Lecture 5 CH102 A2 (MWF 11:15 am) Spring 2018

[TP] In formate, HC(O)O⁻, some electrons are shared between atoms and some electrons are localized on atoms. There are the same number of electrons localized on each O of formate. The number of electrons localized on one O atom is …

20% 1. 5
20% 2. 5 1/3
20% 3. 5 1/2
20% 4. 5 2/3
20% 5. 6

BOSTON UNIVERSITY

Response Counter 10

1

Lecture 5 CH102 A2 (MWF 11:15 am)

Monday, January 29, 2018

- Complete formate, HC(O)O⁻ (delocalized π bonds)
- Postscript on polyatomic MO recipe

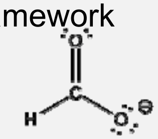
Next: Mahaffy et al., Chapter 11: States of Matter

- Behavior of gases: Macroscopic versus microscopic understanding
- Kinetic molecular theory, PDF: http://goo.gl/njf3em

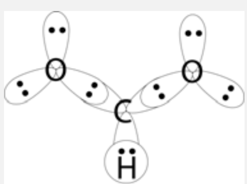
BOSTON UNIVERSITY

Lecture 5 CH102 A2 (MWF 11:15 am) Spring 2018

HC(O)O⁻ sp^2 σ framework



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

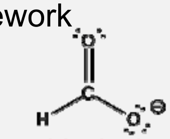


BOSTON UNIVERSITY

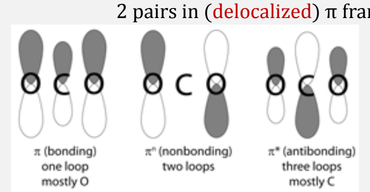
6

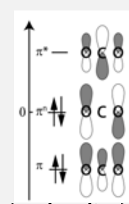
Lecture 5 CH102 A2 (MWF 11:15 am) Spring 2018

HC(O)O⁻ π framework



2 pairs in (delocalized) π framework





1 pair in π (bonding) and 1 pair in π^n (nonbonding); bond order 1

BOSTON UNIVERSITY

8

[TP] In formate, $HC(O)O^-$, some electrons are shared between atoms and some electrons are localized on atoms. There are the same number of electrons localized on each O of formate. The number of electrons localized on one O atom is …

20% 1. 5
20% 2. 5 1/3
20% 3. 5 1/2
20% 4. 5 2/3
20% 5. 6

Response Counter 10

9

[Quiz] The total number of electrons localized on C in formate, $HC(O)O^-$ is …

20% 1. 0
20% 2. 1/3
20% 3. 2/3
20% 4. 1
20% 5. 2

Response Counter 10

10

Postscript on polyatomic MO recipe

The σ framework is a visual representation of the bonding σ MOs.

The antibonding σ MOs are not shown, since they are never needed.

The σ framework does not show the hybrid AO-MO correlation diagram.

11

Postscript on polyatomic MO recipe

The π framework is a visual representation of all π MOs, bonding, non-bonding, and antibonding, and their relative energies.

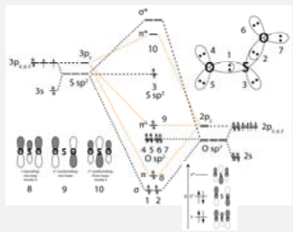
The π framework does not show the hybrid AO-MO correlation diagram.

12

Postscript on polyatomic MO recipe

It is possible to show the σ and π correlation diagrams, and an example is that for SO_2, shown in slide 30 of http://goo.gl/6hBD8X.

However, we will not ask that you do this and so you are not responsible for knowing how to do so.



BOSTON UNIVERSITY 13

Behavior of gases

BOSTON UNIVERSITY 14

[TP] A container of volume V is filled with a gas at 20 °C. If V is decreased (while keeping T constant), pressure P exerted by the gas on the walls of the container must …

25% 1. go down
25% 2. stay the same
25% 3. go up
25% 4. Further information needed

BOSTON UNIVERSITY Response Counter 10 15

Macroscopic behavior

Very likely you know and have a lot of experience working with the ideal gas equation relating P, T, V and n, …

$$PV = nRT$$

In term of the gas constant …

$$R = 8.314 \text{ J /(K mol)}$$

BOSTON UNIVERSITY 16

Macroscopic behavior

Using $PV = nRT$ we know algebraically that if V is decreased (while keeping T constant), the pressure P exerted by the gas on the walls of the container must go up, since the right-hand side of the equation is unchanged.

This is an example of macroscopic understanding.

Microscopic behavior

Our goal is to understand this kind of behavior at a microscopic level.

That is, at the level of the individual particles of the gas.

Our method is called the kinetic molecular theory of gases.

