

[TP] Which **molecule** is more polar? ($\chi_{\text{H}} = 2.1$, $\chi_{\text{B}} = 2.04$, $\chi_{\text{N}} = 3.04$, $\chi_{\text{F}} = 3.98$)

- 0% 1. NH_3 (trigonal pyramid)
- 0% 2. BF_3 (trigonal planar)
- 0% 3. Polarity is the same

Response
Counter

1

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Today:

Chap 8:

- Electronegativity and bond character
- Bond polarity
- Molecular geometry

Next

- chap 9

Electronegativity

Formal charge assumes electrons between atoms are **shared equally**.

Unless two connected atoms are identical, sharing **always favors one atom**.

Electronegativity is a relative measure the tendency of an atom to **attract electrons** shared with another atom in a covalent bond.

Electronegativity, χ (Greek letter chi, like in “kite”)

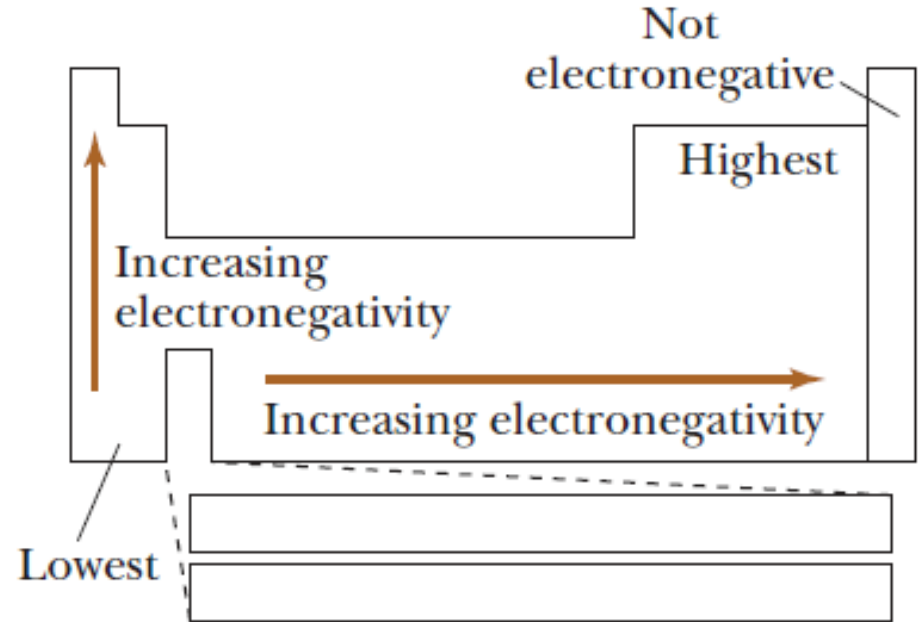
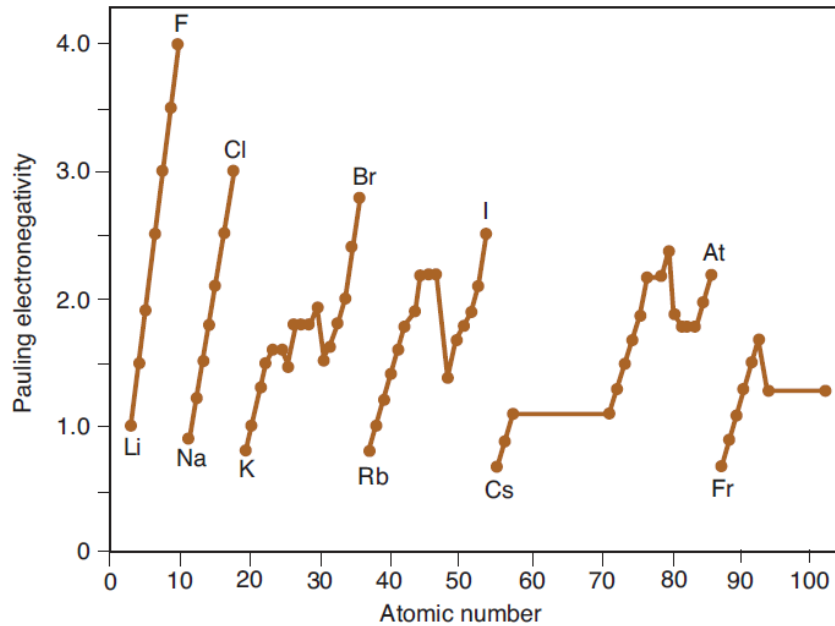
Electronegativity is a relative measure the tendency of an atom to **attract electrons** shared with another atom in a covalent bond.

1 H 2.1																	2 He —
3 Li 0.98	4 Be 1.57											5 B 2.04	6 C 2.55	7 N 3.04	8 O 3.44	9 F 3.98	10 Ne —
11 Na 0.93	12 Mg 1.31											13 Al 1.61	14 Si 1.90	15 P 2.19	16 S 2.58	17 Cl 3.16	18 Ar —
19 K 0.82	20 Ca 1.00	21 Sc 1.36	22 Ti 1.54	23 V 1.63	24 Cr 1.66	25 Mn 1.55	26 Fe 1.83	27 Co 1.88	28 Ni 1.91	29 Cu 1.90	30 Zn 1.65	31 Ga 1.81	32 Ge 2.01	33 As 2.18	34 Se 2.55	35 Br 2.96	36 Kr —
37 Rb 0.82	38 Sr 0.95	39 Y 1.22	40 Zr 1.33	41 Nb 1.6	42 Mo 2.16	43 Tc 1.9	44 Ru 2.2	45 Rh 2.28	46 Pd 2.20	47 Ag 1.93	48 Cd 1.69	49 In 1.78	50 Sn 1.96	51 Sb 2.05	52 Te 2.1	53 I 2.66	54 Xe —
55 Cs 0.79	56 Ba 0.89	57–71 1.1–1.2	72 Hf 1.3	73 Ta 1.5	74 W 2.36	75 Re 1.9	76 Os 2.2	77 Ir 2.20	78 Pt 2.28	79 Au 2.54	80 Hg 2.00	81 Tl 2.04	82 Pb 2.33	83 Bi 2.02	84 Po 2.0	85 At 2.2	86 Rn —

F > O > Cl > N > S > C > P > H
3.98 3.44 3.16 3.04 2.58 2.55 2.19 2.1

Electronegativity, χ

Electronegativity is a relative measure the tendency of an atom to **attract electrons** shared with another atom in a covalent bond.



Bond polarity

The greater the **electronegativity difference** of two covalently bonded atoms, the **more unequal the sharing** of the electrons forming the covalent bond.

Bond character:	Covalent	Polar covalent	Ionic
Electronegativity difference:	$\approx 0 - 0.3$	$\approx 0.4 - 2.0$	$\approx 2.1 - 4.0$

BrI: $2.96 - 2.66 = 0.30$, **covalent**

HCl: $3.16 - 2.1 = 1.0$, **polar covalent**

NaCl: $3.16 - 0.93 = 2.23$, **ionic**

Please keep in mind that these definitions are qualitative, since sharing is **always unequal unless the bonded atoms are identical**.

[TP] Which **bond** is **more polar**? ($\chi_{\text{H}} = 2.1$, $\chi_{\text{B}} = 2.04$,
 $\chi_{\text{N}} = 3.04$, $\chi_{\text{F}} = 3.98$)

33% 1. N-H

33% 2. B-F

33% 3. Polarity is the same

Response
Counter

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Predicting molecular geometries

How atoms are arranged in three dimensions around their central atom is determined by the steric number (SN) the central atom.

SN = attached atoms + lone pairs

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What is SN of C in CO₂?

SN = 2: **Two** attached atoms and **zero** lone pairs

What is the SN of O in H₂O?

SN = 4: **Two** attached atoms and **two** lone pairs

What is the SN of N in NO₂⁻?

SN = 3: **Two** attached atoms and **one** lone pair

SN = attached atoms + lone pairs

What is the SN of B in BF_3 ?

SN = 3: **Three** attached atoms and **zero** lone pairs

What is SN of S in SF_4 ?

SN = 5: **Four** attached atoms and **one** lone pair

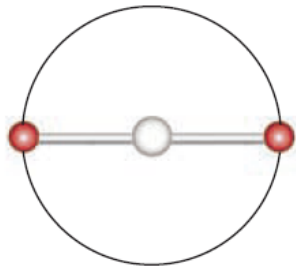
What is the SN of S in SF_6 ?

SN = 6: **Six** attached atoms and **zero** lone pairs

Predicting molecular geometries: $SN = 2$

What is SN of C in CO_2 ?

SN = 2: **Two** attached atoms and **zero** lone pairs



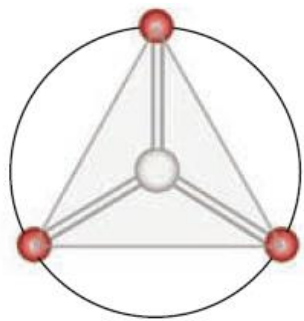
AX_2
linear

Shape is **linear**, bond angle is **180°**

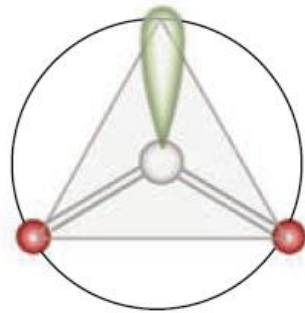
Predicting molecular geometries: SN = 3

What is the SN of N in NO_2^- ?

SN = 3: **Two** attached atoms and **one** lone pair



AX_3
trigonal planar



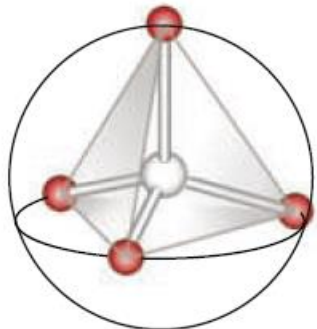
AX_2E
bent

Shape is **bent**, bond angle **a bit less than 120°**

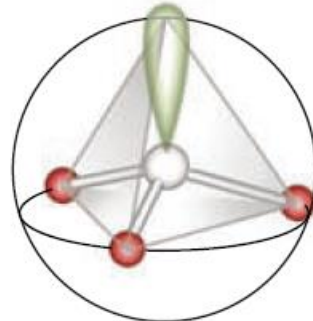
Predicting molecular geometries: SN = 4

What is the SN of O in H₂O?

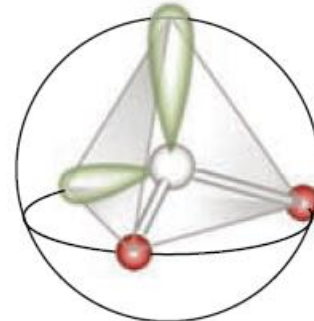
SN = 4: **Two** attached atoms and **two** lone pairs



AX₄
tetrahedral



AX₃E
trigonal pyramidal



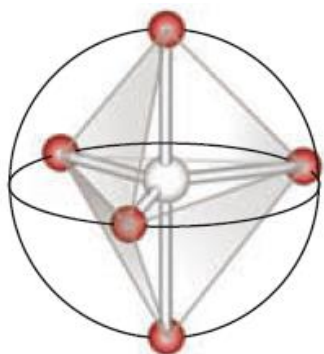
AX₂E₂
bent

Shape is **bent**, bond angle **a little less than 109.5°**

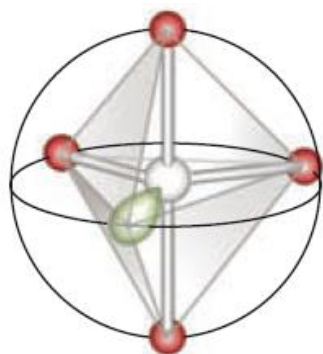
Predicting molecular geometries: SN = 5

What is SN of S in SF₄?

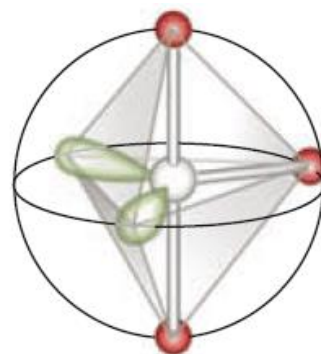
SN = 5: **Four** attached atoms and **one** lone pair



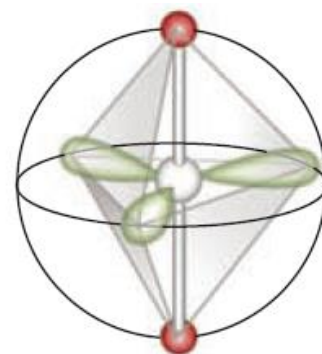
AX₅
trigonal bipyramidal



AX₄E
seesaw-shaped



AX₃E₂
T-shaped



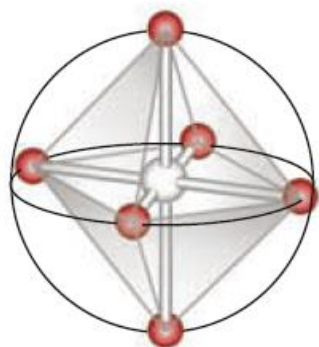
AX₂E₃
linear

Shape is **seesaw**, bond angles are **a little less than 180°, 120°, and 90°**

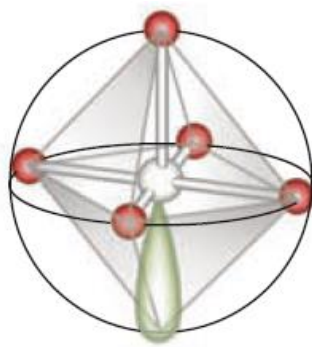
Predicting molecular geometries: SN = 6

What is the SN of S in SF₆?

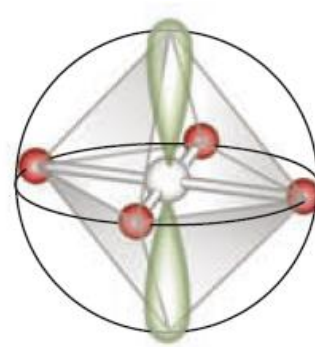
SN = 6: **Six** attached atoms and **zero** lone pairs



AX₆
octahedral



AX₅E
square pyramidal



AX₄E₂
square planar

Shape is **octahedral**, bond angles are **90°**

[TP] What is the molecular shape of ClF_3 ?

- 13% 1. Linear
- 13% 2. Trigonal planar
- 13% 3. Tetrahedral
- 13% 4. Trigonal pyramidal
- 13% 5. Bent
- 13% 6. Seesaw
- 13% 7. T-shaped
- 8. None of these

Response
Counter

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