Chem 3331 Sammakia Fall 2015 Midterm 1

Name _____

page	possible points:
2	(16)
3	(16)
4	(33)
5	(35)
Total	(100)

Periodic Table

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Ha	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

Please sit with an empty seat between you and your neighbors.

Unless specifically asked, you do not have to draw mechanisms for reactions.

Feel free to ask questions about the questions, but please don't ask questions about your answers, it distracts your neighbors.

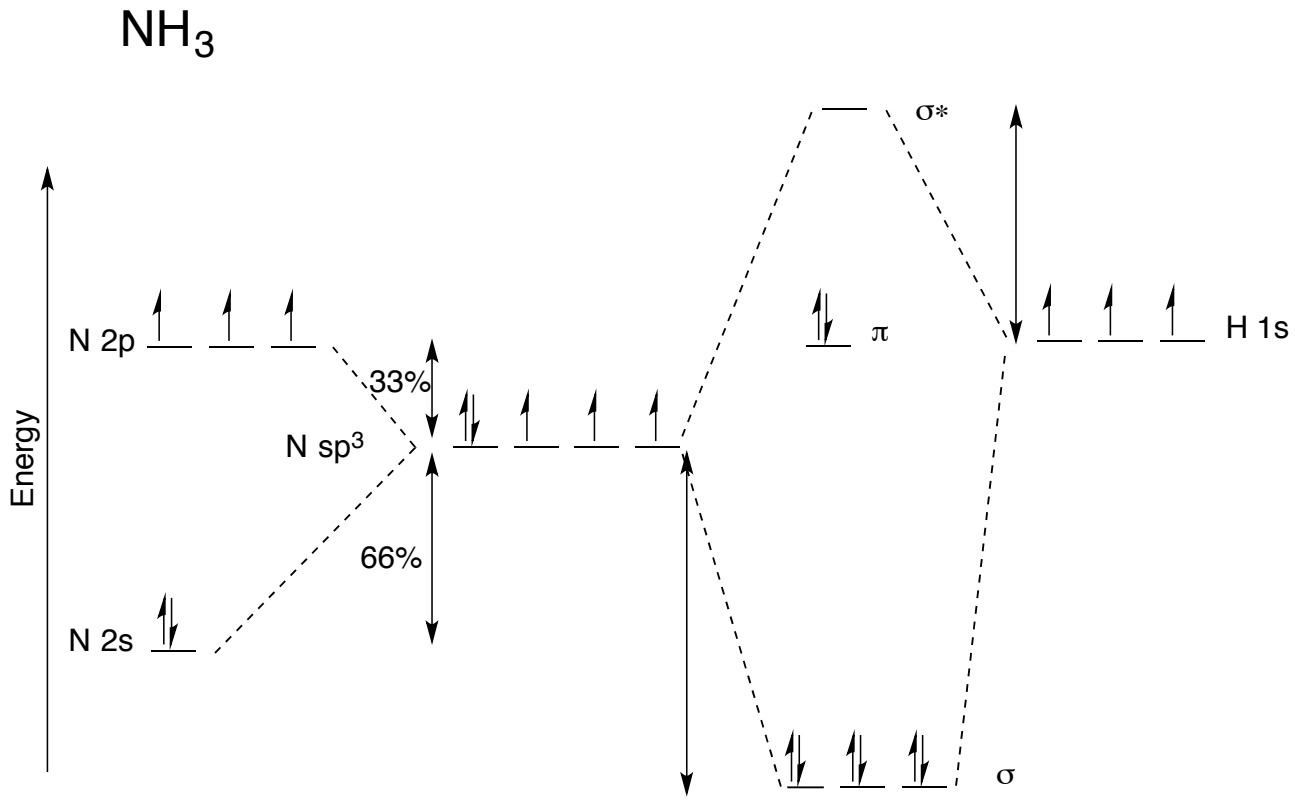
If you are caught cheating or helping anyone cheat or otherwise violating the Honor Code , you will be referred to the Honor Code Council and if found in violation, you will receive and academic sanction up to an F in the class. I don't take Honor Code Violations lightly, so DON'T CHEAT (please)!

1) Provide a definition of the following in one or two sentences (6 pts total):

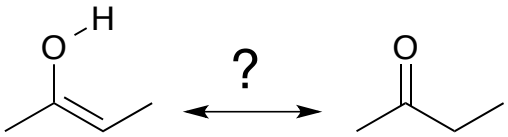
Electrophile:

Anti-bonding Molecular Orbital:

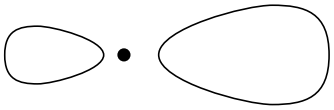
2) Below is a molecular orbital diagram for ammonia that contains errors. Circle all the errors and provide a few words describing the error. If you circle things that are not errors, points will be deducted. If your explanation is wrong, points will be deducted (10 pts total).



3) Are the structures drawn below resonance structures? If they are resonance structures, draw arrows showing the movement of electrons, and circle the most important contributor to the overall structure of the molecule. If they are not resonance structures, explain why not in a few words (4 pts).

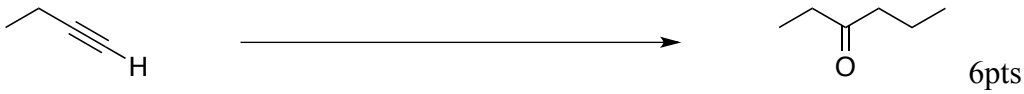


4) A carbon sp hybrid orbital is show in the figure below (6 pts total).
a) Write the mathematical sign of the wave function in each lobe of the orbital.
b) Is this considered an atomic orbital or a molecular orbital? Explain your answer in one sentence.



5) Consider two 2sp hybrid orbitals, one on each of two atoms, oriented head-to-head as in the figure below. Imagine bringing the nuclei closer together until the orbitals overlap and a bond is formed. Sketch the shape of the resulting bonding and anti-bonding molecular orbitals. Pay close attention to the following (6 pts total)
• The sizes of the various lobes
• The signs of the wave function at the various lobes
• The location of all nodes in your drawing (indicate this with a dashed line).

6) Complete the following syntheses using any organic molecule of 5 carbons or less and any reagents you need. You do not have to show the synthesis of the 5-carbon or less molecule you use. If your synthesis requires more than one step, you must provide the product after each step. All chiral products are racemic mixtures and you do not need to show mechanisms.

a) 

6pts

b) 

9 pts

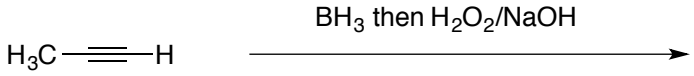
c) 

9 pts

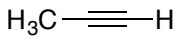
d) 

9 pts

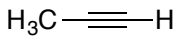
7) Provide the products and mechanisms for the reaction shown below. Show every intermediate with the proper charges and all the arrows required for each step of the reaction including any workup steps (3 pts for product, 10 pts for mechanism)



8) We saw that molecules can act sometimes act as acids and sometimes as bases.
a) Give an example of a reaction we have seen this semester where the alkyne shown below acts as a Brønsted acid in the first step of the mechanism. Provide the reagents and the first step of the mechanism (6 pts).

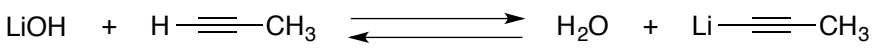


a) Give an example of a reaction we have seen this semester where the alkyne shown below acts as a Brønsted base in the first step of the mechanism. Provide the reagents and the first step of the mechanism (6 pts).



9a) Provide the p*K*a of the following: H_2O_____ acetylene_____ (10 pts total)

9b) What is the equilibrium constant for the reaction shown below:



Tear this page out to use for scratch paper