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Chapter 10 (397935)

About this Assignment

Description
Bonding and Molecular Structure: Orbital Hybridization and Molecular Orbitals

Instructions
Bonding and Molecular Structure: Orbital Hybridization and Molecular Orbitals

1. KT6 10.P.004. [467415] Show Details

Specify the electron-pair and molecular geometry for eachof the following. Describe the hybrid orbital set used by the underlined atom in each molecule or ion?

(a) $\underline{C}Se_2$
- sp
- sp^2
- sp^3
- sp^3d

(b) $\underline{S}O_2$
- sp
- sp^2
- sp^3
- sp^3d

(c) $\underline{C}H_2O$
- sp
- sp^2
- sp^3
- sp^3d

(d) $\underline{N}H_4^+$
- sp
- sp^2
- sp^3
- sp^3d

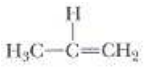
2. KT6 10.P.005. [467257] Show Details

Describe the hybrid orbital set used by each of the indicated atoms in the molecules listed below. (Type your answer using the format sp2 for sp^2.)

(a) left carbon atom in dimethyl ether, CH_3OCH_3

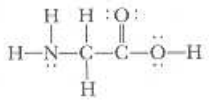
oxygen atom in dimethyl ether

(b) center carbon atom in propene



right carbon atom in propene

(c) nitrogen atom in the amino acid glycine

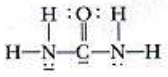


left carbon in glycine

3. KT6 10.P.006. [467285] Show Details

Give the hybrid orbital set used by each of the underlined atoms in the following molecules. (Type your answer using the format sp2 for sp^2.)

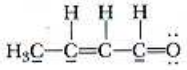
(a)



N

C

(b)

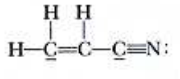


C of CH_3

C of C=C

C of C=O

(c)



C of C=C

C of C≡N

4. KT6 10.P.017. [467181] Show Details

Calcium carbide, CaC_2, contains the acetylide ion, C_2^{2-}.

(a) How many net σ and π bonds does the ion have?

σ =

π =

(b) What is the carbon-carbon bond order?

(c) How has the bond order changed on adding electrons to C_2 to obtain C_2^{2-}?

- yes
- no

(d) Is the C_2^{2-} ion paramagnetic?

- The bond order increases by one going from C_2 to C_2^-.
- The bond order decreases by one going from C_2 to C_2^-.

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5. KT6 10.P.018. [489795] Show Details

Oxygen, O_2, can acquire one or two electrons to give O_2^- (superoxide ion) or O_2^{2-} (peroxide ion). Write the electron configuration for the ions in molecular orbital terms (Do this on paper. Your instructor may ask you to turn in this work.). Compare them with the O_2 molecule on the following bases.

	O_2	O_2^-	O_2^{2-}
(a) magnetic character	---Select---	---Select---	---Select---
(b) net number of π bonds			
(c) bond order			

(d) Which of the following has the shortest bond length. O_2, O_2^-, O_2^{2-}

- O_2
- O_2^-
- O_2^{2-}

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6. KT6 10.P.020.Practice. [509749] Show Details

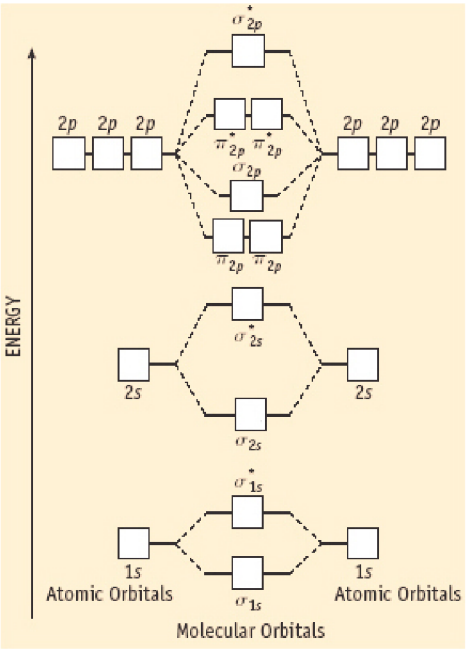
Answer all parts of the following question to receive credit.

Homework 10.20

MAIN QUESTION

Question 1 of 5

The nitrosyl ion, NO^+, has an interesting chemistry. Assume the diagram below applies to this structure. How many total electrons does NO^+ have?



Answer

Enter a response, then Submit.

Submit

Question has not been submitted for scoring.

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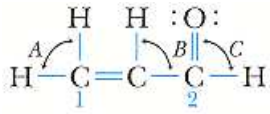
7. KT6 10.P.030. [489814] Show Details

Acrolein, a component of photochemical smog, has a pungent odor and irritates eyes and mucous membranes.



(a) What are the hybridizations of carbon atoms 1 and 2?

- sp^2
- sp^3d^2
- sp^3d
- sp^3

(b) What are the approximage values of angles A, B, and C?

angle A	angle B	angle C
109°	109°	109°
120°	120°	120°
180°	180°	180°

(c) Is *cis-trans* isomerism possible here?

- yes
- no

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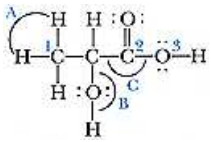
8. KT6 10.P.034. [467410] Show Details

Lactic acid is a natural compound found in sour milk.



(a) How many π bonds occur in lactic acid?

How many σ bonds bonds occur in lactic acid?

(b) Describe the hybridization of each atom 1 through 3.

C(1)
- sp^2
- sp^3
- sp^3d
- sp^3d^2

C(2)
- sp
- sp^2
- sp^3
- sp^3d

O(3)
- sp^2
- sp^3
- sp^3d
- sp^3d^2

(c) Which CO bond is the shortest in the molecule?
- C-O bond
- C=O

Which CO bond is the strongest in the molecule?
- C-O bond
- C=O

(d) What are the approximate values of the bond angles A, B, and C?

A=
B=
C=

---

9. KT6 10.P.044. [489818] Show Details

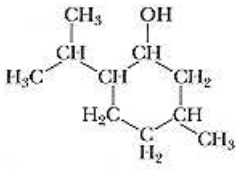
Which of the following molecules or molecule ions should be paramagnetic? What is the highest occupied molecular orbital (HOMO) in each one? Assume the molecular orbital diagram in Figure 10.22 applies to all of them. (Type your answer using the format sigma*2p for σ^*_{2p} or pi 2p for π_{2p}.)

molecule or ion	magnetic behavior	HOMO

(a) CN	---Select---	
(b) O_2^{2-}	---Select---	
(c) OF^-	---Select---	
(d) NO	---Select---	
(e) B_2	---Select---	

10. KT6 10.P.047. [467362] Show Details

Menthol is used in soaps, perfumes, and foods. It is present in the common herb mint, and it can be prepared from turpentine.



Model of menthol.

(a) What are the hybridizations used by the C atoms in the molecule?
- All of the C atoms are *sp* hybridized.
- All of the C atoms are sp^3 hybridized.
- Some of the C atoms are sp^2 hybridized and some are sp^3 hybridized.
- All of the C atoms are sp^2 hybridized.

(b) What is the approximate C-O-H bond angle?
- 60°
- 90°
- 109°
- 120°

(c) Is the molecule polar or nonpolar?
- nonpolar
- polar

(d) Is the six-member carbon ring planar or nonplanar?
- planar
- nonplanar

Submit for Testing