

Name: \_\_\_\_\_

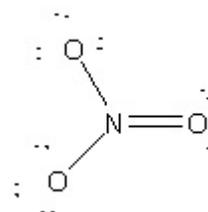
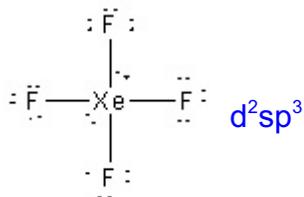
(4 points)

## Chemistry 114 First Hour Exam

**Remember- Show all work for partial credit**

All questions are worth 12 points.

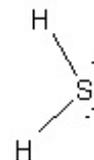
1. (12 points) Write Lewis structures and predict the hybridization around the central atoms for the following compounds:



$sp^3$

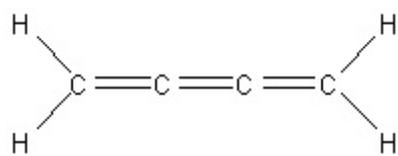


$sp^2$



$sp^3$

2 The hydrogens in butatriene ( $\text{C}_4\text{H}_4$ ) are locked in the same plane. Draw a structure for butatriene and explain why.

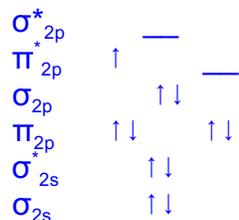


If the H's on the left are in the plane of the paper, then the electrons in the first  $\pi$  bond must be above and below the paper. The electrons in the next  $\pi$  bond must be in a different plane, so they must be in the plane of the paper. The final  $\pi$  bond must be above and below the paper, making the final hydrogens in the plane of the paper

3. One of the compounds you have met in the lab is NO gas, the nasty smelling brown gas that can come out of an internal combustion engine and that forms the brown haze of air pollution around big cities. NO uses the same series of molecular orbitals as C<sub>2</sub> or N<sub>2</sub>. Show the occupied and unoccupied molecular orbitals for NO, calculate the Bond order for NO, and predict whether NO would be attracted to or repelled from a magnetic field.

$$5+6 = 11 \text{ electrons}$$

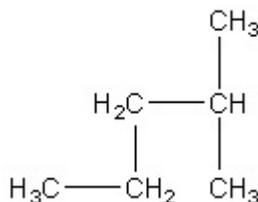
Molecular orbitals:



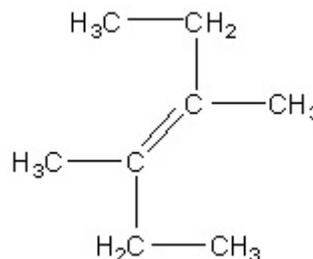
1 unpaired electron so paramagnetic and attracted to a magnetic field

$$\begin{aligned} \text{BO} &= (\# \text{ pro} - \# \text{ anti})/2 \\ &= (8 - 3)/2 \\ &= 2 \frac{1}{2} \end{aligned}$$

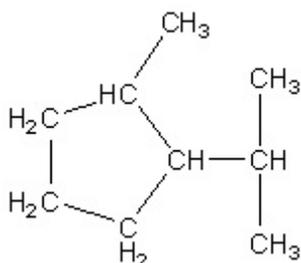
4. Give the proper IUPAC names for the organic chemicals shown below:



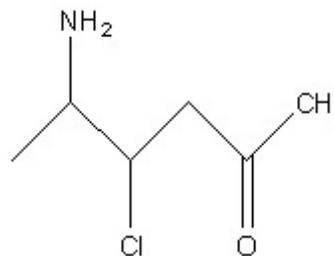
2-Methylpentane



*trans* 3,4-dimethyl-3-hexene



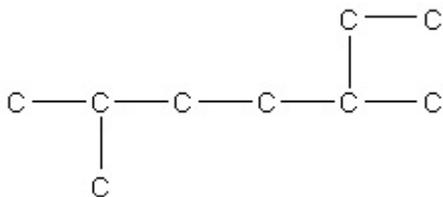
1-isopropyl-2-methylcyclopentane



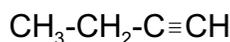
5-amino-4-chloro-2-hexanone

5. Draw the structures for the following organic compounds. Some the given names may be incorrect. If a name is not correct, give the correct name for the compound

2-methyl-6-ethylhexane



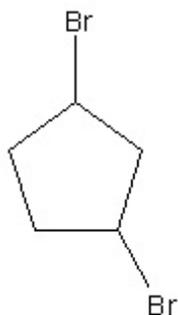
3-butyne



1-butyne or butyne

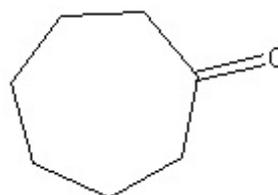
2-methyloctane

1,4 dibromocyclopentane



1,3-dibromocyclopentane

Cycloheptanone



Name is fine

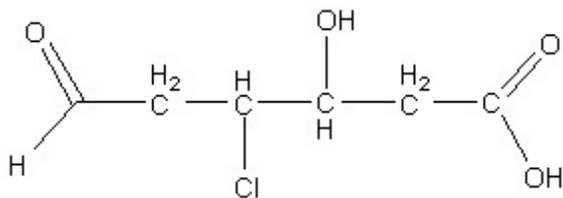
6A. Draw the structure of an organic compound that contains a halogen, an alcohol, an aldehyde, and a carboxylic acid. Circle and identify each of these groups in your structure. Include all hydrogens and all lone pairs of electrons in your structure because it has to make complete chemical sense.

Biggest problem is making sure that functional groups don't overlap and change their

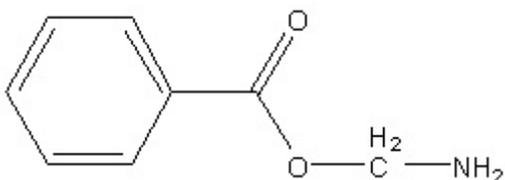
functionality my example is:

left-to-right,

aldehyde, halogen, alcohol, carboxylic acid



6 B. Draw the structure of an organic compound that contains an ester, an amine, and an aromatic ring. Circle and identify each of these groups in your structure. Include all hydrogens and all lone pairs of electrons in your structure because it has to make complete chemical sense.



aromatic ring, ester, amine

7. Name the three major biopolymers and give the name or structure of one of the monomers that goes to make each polymer.

Polymer	Monomer
Protein	Amino acid
Nucleic Acid (DNA or RNA)	Nucleotide (base, sugar, phosphate)
Carbohydrate	Simple sugar

8. Define the following terms:

$\pi_{2p}^*$  an antibonding pi orbital (electrons on either side of a line connecting the atoms) made hybridized from a 2p atomic orbital

$\sigma_{2p}$  A bonding sigma orbital (electrons along a line connecting the atoms) hybridized from a 2p atomic orbital

Diamagnetic - Not attracted or even repelled from a magnetic field because all electrons are paired

A substitution reaction: A reaction where a new atom is substituted for a single H on an alkane or an aromatic hydrocarbon. Example  $\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$   
Requires UV light for an alkane or a catalyst for an aromatic

An isomer: Compounds that have the same molecular formula, but different physical structures so they have different physical properties.

A addition polymerization reaction

A polymerization reaction where monomers are joined directly and no byproducts are created, usually done using a free radical intermediate.