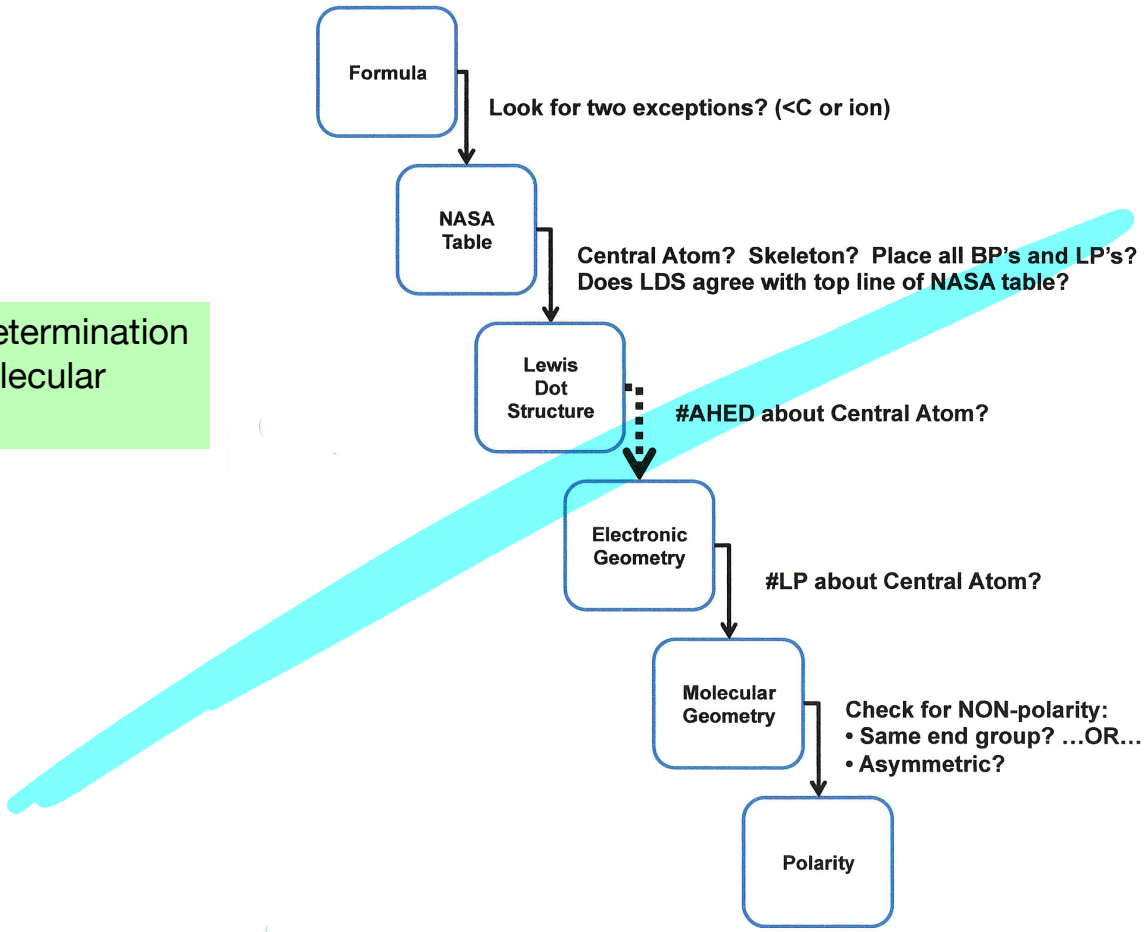
CHAPTER 12
BONDING &
LEWIS DOT STRUCTURES

12

Formula → NASA → LDS → EG → MG → Polarity

Protocol for the Determination of Electronic & Molecular Configurations



CHAPTER 12
BONDING AND LEWIS DOT STRUCTURES

$(Reaction)$	$ionic$	$vs.$	$redox$
$(Bond\ type)$	$ionic$	$vs.$	$covalent$
$(Bond\ Makeup)$	$electrostatic$	$vs.$	$sharedelectron$
$(Nomenclature)$	$TypeI,\ II$	$vs.$	$TypeIII$

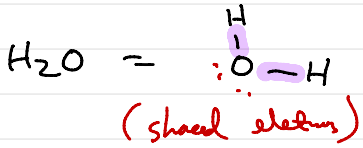
Two Types of Bonds

Ionic Bonds

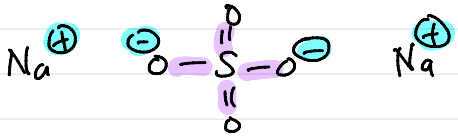
↳ opposite charge holds molecule together
↳ "electrostatic" bond
↳ eg. NaCl → Na^+ + Cl^-

Covalent Bonds

↳ "shared electrons hold molecule together
↳ eg. H_2O → H:O:H



Note: some compounds have both



Bonds: Force, Energy, and Shape

↳ BONDS represent the Force that holds atoms together
↳ bonds are arranged in a way to give the molecule a SHAPE
↳ ENERGY is tied up in those bonds

ethane + air → carbon dioxide + water

$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$

$2\ C_2H_6 + 7\ O_2 \rightarrow 4\ CO_2 + 3\ H_2O$

2 C–C + 6 C–H + 7 O=O —> 4 C=O + 6 OH

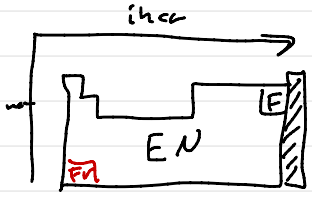
Polarity

Formula → NASA → LDS → EG → MG → Polarity

Polarity gives an indication of:
↳ equal vs. unequal sharing
↳ if unequal, how much unequal

Polarity in common parlance:
“Lopsided electron sharing or not? And if lopsided, by how much?”

Electronegativity

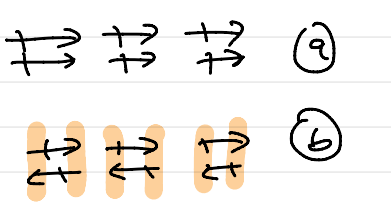


$$\Delta EN = EN_x - EN_{x'}$$

$\delta+$ $\delta-$

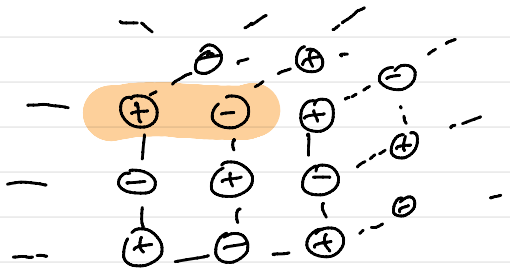
H – F:

"bipolar"



		ΔEN
F ← F 4.0 4.0		∅
H – F 2.1 4.0	H⊕F⊖	1.9
O – F_2 3.5 4.0		0.5

Formula Unit

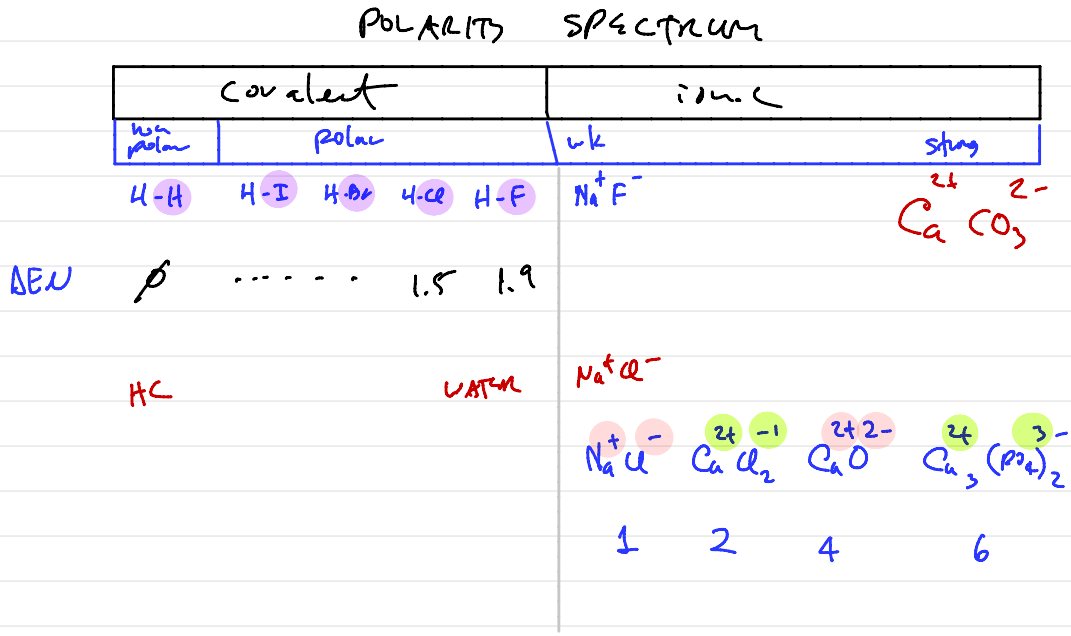


$NaCl_x$ ← $x = 10^{16}$'s

$NaCl$

"FORMULA UNIT WEIGHT"

Polarity Spectrum

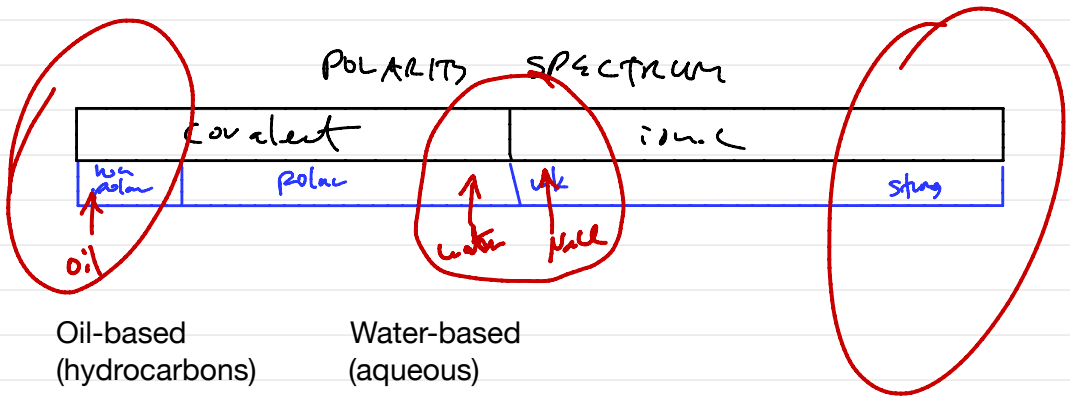


“Like dissolves like”

- Like materials tend to dissolve similar (“like”) materials
- e.g., oily materials tend to dissolve oily materials

(oil-based paint cleans up with paint thinner)…
and water-based materials tend to dissolve “watery” materials
(latex paint cleans up with water)

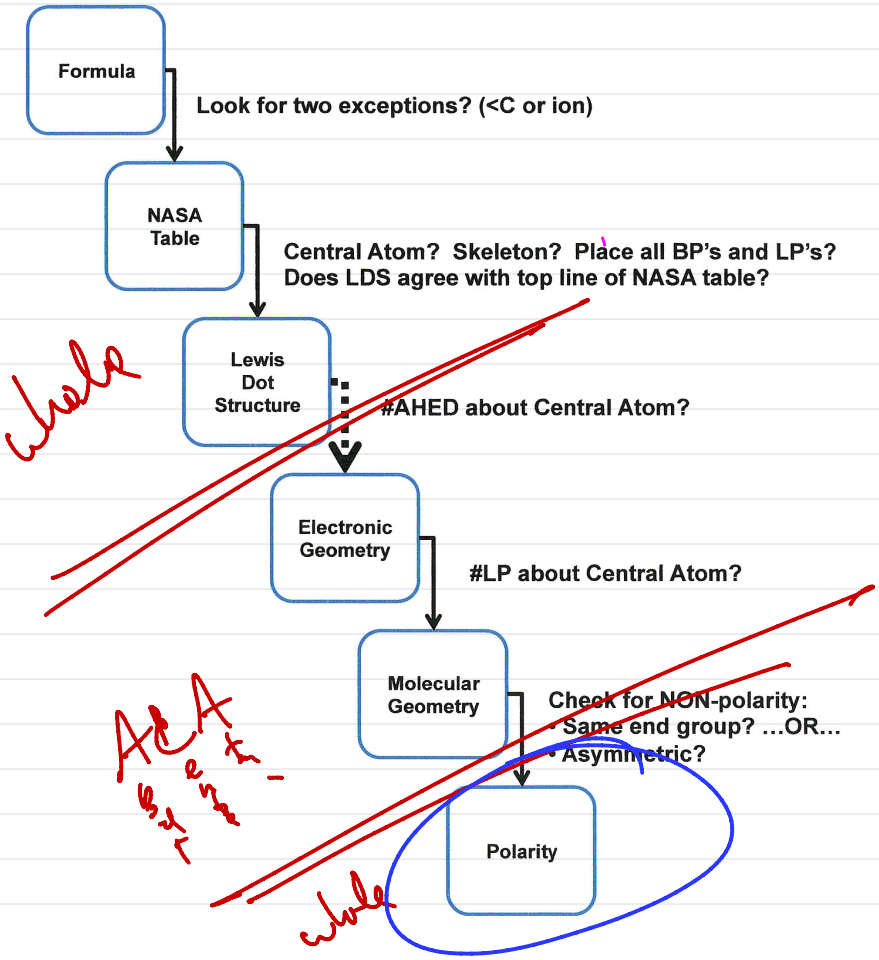
- “Like” materials tend to be close to each other on the Polarity Spectrum

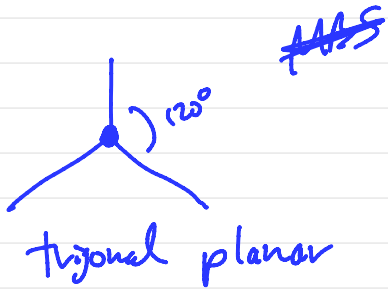


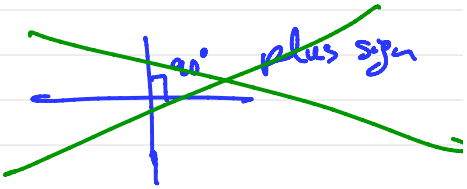
Oil-based
(hydrocarbons)

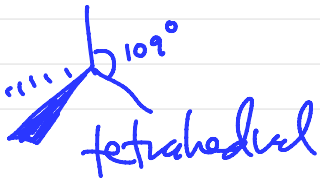
Water-based
(aqueous)

LEWIS DOT, GEOMETRIES, & POLARITY









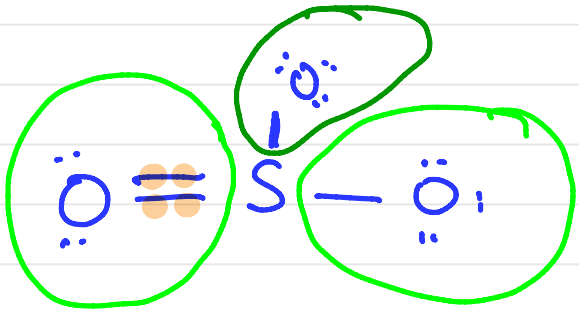
Practice Problem (solution next page)

SO_3

	S	O
Need	$N = 1(8) + 3(8) = 32$	
Available	$A = 1(6) + 3(6) = 24$	
Shared	4 BP	8
Alone	8 LP	16

bond pair, lone pairs

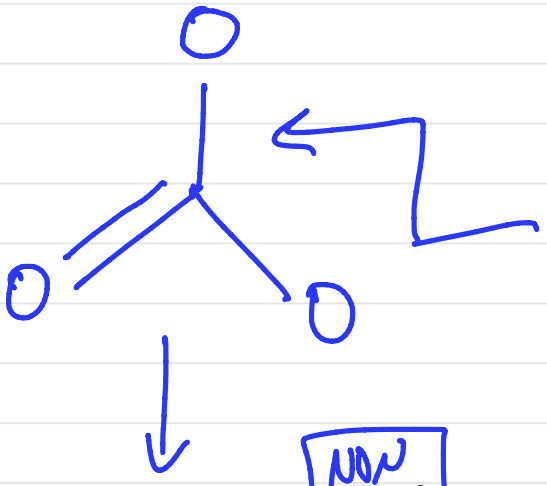
1 place BP
2 place LP



skeleton

Octet = 8

AHED
" A count "



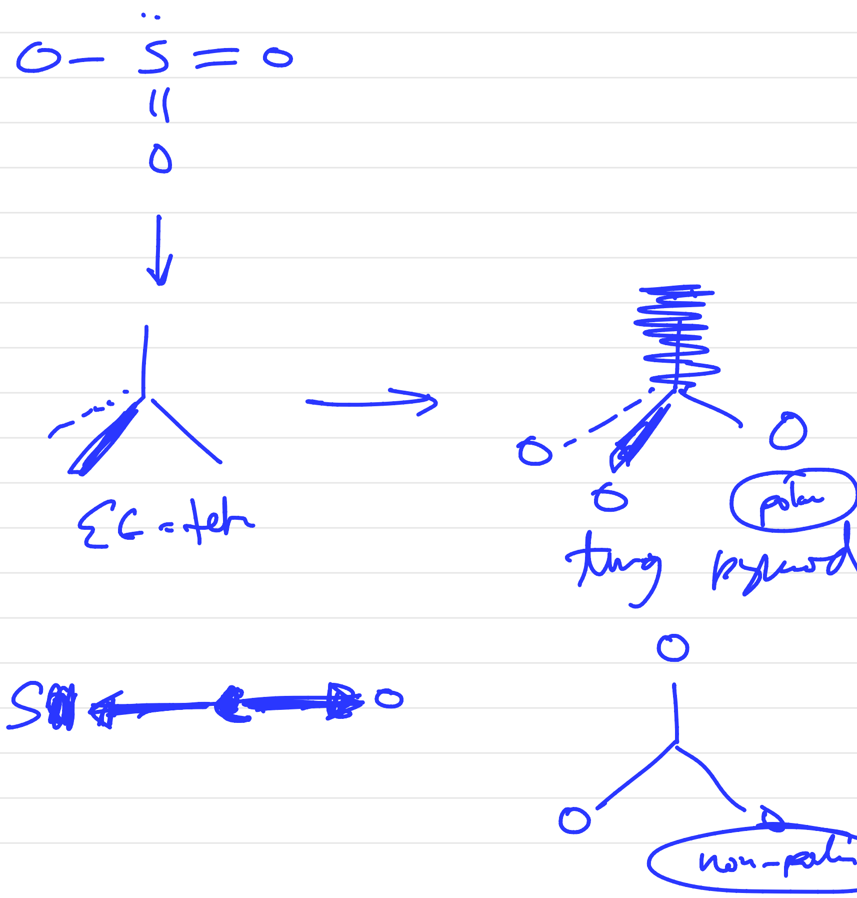
LP acc

NON POLAR

☑ Symmetric ? Trig planar

AND

☑ Same PG ?



C

POLAR

☒ symm?

— or —

☒ same EG?

NON POLAR

☑ symm?

— and —

☑ same EG?

~~① < C ?~~

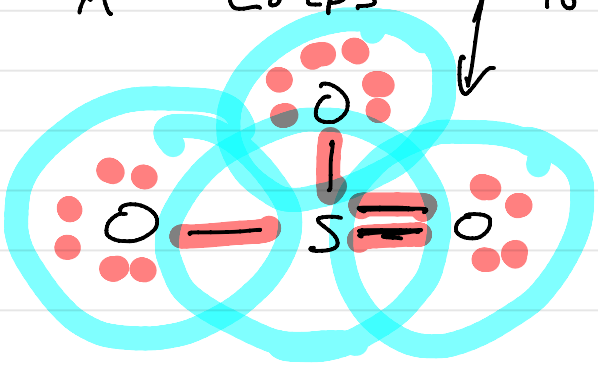
SO_3 ② ~~ion~~

N = 1(8) + 3(8) = 32

A = 1(6) + 3(6) = 24

S [4bp] − 8

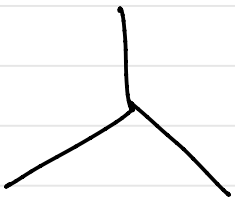
A [8 LP] −16



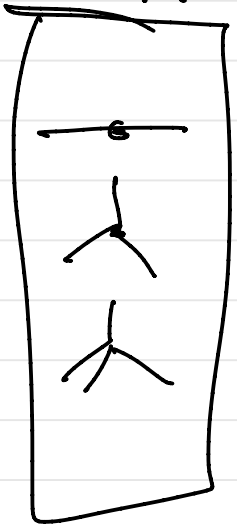
"4-count"

↓ # ALND (aca) = 3

2 =
1 =

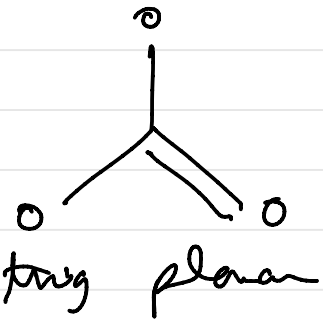


Symmetric



trig planar

aca ↓ # LP (hole) = ∅



trig planar

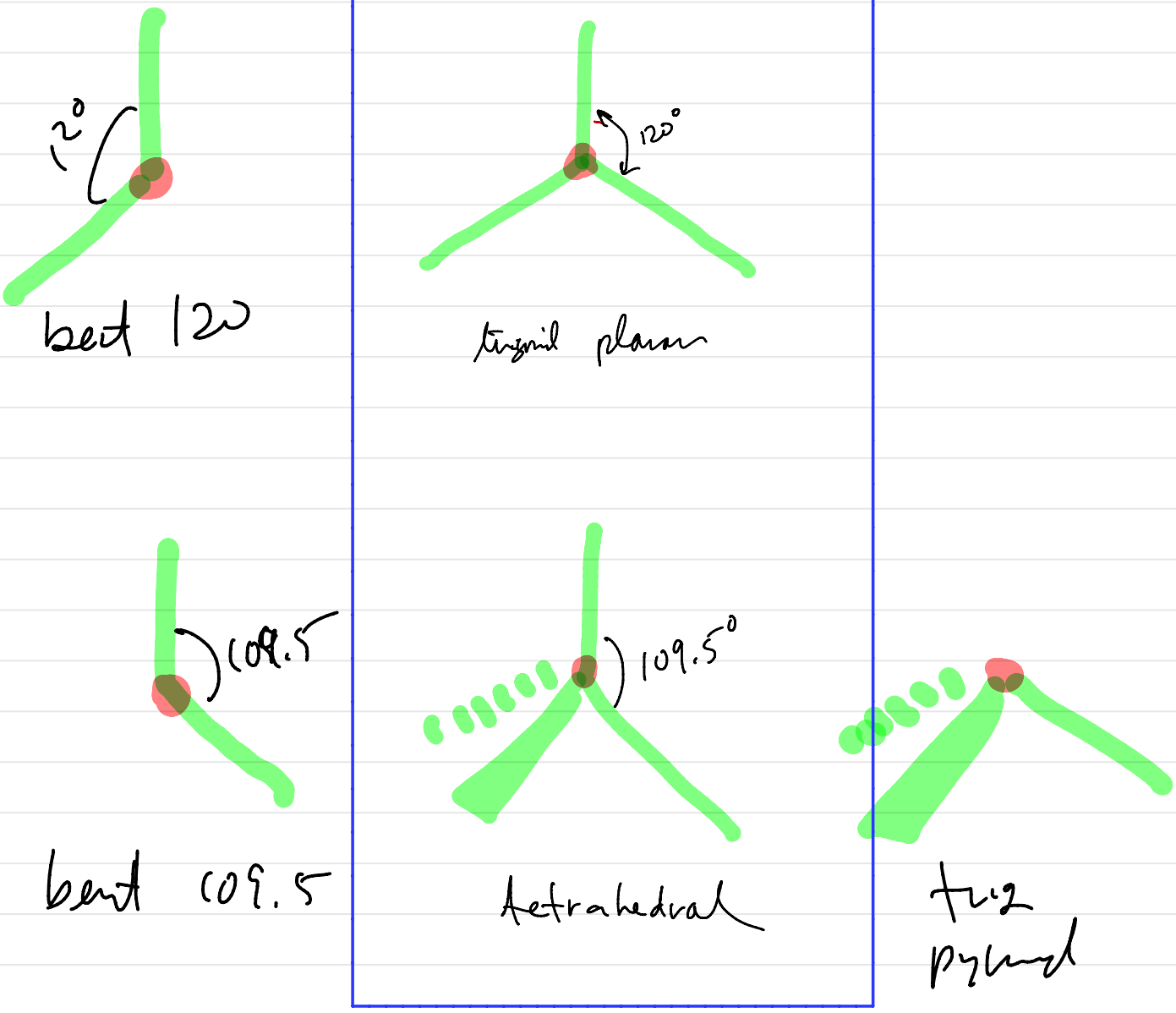
	NON POLAR	POLAR
EG	✓ AND	✗ OR
Symm	✓	✗

① EG ✓

② Symm ✓

→ NON-polar

The 3 Electronic and 6 Molecular Geometries



symmetrical

SO_3^{2-}

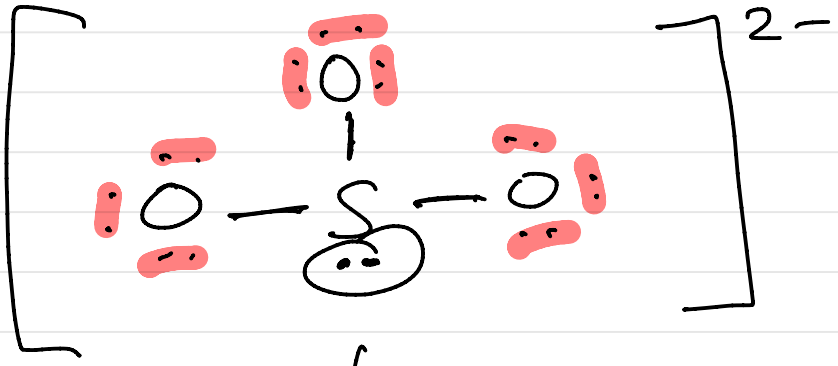
↓

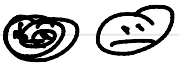
$N = 1(8) + 3(8) = 32$

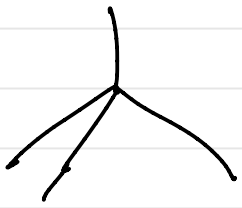
$A = 1(6) + 3(6) + 2 = 26$

S ~~[3bp]~~ 6

A ~~[1LP~~ 20

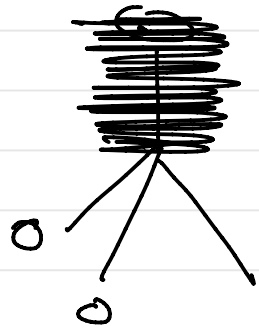


↓ "4-cort" = 4 { 3 — , 1  }



↓ 1 LP

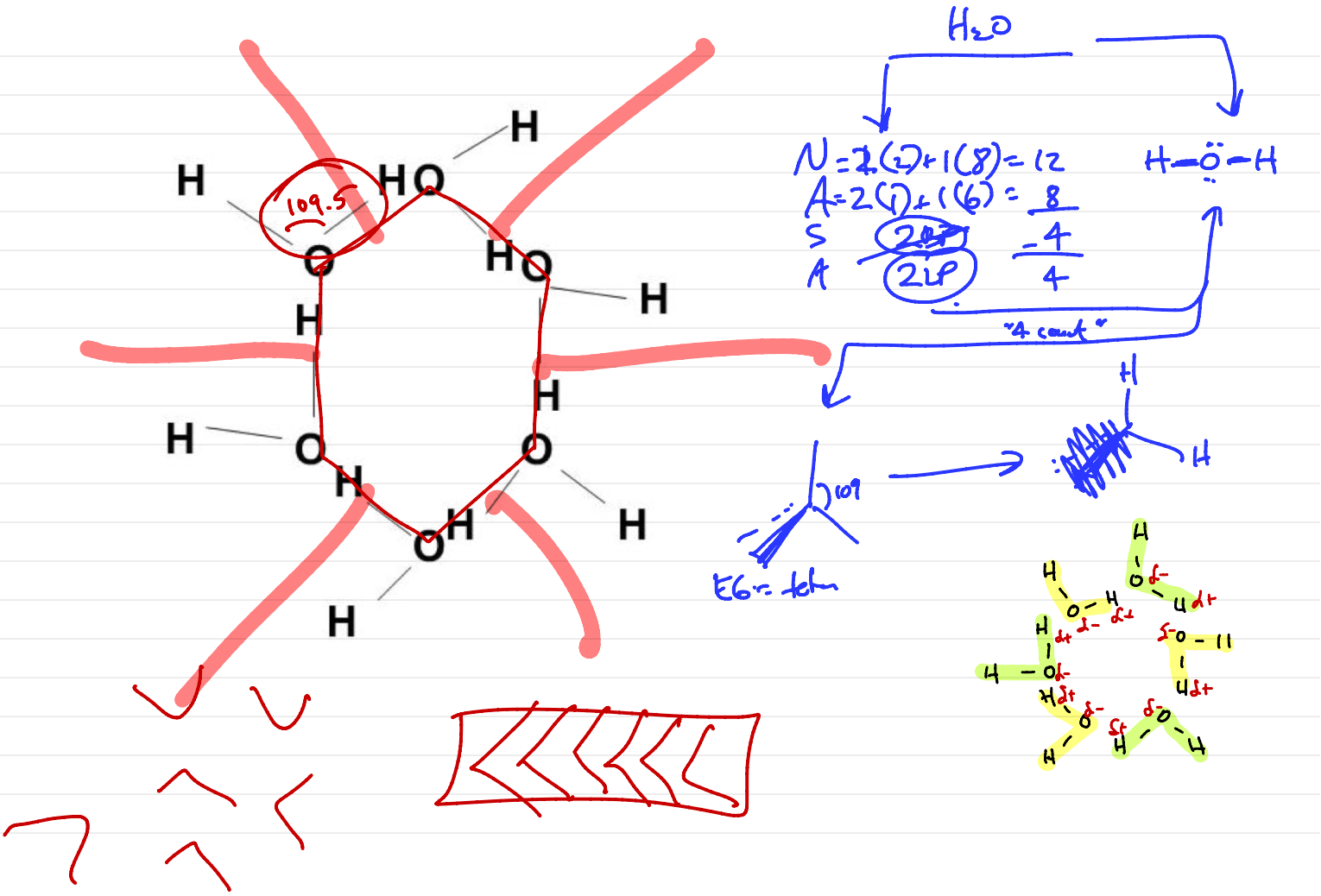
1 LP →



O

O O

trig pyramid


H2O
N=2(2)+1(8)=12
A=2(1)+1(6)=8
S
A
2LP
-4
4
"4 count"
H—Ö—H
109
109
EG= tetra