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(EVEN THOUGH YOU ALREADY DID THIS ON THE COVER PAGE)
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STUDENTS WHOSE NAMES WE CAN'T READ!**

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FIRST NAME _____ *PRINTED*
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Points by question

1 _____ /18

2 _____ /16

3 _____ /12

4a _____ /2

4b _____ /36

4c _____ /10

5 _____ /10

6 _____ /12

7 _____ /27

8 _____ /16

9 _____ /16

Points Removed for cover errors ____/2

Extra Credit ____/5

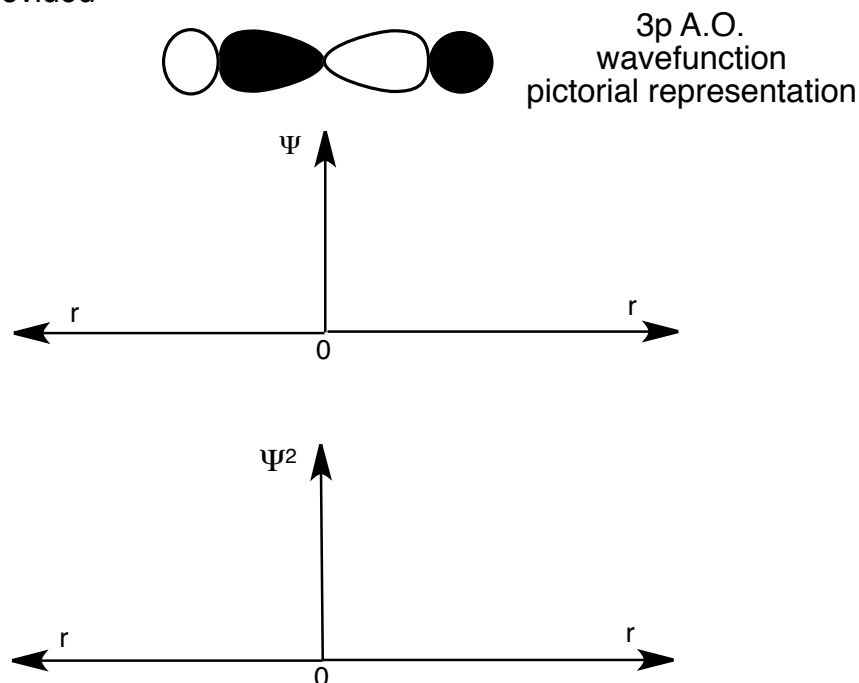
Total (incl Extra) _____/175+5

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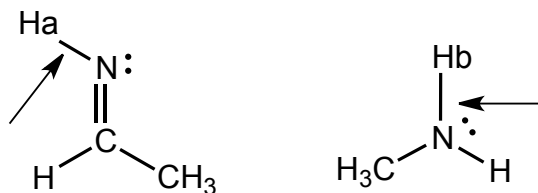
Question 1 (18 pts.) Here is a pictorial representation of the Ψ of a 3p atomic orbital.

a) Give a plot of the magnitude of the wavefunction (Ψ) versus distance from the nucleus, r , on the axes provided, **AND IDENTIFY ANY NODES ON THIS PLOT**

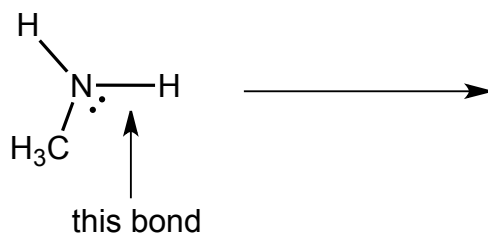
b) Give a plot of the magnitude of the wavefunction squared (Ψ^2) versus distance from the nucleus, r , on the axes provided



Question 2 (16 pts.) For the N-Ha and N-Hb bonds in the 2 structures below, explain which would have the LARGER bond dissociation energy (BDE) and give a BRIEF explanation that must include the term "energy of the electrons".



Question 3 (12 pts.) For homolytic dissociation of the N-H bond indicated below by the arrow, draw the curved arrow-pushing that describe bond breaking and give the product of bond breaking. Include all non-bonding electrons



Question 4 For the molecular formula C_5H_8

a) (2 pts.) Give the degrees of unsaturation

b) (36 pts.) Draw **SIX** structural isomers that obey the normal rules of valence for each atom. You can draw Lewis structures or line-angle structures (your choice).

c) (10 pts.) Draw **ONE PAIR** of stereoisomers that obey the normal rules of valence for each atom for C_5H_8 . You do NOT have to identify cis- or trans-isomers. **DO NOT INCLUDE ANY STRUCTURES in part c) THAT WERE DRAWN AS PART OF YOUR ANSWER TO PART b) OF THIS QUESTION**

Question 5 (10 pts.) Convert the provided condensed formula into a line-angle structure (include all non-bonding electrons).



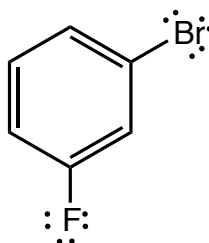
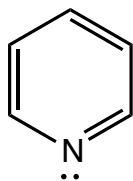
Extra Credit (5 pts.) In the "Organic Chemistry in Real Life" pages, anti-bonding molecular orbitals were described as playing an important role in which of the following

color

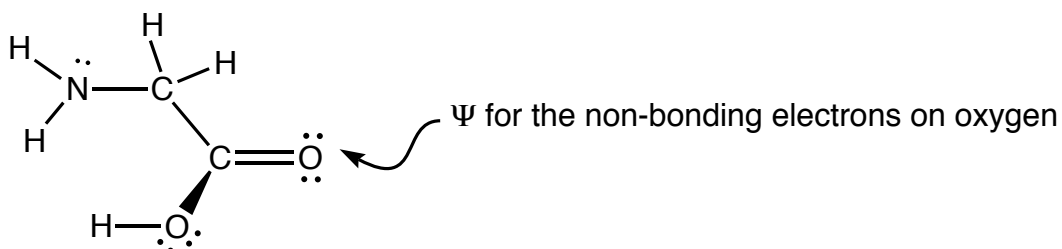
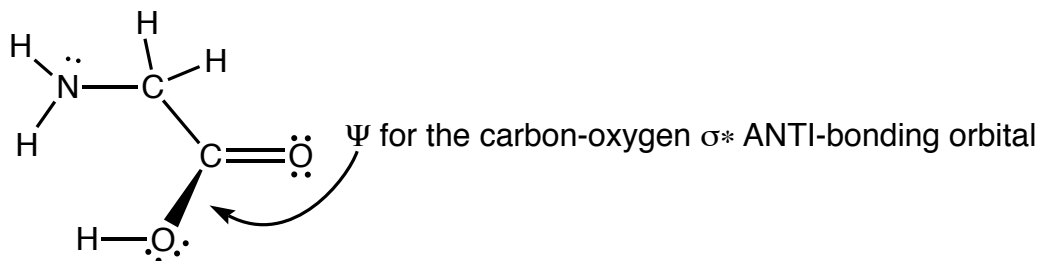
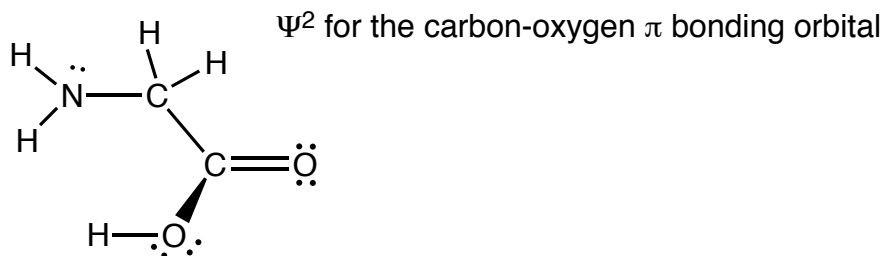
burning hydrocarbons

ATP energy conversion

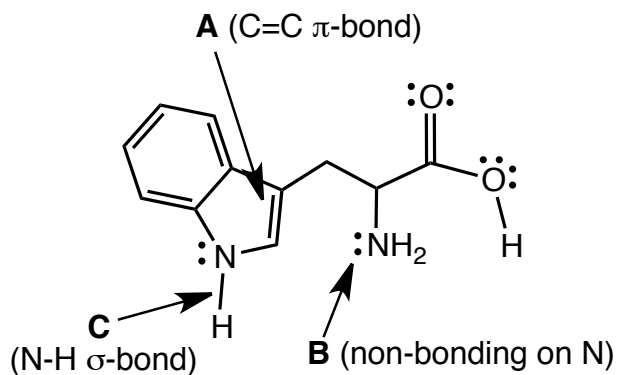
Question 6. (12 pts). Indicate the direction of the MOLECULAR dipole moments in the following.



Question 7 (27 pts.) Shown below is the simplest amino acid, glycine, in its neutral form. For the orbitals indicated, draw directly ON TOP of the molecule either Ψ or Ψ^2 as requested (read the question carefully!) and **indicate the appropriate atomic orbitals that are involved**. For drawings of Ψ , **indicate ALL NODES**. For drawings of Ψ^2 , **indicate all places where the probability of finding the electrons is zero**.

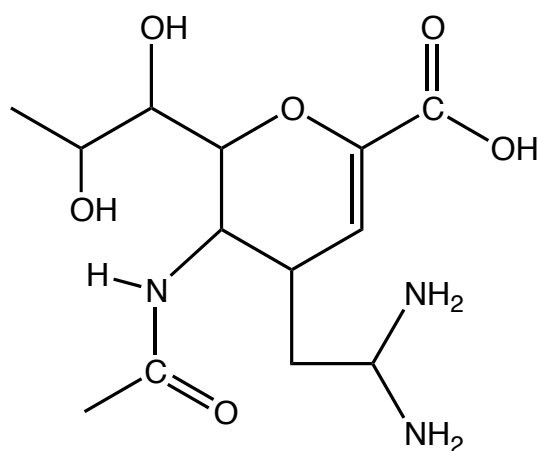


Question 8 (16 pts.) Rank the indicated pairs of electrons **A - C** in the essential amino acid tryptophan (shown in its neutral form) in order of increasing energy. Give a BRIEF explanation for your choice (all of the points are for the explanation, not the order)



_____ < _____ < _____
 lowest energy highest energy

Question 9 (16 pts.) Circle and identify all functional groups in the following structure, ignore alkyl groups. Indicate any amines, amides or alcohols as primary, secondary or tertiary, as appropriate. Non-bonding electrons are omitted in this structure for clarity.



structure based on that of
Relenza - a flu drug