

Resonance Structures

UCI Chem 51A

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Goals

1. Explain the need for resonance theory.
2. Explain what is a resonance structure and what is not.
3. Draw valid resonance structures.
4. Properly use curved arrow notation.
5. Identify major and minor resonance contributors.
6. Draw the resonance hybrid for a structure.

Resonance Theory

- ☉ Resonance structures are NOT REAL.
- ☉ Resonance structures are NOT IN EQUILIBRIUM. (Note the arrow type.)
- ☉ Resonance structure are NOT ISOMERS.
- ☉ So what are they?!

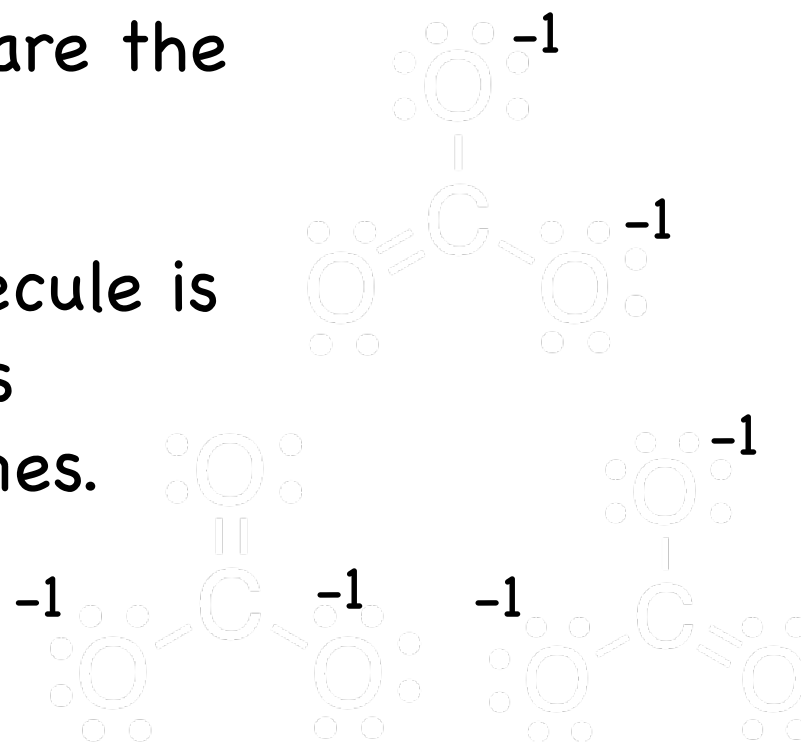
Resonance Hybrids



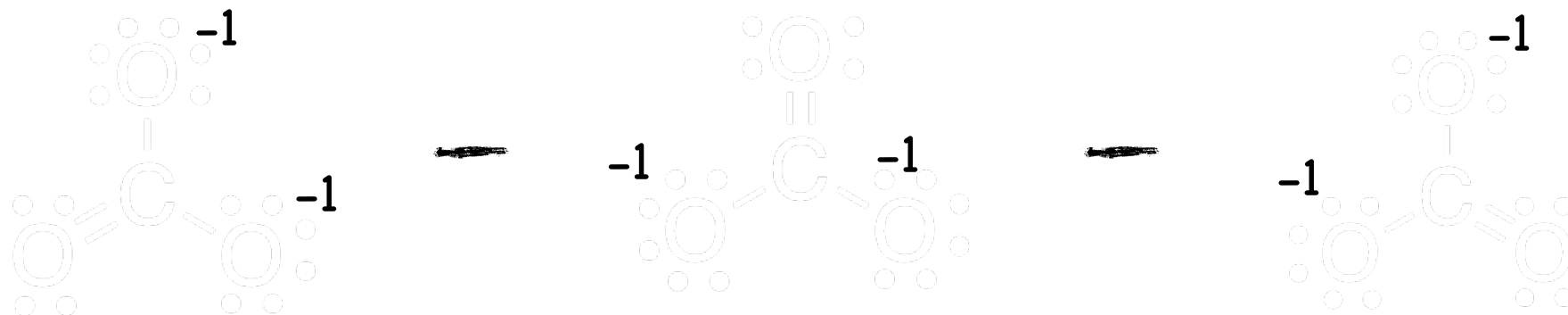
① Resonance structures we draw are the extremes of a spectrum.

② The "real" structure of the molecule is called a resonance hybrid and is somewhere between the extremes.

③ How do we know that?

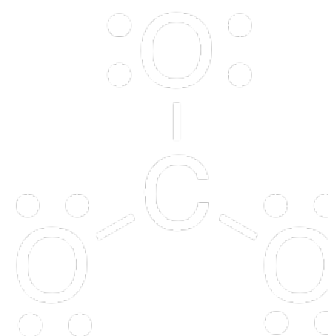


Evidence that Lewis Structures Fail



Bond	Length
C-O	143 pm
C=O	122 pm
carbonate	129 pm

All C-O bonds equal!

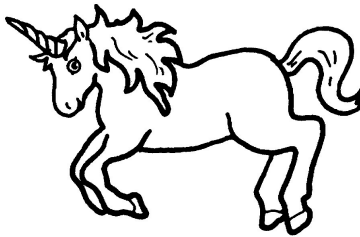


More on Resonance Hybrids



Fictitious

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Fictitious

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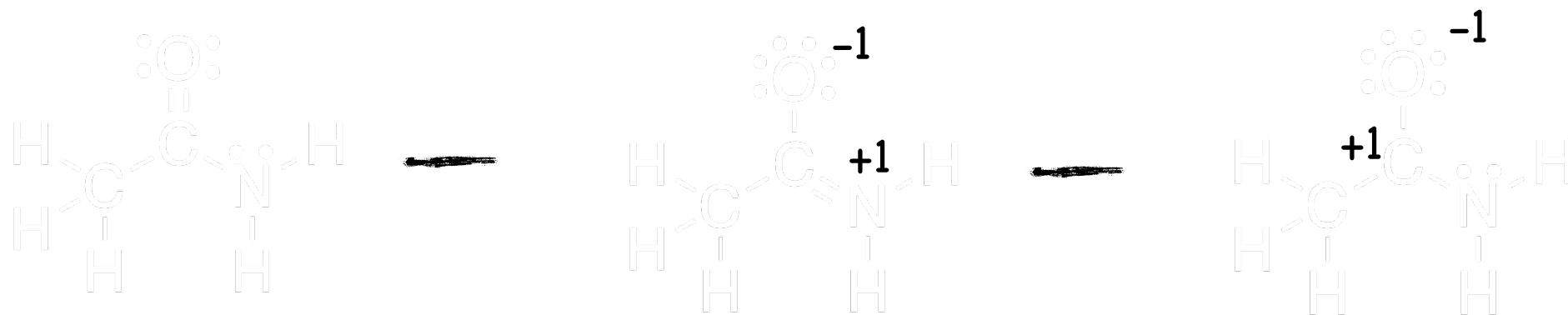
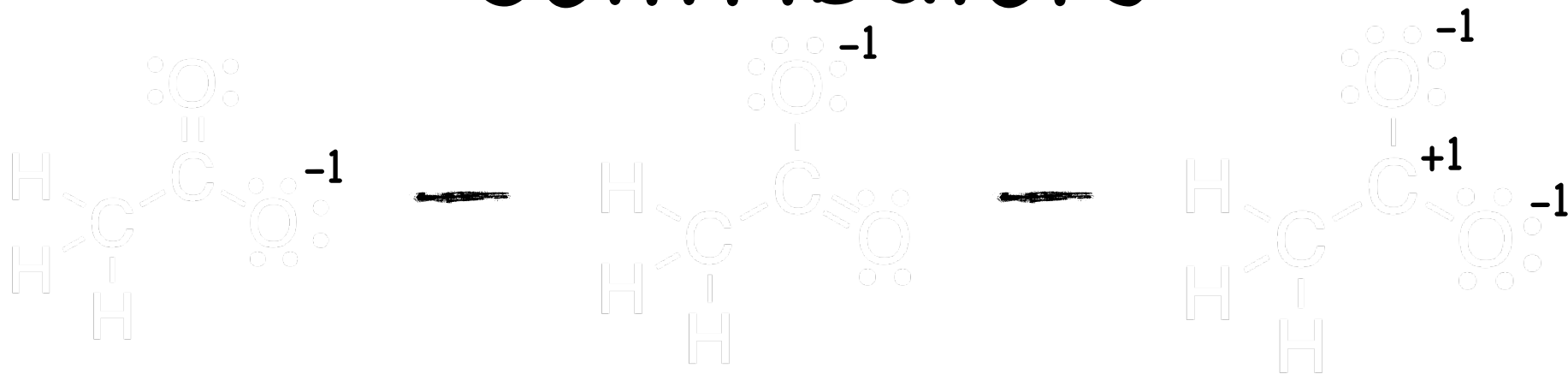


Real!

Not All Resonance Structures are Created Equally!

- ④ Maximize bonds and octets.
- ④ Minimize formal charge.
- ④ When formal charge is necessary, (-) on more electronegative atoms, (+) on less electronegative atoms.
- ④ Major contributors vs. minor contributors.

Major and Minor Contributors



Wrapping Up

- ④ Practice drawing resonance structures, including formal charge.
- ④ Practice using the curved arrow notation.
- ④ Practice determining whether a resonance structure would be a major or minor contributor to the resonance hybrid.
- ④ Practice drawing the resonance hybrid.