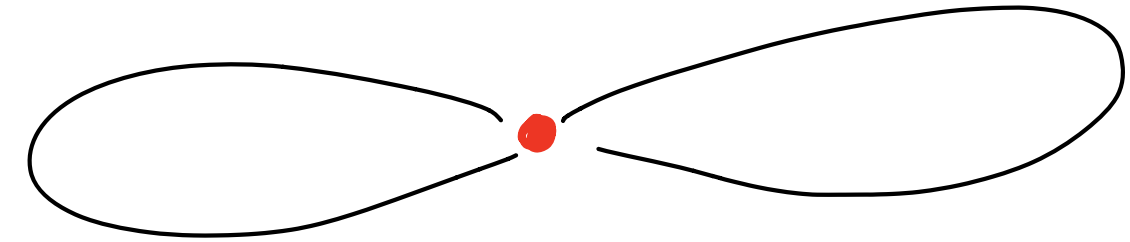
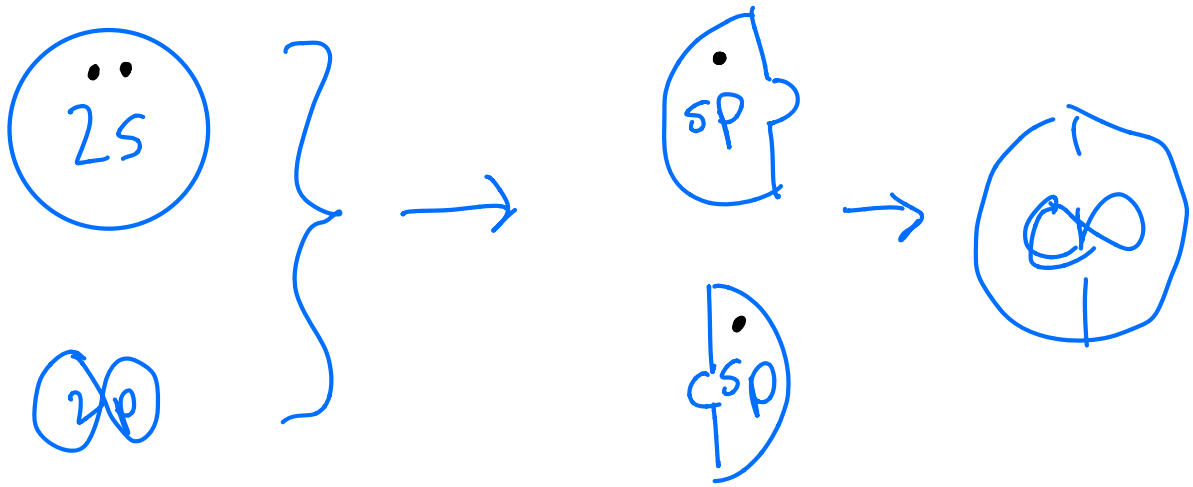
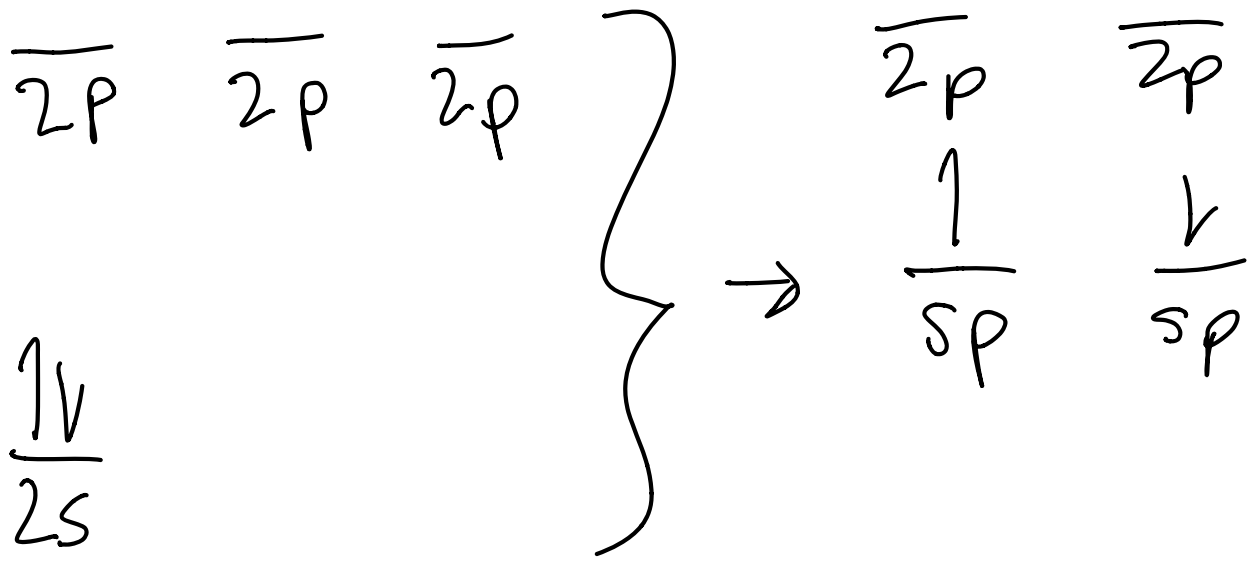
Linear – sp

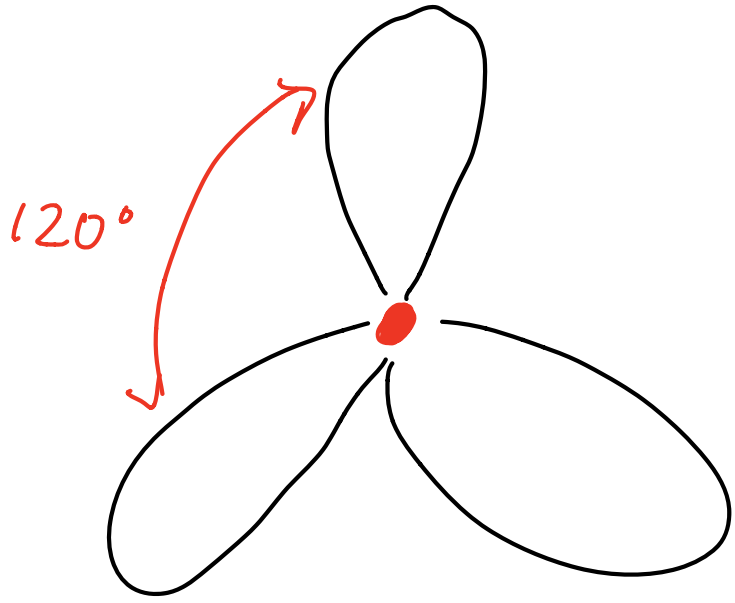






sp orb. → 50% s, 50% p

Trigonal Planar – sp^2



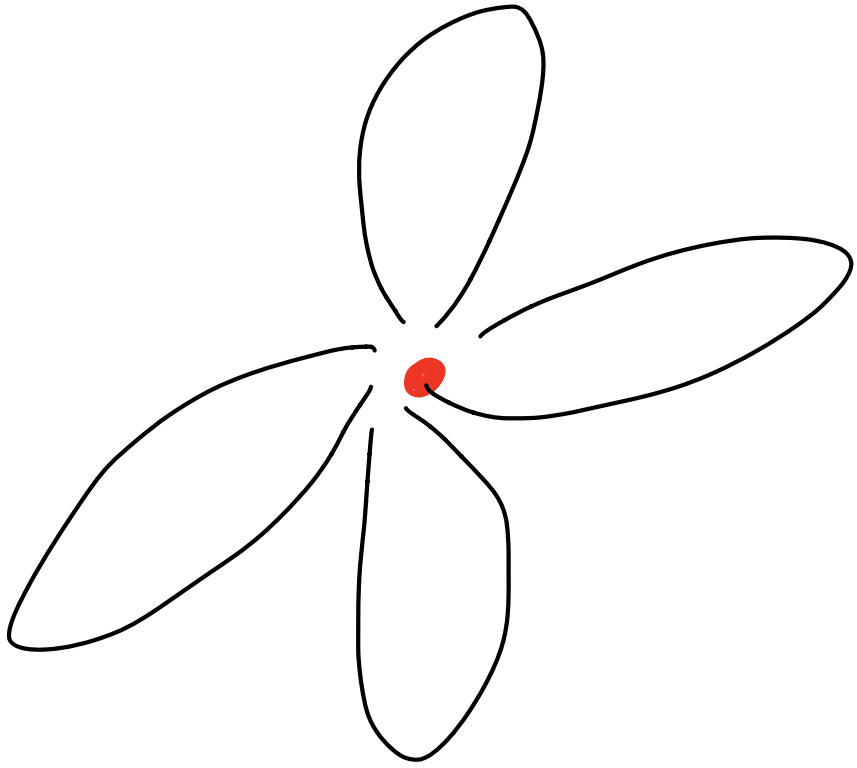
$\frac{1}{2p}$ $\frac{}{2p}$ $\frac{}{2p}$

$\frac{1}{2s}$

} → $\frac{1}{sp^2}$ $\frac{1}{sp^2}$ $\frac{1}{sp^2}$

sp^2 orb : 33% s, 67% p

Tetrahedral – sp^3



$\frac{1}{2p}$ $\frac{1}{2p}$ $\frac{}{2p}$

$\frac{1}{2s}$

} → $\frac{1}{sp^3}$ $\frac{1}{sp^3}$ $\frac{1}{sp^3}$ $\frac{1}{sp^3}$

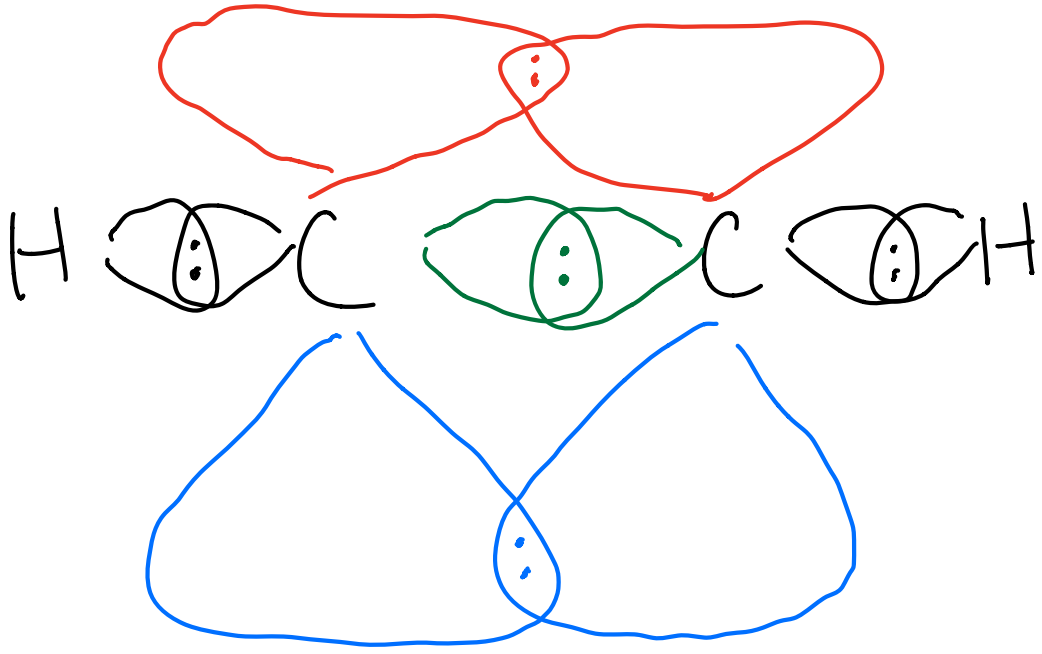
sp^3 → 25% s, 75% p

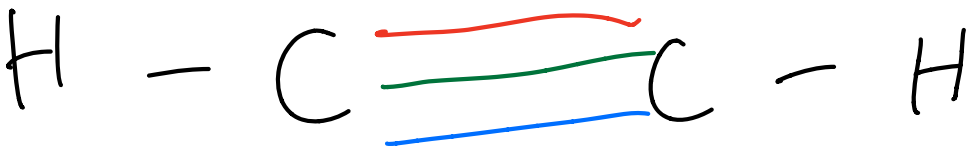
C_2H_2

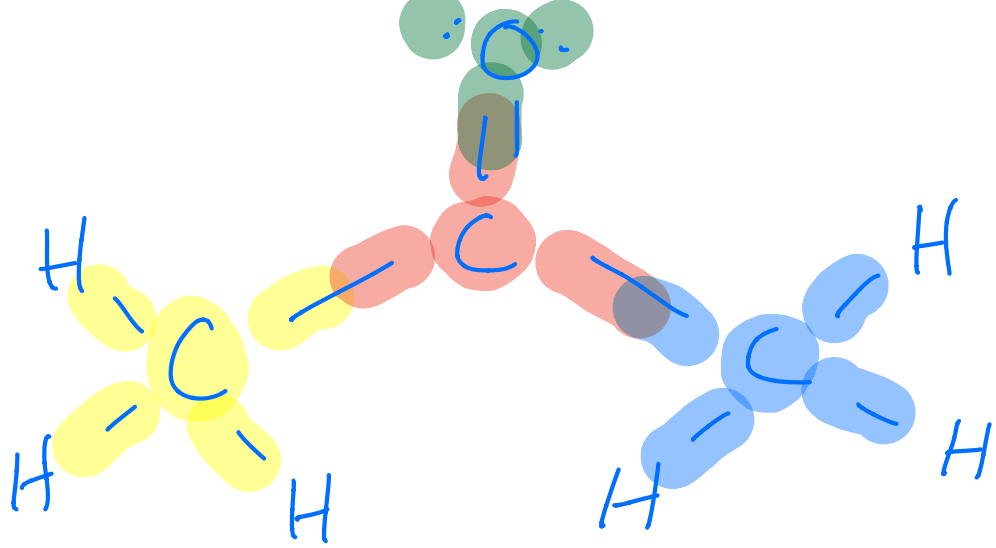
Bond #1 : σ bond
(side to side)

Bond # 2 : π bond
(overlap)

Bond # 3 : π bond
(overlap)


H
C
C
H


H - C C - H



How many sp atoms?

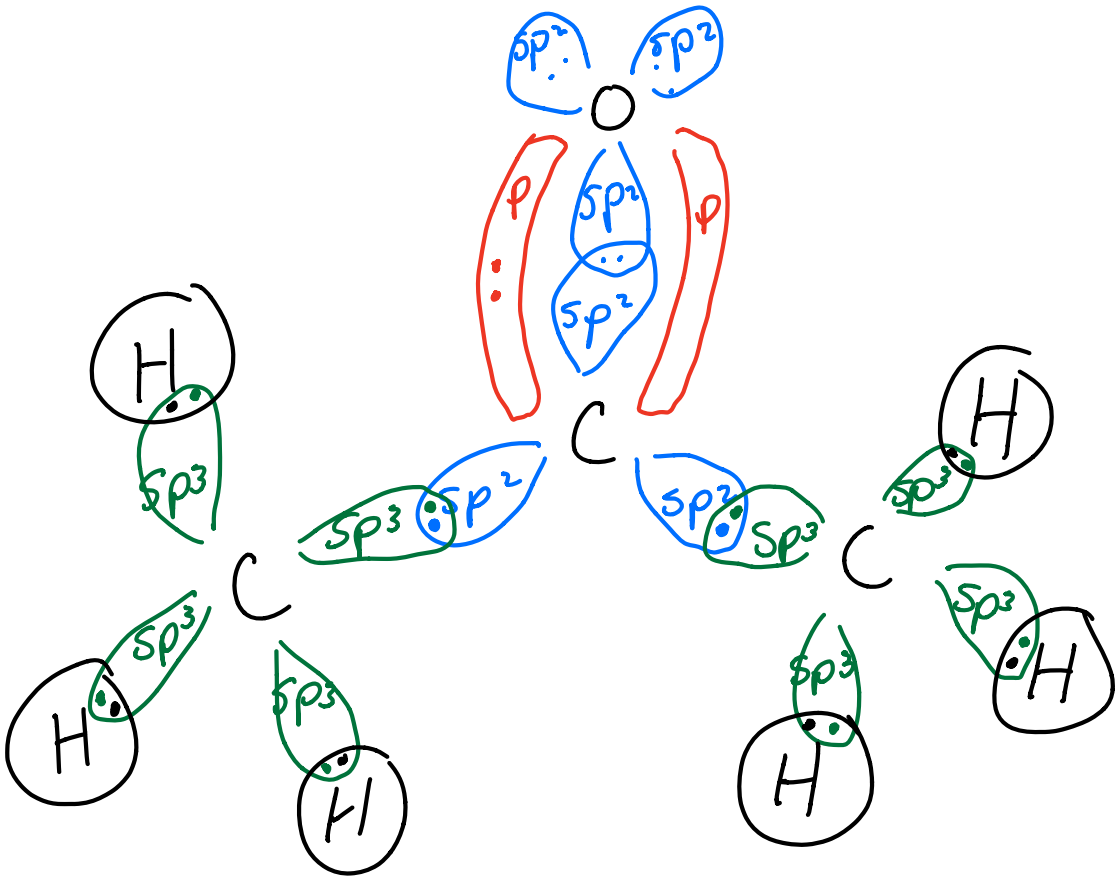
0

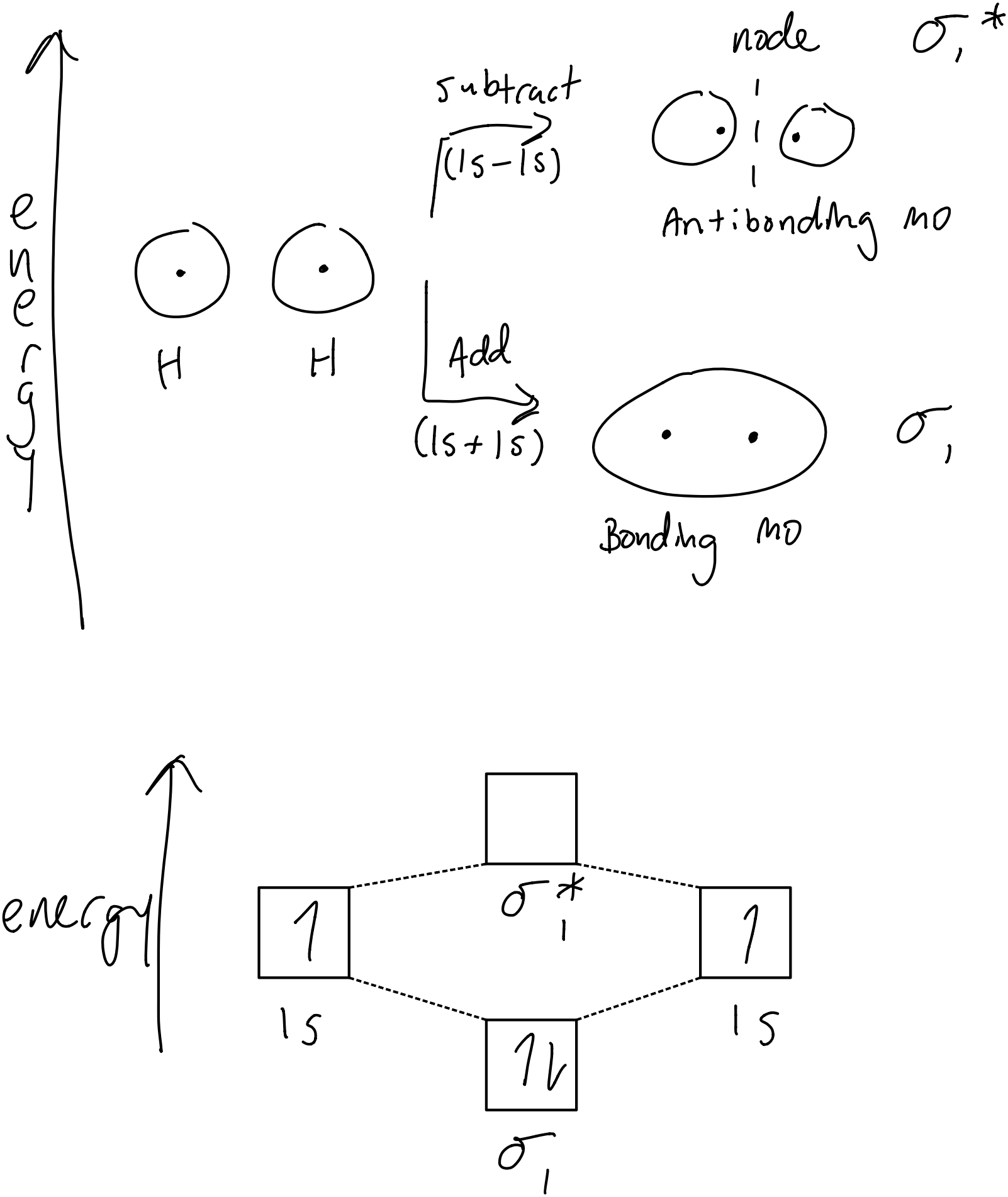
How many sp^2 atoms?

2

How many sp^3 atoms?

2


sp²
sp²
O
p
sp²
p
sp²
C
C
C
H
H
H
H
H
sp³
sp³
sp²
sp²
sp³
sp³
sp³
sp³
sp³


energy
H
H
Add
(1s+1s)
Subtract
(1s-1s)
node
σ1*
Antibonding MO
σ1
Bonding MO

energy
1
1s
σ1*
1
1
1s
1↓
σ1

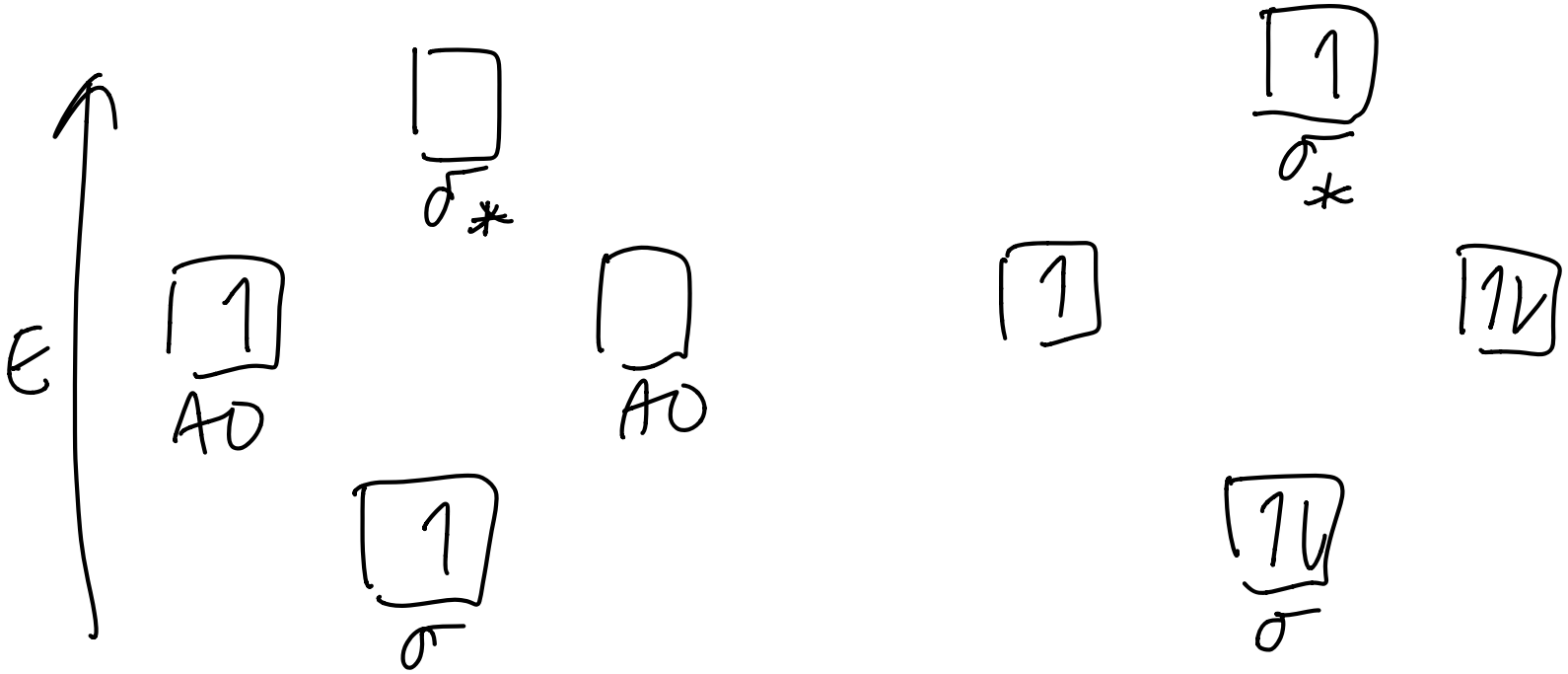
Bond order $= \frac{1}{2}\left[(\#\ e^- \text{ in } \sigma) - (\#\ e^- \text{ in } \sigma^*)\right]$

If Bond order is...

⊕ → reaction will proceed

0 → no reaction

Use MO diagrams to find bond orders and determine if H_2^+ and H_2^- exist



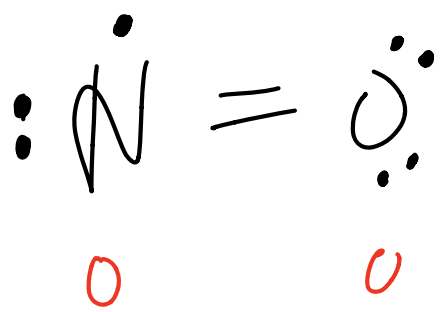
H_2^+

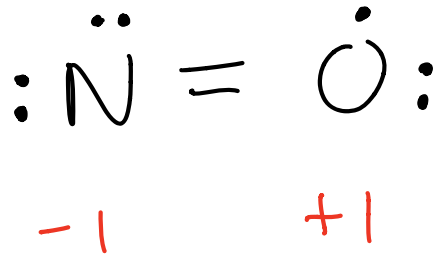
H_2^-

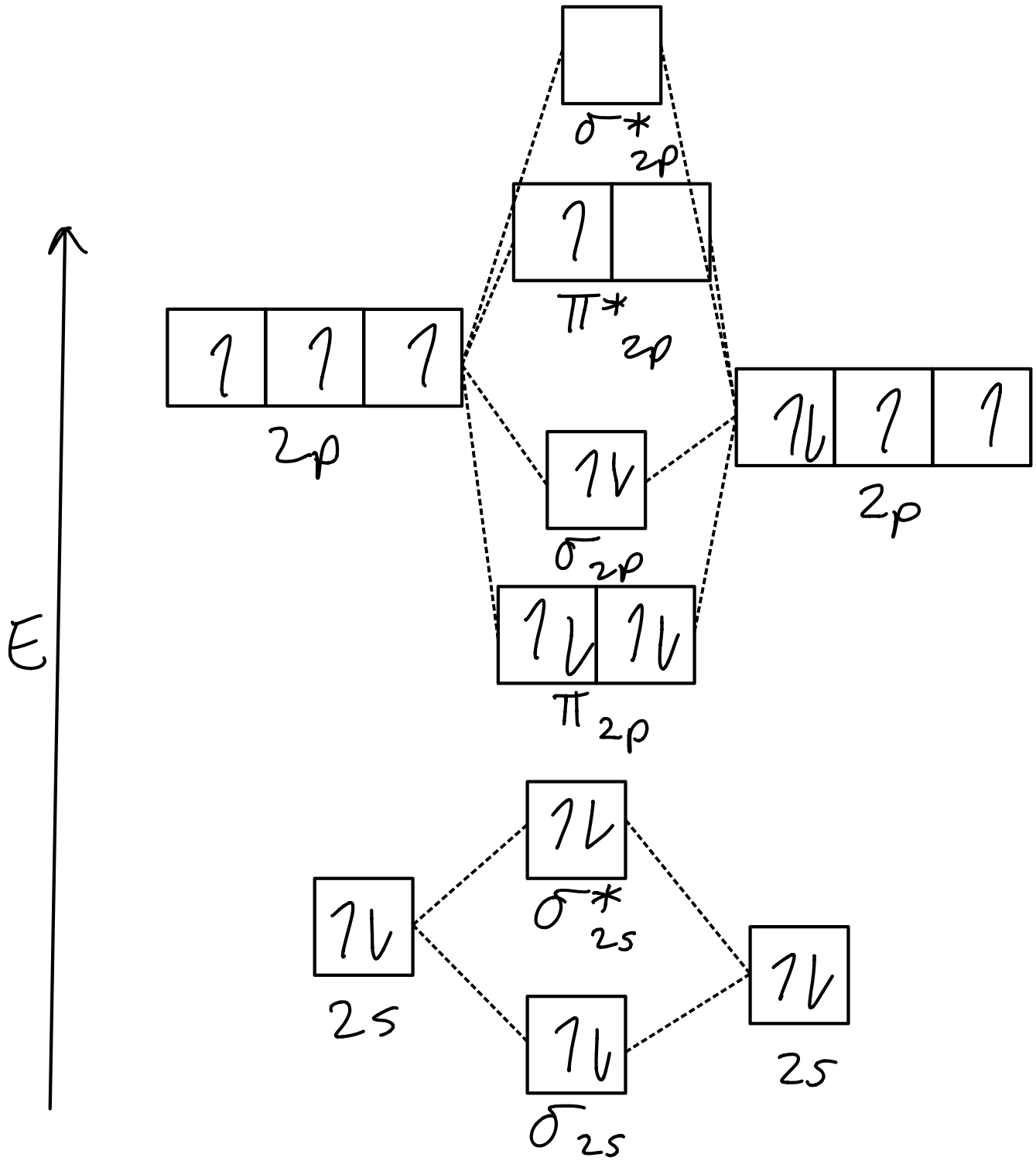
$H\cdot + H^+ \rightarrow H_2^+$

$H:^- + \cdot H \rightarrow H_2^-$

NO






σ*2p
π*2p
2p
2p
σ2p
π2p
σ*2s
2s
2s
σ2s
E
AO of N
MO of NO
AO of O