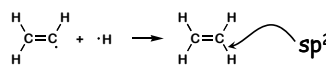
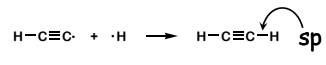


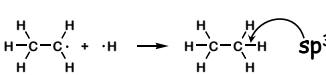
Bond Energies

$$\cdot\text{C}\cdot + \cdot\text{H} \longrightarrow \text{C-H} + \text{heat } (\Delta H^\circ)$$

What is the order of following reactions with respect to increasing heat released (ΔH°)?

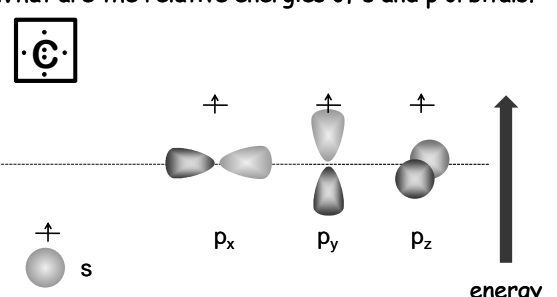
i  **sp²** A. i < ii < iii
increasing heat of reaction

ii  **sp** B. i < iii < ii
increasing heat of reaction

iii  **sp³** C. ii < iii < i
increasing heat of reaction

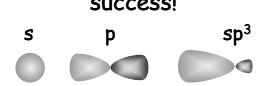
D. iii < i < ii
increasing heat of reaction

What are the relative energies of s and p orbitals?



s orbitals are more electronegative than p orbitals
electrons in orbitals with more s character are more stable
bonds using orbitals with more s character are stronger

success!



a lot of success but still under development.

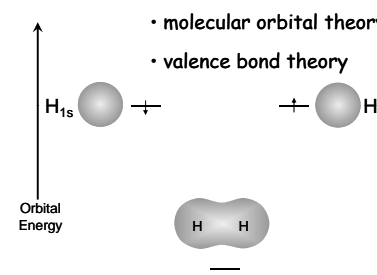
- molecular orbital theory
- valence bond theory

from the application of quantum mechanics to H· we can derive all of the atomic orbitals as well as their hybrids.

CH₄ and larger molecules

quantum mechanics

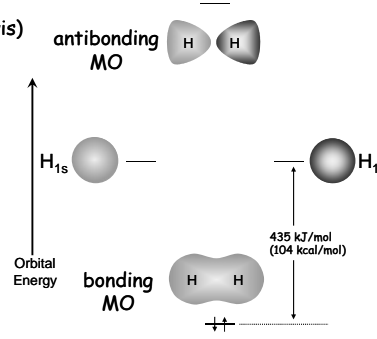
resonance (Lewis) structures



- molecular orbital theory
- valence bond theory

- valence bond theory
- molecular orbital theory

resonance (Lewis) structures

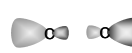


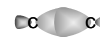
antibonding MO


bonding MO


435 kJ/mol (104 kcal/mol)

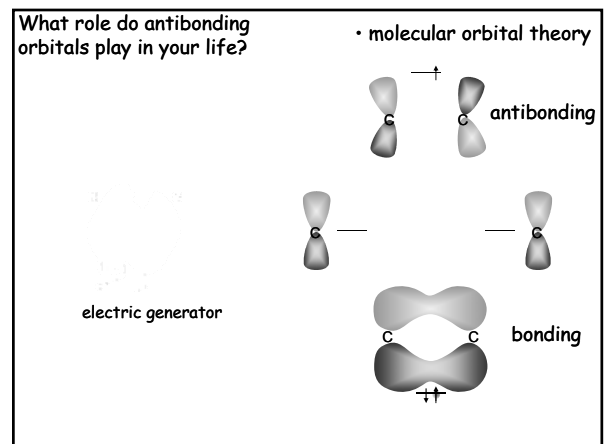
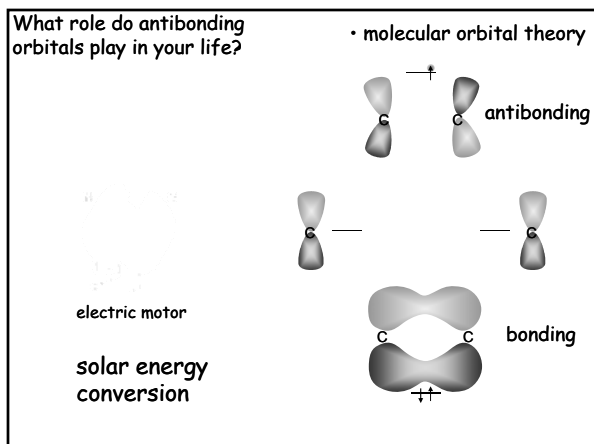
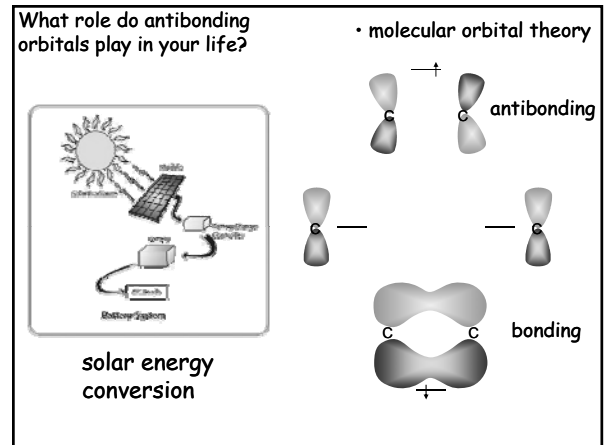
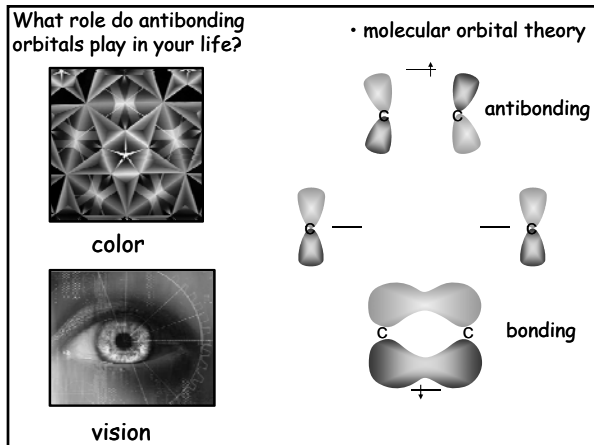
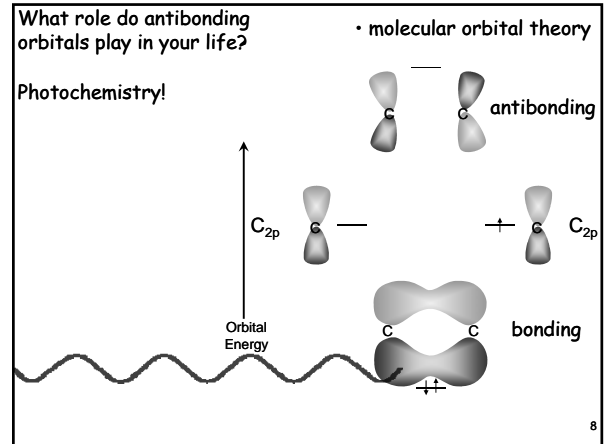
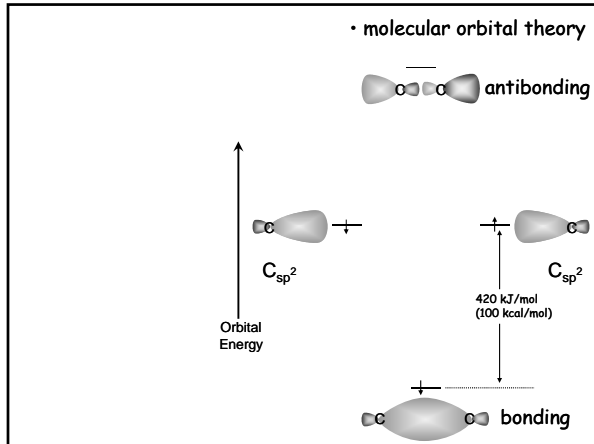
For a C=C bond choose the π -antibonding molecular orbital from the following list.

(A)  σ -antibonding molecular orbital


(B)  σ -bonding molecular orbital

(C)  π -bonding molecular orbital

(D)  π -antibonding molecular orbital

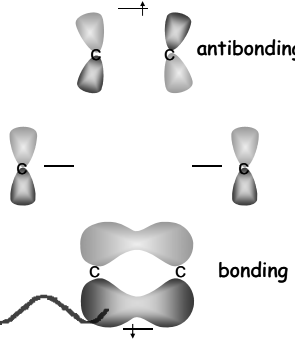


What role do antibonding orbitals play in your life?



displays light emitting diodes (LEDs)

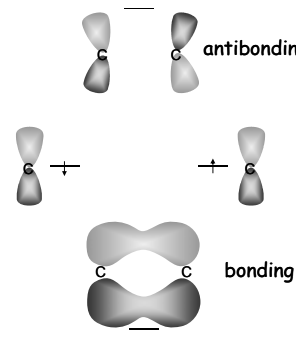
• molecular orbital theory



• valence bond theory

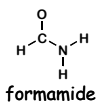
resonance (Lewis) structures

An alternative view of bonding



14


Draw the best Lewis (resonance) structure for formamide (CH_3NO).



start with correct structure

formamide

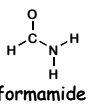
not



nitrosomethane

15

Draw the best Lewis (resonance) structure for formamide (CH_3NO).



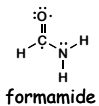
formamide

1. add electrons
2. maximize bonding
3. add formal charges

	3	4	5	6	7
B	C	N	O	F	
	Si	P	S	Cl	
					Br
					I

16

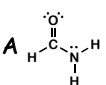
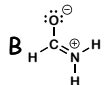
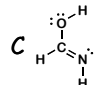
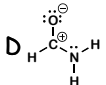
Choose the best Lewis (resonance) structure for formamide.



formamide

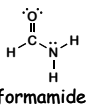
1. add electrons
2. maximize bonding
3. add formal charges

	3	4	5	6	7
B	C	N	O	F	
	Si	P	S	Cl	
					Br
					I

A  B  C  D 

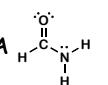
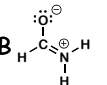
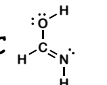
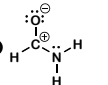
17

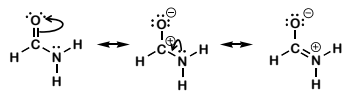
Choose the structure that is *not* a resonance structure of formamide.



formamide

Resonance structures are different electronic configurations of the *same* structure.

A  B  C  D 



18

Choose the order that has the following structures arranged with respect to increasing stability.

3	4	5	6	7
B	C	N	O	F
Si	P	S	Cl	
				Br
				I

1. maximum bonding (very important)
2. minimize charge separation.
3. \ominus charges on electronegative atoms.
 \oplus charges on electropositive atoms.

1

2

3

A

1 2 3
increasing
stability

B

1 3 2
increasing
stability

C

2 1 3
increasing
stability

D

2 3 1
increasing
stability

E

3 2 1
increasing
stability

F

3 1 2
increasing
stability

19

Arrange the following compounds in order of increasing stability.

3	4	5	6	7
B	C	N	O	F
Si	P	S	Cl	
				Br
				I

1. maximum bonding (very important)
2. minimize charge separation.
3. \ominus charges on electronegative atoms.
 \oplus charges on electropositive atoms.

$\xrightarrow{\text{increasing stability}}$

20

the complete story

a true but incomplete story

a good story

an excellent story

21

Predict the more acidic compound.
Draw both products and their resonance structures.

A

B

24

Predict the major product of the following reaction.
Draw both products and their resonance structures.
The product with the best resonance structures is predicted to be most stable.

A

B

25

Which of the following C=O compounds is more stabilized by resonance?

A

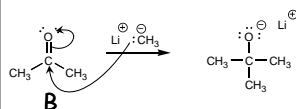
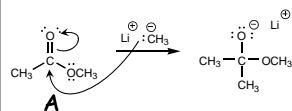
non octet structures

B

octet structures

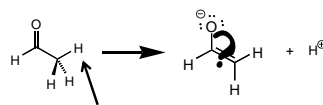
26

Which of the following C=O compounds would you expect to react faster with methyl lithium?

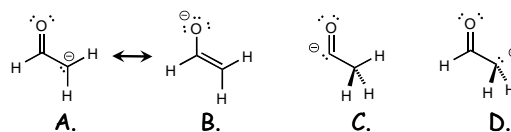


2

The molecule below is called acetaldehyde. Remove the indicated proton from the molecule and draw the single most important Lewis representation of the resulting anion.

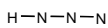
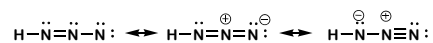


remove this proton



29

Draw a full set of Lewis structures and predict the geometry of hydrazoic acid, HN₃.



30

text