

ch. 8.5 formal charges

- used to select the "best" Lewis structure(s)
- "fake" charges on atoms in a molecule

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"steps / rules" to assign formal charges

$$\begin{aligned} \text{formal charge on an atom} &= \\ &= \# \text{ valence electron of atom} - \frac{1}{2} (\# \text{ bonding electrons}) - \# \text{ nonbonding electrons} \\ &= \# \text{ valence electron of atom} - (\# \text{ lines} + \# \text{ dots}) \end{aligned}$$

example: CO₂

$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{O: } 6 - (2 + 4) = 0$$



$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{O: } 6 - (3 + 2) = +1$$

$$\text{O: } 6 - (1 + 6) = -1$$

note: $\sum \text{formal charges on atoms} = \text{charge of molecule}$, where could use this relationship to find the formal charge of an atom

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select the "best" Lewis structure based on formal charges

- "want" minimum (magnitude) formal charges
- Negative formal charge on most electronegative atom
- example 1 of 2: CO₂



$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{O: } 6 - (2 + 4) = 0$$



$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{O: } 6 - (3 + 2) = -1$$

$$\text{O: } 6 - (1 + 4) = +1$$

↑
"best" since has minimum formal charges

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example 2 of 2: SCN⁻ --- "best" Lewis structure ?

$$\text{N: } 5 - (2 + 4) = -1$$

$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{S: } 6 - (2 + 4) = 0$$



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

$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{N: } 5 - (3 + 2) = 0$$



$$\text{N: } 5 - (3 + 2) = 0$$

$$\text{C: } 4 - (4 + 0) = 0$$

$$\text{S: } 6 - (1 + 6) = -1$$

no; large formal charge magnitude

as electronegativity: N > S, select far left Lewis structure

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