

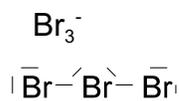
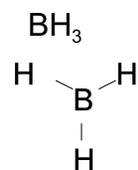
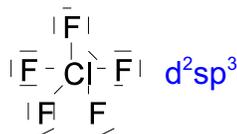
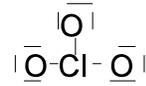
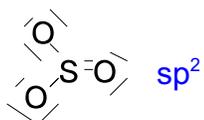
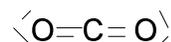
Name: _____

(4 points)

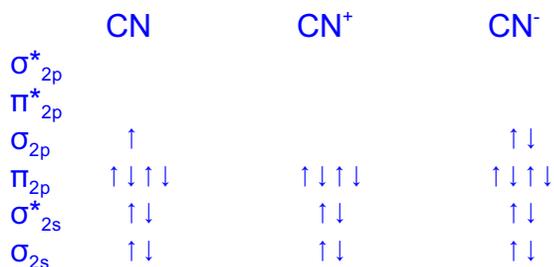
Chemistry 114 First Hour Exam

Remember- Show all work for partial credit

1. (12 points) What is the hybridization of the central atom in the following six molecules **While the question doesn't say you have to make a Lewis structure, but you can't find the answer without doing a Lewis Structure first!**

 dsp^3  sp^2  d^2sp^3  sp^3  sp^2  sp

2. (12 points) Cyanide (CN) is a deadly gas. Sketch the molecular orbitals found in CN, CN^+ and CN^- and show which of these orbitals are occupied by electrons.



B.O. (7-2)/2 (6-2)/2 (8-2)/2

Use the above molecular orbitals to answer the following questions:

Which of the forms of cyanide is attracted to a magnetic field?

Attracted to magnetic field, paramagnetic due to Unpaired electrons: CN

Which of the forms of cyanide has the shortest bond length?

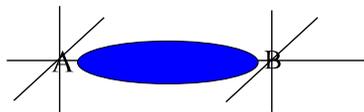
Shortest bond length correlates to strongest bond and highest bond order: CN^-

Are any of these forms of cyanide unstable? (i.e. 0 bond order?)

No

3. (12 points) Below is a sketch that shows two atoms, A and B that are going to be bonded to each other. For each bond listed, sketch the shape and position of the specified molecular orbital.

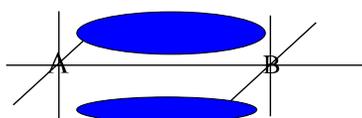
Probonding σ molecular orbital



Antibonding σ molecular orbital



Probonding π orbital



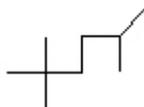
Antibonding π orbital



4. (12 points) Name or give structures for the following six hydrocarbons

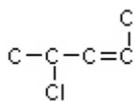
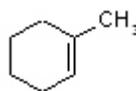
Name

Give Structure



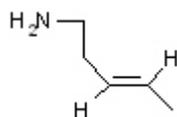
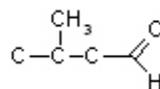
2,2,5-trimethylhexane

1-Methylcyclohexene



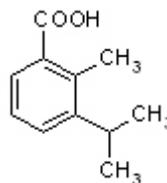
4-chloro-2-pentene

3-Methylbutanal



trans-5-amino-2-pentene

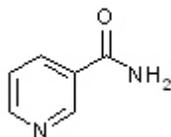
2-Methyl-3-isopropylbenzoic Acid



5. (12 points) Identify functional groups on the following vitamins:

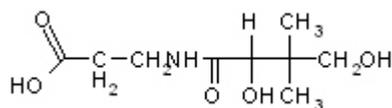
I can't make the graphics point to the actual groups, so I have just listed the groups I wanted to see identified

Nicotinamide (Niacin)



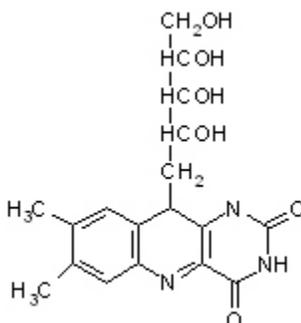
Amine, Amide, Aromatic ring

Pantothenic Acid



Carboxylic Acid, Amide, Alcohols

Riboflavin (Vitamin B₂)

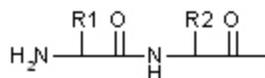


4 Alcohols, 2 amides, an amine, a large aromatic system

6. (12 points) Given an chemical structure for:

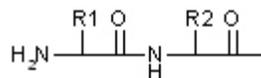
a biopolymer (Natural polymer)

Protein, DNA, or complex carbohydrate. Structure of protein:



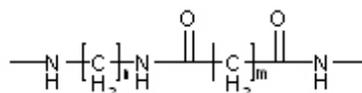
a polymer formed by a condensation reaction

You could use protein again if you wanted:



a copolymer

Nylon:



7. (12 points) X-rays were used to analyze an aluminum crystal. The distance between atoms in this crystal is 2.33 Å, and the first order reflection was at an angle of 19.3°. What was the wavelength of the X-rays used in this experiment?

$$n\lambda = 2d\sin\theta$$

$$1(\lambda) = 2(2.33\text{Å})\sin(19.3^\circ)$$

$$= 1.54\text{Å}$$

8. (12 points) Define the following terms:

delocalized π bond

A pi bond that is in an aromatic system so it can 'move' around.

σ bond

A bond that lies along a line connecting two atoms.

bonding or antibonding orbital

A bond that holds atoms together because the electrons are located between the atoms to hold them together and the energy of the electrons in this orbital is lower than the energy that they would have in the original atomic orbitals.

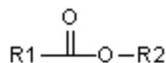
dehydrogenation reaction

A reaction where hydrogens are removed from two adjacent carbon atoms to form a multiple bond between the carbons.

surface tension

The resistance of a liquid to changes in its surface area due to the cohesive forces within the liquid trying to keep its surface area to a minimum.

ester



molecular solid

A solid where entire molecules reside at the lattice point that define the crystal.