-bromo-4-chloro-1-heptene

Hw:

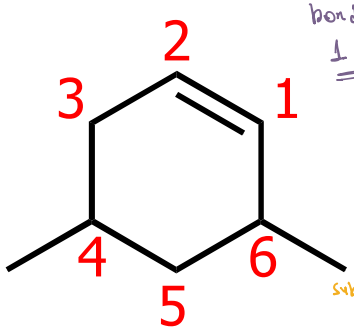






3,5-Dimethylcyclohexene

NOT



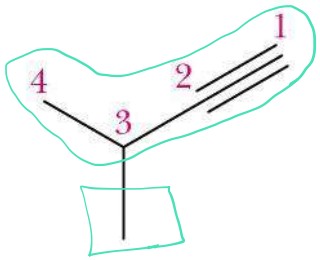
4,6-Dimethylcyclohexene

- IUPAC nomenclature of alkynes

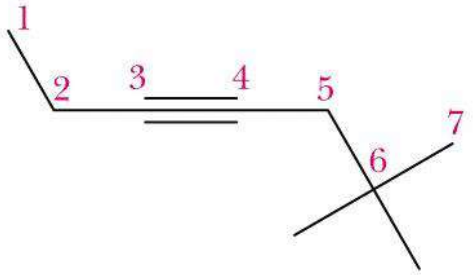
  – Use the infix **-yne** to show the presence of a carbon-carbon triple bond.

  – Number the parent chain to give the 1st carbon of the triple bond the lower number.

  – Follow IUPAC rules for numbering and naming substituents.



3-Methyl-1-butyne



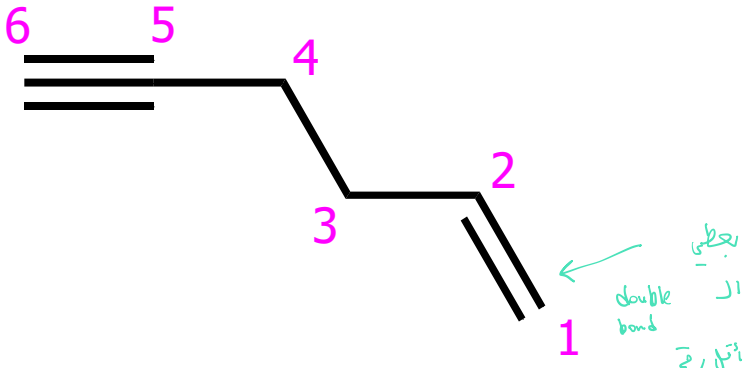
6,6-Dimethyl-3-heptyne

- Common Name:

$HC \equiv CH$

acetylene (ethyne)

طب شو نعمل لو اجا في
نفس المركب رابطة ثنائية
وثلاثية مع بعض ؟ الجواب :
مطلوب منا حالة وحدة في
الكتاب وبنلتزم فيها والي هيه
لما يكون الهم نفس ال
priority ✨🦦

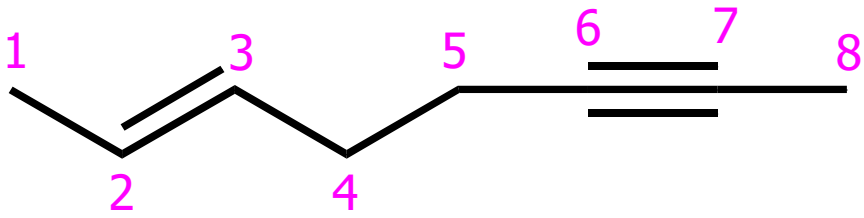


Hex-1-en-5-yne

6c

double bond

triple bond



(2E)-Oct-2-en-6-yne

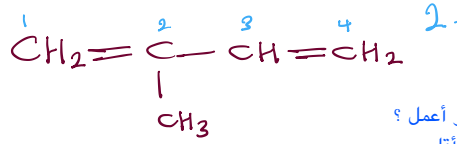
انسوها 2
بيجي عنها بجدين

8C

double bond

triple bond

ex:



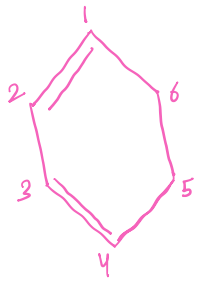
2-methyl-1,3-butadiene

لو اجا double bond 2 في السؤال شو أعمل ؟
بكل بساطة بتختار أطول سلسلة وبتختار أقل
ترقيم وبتعطي اهتمام لل substituent
لكن الشيء الجديد ما بتحكي ene لإنه انت ما
عندك بس رابطة ثنائية وحدة بتحط diene 🧕

هون لو رقمنا من اليمين لليسار
أو من اليسار إلى اليمين ما حيفرق الرقم

بالتالي بناخذ من اليسار إلى اليمين بحيث أقل
رقم لل double bond
وتاني رقم لل
substituent

ex:



1,3-cyclohexadiene

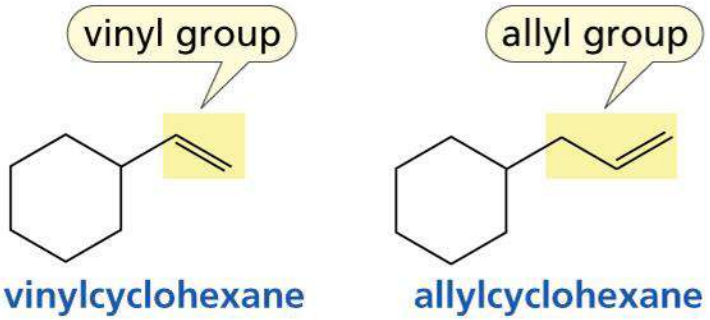
Vinyl and Allyl Groups

A vinyl group is the smallest group that contains a vinylic carbon.

An allyl group is the smallest group that contains an allylic carbon.

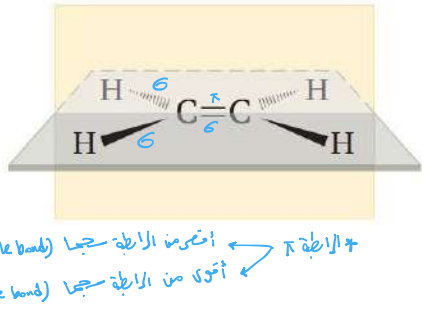
	$CH_2{=}CH-$	$CH_2{=}CHCH_2-$
	vinyl group	**allyl group**
	$CH_2{=}CHCl$	$CH_2{=}CHCH_2Br$
common name:	**vinyl chloride**	**allyl bromide**
systematic name:	**chloroethene**	**3-bromopropene**

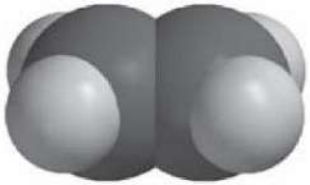
The substituent is on the vinylic or allylic carbon.

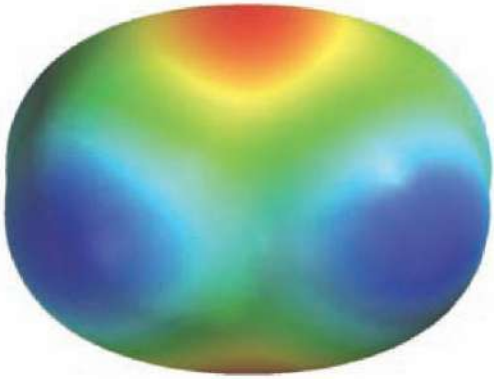


Bonding in Alkenes

- Alkenes are sp^2 hybridized
- Trigonal planar – bond angle ~120°
- 3 σ and 1 π bond (or 2 single and 1 double)
- C=C double bond ~ 1.34 Å
- The π bond lock the geometry to planar

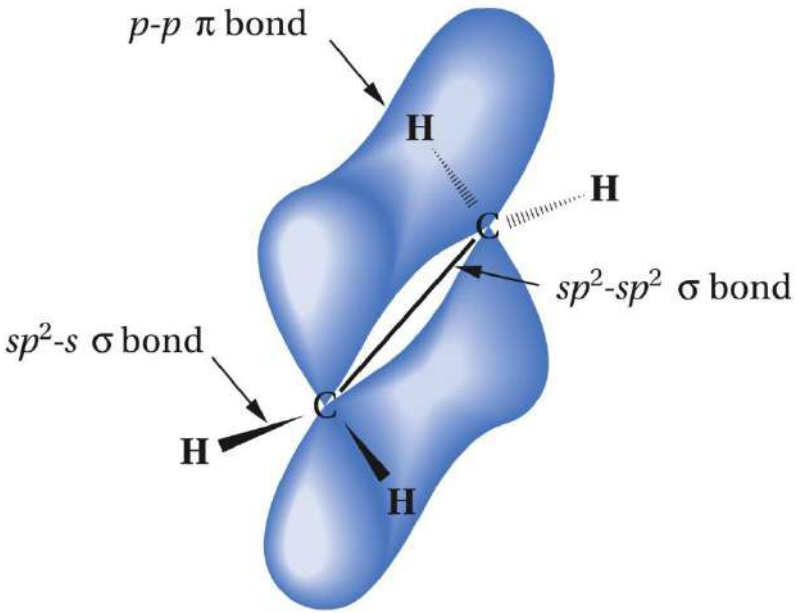


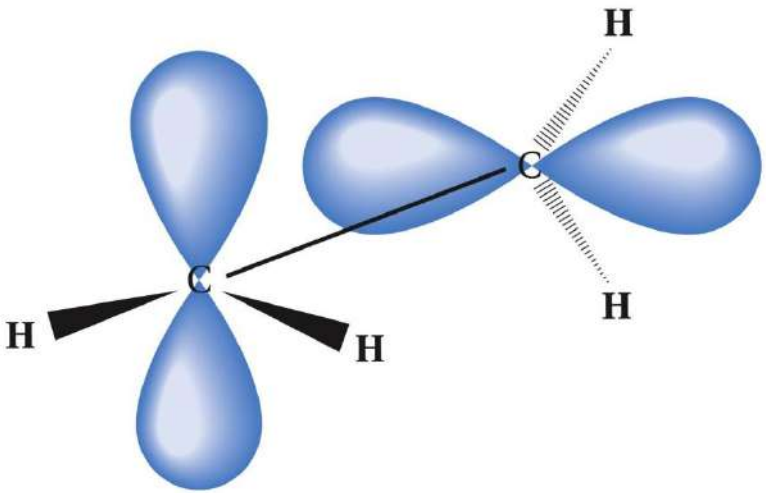




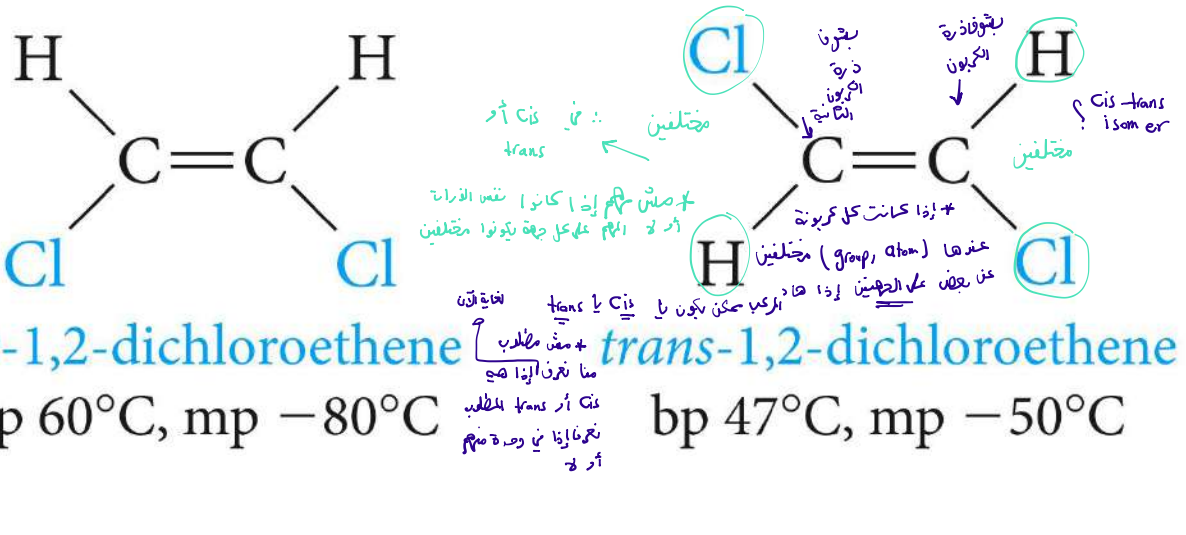
Cis – Trans Isomerism

The double bond in an alkene is rigid, that is it will not rotate freely. Therefore substituents on the carbon atoms will produce geometric isomers the same as on a cycloalkane ring.



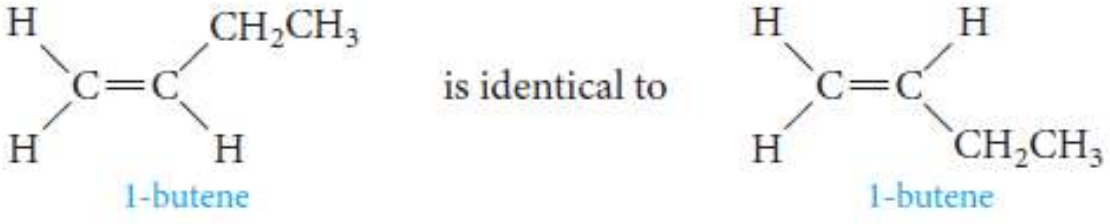


If the two non-hydrogen atoms or groups are on the same side of the double bond it is a cis- arrangement, on opposite sides a trans- arrangement, i.e.



Note that they have different physical properties, this is because their dipole moments are different.

For *cis–trans* isomerism to occur in alkenes, *each* carbon of the double bond must have two different atoms or groups attached to it.



Polar reagents can be divided into :

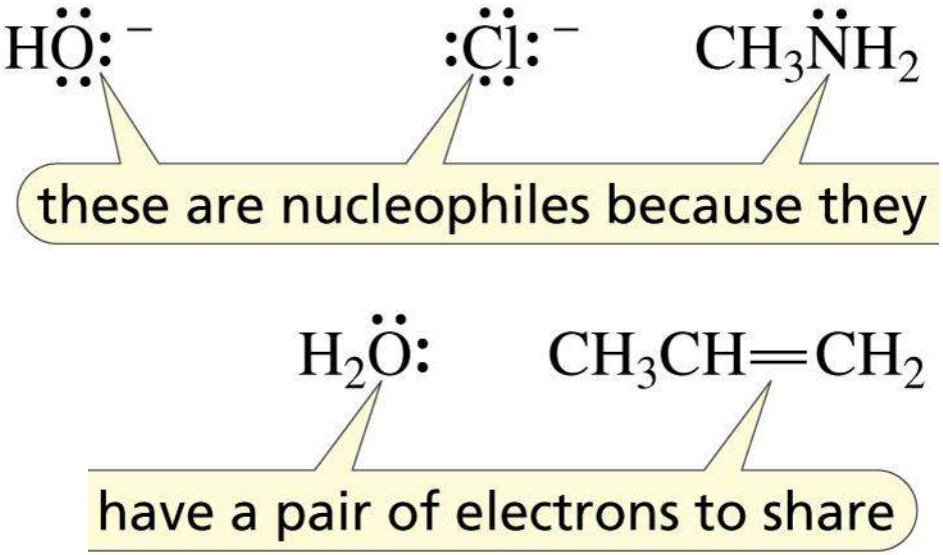
Nucleophiles

A nucleophile has

a negative charge,

a lone pair,

or a π bond.



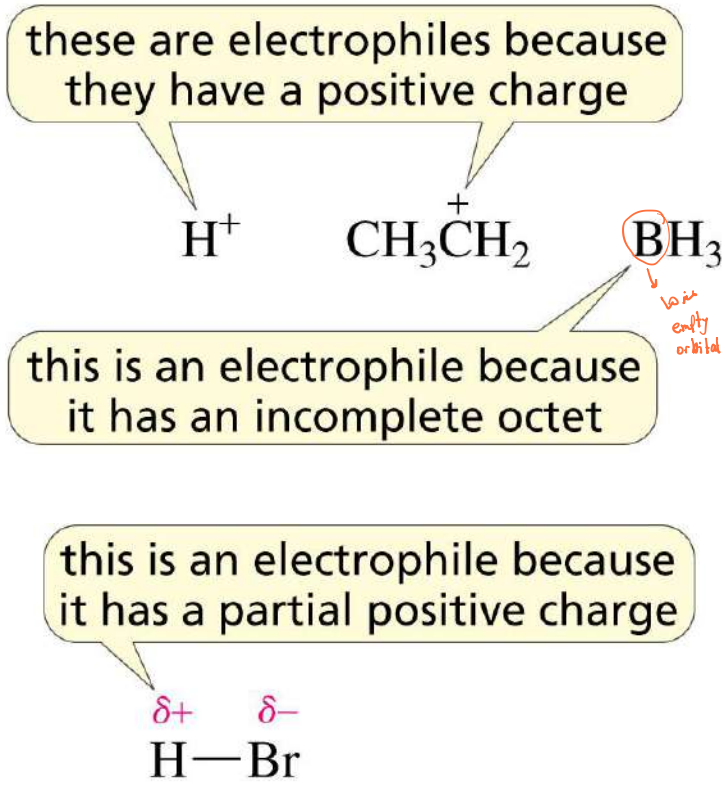
Electrophiles

An electrophile has

a positive charge,

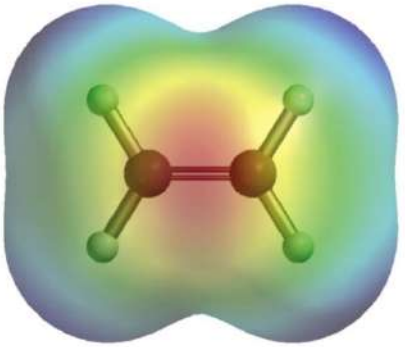
a partial positive charge,

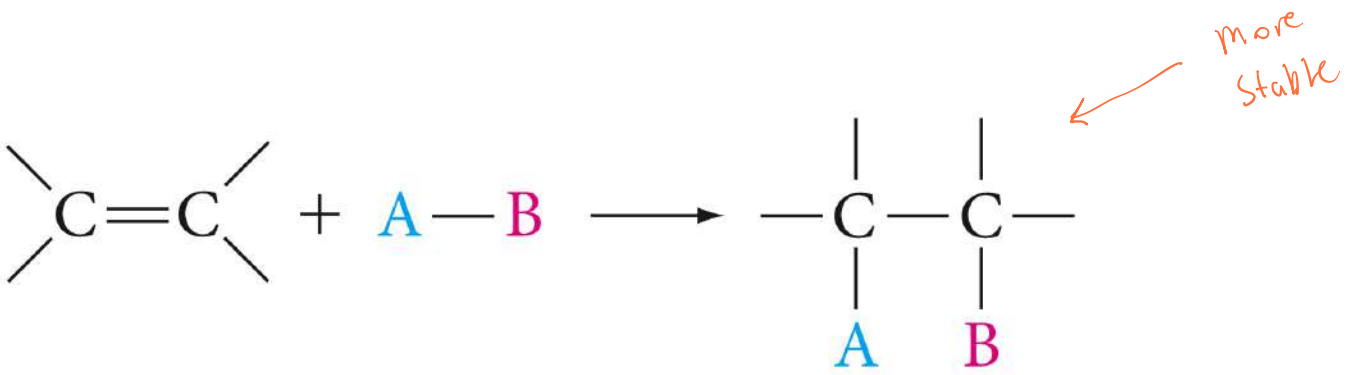
or an incomplete octet.



Chemical Reactivity

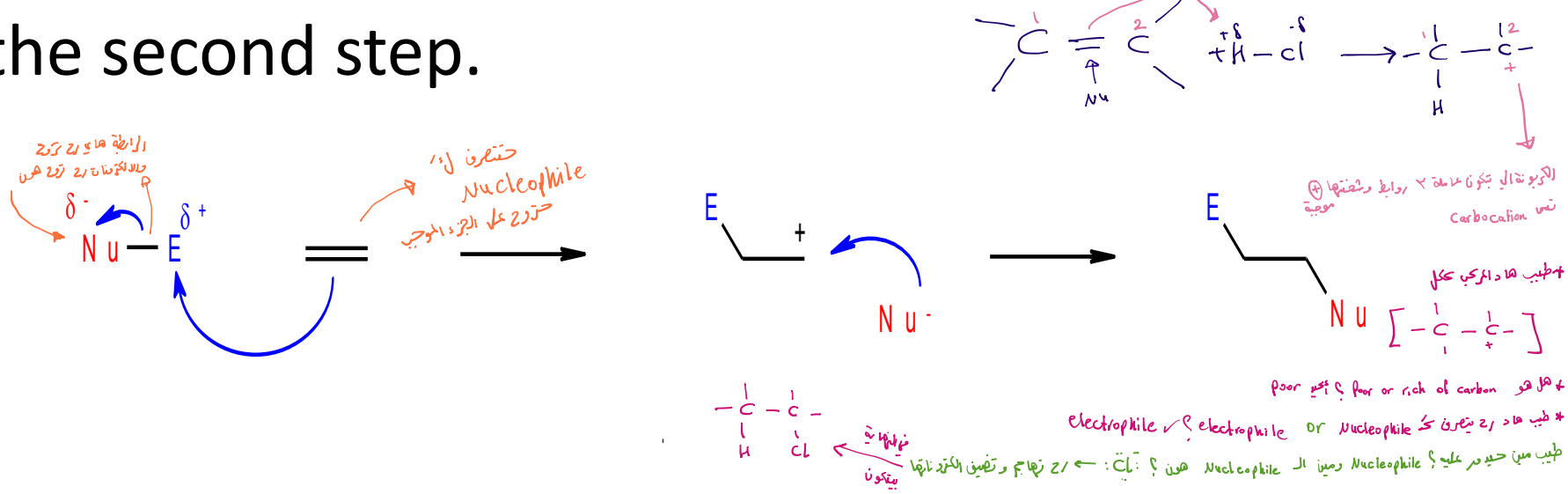
The chemical reactivity of alkenes arise from the π electrons. The π bond is weaker than the σ bond so these electron react first. The reagent will add across the double bond so these are *addition reactions*.

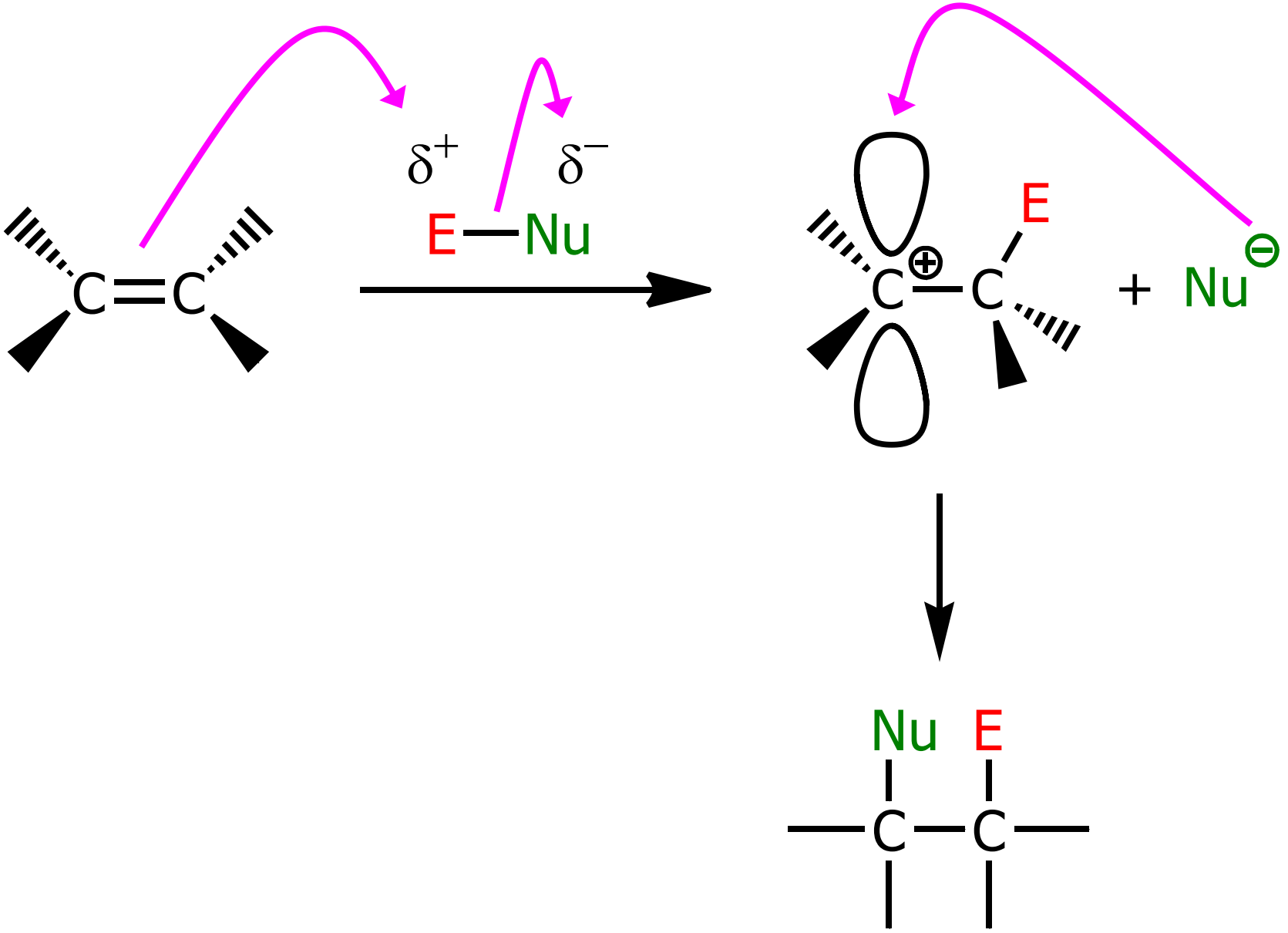




Electrophilic Addition Mechanism

The basic mechanism is the same for all reagents, a two step reaction where an electrophile (E) add to the π bond in the first step creating a ***carbocation*** intermediate. A nucleophile (Nu) then adds to the carbocation in the second step.

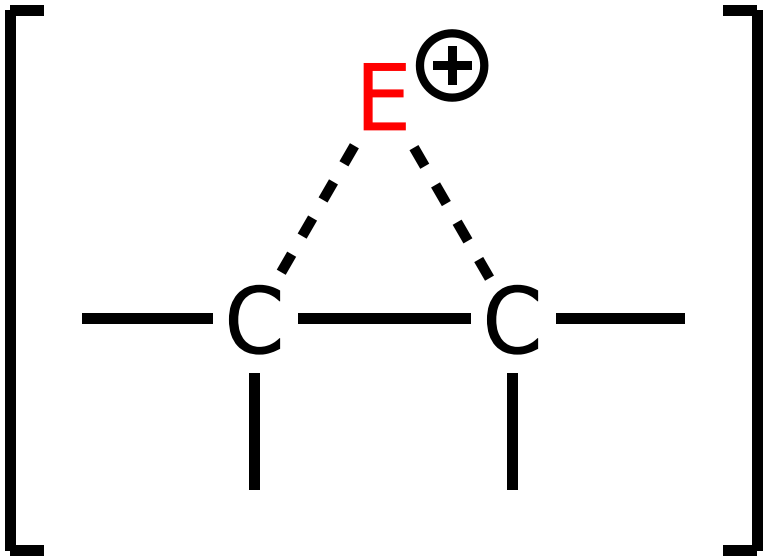



δ+
δ−
E
Nu
C
C
E
C
C
+
Nu
Nu
E
C
C

- **Mechanism**
  - **Sometimes do not go through a “free carbocation”, may go via**

في بعض الأحيان ال carbocation بيتخذ الشكل ده Bridge

* 2/* نحكي عنه بعدين



Wednesday

20-3-2024