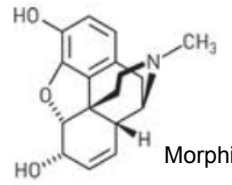
CHAPTER1:DISCUSSION 1:

Carbon = atom found in all living things

Bond type of C?

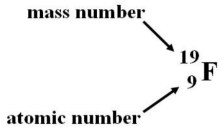


Morphine

Natural vs Synthetic Compounds:

Same structure?

Benefits of synthetic?



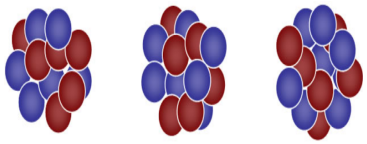
(A) Structure of the Atom:

atomic number:

mass number:

atomic mass:

isotopes:



carbon-12	carbon-13	carbon-14
98.9%	1.1%	<0.1%
6 protons	6 protons	6 protons
6 neutrons	7 neutrons	8 neutrons

(B) Electrons:

electron cloud:

electron configuration:

subshells:

Rules for filling e-:

Hunds Rule

Aufbau Principle

Two types of e-:

Core Electrons

Valence Electrons

Practice:

Draw the e- configuration of Nitrogen:

ID # core e-
ID # valence e-
Which p orbitals have an e- and how many

Ionic/ Covalent Bonds:

Ionic Bonds:

Example of ionic bond:

Covalent Bonds:

Nonpolar covalent:

Example:

Polar covalent:

Example:

Practice:

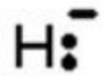
Which bond is more polar?
H-F or H-Cl

Use the partial polarity symbol to indicate the direction of the molecules polarity in an NH_3 molecule.

What type of bond does C normally form?

Hydrogen -

form protons H^+

or form hydride ions 

Electrostatic Potential Maps:

- to show the distribution of electrons in a molecule

- useful for showing a molecule is polar or nonpolar and can give you insight into the chemical behavior of the molecule

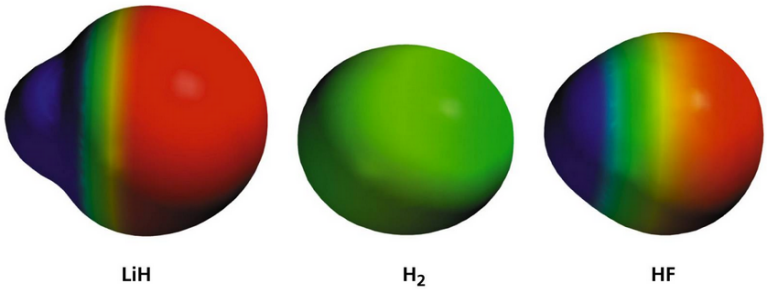
- red: greater electron density (partial negative charge)

- blue: less electron density (partial positive charge)

most negative ↓ positive ↓

- RED -- ORANGE -- YELLOW -- GREEN -- BLUE

↑ attracts ↑ a positive charge a negative



http://www2.onu.edu/~b-myers/organic/

Lewis Structures:

- Make all atoms happy by sharing e-
- Show Formal charges on atoms

How to find a formal charge:

1.) Draw correct lewis structure
2.) Focus on each atom at one time

f.c. = # valence - (#lone pair + 1/2 bonded e-)

Ex: Draw Lewis strucure for each and/or find formal charges

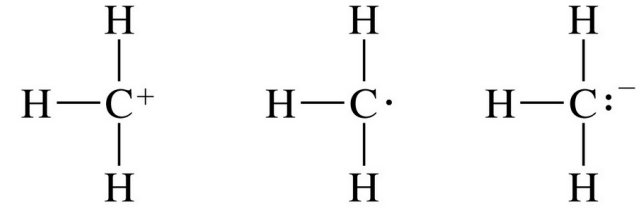
H_2O

H_3O^+

OH^-

NH_3

NH_4



carbocation radical carbanion

http://wps.prenhall.com/esm_bruice_essentials_2/110/28209/7221752.cw/index.html

When drawing organic structures:

Number of bonds per atom:

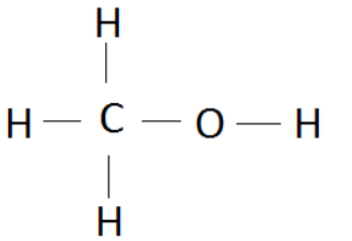
H	Oxygen
Halogens	Nitrogen
Carbon	

Kekule Structures:

- only show bonds and atoms, understand that the lone pairs are present

Condensed Structures:

- only provide order of atoms and subscripts



methyl alcohol (Kekulé Structure)

= CH_3OH

Practice as a class:

12a

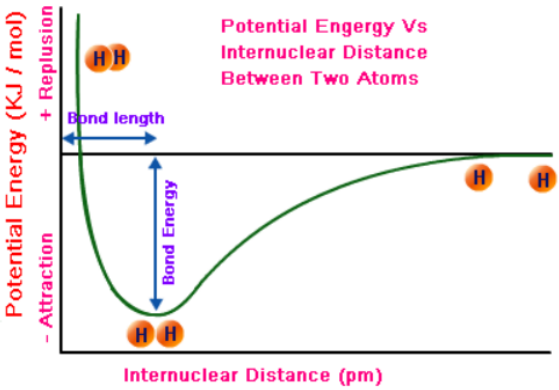
13a

14a

17

What is a constitutional isomer?

Covalent bond formation

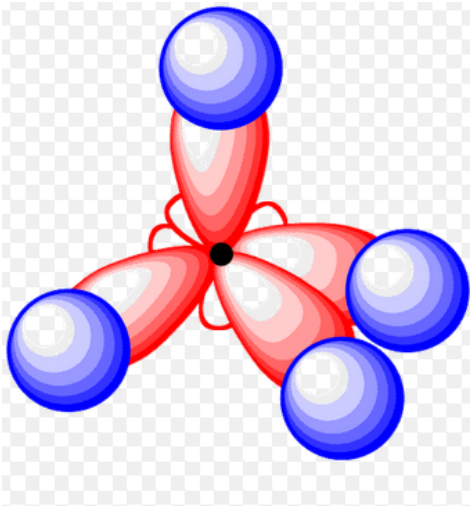


What is happening as atoms bond, according to this graph?

Formation of bonds (hybridization)

Single bonds:

ex: Methane CH_4



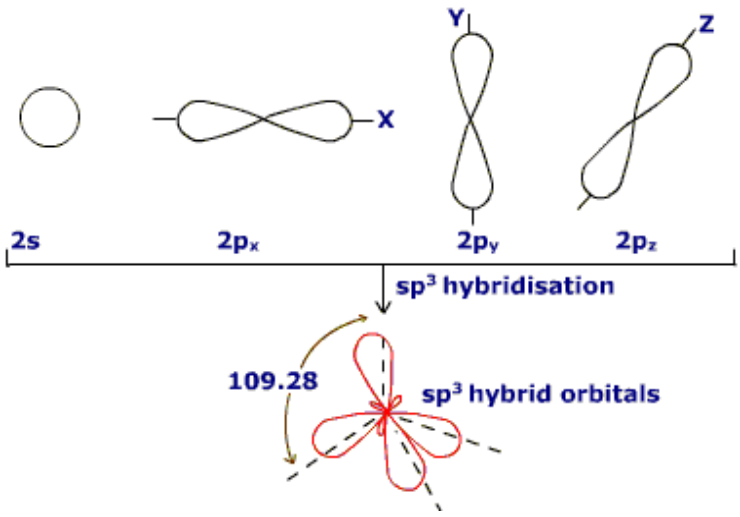
Draw valence orbitals of C?

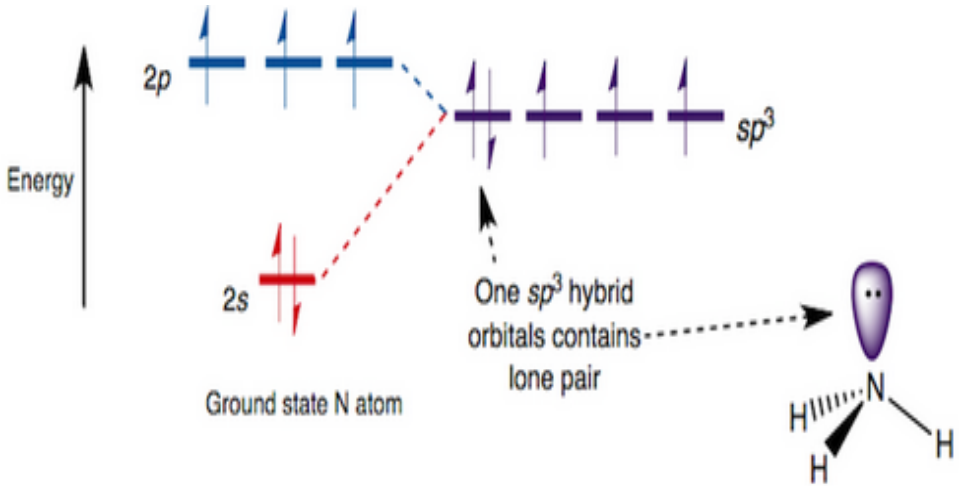
How many bonds does it need to form?

This is possible due to hybridization

Shape of an sp^3 hybrid orbital?

Draw the 3-d shape of the molecule, label/shape orbitals


Y
Z
X
2s
2p$_x$
2p$_y$
2p$_z$
sp^3 hybridisation
109.28
sp^3 hybrid orbitals


Energy
2p
sp3
2s
Ground state N atom
One sp3 hybrid
orbitals contains
lone pair
N
H
H
H

Double bonds

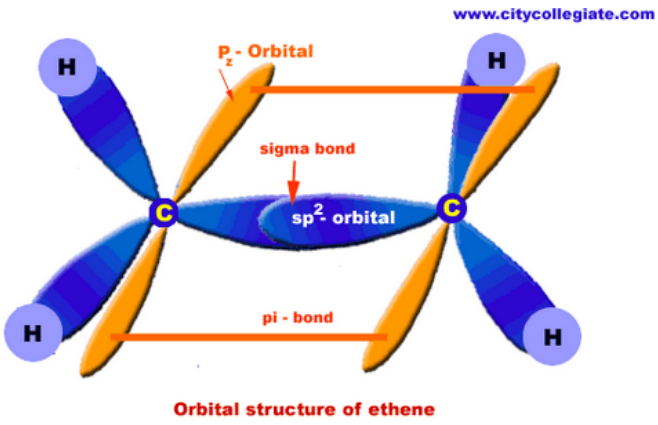
Ex: Ethene CH_2CH_2

Each Carbon needs to bond to 3 atoms, how will it hybridize?

What happens to the unhybridized orbital?

Draw in 3-D, showing all shapes of orbitals and label

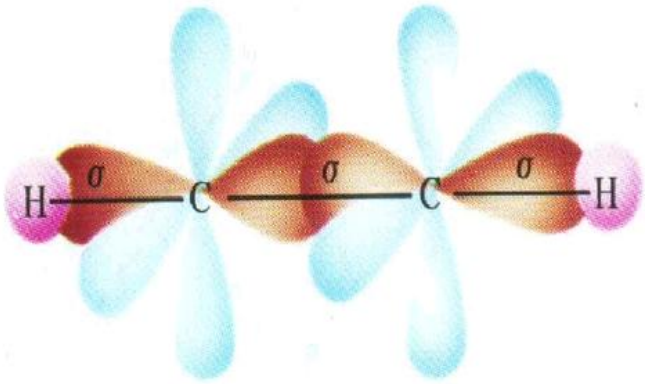
Which are the sigma, pi bonds?



Orbital structure of ethene

A triple bond with C

Ex: C_2H_2



Each C needs how many bonds?

Show the original orbitals and how many e- they hold

Only 2 orbitals hybridize, other 2 do not. This looks like:

Draw the 3-D shape and include proper shape of orbitals. Label sigma and pi bonds.

Hybridization specific to each of the following:

Methyl cation ($^{+}CH_3$)

Draw C orbitals:

How many bonds?

Type of hybridization?

What is held in the last orbital?

3-D structure

Methyl radical ($^{\bullet}CH_3$)

Draw C orbitals:

How many bonds?

Type of hybridization?

What is held in the last orbital?

3-D structure

Methyl anion ($:CH_3$)

Draw C orbitals:

How many bonds?

Type of hybridization?

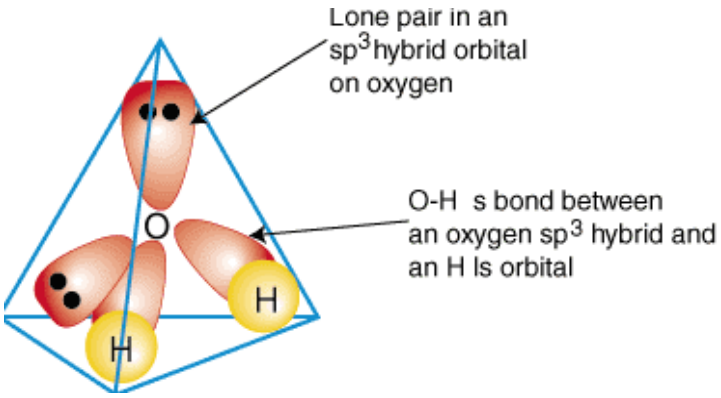
3-D structure

More hybridization:

H_2O

Draw O orbital diagram:

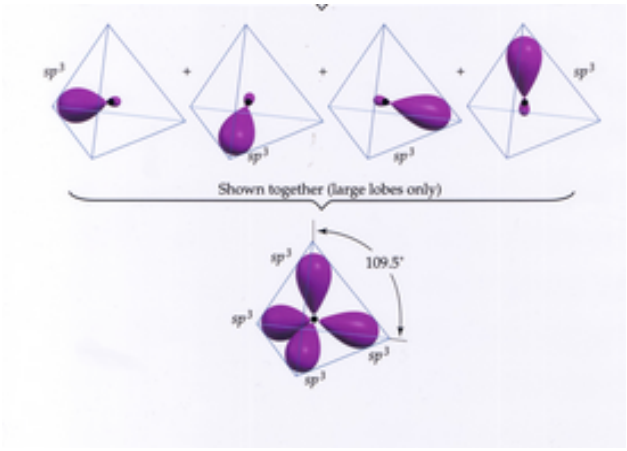
How can it be hybridized so the lone pairs are = and the bonds are =?



NH_3 and NH_4^+

How many bonds/lone pairs are on each N?

What type of hybridization exists?



H-Halide bonds

All 3 lone pairs on the halide are = angles, + the bond

Thus they are hybridized as?

Which of the H-halides has the weakest bond? (HF, HCl, HBr, HI)

Table 1.6 Hydrogen–Halogen Bond Lengths and Bond Strengths

Hydrogen halide	Bond length (Å)	Bond strength kcal/mol	Bond strength kJ/mol
H—F	0.917	136	571
H—Cl	1.2746	103	432
H—Br	1.4145	87	366
H—I	1.6090	71	298

Hybridization in summary:

For the Atoms of Carbon, Oxygen and Nitrogen

- Look for and count the # of Pi bonds present in molecule

Pi Bonds

none = sp3

1 = sp2

2 = sp