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Bond Polarity

Common Electronegativities

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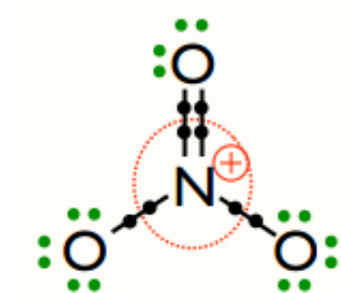
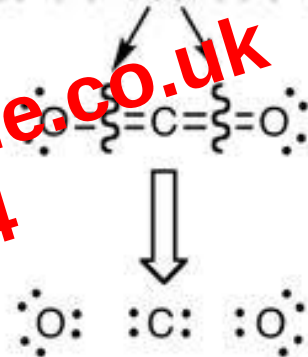
Element	Electronegativity
H	2.1
C	2.5
N	3.0
O	3.5
F	4.0
S	2.5
Cl	3.0
Br	2.8

Highest value,
set to 4

Formal Charge

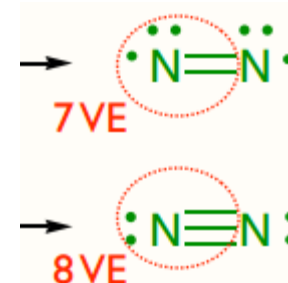
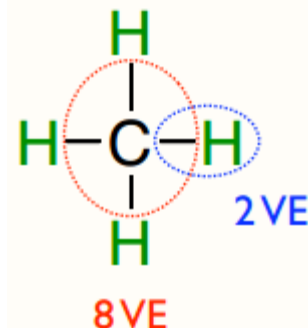
Split all bonds in the middle
=> "real" charge on atoms

"Split" electrons in
covalent bonds evenly



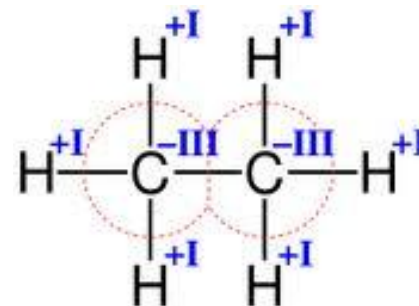
(2) Octet Rule

Count all bonding electrons for
one atom
=> 8 is most stable



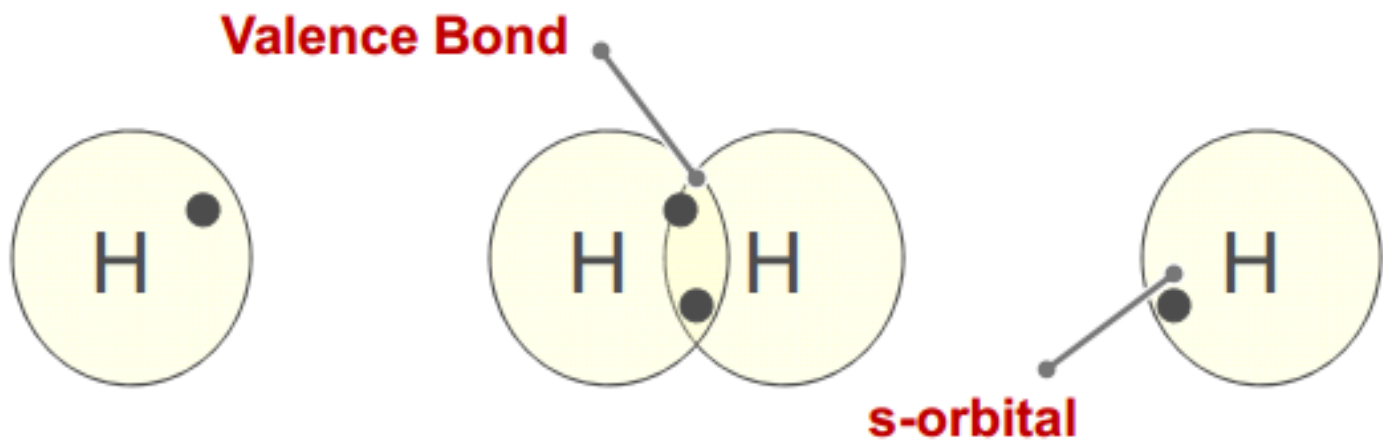
(3) Oxidation Number

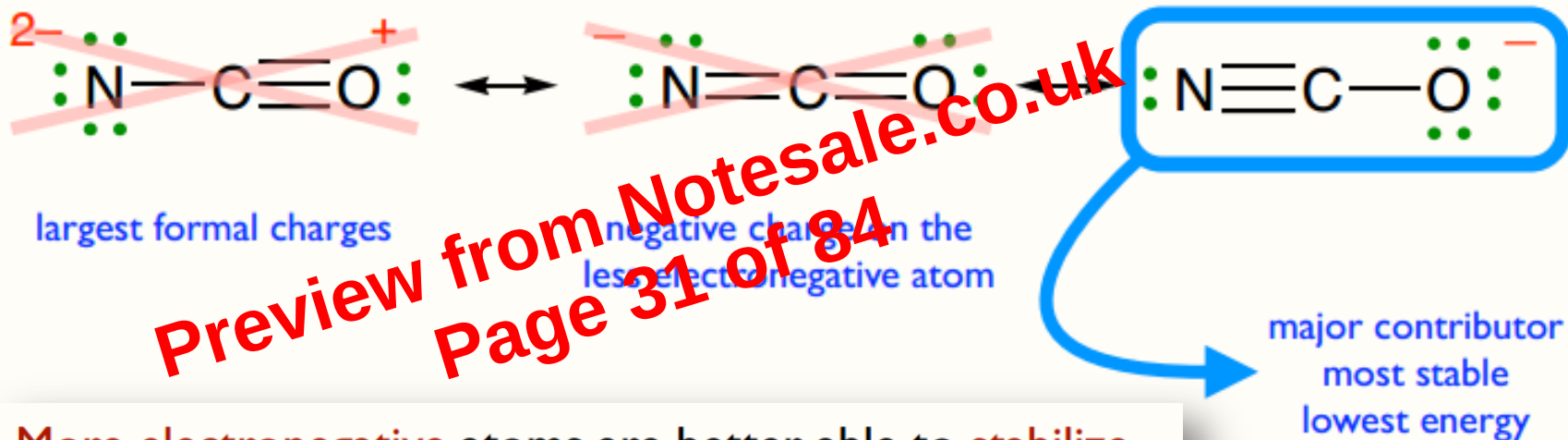
Give all bonding electrons to
the more electronegative atom



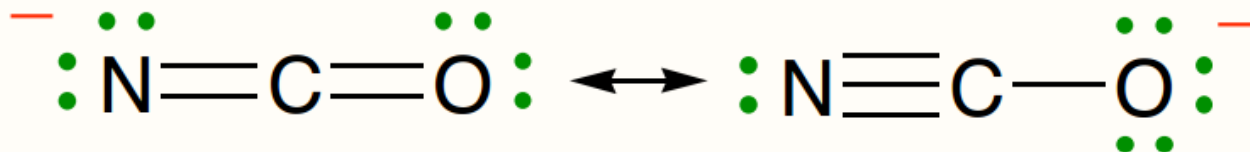
Valence Bond Theory – Bonds are formed by the orbitals of atoms overlapping.

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More electronegative atoms are better able to stabilize negative charge (lower the energy).



Oxygen is more electronegative than nitrogen.
 Therefore, a negative charge on oxygen is more stable than a negative charge on nitrogen.

Important exception: Carbon Monoxide !

Hybrid Orbitals

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- Atomic orbitals can **mix** or **hybridize** in order to adopt an appropriate geometry for bonding.
- Hybridization is determined by the electron domain geometry.

sp Hybrid Orbitals

- Consider the BeF_2 molecule (experimentally known to exist):

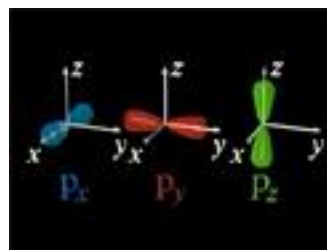
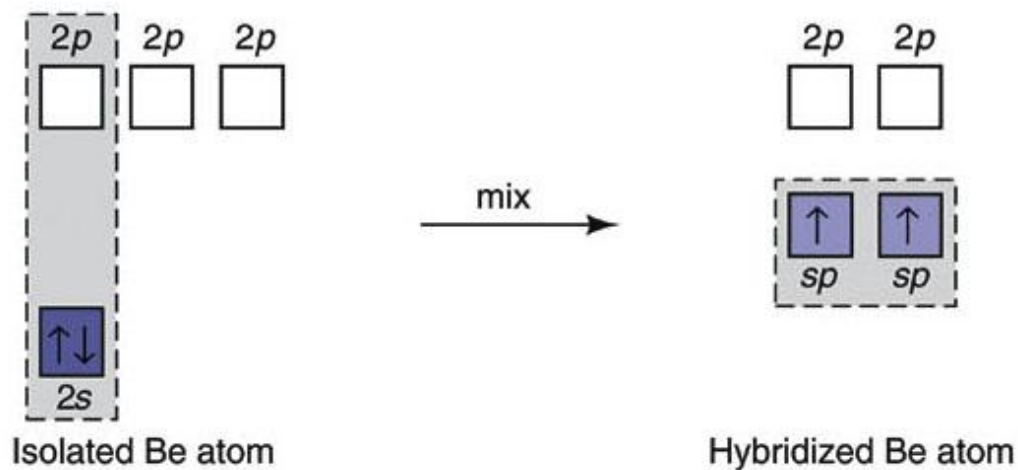
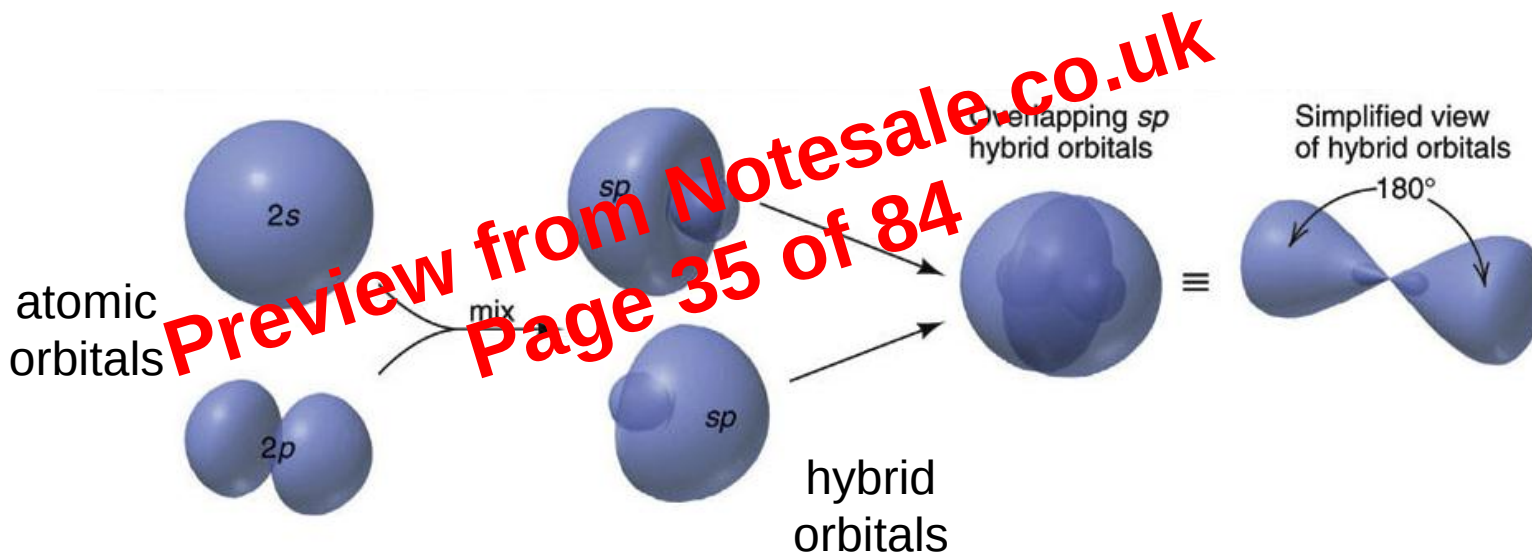


Figure 11.2 The sp hybrid orbitals in gaseous BeCl_2 .

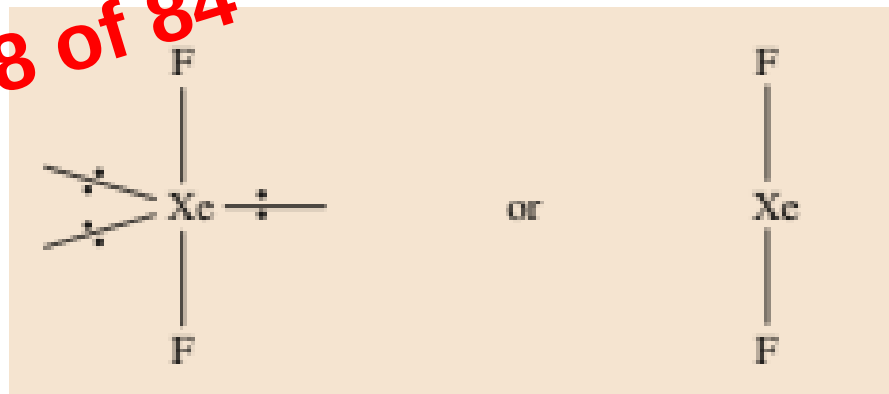


orbital box diagrams

Examples

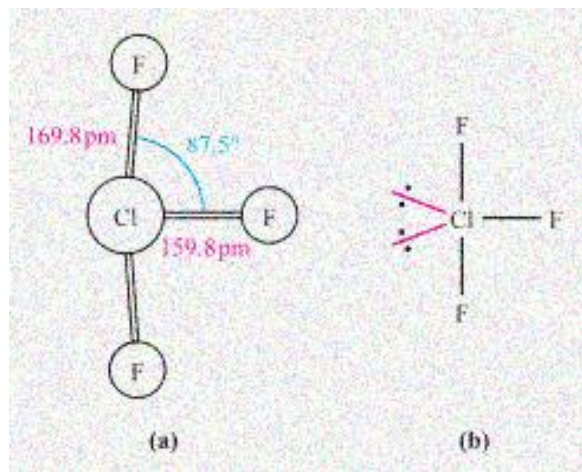
XeF_2

The lone pair needs most space, so they are in equatorial position (bond angle 120 deg)



ClF_3

lone pairs again in eq. position so have max. distance

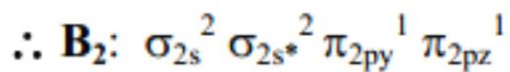


Electron Configurations and Molecular Properties

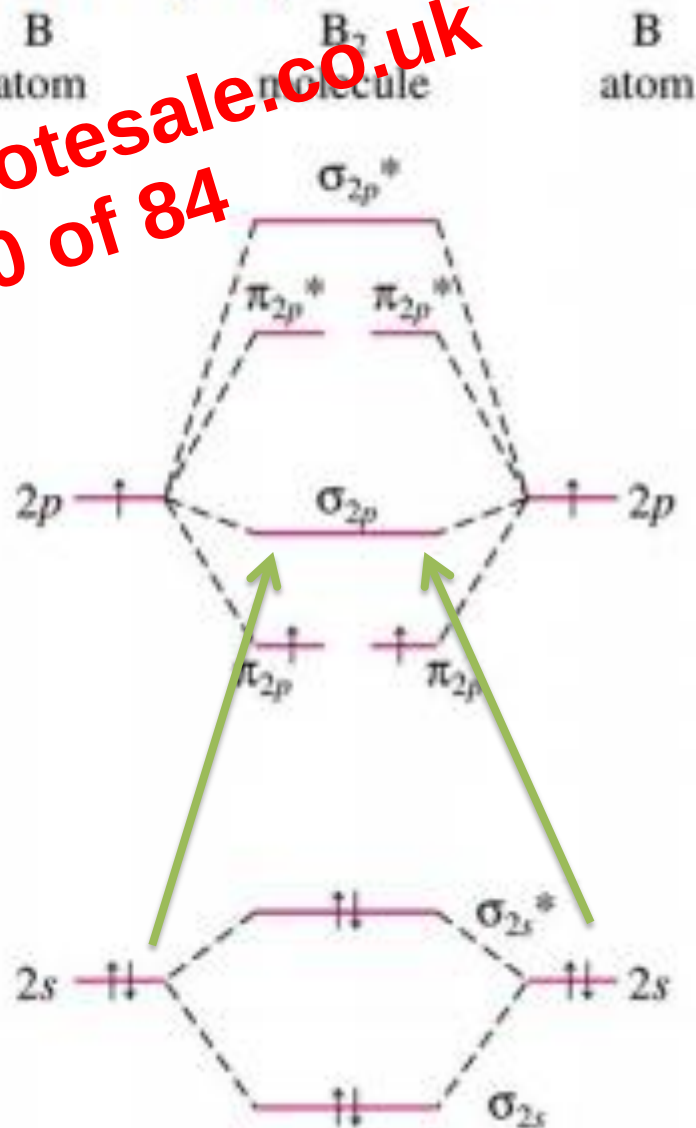
- Two types of magnetic behavior:
 - **paramagnetism** (unpaired electrons in molecule): strong attraction between magnetic field and molecule;
 - **diamagnetism** (no unpaired electrons in molecule): weak repulsion between magnetic field and molecule.
- Magnetic behavior is detected by determining the mass of a sample in the presence and absence of magnetic field:

B₂ from two atoms of **B**: [He] 2s² 2p¹

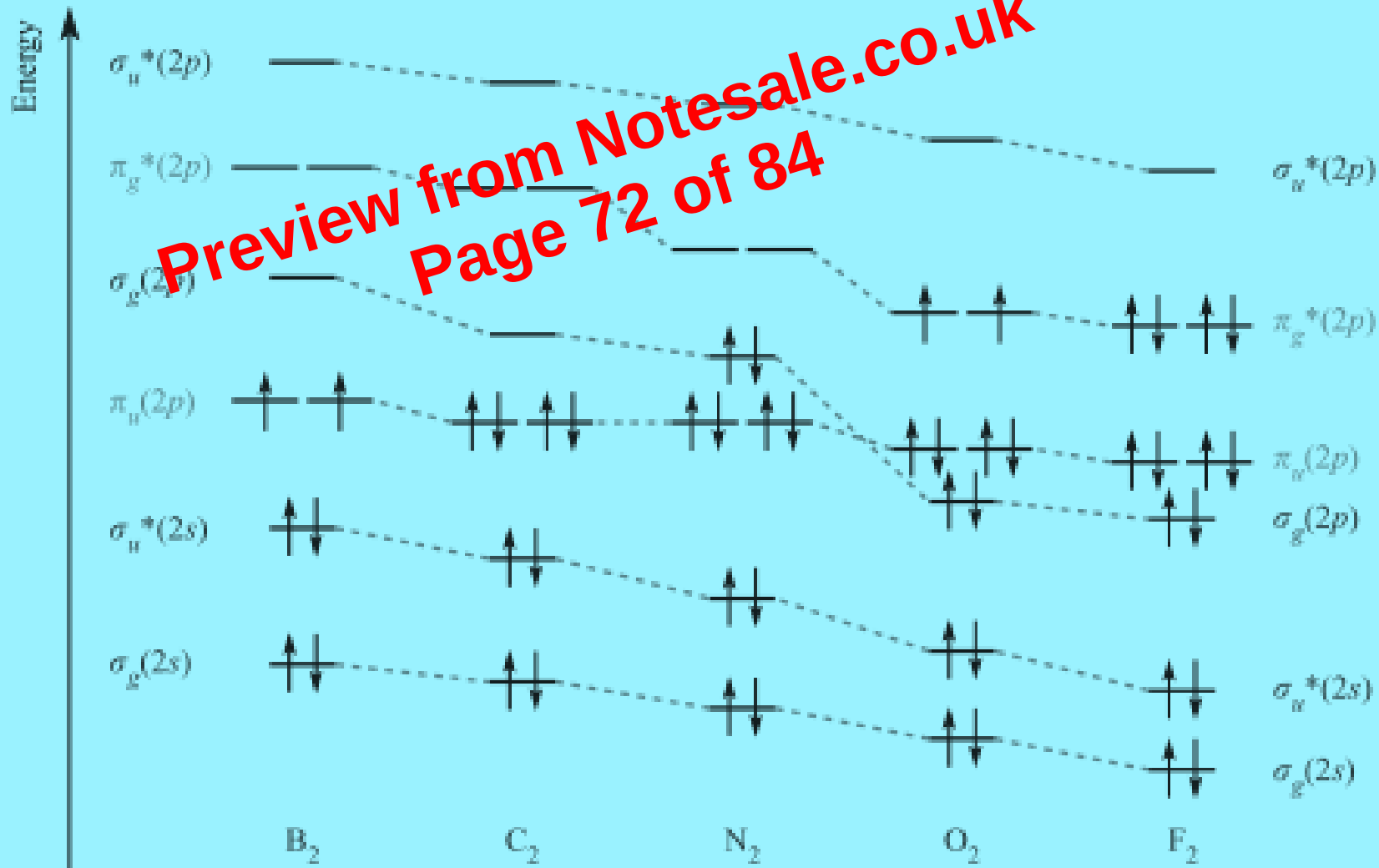
Please try to
draw the AO's
and MO's



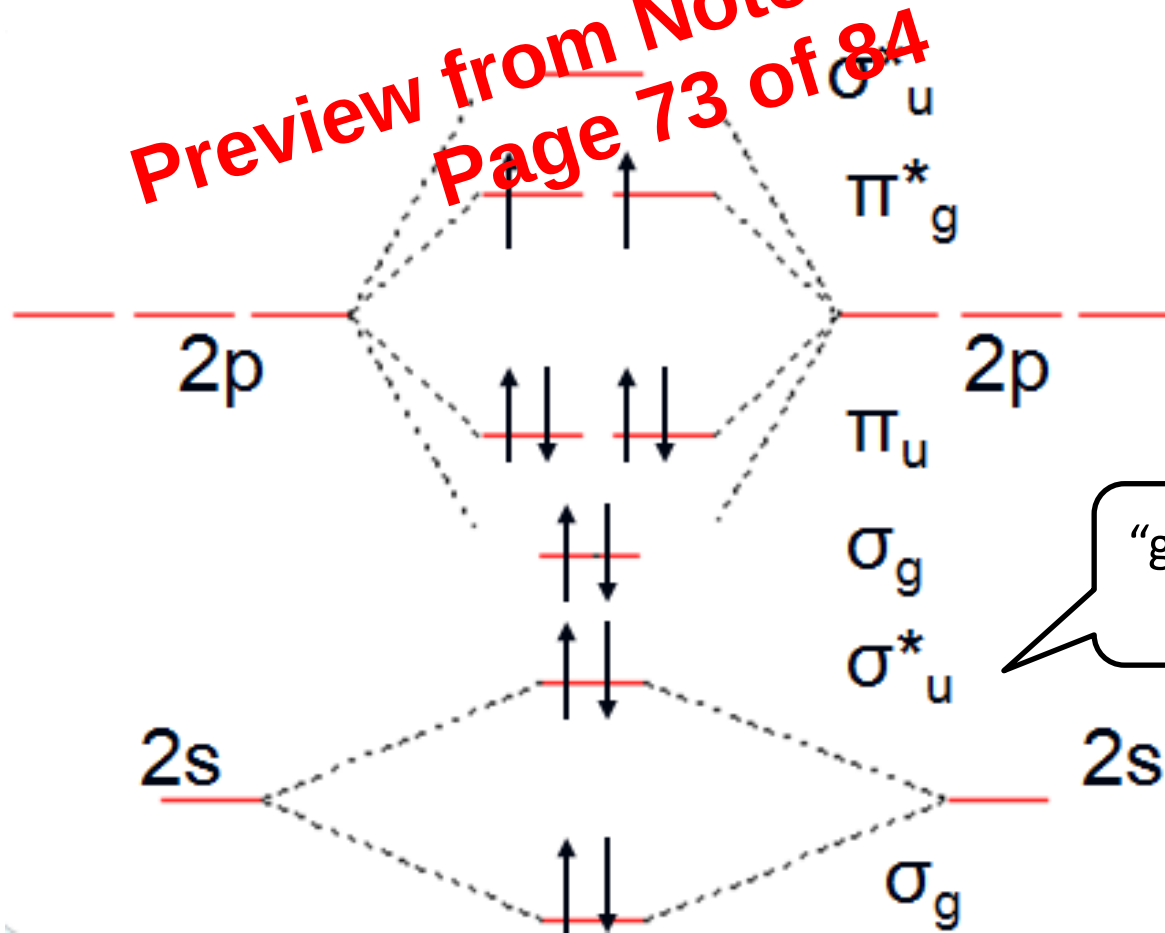
paramagnetic and bond order = 1



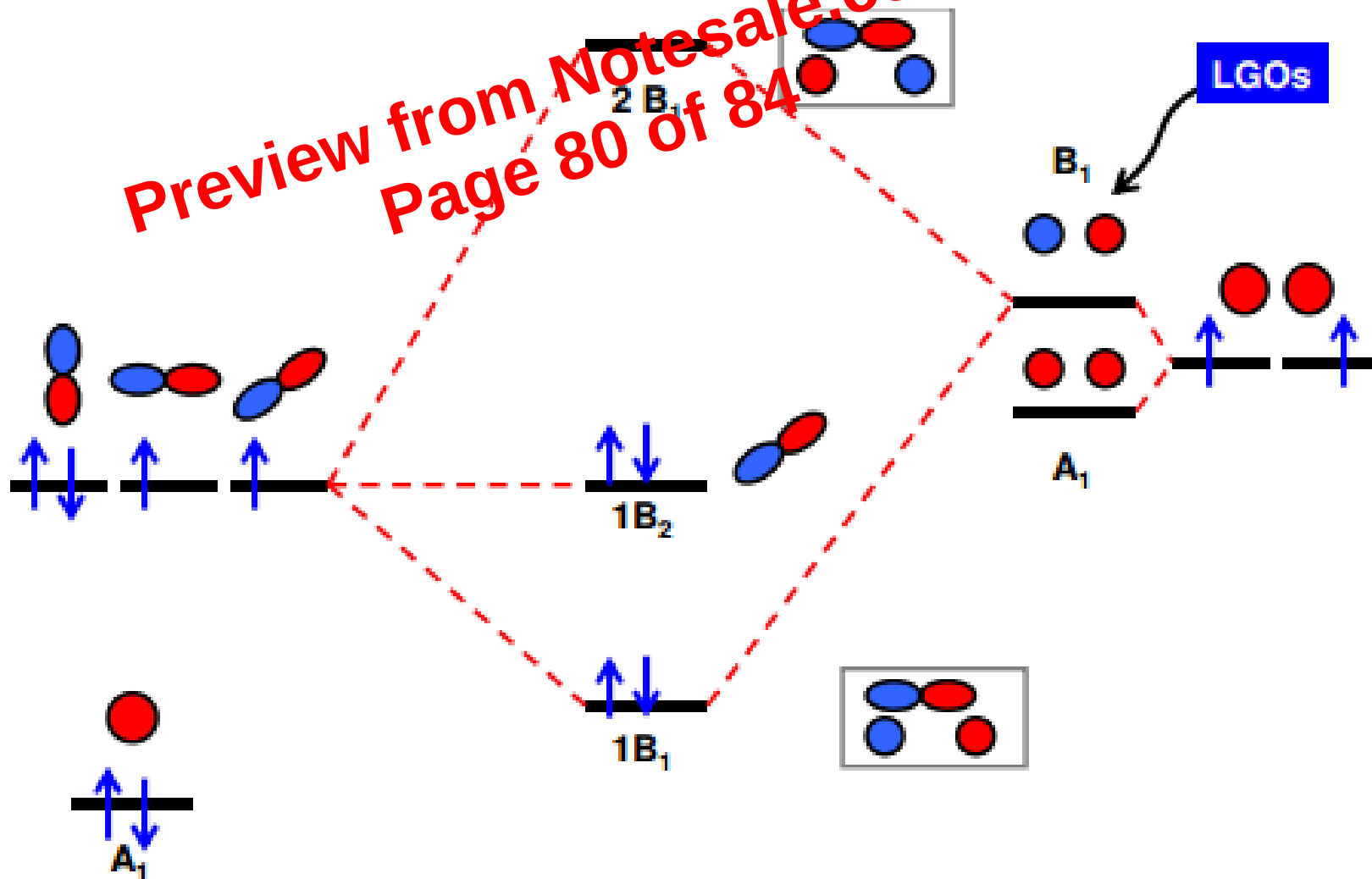
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Naming of MO's: example O_2 molecule



Interaction 2: out-of-phase H orbitals



BH₃ molecule

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Combination of 3 H
orbitals to
3 group orbitals

