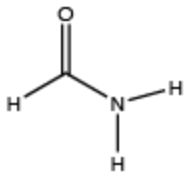
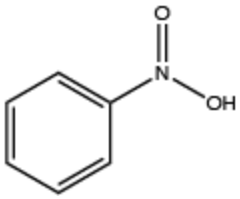
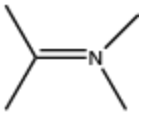
Name:_____ S17BioE11 Orgo Midterm February 16, 2017

Warning: formal charges not always indicated/drawn, but you should in your answers!

1. Draw resonance forms for the following structures. (9 pts).







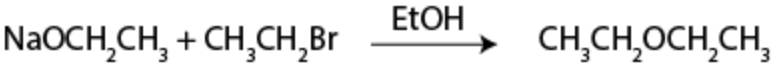
2. Which is more stable, O_2 or O_2^+? Explain your rationales using molecular orbitals and calculations of the bonding orders for both. (12 pts).

3. Identify if the below molecules are nucleophilic or electrophilic and where the electrons would originate or attack. (5 pts).

H_2S

CH_2O

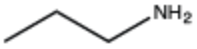
4. For the following SN2 reaction: (6 pts).



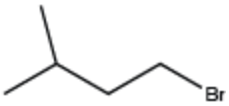
a) Replace bromoethane with bromomethane. Will the reaction happen slower, faster, or at the same rate?

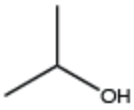
b) Replace EtBr with $EtNH_3$? Will the reaction happen slower, faster, or at the same rate?

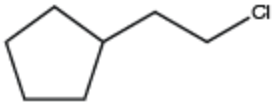
5. Which of the following compounds would be expected to react in an SN2 manner at a reasonable rate with sodium azide (NaN_3) under basic conditions in an aprotic solvent? For those that do not react at a reasonable rate, explain why not. (12 pts).

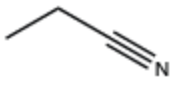
a) 

b) 

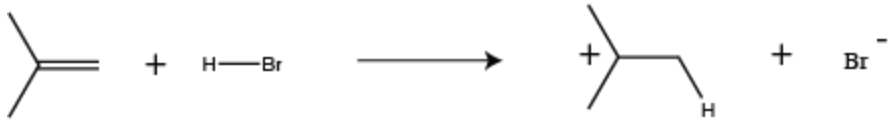
c) 

d) 

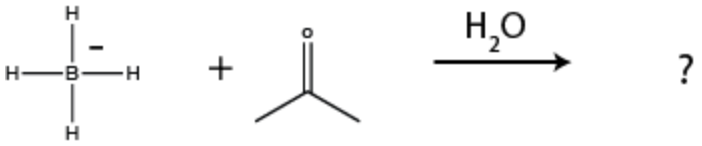
e) 

f) 

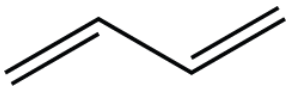
6. For the following reaction, identify the HOMO and LUMO: (8 pts).



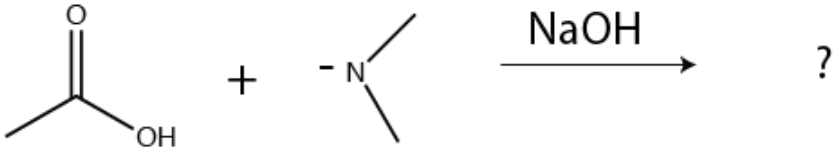
7. Draw a mechanism with an arrow-pushing mechanism for the following reaction: (5 pts).



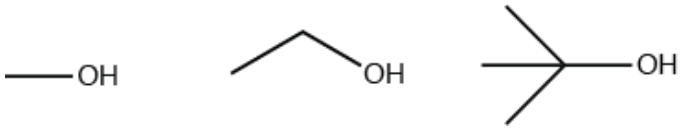
8. Draw the molecular orbitals participating in pi bonding for the below allyl. How many electrons are in this pi system. Fill up the orbitals with electrons. (8 pts).



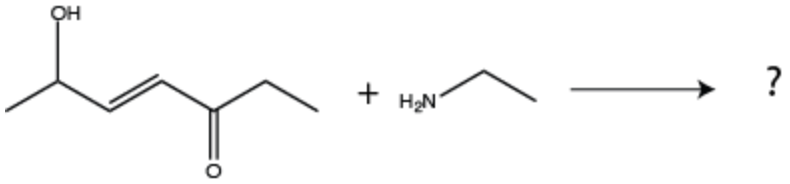
9. Will a product be formed? If yes, what product? If no, explain why not. (8 pts).



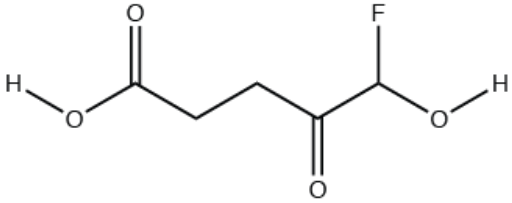
10. Which molecule is the best acid of those listed below? (6 pts).



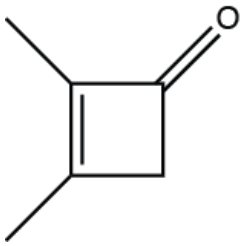
11. Draw the mechanism and product for the following reaction: (6 pts).



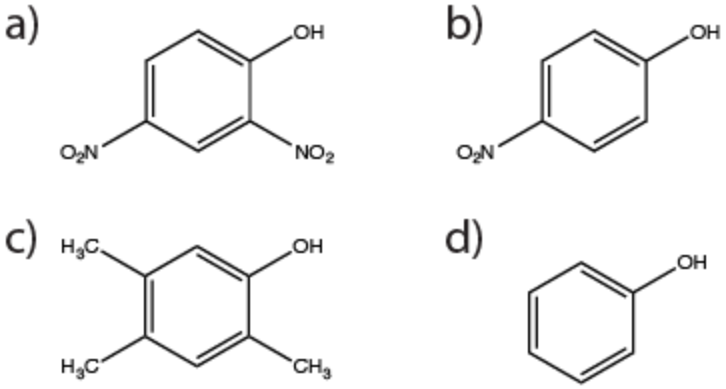
12. Compare the two protons identified below. Which proton is more acidic and explain why? (5 pts).



13. Identify the geometry for every atom in the compound. (5 pts).



14. These phenols have approximate pK_a values of 4, 7,10, and 11. Suggest with explanations which pK_a value belongs to which phenol. (5 pts).

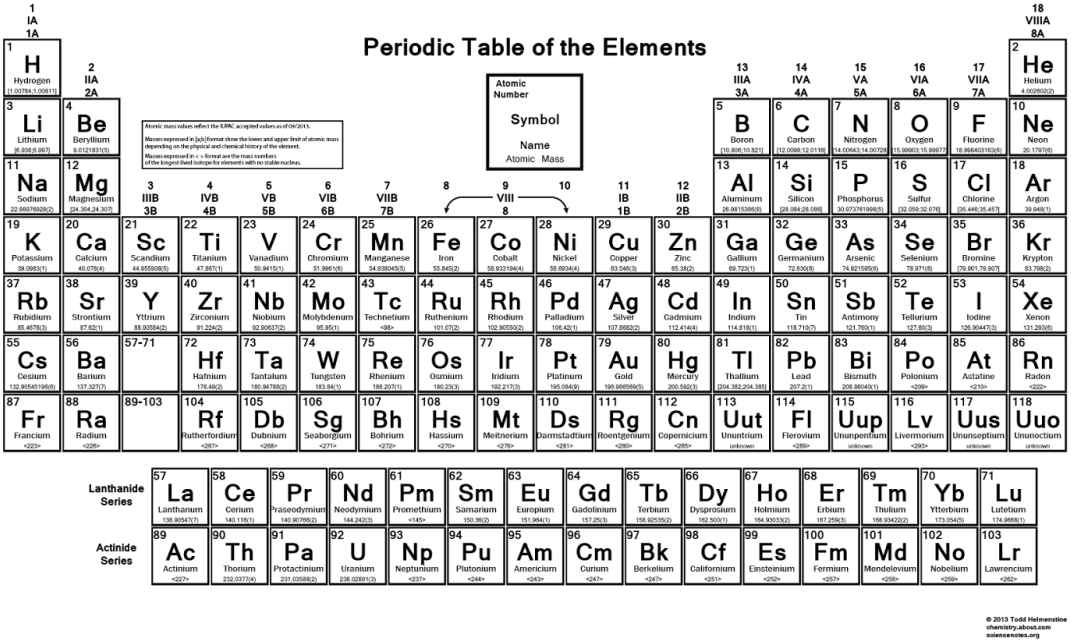


a)

b)

c)

d)


Periodic Table of the Elements
Atomic Number
Symbol
Name
Atomic Mass
Atomic mass values reflect the IUPAC accepted values as of 04/2013.
Masses expressed in [a,b] format show the lower and upper limit of atomic mass depending on the physical and chemical history of the element.
Masses expressed in < > format are the mass numbers of the longest-lived isotope for elements with no stable nucleus.
Lanthanide Series
Actinide Series
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