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[TP] In formic acid, HC(O)OH , the hybridization on the O double-bonded to the C is (use the Lewis structure) ...

25% 1. none
 25% 2. sp
 25% 3. sp^2
 25% 4. sp^3

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 Friday, January 27, 2017

- Polyatomic MO recipe: Formic acid, HC(O)OH (localized π bonds)
- Polyatomic MO recipe: Formate, HC(O)O^- (delocalized π bonds)

Begin Mahaffy et al., Chapter 11: States of Matter

- Behavior of gases: Macroscopic versus microscopic understanding

Next: Begin kinetic molecular theory, PDF, <http://goo.gl/njf3em>

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Polyatomic MO recipe: Formaldehyde, H_2CO

1. Use the Lewis structure to get ...
 - the number of electron pairs
 - make hybrid AO's on each atom; terminal atoms (except H) have same hybrids as central atom
2. Sketch the σ framework and place pairs ...
 - in each bonding σ MO
 - in each nonbonding hybrid AO
3. Sketch the π framework MO's:
 - mark as bonding, nonbonding, and antibonding
 - place remaining pairs (Auf Bau)
 - get the π bond order

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H_2CO π framework

1 pair in (localized) π framework

π (bonding) one loop mostly O

π^* (antibonding) two loops mostly C

1 pair in π (bonding); bond order 1

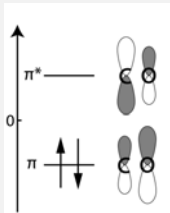
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[Quiz] The difference on AO size in the π bonding orbital is ...

25% 1. not physically significant
 25% 2. because IE_C is larger than IE_O
 25% 3. because IE_C is smaller than IE_O
 25% 4. some other reason



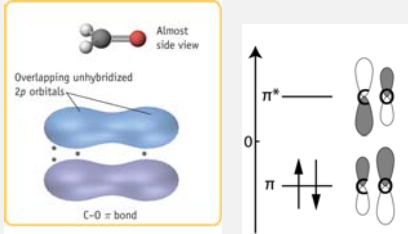
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H_2CO π framework

1 pair in (localized) π framework



(c) The C-O π bond comes from the sideways overlap of p orbitals on the two atoms.

1 pair in π (bonding); bond order 1

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Formic acid, $HC(O)OH$

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[TP] In formic acid, $HC(O)OH$, the hybridization on the O double-bonded to the C is (use the Lewis structure) ...

25% 1. none
 25% 2. sp
 25% 3. sp^2
 25% 4. sp^3

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[TP] In formic acid, HC(O)OH, the hybridization on the O **single-bonded** to the C is (use the Lewis structure) ...

25% 1. none
25% 2. sp
25% 3. sp²
25% 4. sp³

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HC(O)OH σ framework

- Hybridization of **terminal atoms** the **same as their central atom**
- Terminal H **never hybridized**
- One pair in each hybrid AO **σ bonding MO**
- One pair in each **non-bonded hybrid AO**

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π framework

- mark as **bonding, nonbonding, antibonding**
- place **remaining pairs** (Auf Bau)
- get the **π bond order**

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HC(O)OH π framework

1 pair in (**localized**) π framework

π (bonding) one loop mostly O

π^* (antibonding) two loops mostly C

1 pair in π (bonding); **bond order 1**

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Formate, $\text{HC(O)}\text{O}^-$

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[TP] Formic acid, HC(O)OH , and its conjugate base formate, $\text{HC(O)}\text{O}^-$, each have 9 pairs of electrons. How many pairs of electrons are in the σ framework of formate?

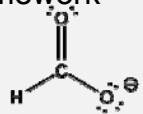
20% 1. 3 pairs
20% 2. 5 pairs
20% 3. 7 pairs
20% 4. 8 pairs
20% 5. 9 pairs

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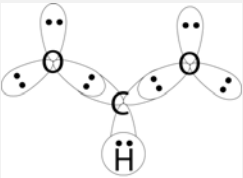
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$\text{HC(O)}\text{O}^-$ sp^2 σ framework



9 pairs in Lewis structure, 7 pairs in σ framework, and so 2 pairs in (delocalized) π framework.



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[TP] How many pairs of electrons are in the π framework of formate?

25% 1. 0 pairs
25% 2. 1 pair
25% 3. 2 pairs
25% 4. 3 pairs

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