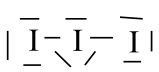
Name:

Chem 114
Hour Exam I

1. (12 points) Write the Lewis structure and give the expected hybrid orbitals around the central atom of the following compounds

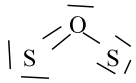
BeH_2
4 e^-, 2 pairs
H-BE-H
sp hybridization

I_3^-
7x3+1 = 22 e^- ; 11 pairs



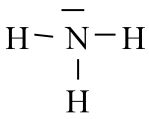
dsp^3 hybridization

SO_2
3x6=18 e^- = 9 pairs



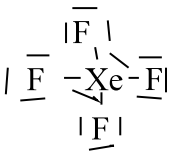
sp^2 hybridization

NH_3
5+3 = 8 e^- ; 4 pairs



Sp^3

XeF_4
8+4(7) = 36 e^-; 18 pairs



D^2sp^3

2. (12 points) NO is the reactive diatomic gas responsible for the brown haze associated with air pollution. It may also be possible to form the ions NO^+ and NO^-. Assuming that NO and its ions use a molecular orbital order similar to N_2, write the electron configurations and predict the bond order, relative bond lengths, and magnetic properties of these three species.

	NO 11 e^-	NO^+ 10e^-	NO^- 12e^-
σ^*_{2p}	— —	——	
π^*_{2p}	↑		↑ ↑
σ_{2p}	↑↓	↑↓	↑↓
π_{2p}	↑↓↑↓	↑↓↑↓	↑↓↑↓
σ^*_{2s}	↑↓	↑↓	↑↓
σ_{2s}	↑↓	↑↓	↑↓
BO	(8-3)/2=2.5	(8-2)/2=3	(8-4)/2=2
Length	medium	short	long
	Paramagnetic	diamagnetic	Paramagnetic

3. (12 points) Define the following terms:

sigma bond

A covalent bond where the shared electrons are located along a line connecting the atoms

probonding orbital

A molecular orbital that is at a lower energy level than the atomic orbitals used to make the molecular orbital, hence it favors the bonding of the atoms together.

paramagnetic

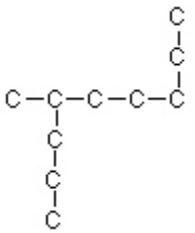
A magnetic force that attracts a compound to an external magnetic field due to the presence of unpaired electrons within the compound.

hybridization

Creating a new orbital by combining two or more other orbitals

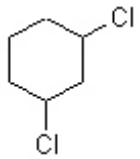
4. (16 points) Below are the names of four organic compounds. Write a reasonable structure for each compound. One or more of these compounds may be incorrectly named. Identify any incorrectly named compounds and give their correct names.

2-propyl-5-ethylpentane



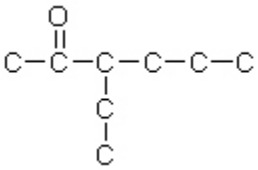
4-methylnonane

3,5- dichlorocyclohexane



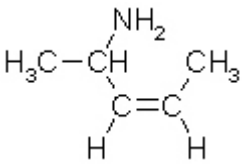
1,3-dichlorohexane

3-ethyl-2-hexanone



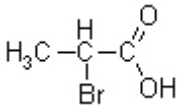
Name OK!

cis-2-amino-3-pentene

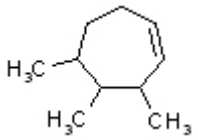


Cis-4-amino-2-pentene

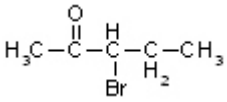
5. (12 points) Below are the structures of 4 different organic molecules. Give the correct IUPAC name for each compound.



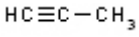
2-bromopropanoic acid



3,4,5-trimethylcycloheptene

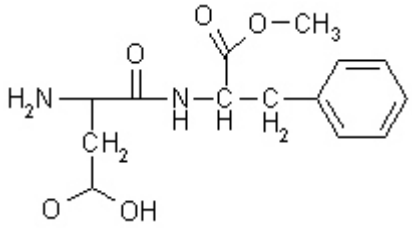


3-bromo-2-pentanone



Propyne

6. (12 points) Aspartame, the artificial sweetner marketed under the name Nutra-Sweet has the following structure:



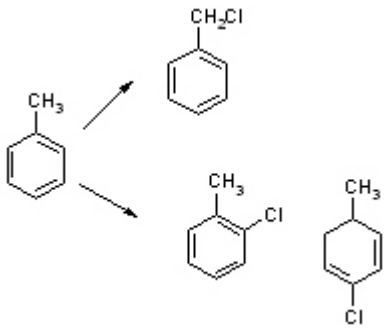
Find and label at least four different functional groups in this compound.

Groups (not circled because I can't do that with the computer)

Amine (NH_2) Amide (CONH)

Carboxylic Acid (COOH) Ester ($COOCH_3$) Aromatic ring

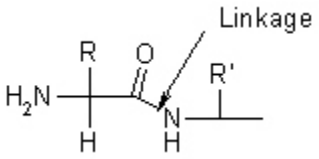
7. (12 points) When toluene ($C_6H_5CH_3$) reacts with chlorine gas in the presence of Fe^{+3} catalyst, the product of the reaction is a mixture of ortho- and para- isomers of $C_6H_4ClCH_3$. However, when the reaction is light catalyzed with no Fe^{+3} catalyst, the product is $C_6H_5CH_2Cl$. Explain. (Hint: draw the structures of the starting material and the products before you try to answer the question!)



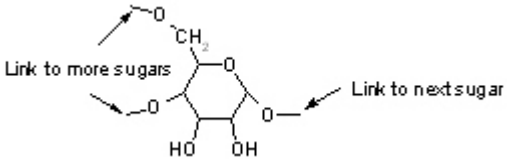
Upper reaction (with light) is typical substitution for an alkane, so the Cl goes on the unsaturated part of they molecule. The lower reaction, with the Fe catalyst is a typical substitution for an aromatic ring, so the Cl goes on the benzene ring part of the molecule

8. (12 points) For each of the three major biopolymers found in your body give:
The common name of the polymer, the structure of two monomers joined together, and give one or more of the polymer's functions. Note: the last page of this test contains the structures of some possible monomers

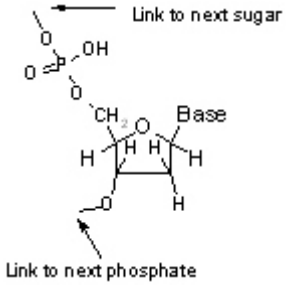
Protein - used for some cellular and extracellular structures and to make all the catalytic enzymes in your body



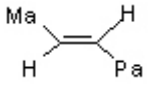
Carbohydrates - Used for structure in plants, and as energy storage in plants and animals



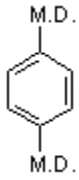
Nucleic Acids - used to store and transmit information

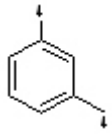


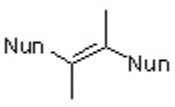
9. Freebies Give these chemical structures a try. (I'll give you the first one so you can get the right idea.

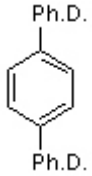


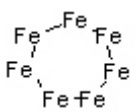
Name: transparent

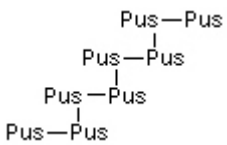












Possible Monomer structures for Problem 8