Name ____________________________ Test 1 (10/1)

CHEM 0201 (Organic) Fall 2008

1. (8 pts. ea.) Draw Lewis structures for the following condensed structures

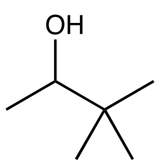
a. CH_3CH_2CN

b. $CH_3C(O)OCH_3$

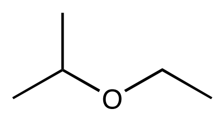
2. a. (8 pts. ea.) Draw Lewis structures for the following skeletal structures.

b. (6 pts. ea.) Provide IUPAC names for the following molecules.

a.



b.



____ ______________________________________

3. a. (8 pts.) Explain why $HClO_3$ is a stronger acid than $HClO_2$.

b. (2 pts.) Which has the higher pK_a, the $HClO_3$ or the $HClO_2$?

1. ________

2. ________

3. ________

4. ________

5. ________

6. ________

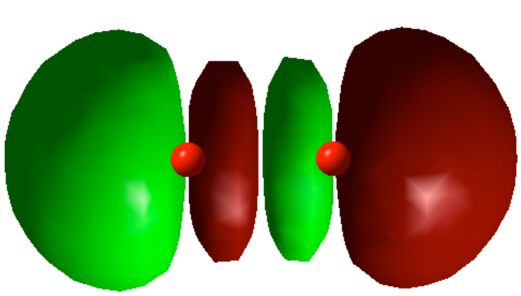
7. ________

8. ________

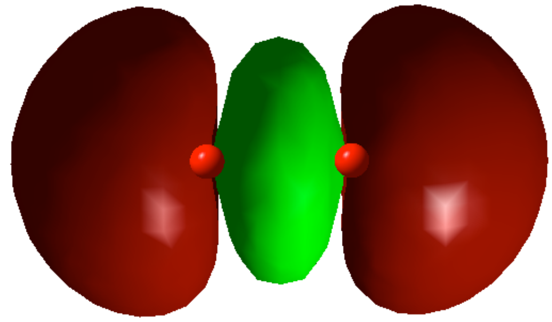
9. ________

10. ______

4. According to the LCAO version of MO theory, when two p_z orbitals are combined in a diatomic molecule like O_2, two molecular orbitals result. They are drawn below.



1



2

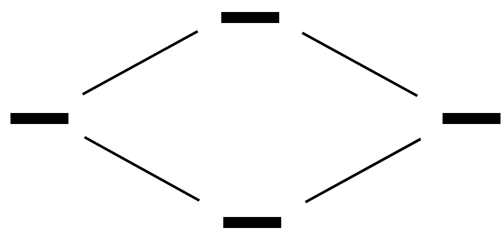
a. (4 pts.) Which molecular orbital is lower in energy? Explain your choice.

b. (3 pts) Which is the bonding orbital?

c. (3 pts.) Which is the antibonding orbital?

5. An MO diagram for He_2^+ is drawn below.

a. (5 pts.) Label the atomic and molecular orbitals.

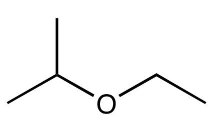


b. (3 pts.) Populate the orbitals with the appropriate number of electrons.

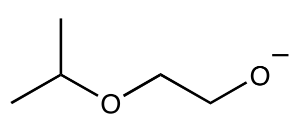
c. (6 pts.) Would you expect an He and an He^+ ion to be more stable as an He_2^+ molecule or as individual atoms/ions? Explain.

6. (8 pts.) Identify the atom on each of the following molecules to which a proton would most likely be attracted. Skeletal structures have been provided.

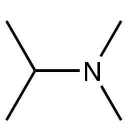
a.



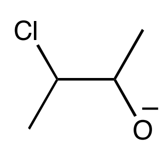
b.



c.

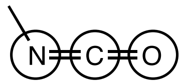


d.



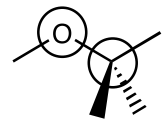
7. (2 pts. ea.) Determine the hybridization of the circled atoms. Skeletal structures are provided.

a.



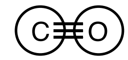
N ______ C ______ O ______

b.



O ______ C ______

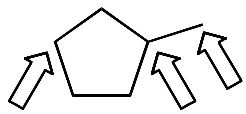
c.



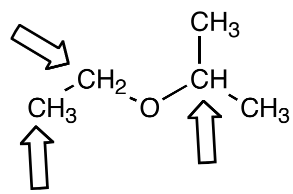
O ______ C ______

8. (2 pts. ea.) Determine the degree of substitution (1°, 2°, 3°, 4°) for the indicated C atoms.

a.



b.



9. (8 pts.) Cyclohexanes are stable molecules because each carbon atom can assume an almost ideal tetrahedral geometry. Cyclobutanes, on the other hand, are extremely reactive. Explain the reactivity of cyclobutanes. In your response remember to consider (1) the C–C–C bond angles in cyclobutane, (2) the ideal bond angles for a tetrahedral C atom, and (3) the implications of 1 and 2 on hybrid orbital overlap in the C–C bonds of cyclobutane.

10. Cyclopentanes are not planar even though bond angles in planar cyclopentanes would be 108°.

a. (6 pts.) Draw a Newman projection down one of the C–C bonds of a planar cyclopentane, and describe the geometry (staggered, staggered with gauche interactions, eclipsed) of the molecule.

b. (4 pts.) Explain why the ring would pucker even though bond angles aren't improved in the puckered version.