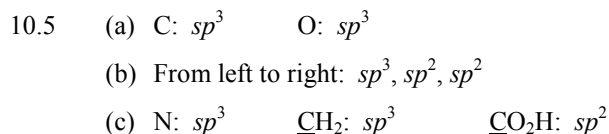
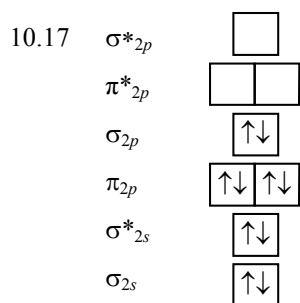
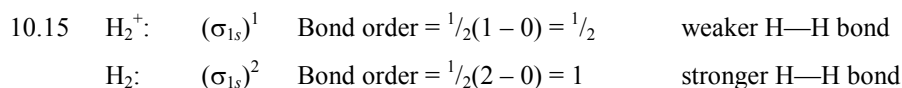


## AP Chemistry Chapter 10 Answers - Kotz

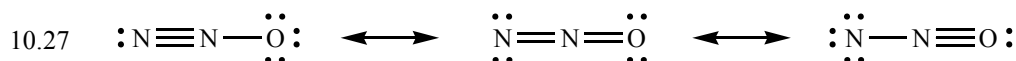
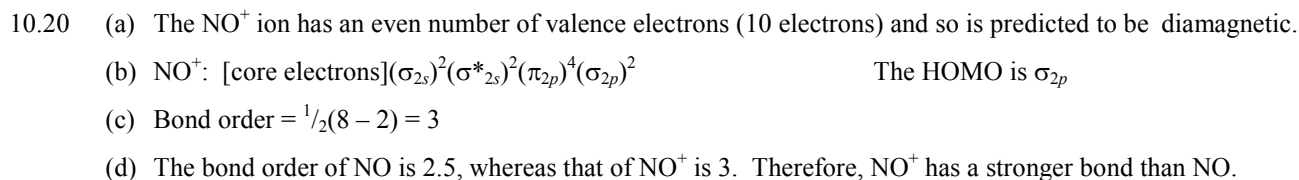
Text Problems: 3, 5, 11, 15, 17, 20, 27, 32, 35, 37, 41, 43, 53



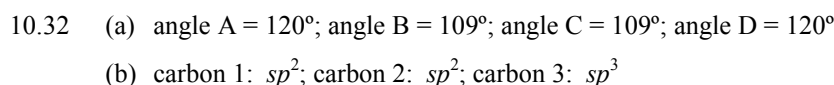
10.11 The C atom is  $sp^2$  hybridized. Two of the  $sp^2$  hybrid orbitals are used to form C—Cl  $\sigma$  bonds. The third is used to form the C—O  $\sigma$  bond. The  $p$  orbital not used in the C atom hybrid orbitals is used to form the CO  $\pi$  bond.



The  $\text{C}_2^{2-}$  ion has a bond order of  $\frac{1}{2}(8 - 2) = 3$  (one  $\sigma$  bond and two  $\pi$  bonds). The  $\text{C}_2$  molecule has two fewer electrons and a bond order of  $\frac{1}{2}(6 - 2) = 2$ . The  $\text{C}_2^{2-}$  ion is diamagnetic.

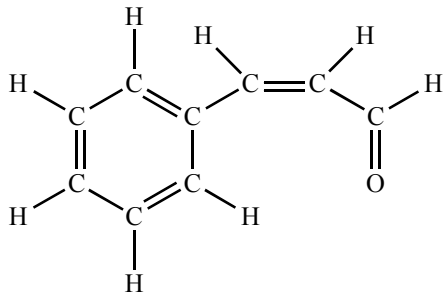


In each structure the central N atom is  $sp$  hybridized. The other N atom hybridization changes from  $sp$  to  $sp^2$  to  $sp^3$ . The two  $sp$  hybrid orbitals on the central N atom are used to form N—N and N—O  $\sigma$  bonds. The two  $p$  orbitals not used in the N atom hybridization are used to form NN and NO  $\pi$  bonds.



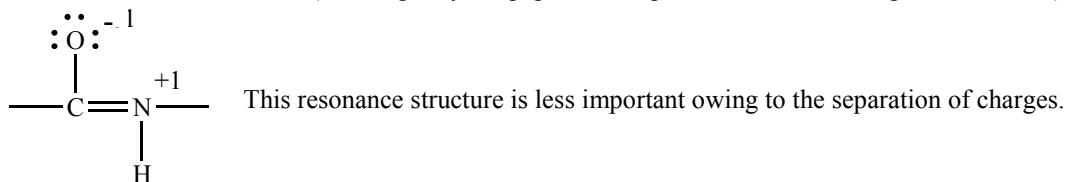
- 10.35 (a) The geometry about the boron atom is trigonal planar in  $\text{BF}_3$ , tetrahedral in  $\text{H}_3\text{N}-\text{BF}_3$ .  
 (b) Boron is  $sp^2$  hybridized in  $\text{BF}_3$ ,  $sp^3$  hybridized in  $\text{H}_3\text{N}-\text{BF}_3$ .  
 (c) Yes

- 10.37 (a) The  $\text{C}=\text{O}$  bond is the most polar bond in the molecule.  
 (b) There are 18  $\sigma$  bonds and 5  $\pi$  bonds in the molecule.  
 (c) The *trans* isomer is shown. The *cis* isomer is



- (d) All carbon atoms in the molecule are  $sp^2$  hybridized.  
 (e) All three angles are  $120^\circ$ .
- 10.41 (a)  $\left[ \begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{O} \\ \cdot\cdot \\ \cdot\cdot \end{array} - \begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \text{O} \\ \cdot\cdot \\ \cdot\cdot \end{array} \right]^-$  bond order = 1  
 (b)  $[\text{core electrons}](\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^4$  bond order =  $\frac{1}{2}(8 - 6) = 1$   
 (c) Yes, the two bonding theories lead to the same magnetic character (diamagnetic) and bond order.
- 10.43  $\text{B}_2$  and  $\text{O}_2$  are diamagnetic,  $\text{Li}_2$ ,  $\text{B}_2$ , and  $\text{F}_2$  have a bond order of 1,  $\text{C}_2$  and  $\text{O}_2$  have a bond order of 2, and  $\text{N}_2$  has the highest bond order, 3.
- 10.53 (a) C atom:  $sp^2$ ; N atom:  $sp^3$

- (b) Another resonance structure (showing only the peptide linkage and the formal charges on O and N) is



- (c) The fact that the amide link is planar indicates that the resonance structure shown above has some importance.