ELECTRONEGATIVITY → an atom's ability to pull a shared e⁻ pair toward itself

Pauling Scale

F 4.0 scale

Cs 0.7

↑ increasing →

polar covalent bond ⇒ results from an unequal sharing of e⁻'s

$\overset{\delta+}{H}-\overset{\delta-}{F}$

EN 2.1 4.0

+ → dipole moment

+ −

2 atoms w/ = EN, ΔEN = 0.0, "pure covalent bond"

diatomics: H_2, N_2, O_2, F_2...

C–C, C=C, C≡C

ΔEN ≠ 0 → polar covalent bond

ΔEN > 2.0 ⇒ IONIC BOND

ΔEN: 0.0 — POLAR → IONIC — 2.0

"ionic character"

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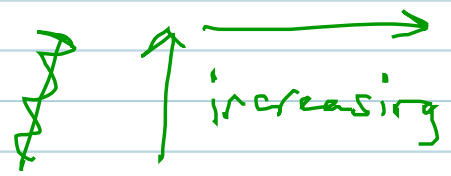
Pauling Scale

F 4.0 Scale

Cs 0.7



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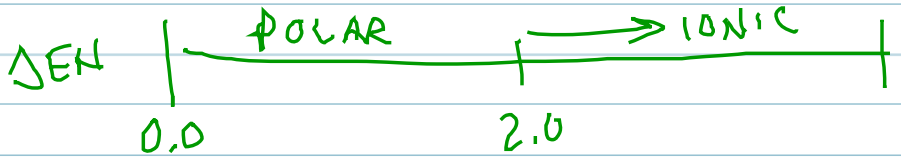


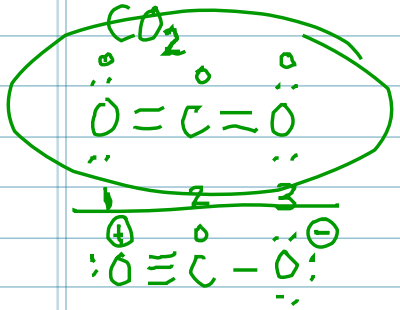
"ionic character"

FORMAL CHARGE → a way of keeping track of the bonding e⁻ distribution

→ predicts the most likely "actual" bonding scenario

$$FC = \left[\begin{array}{l}\#\text{valence e}^- \\ \text{of neutral atom}\end{array}\right] - \left[\begin{array}{l}\text{total \#} \\ \text{nonbonding} \\ \text{valence e}^- \\ \text{(lone pair)}\end{array}\right] - \frac{1}{2}\left[\begin{array}{l}\text{total \#} \\ \text{bonding e's}\end{array}\right]$$

CO_2



FC O#1 $6 - 4 - \frac{1}{2}(4) = 0$

O#3

C $4 - 0 - \frac{1}{2}(8) = 0$

O#1 $6 - 2 - \frac{1}{2}(6) = +1$

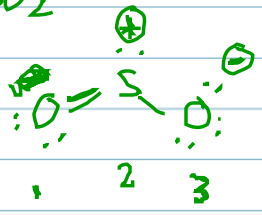
O#3 $6 - 6 - \frac{1}{2}(2) = -1$

C $= 0$

* if there is more than 1 possible structures, the more plausible one is the one with the fewer or smaller (absolute value) formal charges

* if there MUST be formal charges the more EN element should get the (-) FC

SO_2



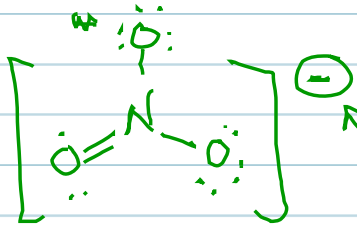
O#1 $6 - 4 - \frac{1}{2}(4) = 0$

O#3 $6 - 6 - \frac{1}{2}(2) = -1$

S $6 - 2 - \frac{1}{2}(6) = +1$

for any neutral compound → 0

NO_3^-



N–O $6 - 6 - \frac{1}{2}(2) = -1$

N–O -1

N=O $6 - 4 - \frac{1}{2}(4) = 0$

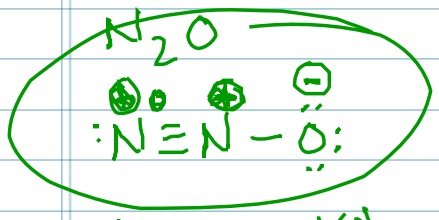
N $5 - 0 - \frac{1}{2}(8) = +1$

-1

polyatomic ion

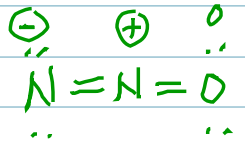
sum of FC's = ion's charge

N_2O



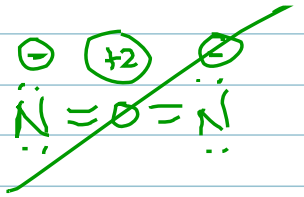
N1 $5 - 2 - \frac{1}{2}(6) = 0$

N2 $5 - 0 - \frac{1}{2}(8) = +1$



N1 = $5 - 4 - \frac{1}{2}(4) = -1$

N2 = $5 - 0 = \frac{1}{2}(8) = +1$

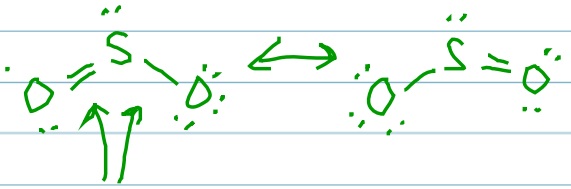


N ⇒ $5 - 4 = \frac{1}{2}(4) = -1$

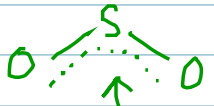
O ⇒ $6 - 6 - \frac{1}{2}(8) = +2$

RESONANCE

SO_2

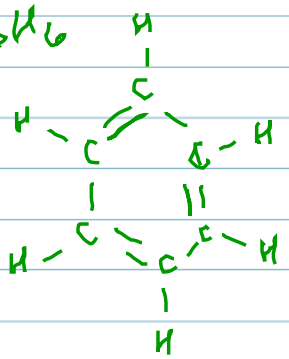


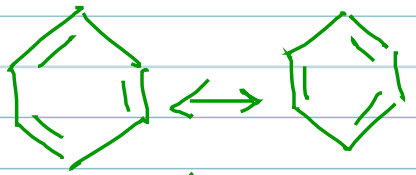
identical bonds
- length
- strength



delocalized e⁻ pair

C_6H_6





3 delocalized e⁻ pairs shared by 6 atoms