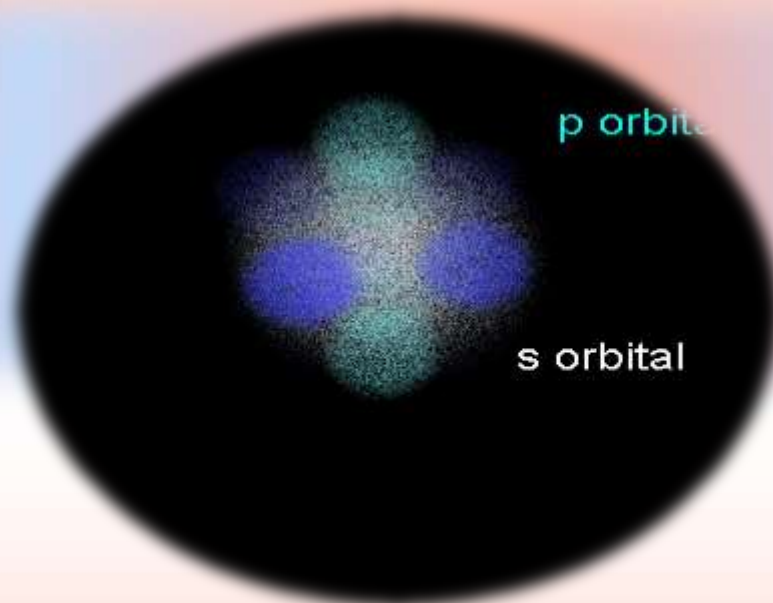


Hybridization

Class XI



A.K. Gupta



केन्द्रीय विद्यालय संगठन
शिक्षा एवं प्रशिक्षण का आंचलिक संस्थान भुवनेश्वर
केन्द्रीय विद्यालय संगठन के शिक्षकों के लिए अग्रणी संस्थान
Kendriya Vidyalaya Sangathan
Zonal Institute of Education & Training, Bhubaneswar
A Pioneer Institute for the teachers and staff of Kendriya Vidyalaya Sangathan

A.K. Gupta, PGT Chemistry
KVS ZIET Bhubaneswar



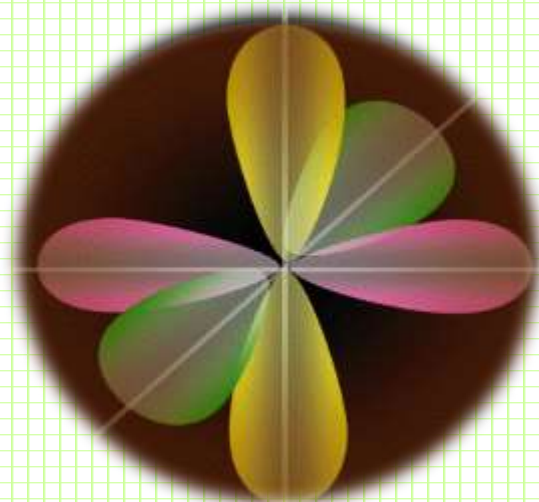
What is hybridization?

Hybridisation (or hybridization) is the concept of mixing atomic orbitals into new *hybrid orbitals* (with different energies, shapes, etc., than the component atomic orbitals) suitable for the pairing of electrons to form chemical bonds in valence bond theory.

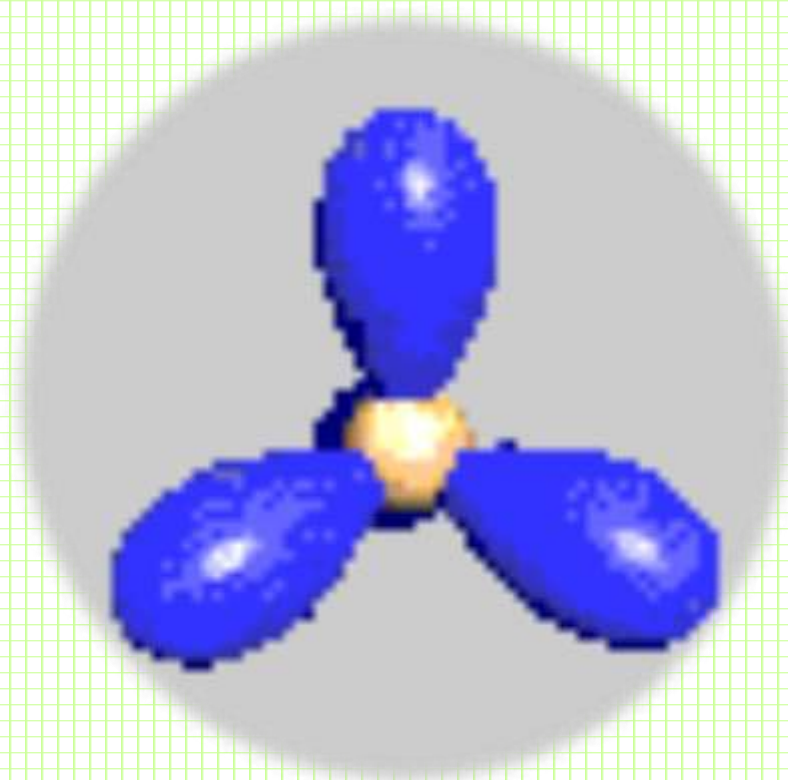
Types of hybridisation

sp^3

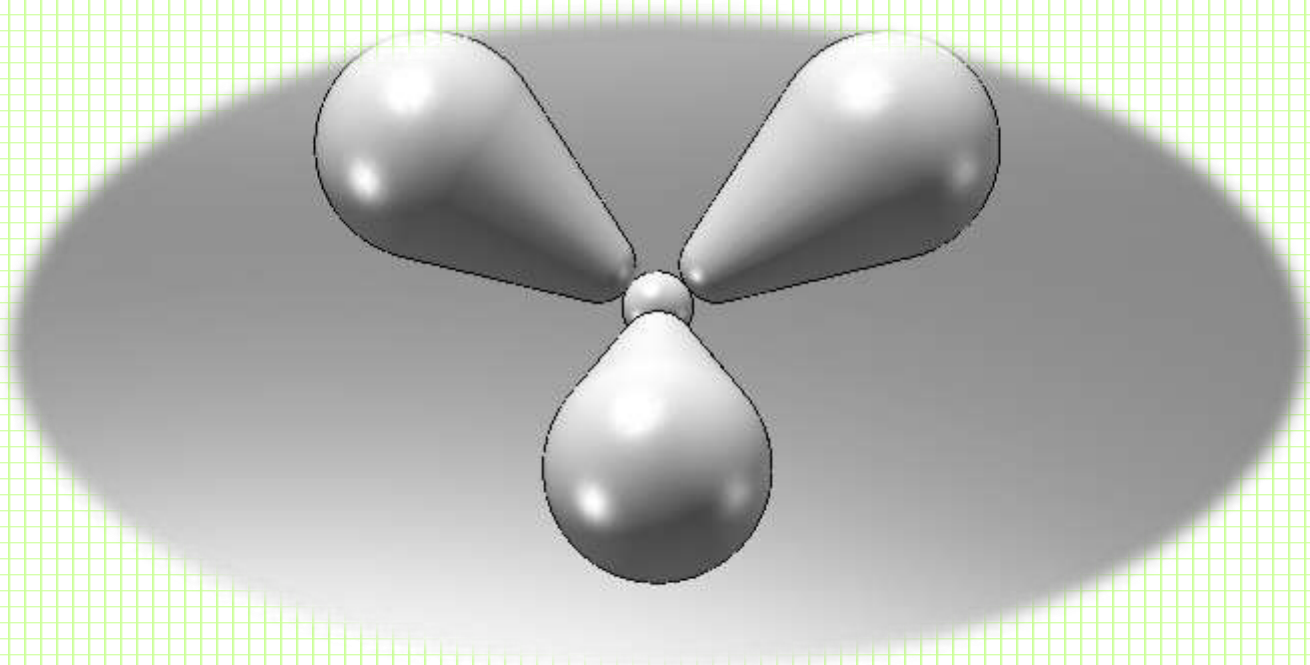
C	$\uparrow\downarrow$	$\uparrow\downarrow$	\uparrow	\uparrow		C atom ground state
	1s	2s	2p	2p	2p	
C*	$\uparrow\downarrow$	\uparrow	\uparrow	\uparrow	\uparrow	C atom excited state
	1s	2s	2p	2p	2p	
C*	$\uparrow\downarrow$	\uparrow	\uparrow	\uparrow	\uparrow	C atom sp^3 hybridized
	1s	sp^3	sp^3	sp^3	sp^3	



sp^3 Hybridization

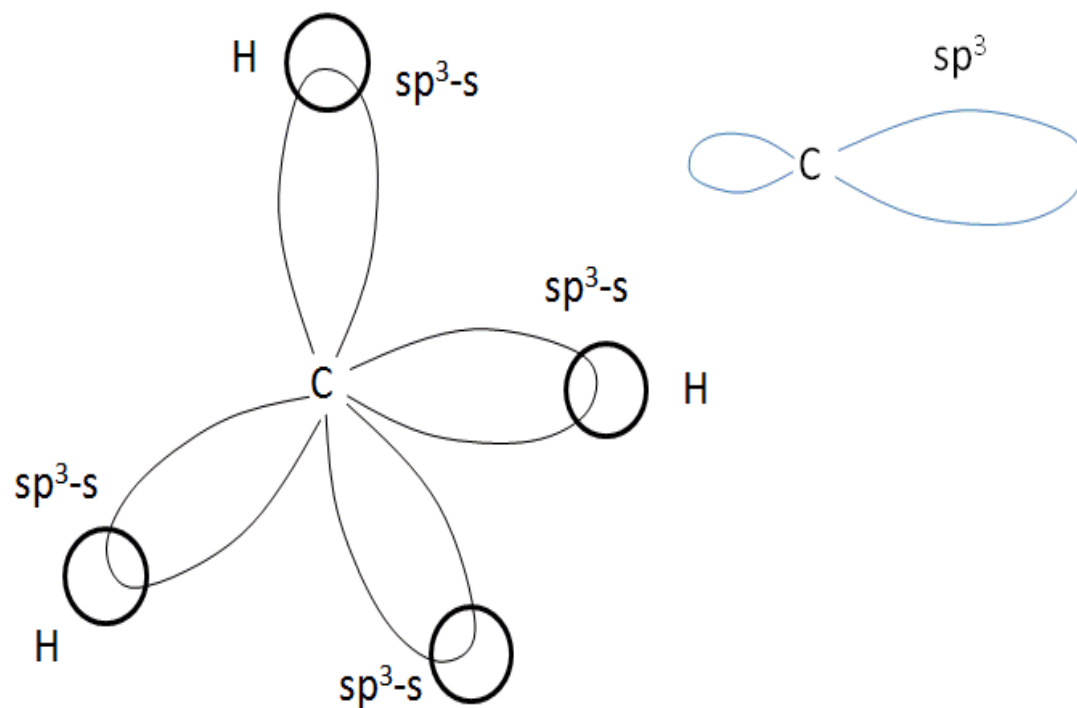
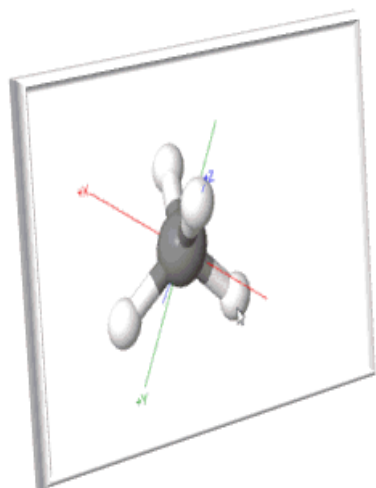


sp^3 Hybridization



Bonding in Methane (CH_4)

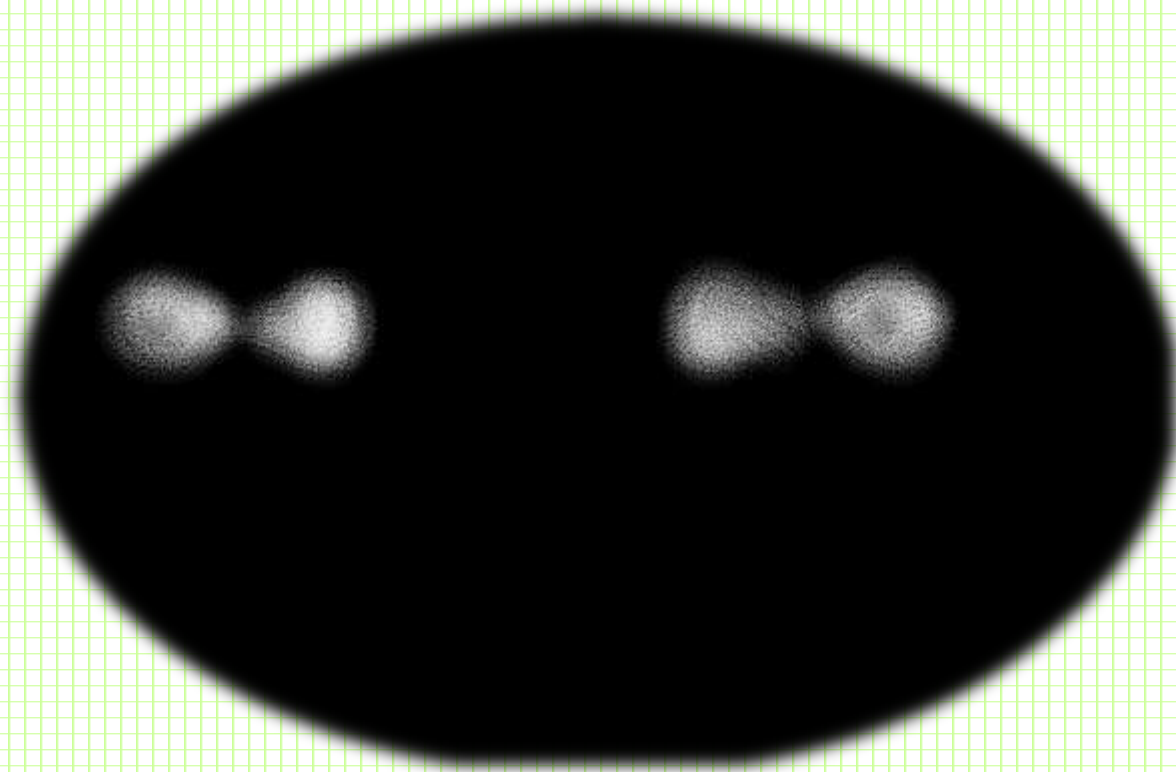
Bonding in Methane : Carbon uses sp^3 hybridized orbital to form 4 covalent bond with hydrogen in methane.

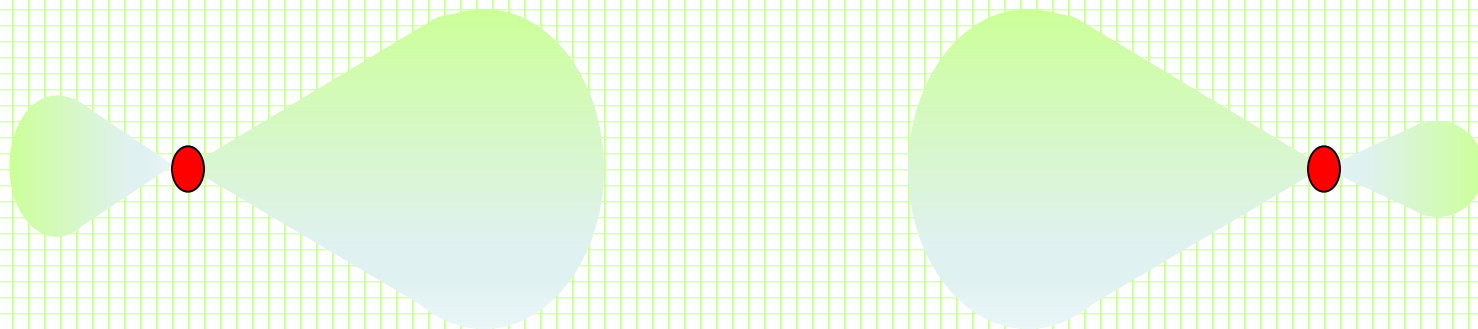


Summary

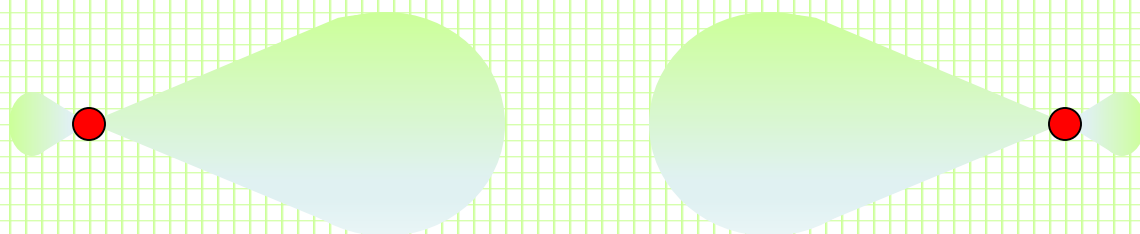
- sp^3 hybridization occurs when a C has 4 attached groups
- sp^3 hybrid orbital has 25% s and 75% p character
- the 4 sp^3 hybrids point towards the corners of a tetrahedron at 109.28° to each other
- each sp^3 hybrid orbital is involved in σ bond formation.

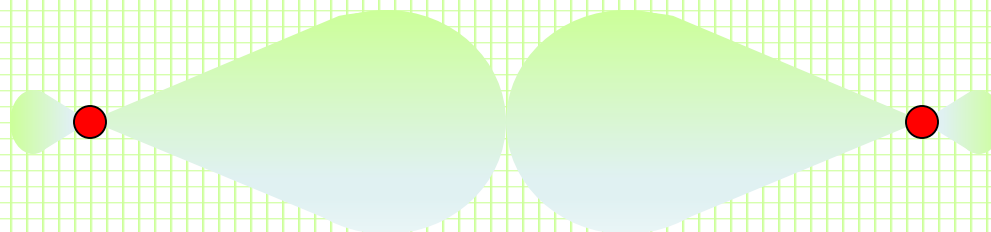
Formation of Sigma Bond

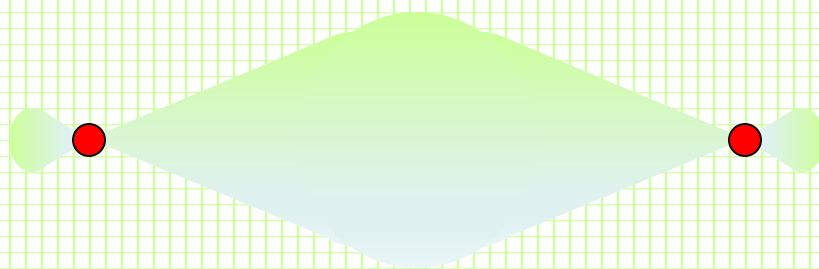




hybrid orbitals - sp , sp^2 , or sp^3

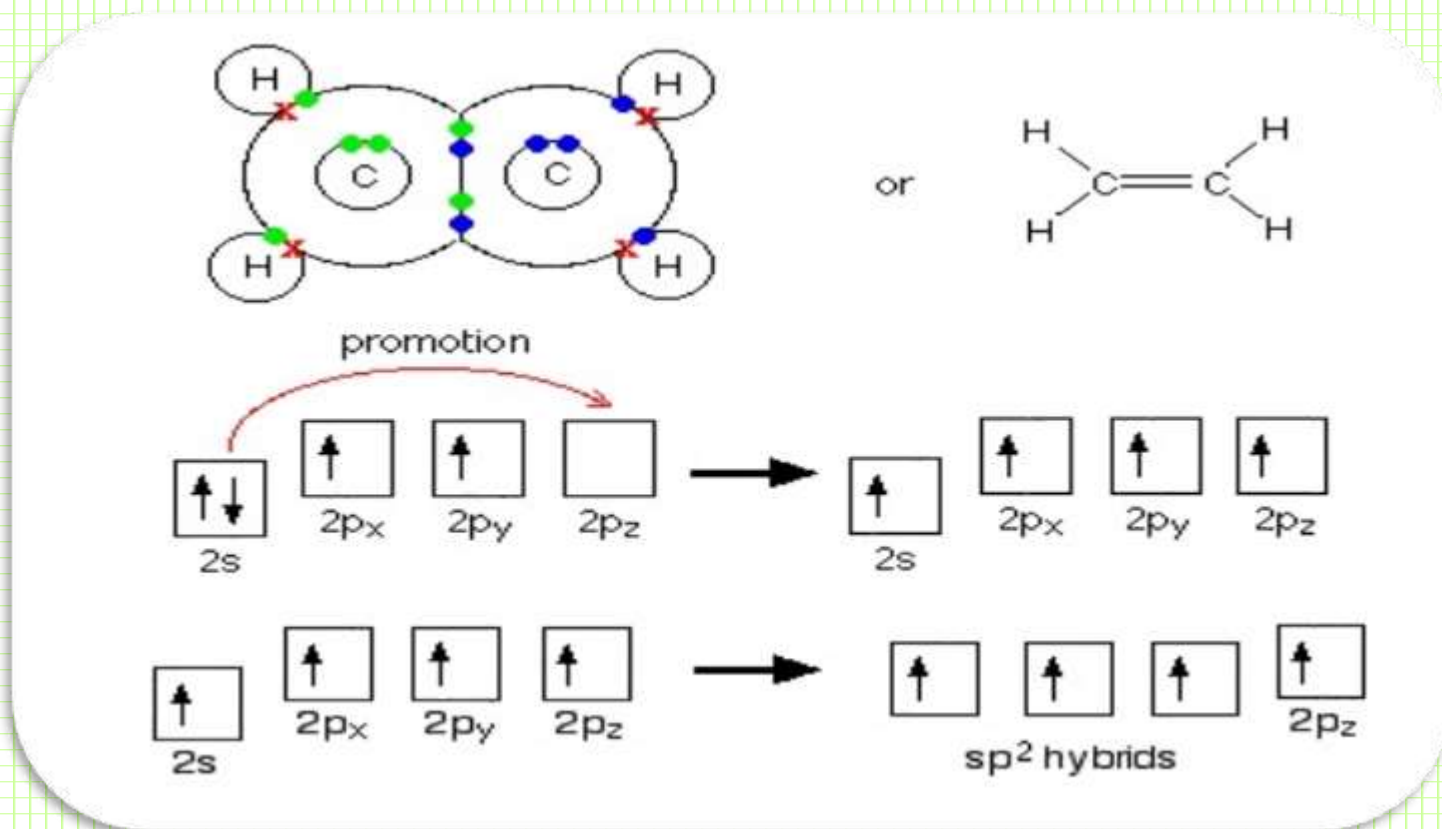


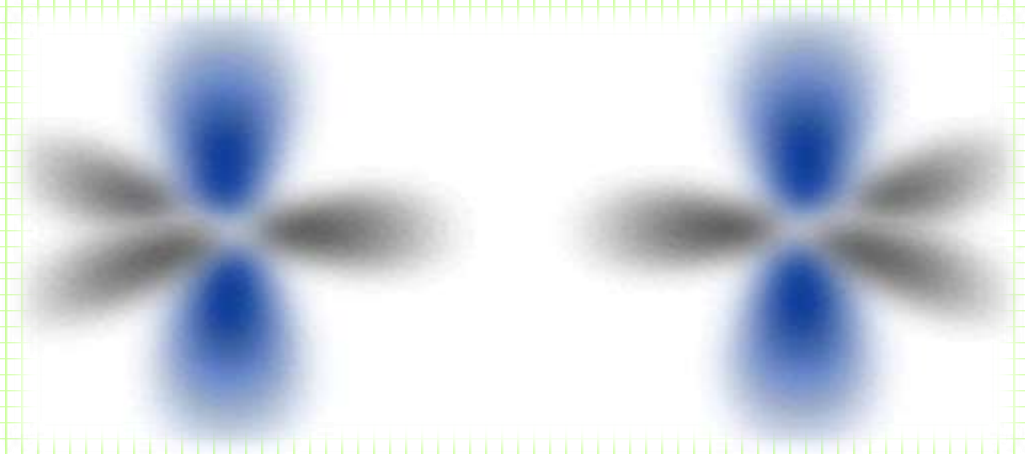




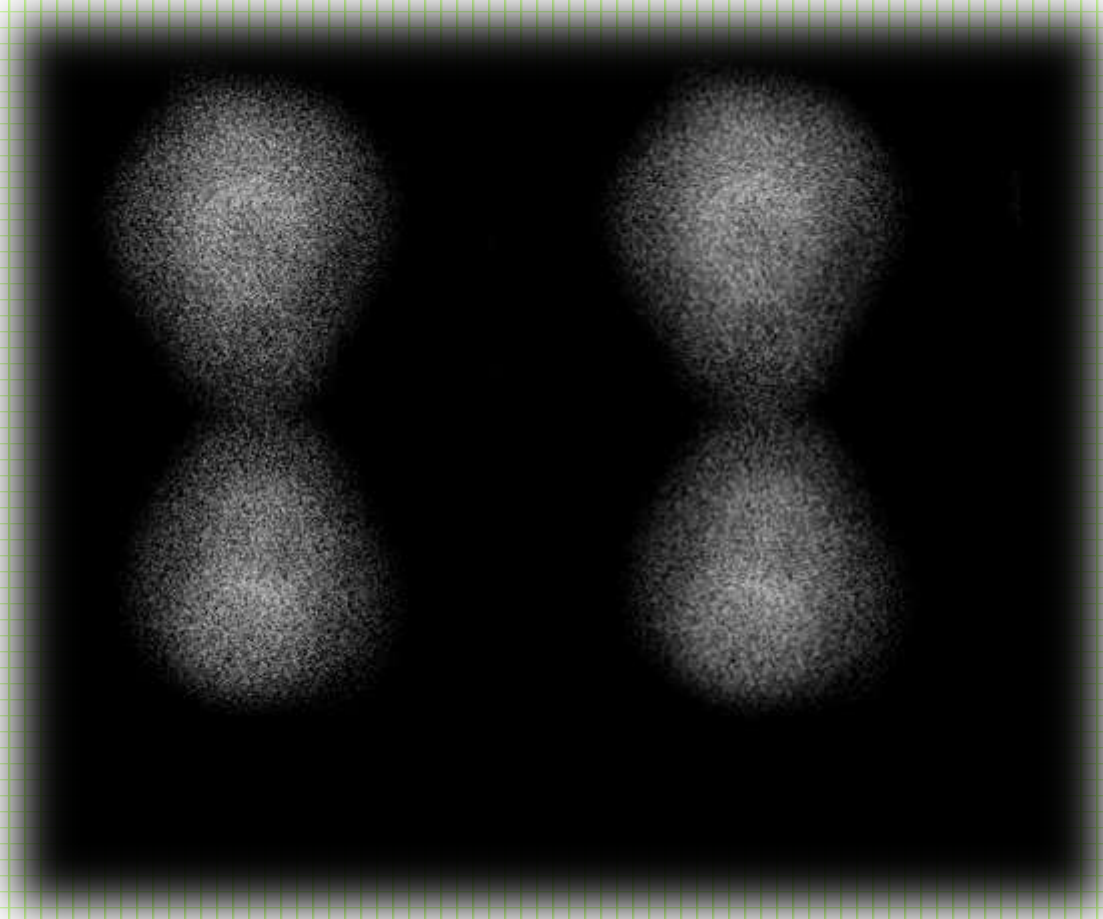
Formation of σ bond

sp^2 Hybridization

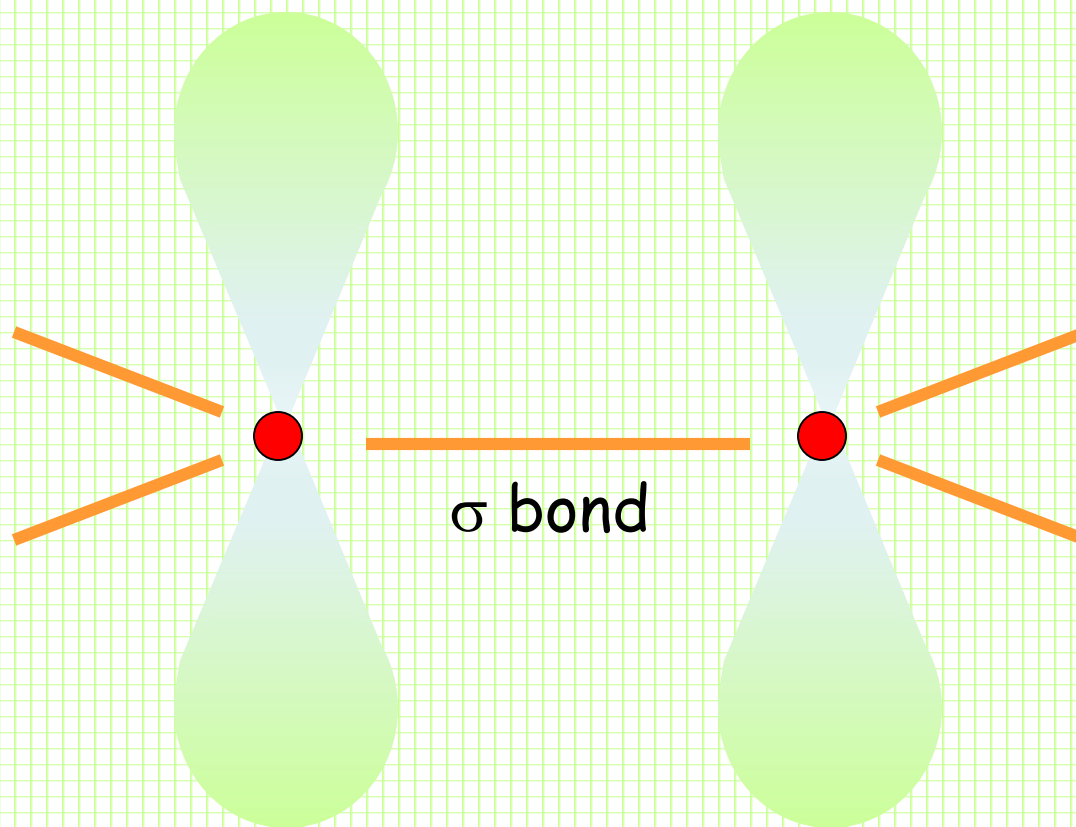




Formation of π bond

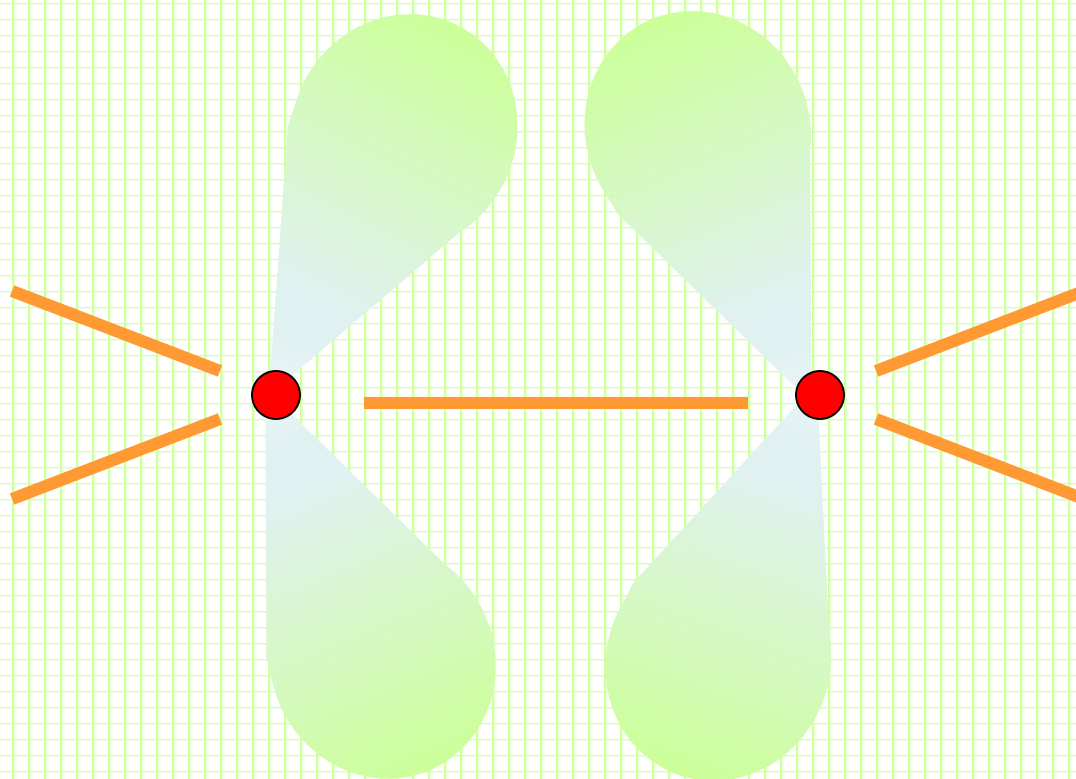


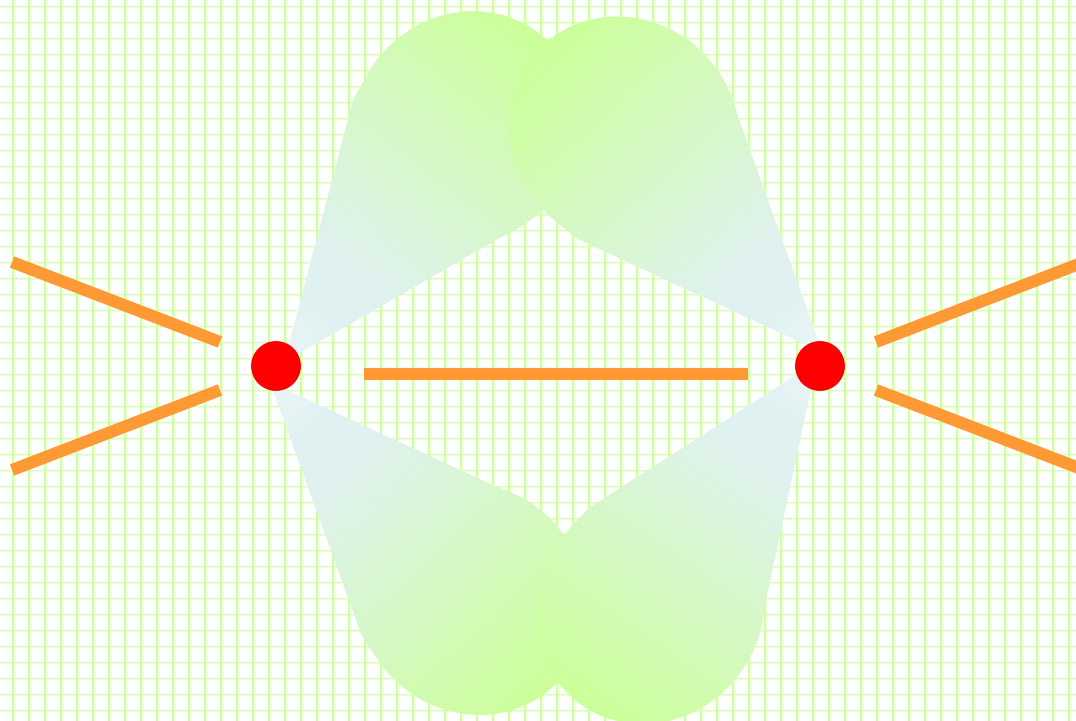
A.K.Gupta, PGT Chemistry, KVS
ZIET BBSR



Remaining **p** orbitals from sp or sp^2

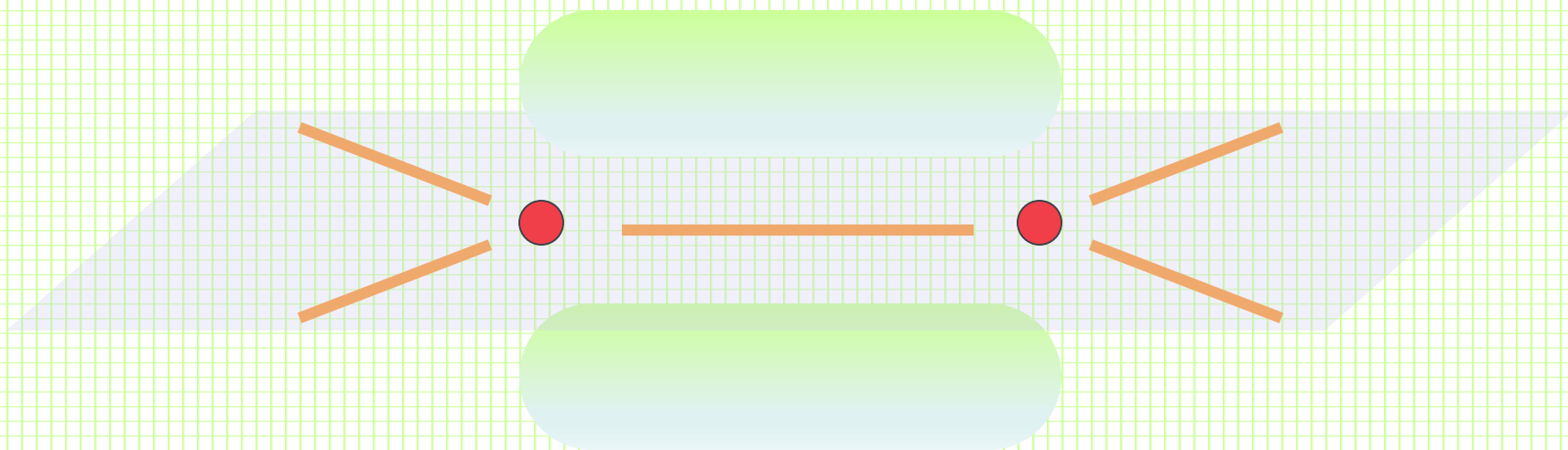
A.K.Gupta, PGT Chemistry, KVS
ZIET BBSR





Planar molecule (each carbon is trigonal planar)
with π cloud **above** and **below** the plane

π bond hinders free rotation about the carbon-to-carbon bond



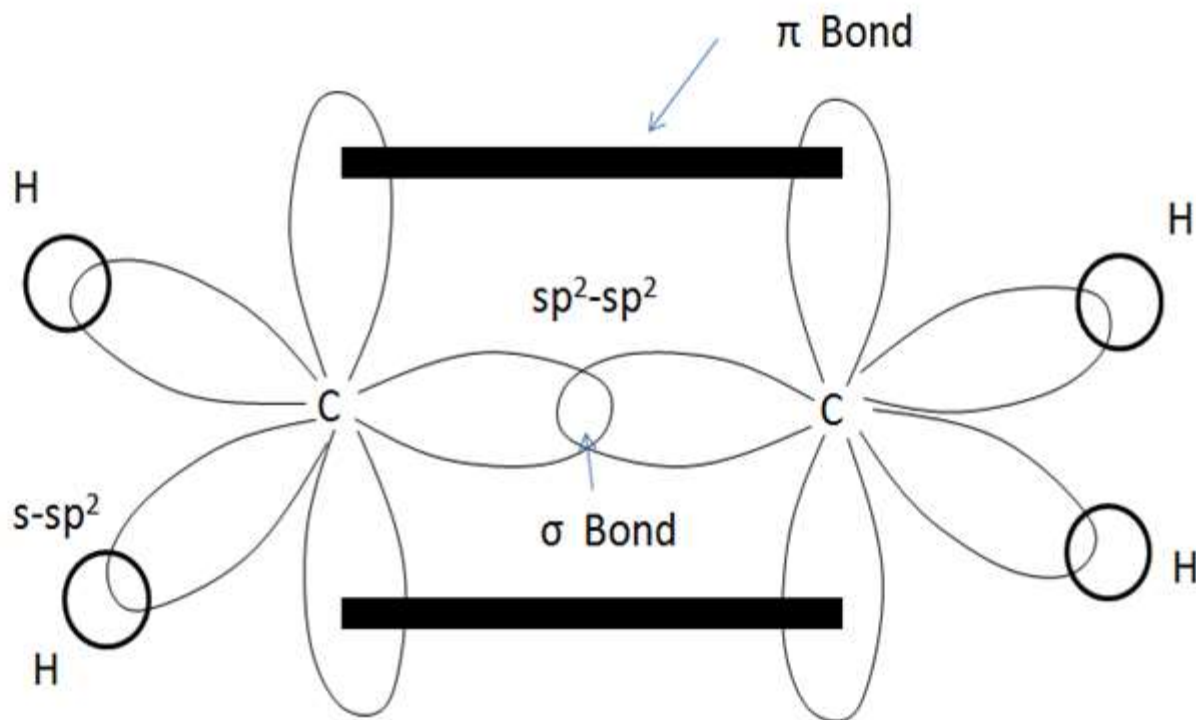
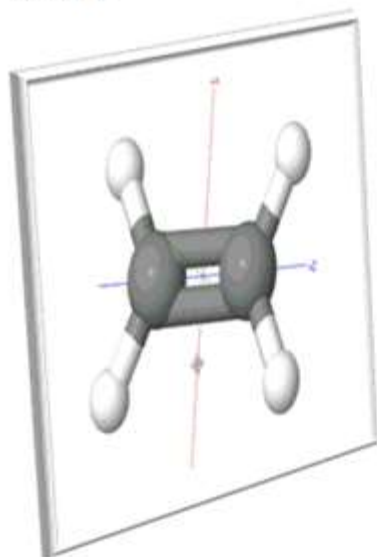
Formation of **π** bond

Summary

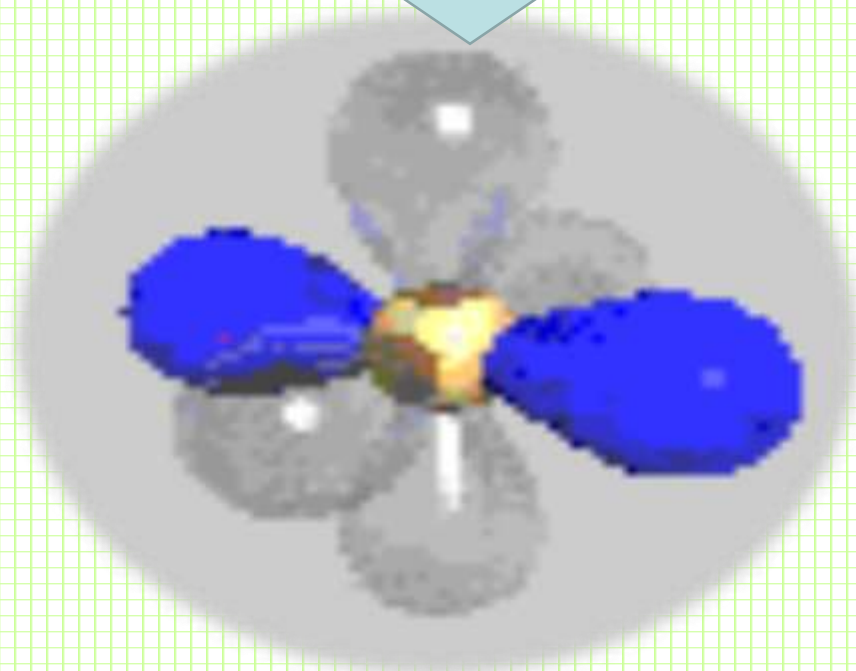
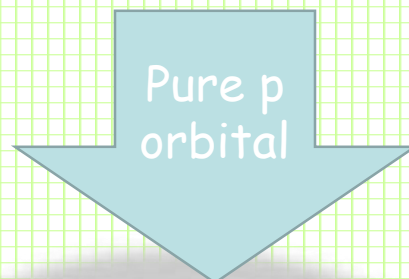
- sp^2 hybridization occurs when a C has 3 attached groups
- sp^2 hybrid orbital has 33% s and 67% p character
- the 3 sp^2 hybrids point towards the corners of a triangle at 120° to each other
- each sp^2 hybrid orbital is involved in a σ bond formation and the remaining p orbital forms the π bond
- a double bond as a $\sigma + \pi$ bond

Bonding in Ethene ($\text{H}_2\text{C}=\text{CH}_2$)

Each carbon uses sp^2 hybridized orbital to form 2 sigma bonds with hydrogen and 1 sigma bond with other carbon. Pure p-orbital of C forms Pi bond.



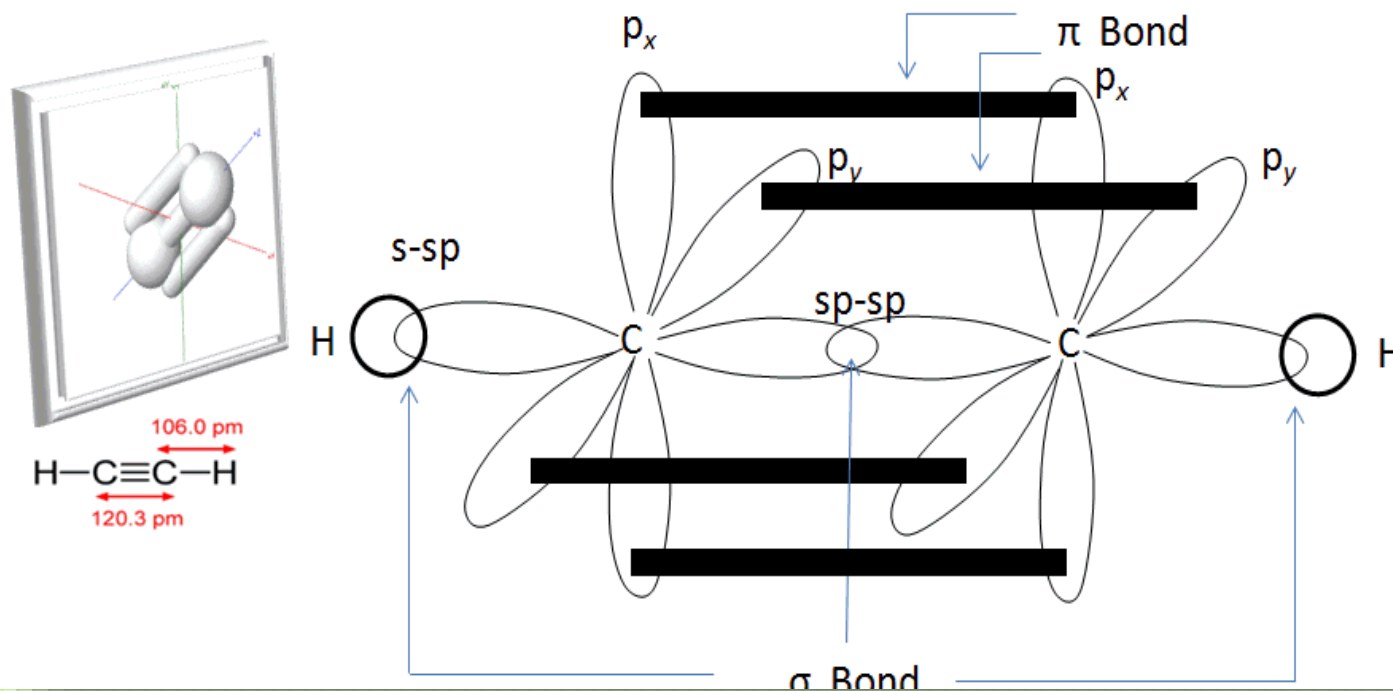
sp Hybridization



Sp hybrid orbital

Bonding in Acetylene

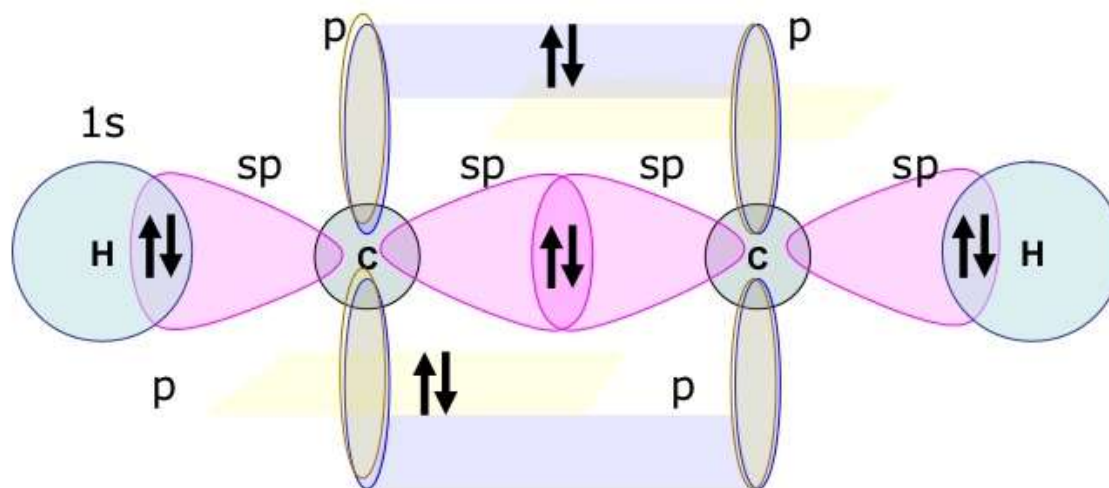
Each Carbon atom in acetylene uses sp hybridized orbital's to form 2 sigma bonds with neighbouring Hydrogen and 1 Carbon atom. 2 pure orbital's forms 2 Pi bonds as shown.



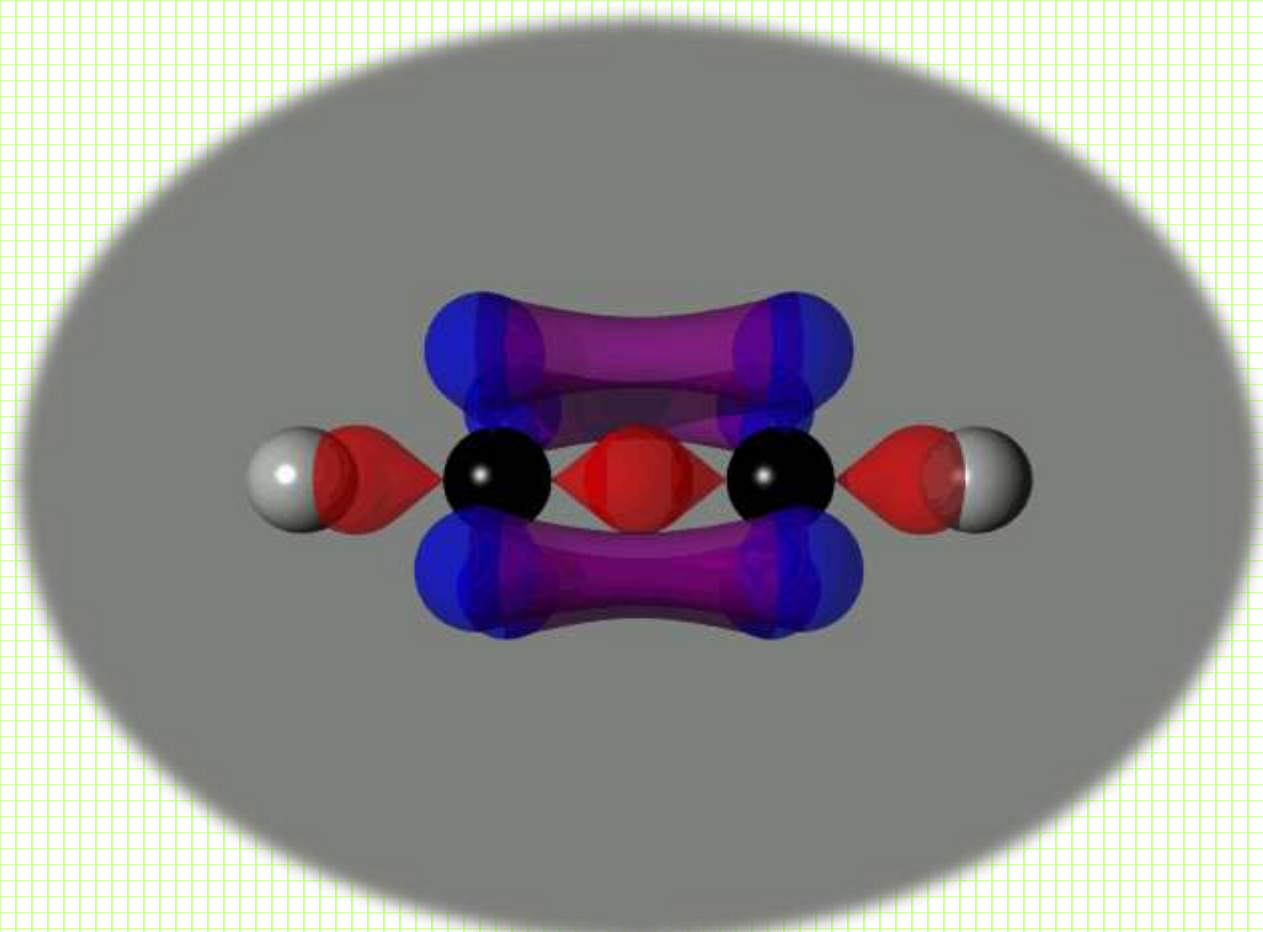
sp Hybridization

HYBRIDIZATION

Example: **Ethyne (C_2H_2)**



Bonding in Acetylene



A.K.Gupta, PGT Chemistry, KVS
ZIET BBSR

Summary

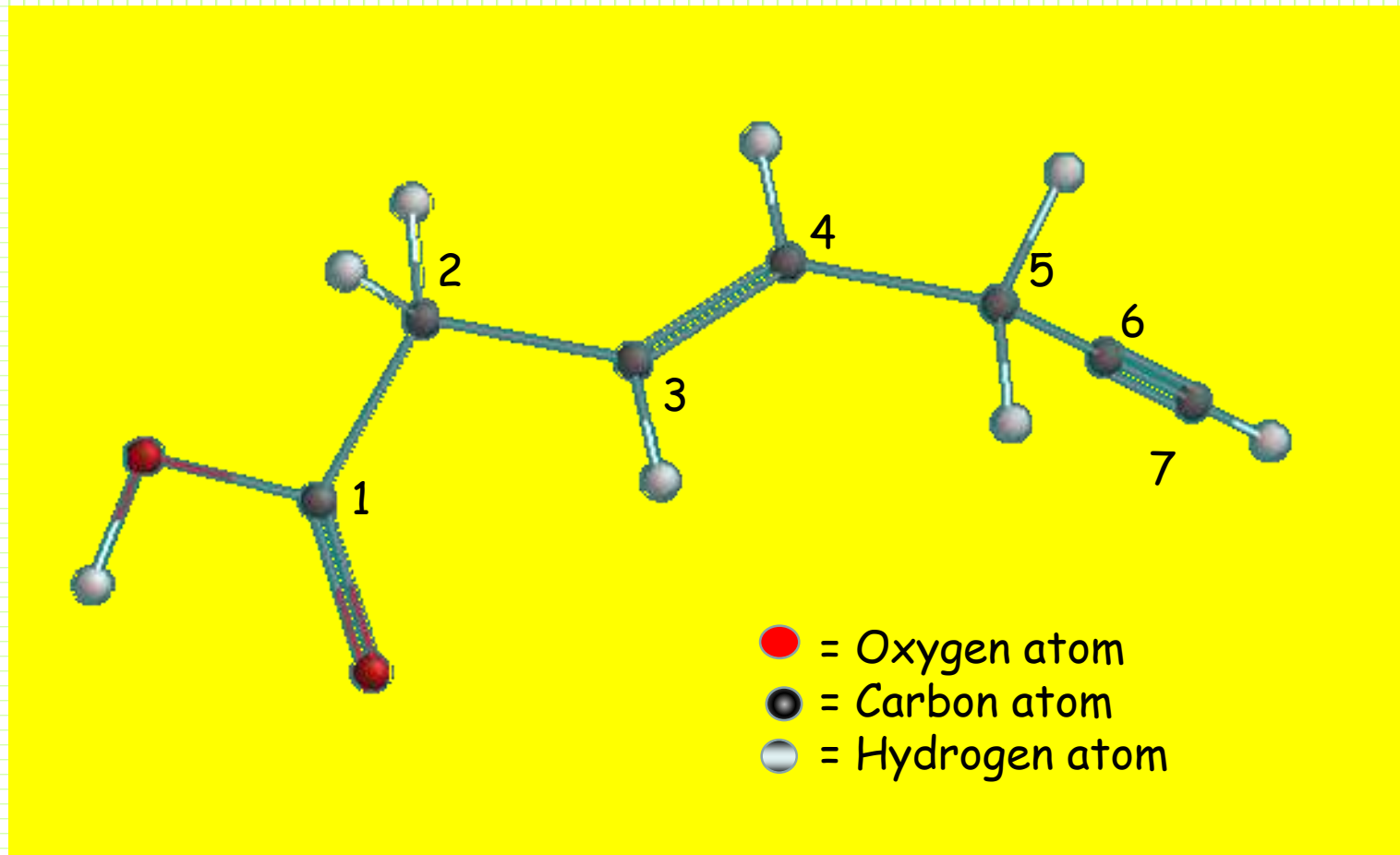
- sp hybridization occurs when a C has 2 attached groups
- sp hybrid orbital has 50% s and 50% p character
- the 2 sp hybrids are oriented at an angle of 180° to each other
- each sp hybrid orbital is involved in a σ bond formation and the remaining two p orbitals form two π bonds
- a triple bond = one σ + two π bonds

Bond formation from hybridization

- Single bond
 - sigma bond
 - Double bond
 - sigma bond + pi bond
 - Triple bond
 - sigma bond + pi bond + pi bond
- end-to-end
- side-to-side

How are the two pi bonds in the triple bond oriented?

What is the hybridization in each carbon atom?

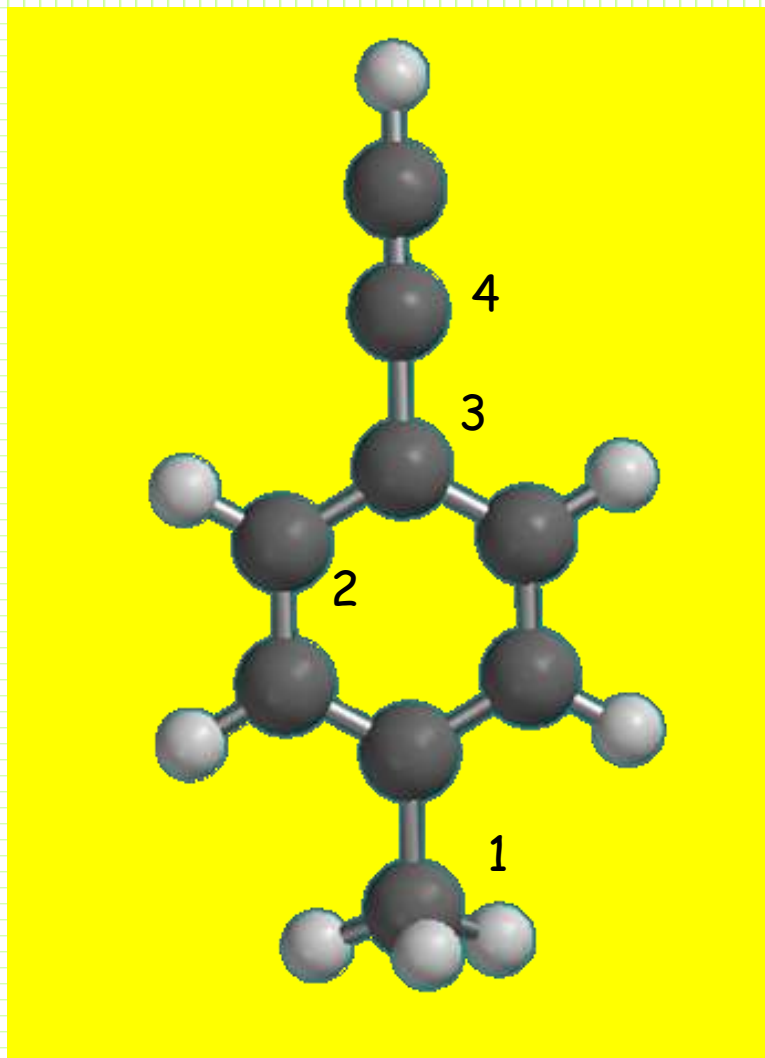


sp^3 - 2, 5
tetrahedral

sp^2 - 1, 3, 4
trigonal planar

sp - 6, 7
linear

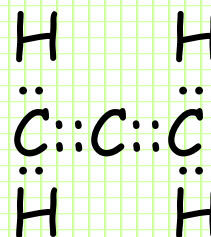
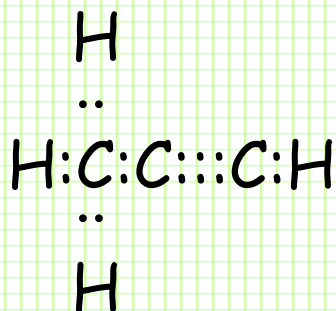
What is the hybridization in each carbon atom?



Draw the Lewis dot structure -
 C_3H_4

Remember to chain the carbon atoms and fill the octet of the center carbon atom in the chain first.

You should have come up with one of these structures:



Thanks

Please send your feedback
To
ashokkgupta62@rediffmail.com