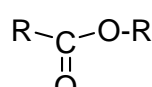
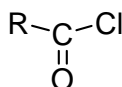
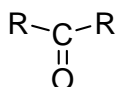
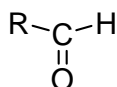
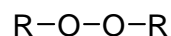
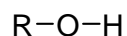
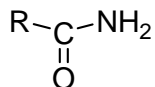


Name _____

1) Identify the class of compounds that the following molecules belong to (12pts).



2) Draw a Lewis structure **including lone pairs** for the following similar but different species: (12pts)

Nitronium Ion NO_2^+

Nitrosonium Ion NO^+

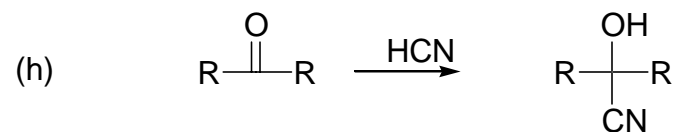
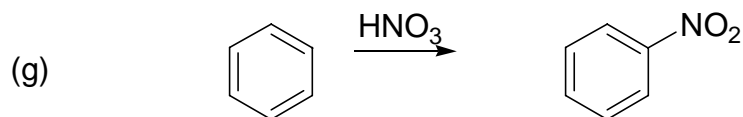
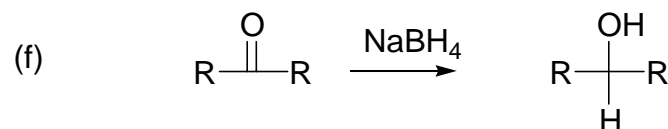
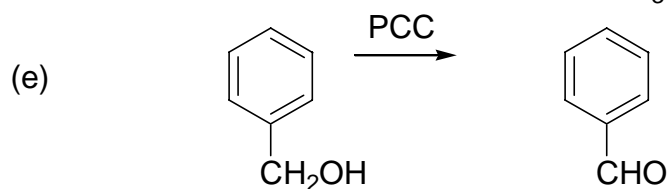
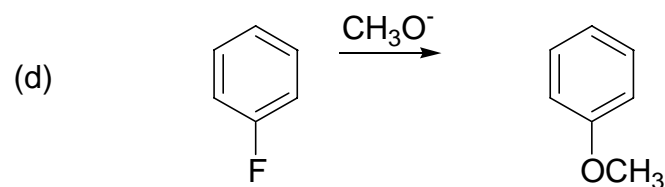
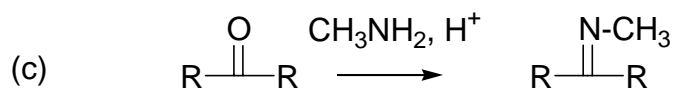
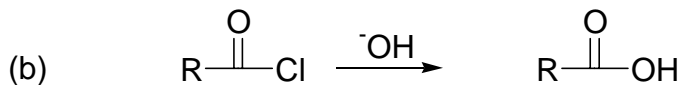
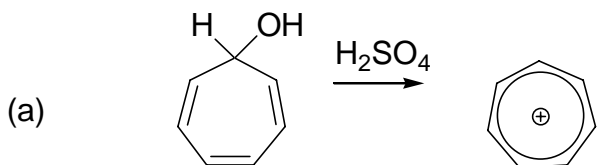
Nitric Acid HONO_2

Nitrous Acid HONO

3) Circle a molecule in (2) with an sp^2 hybridized Nitrogen atom. (1.5pts)

4) Put a cross through a compound in (1) which has ring strain (1.5pts).

5) Identify the general class of each of the below reactions (e.g. oxidation, electrophilic addition, etc) (16pts)



6) Define the following terms (10.5pts).

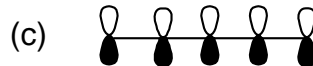
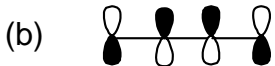
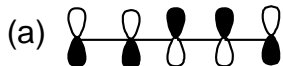
CONCERTED REACTION

PERICYCLIC REACTION

THERMODYNAMIC PRODUCT

7) Give one use of Molecular Orbital theory, and also state a **disadvantage** of MO theory. (4pts).

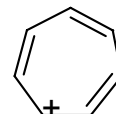
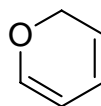
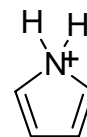
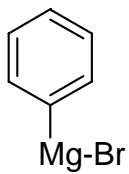
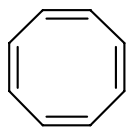
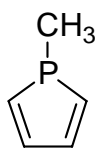
8) State whether each of the following Molecular orbitals are overall bonding, antibonding or nonbonding (4.5pts).



9) Draw two Lewis resonance structures for a carboxylate anion RCO_2^- (4pts).

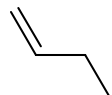
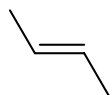
10) Which one is more stable (2pts)?

11) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)

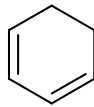
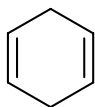


12) Circle the more stable species in these pairs. (8pts)

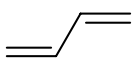
a)



b)



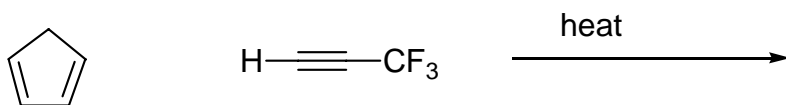
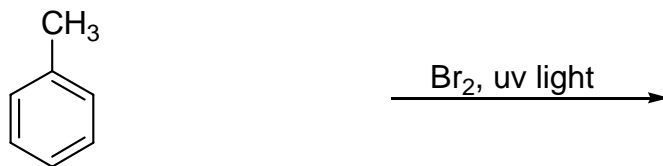
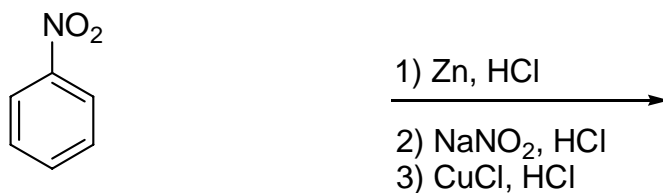
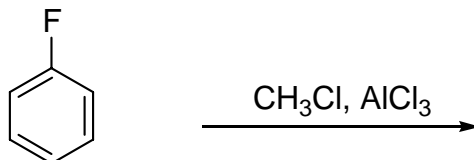
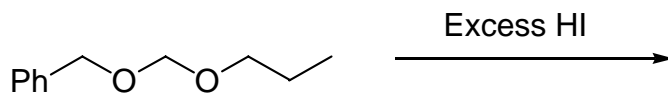
c)



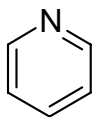
d)



13) Give the products in **six** of the following reactions, paying attention to regio/stereochemistry where applicable. (18pts)



14) The below heterocycle is pyridine, and it is 6π Hückel aromatic.



Explain why there are 6π electrons (2pts)

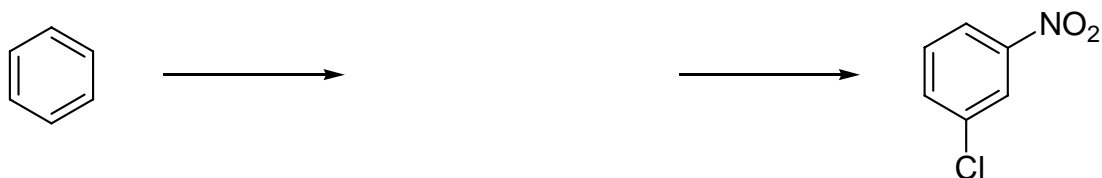
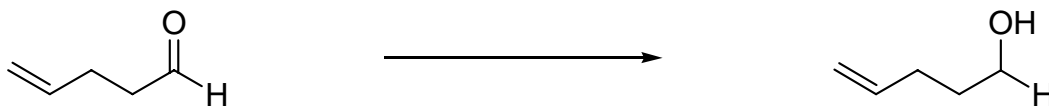
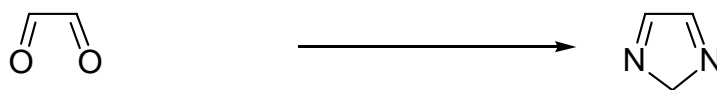
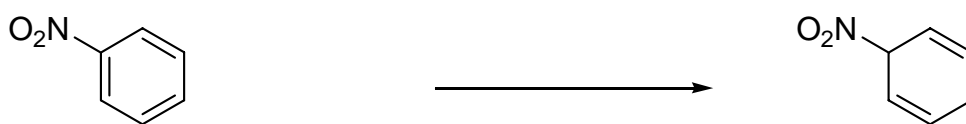
What is the hybridization of the 5 carbons in the ring (1.5pts)

What is the hybridization of the Nitrogen atom (1.5pts)

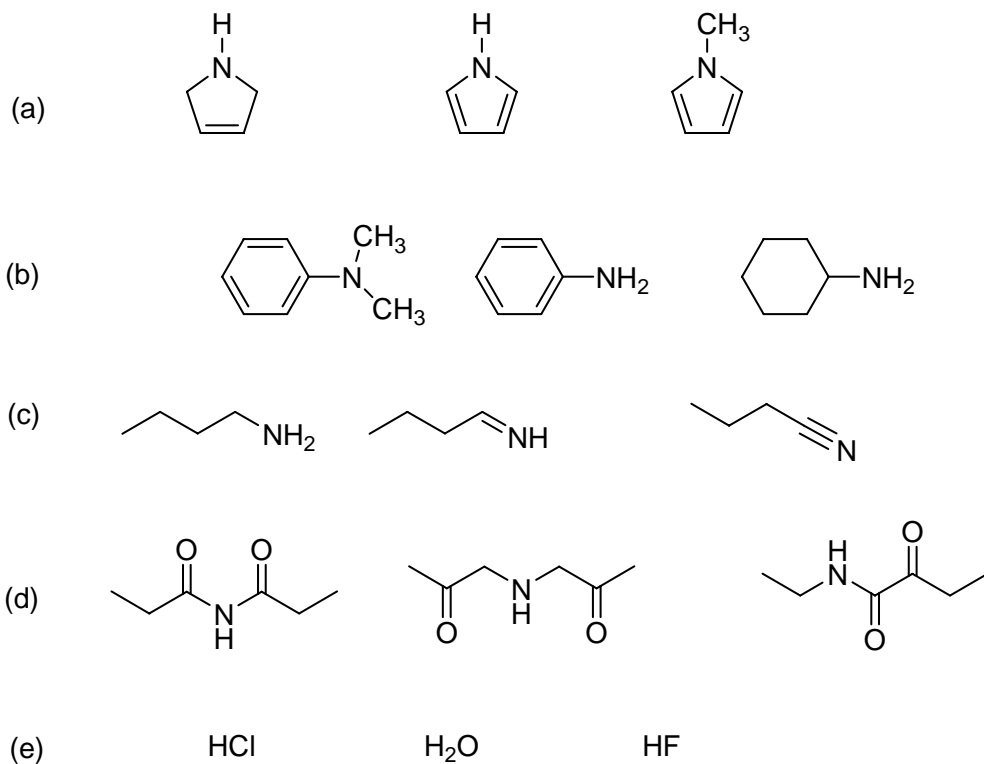
15) Write the mechanism for the electrophilic aromatic substitution reaction below. (8pts)



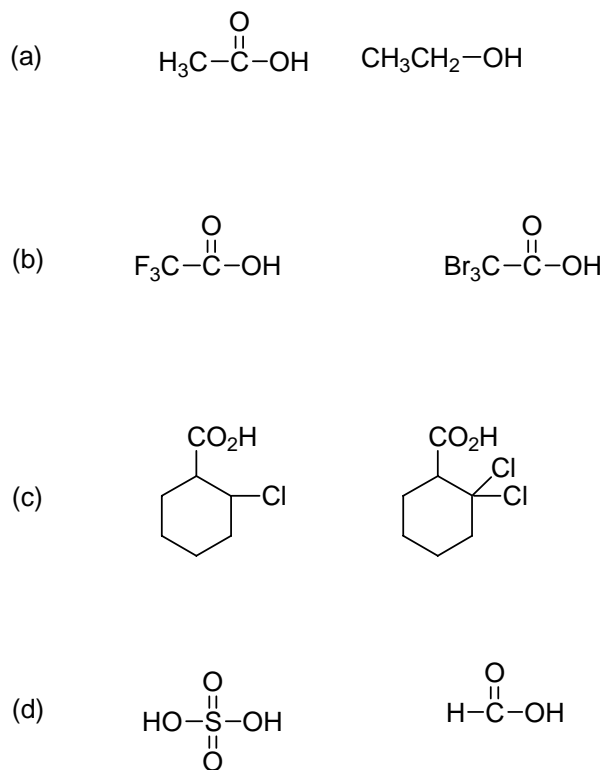
16) Give reagents and conditions to accomplish **five** of the following transformations. (15pts)



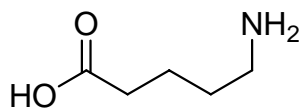
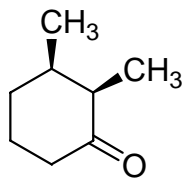
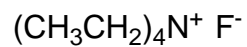
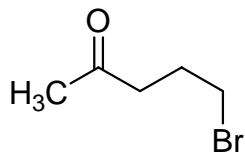
17) Circle the stronger base in the following threesomes. (10pts)



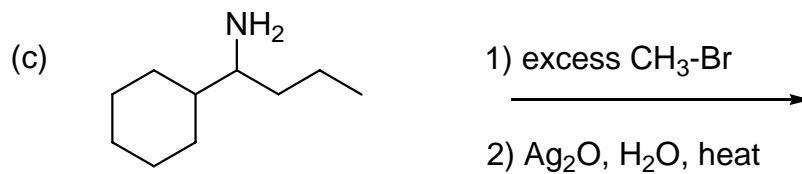
18) Circle the stronger acid in the following pairs. (8pts)



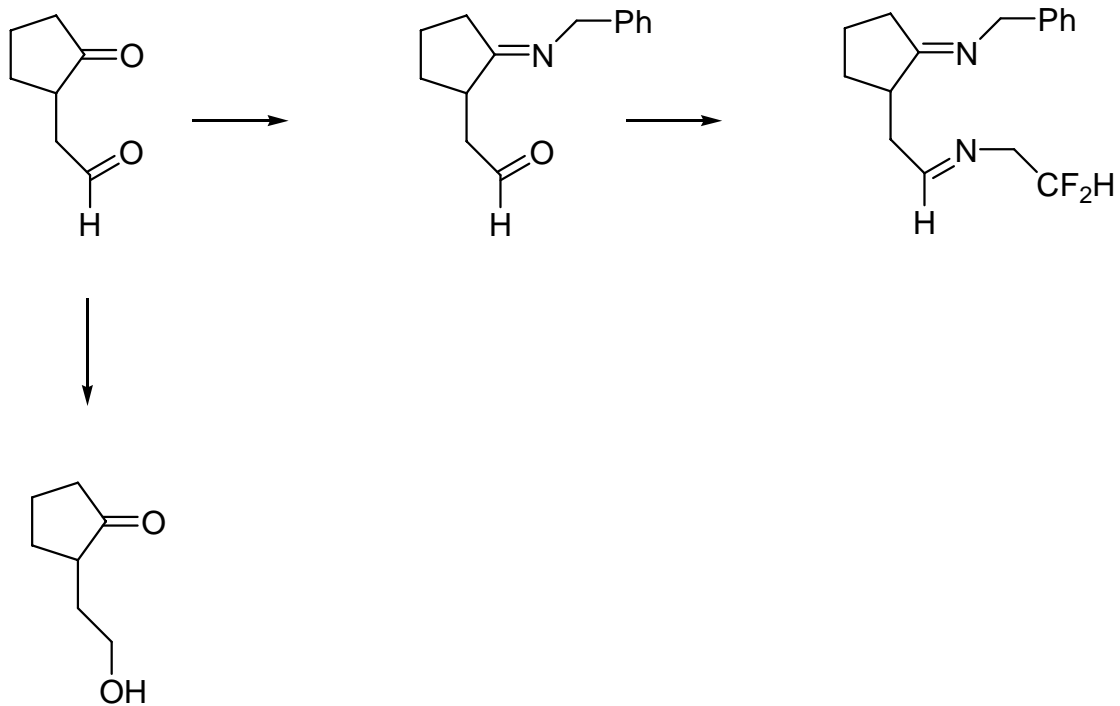
19) Name the following compounds in IUPAC form (14pts).



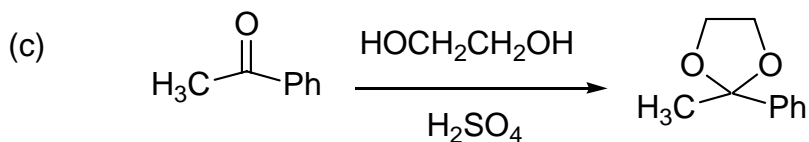
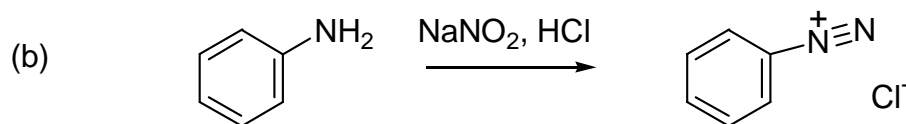
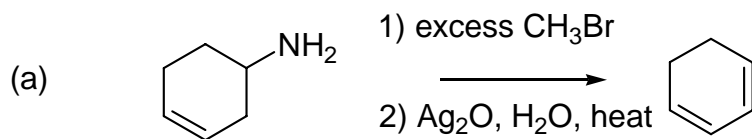
20) Fill in the blanks for **two** of the following reactions. (6pts)



21) Give reagents for the following transformations. (9pts)



22) Give the mechanism for **two** of the below conversions. (16pts)

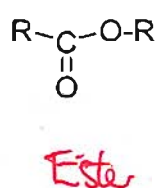
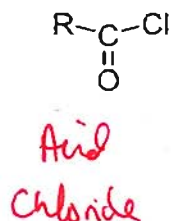
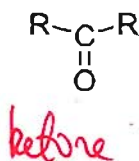
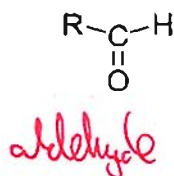
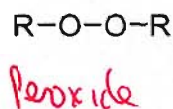
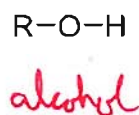
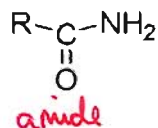


Bonus question (up to 4 points)

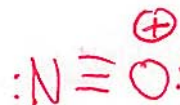
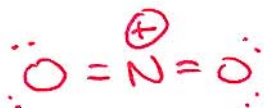
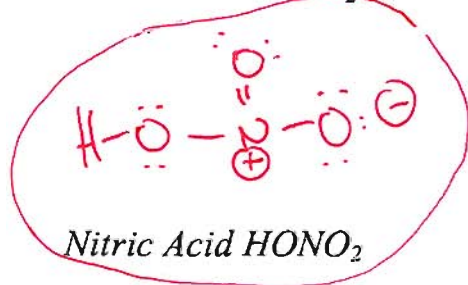
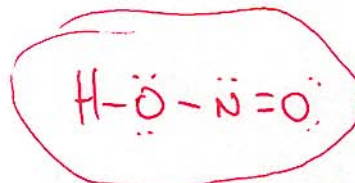
Give four different ways that knowledge of organic chemistry could help you make money.

Name BEA C. IN YA

1) Identify the class of compounds that the following molecules belong to (12pts).



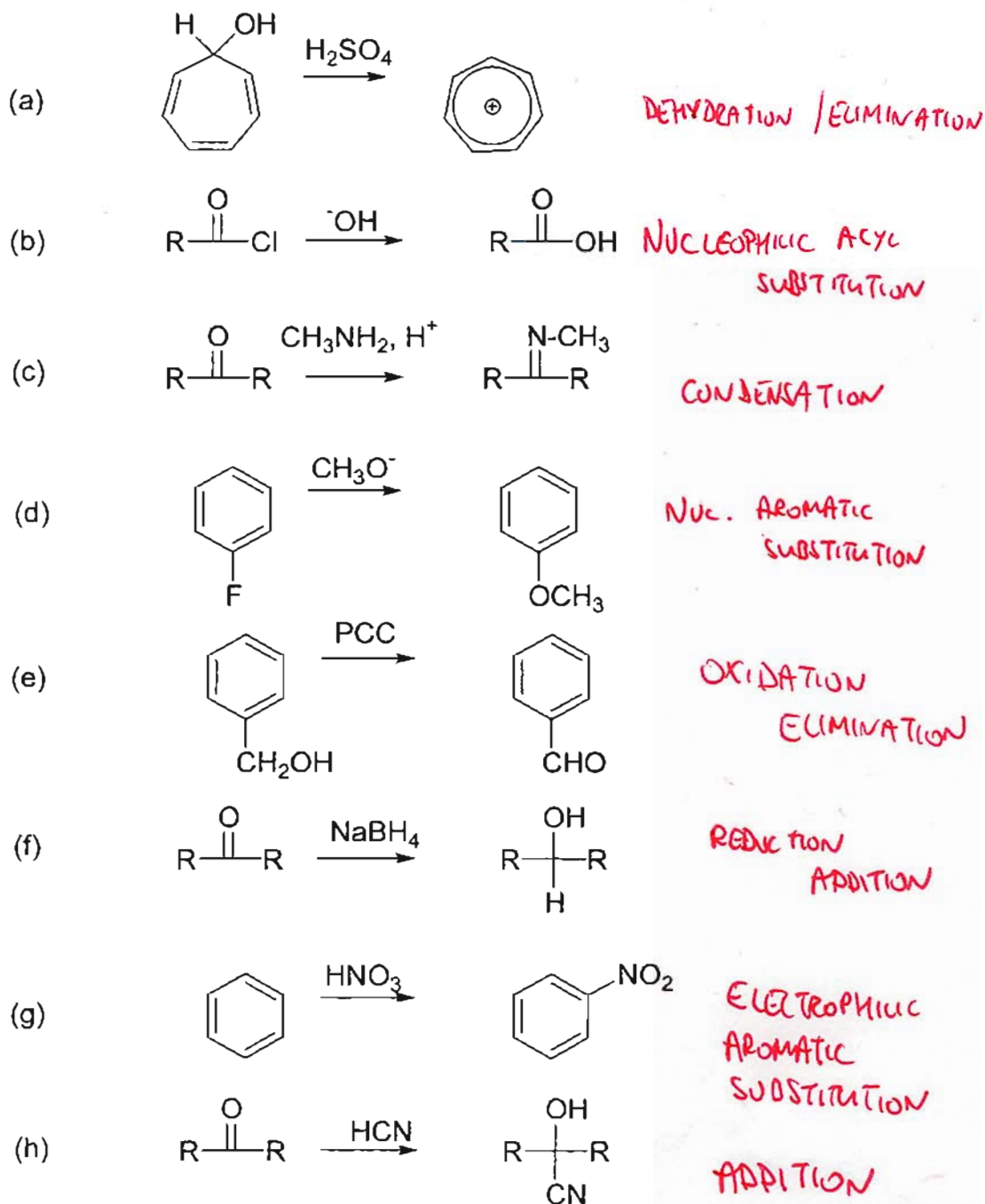
2) Draw a Lewis structure **including lone pairs** for the following similar but different species: (12pts)

Nitronium Ion NO_2^+ Nitric Acid HONO_2 Nitrosonium Ion NO^+ Nitrous Acid HONO

3) Circle a molecule in (2) with an sp^2 hybridized Nitrogen atom. (1.5pts)

4) Put a cross through a compound in (1) which has ring strain (1.5pts).

5) Identify the general class of each of the below reactions (e.g. oxidation, electrophilic addition, etc) (16pts)



6) Define the following terms (10.5pts).

CONCERTED REACTION

A reaction that occurs in one step (bond breaking & formation at the same time).

PERICYCLIC REACTION

Electron movement within a closed loop of interacting orbitals.

THERMODYNAMIC PRODUCT

The most stable product.

7) Give one use of Molecular Orbital theory, and also state a **disadvantage** of MO theory. (4pts).

Explains - delocalized bonding/aromaticity/cycloaddition reactions.

It can be complicated or confusing.

8) State whether each of the following Molecular orbitals are overall bonding, antibonding or nonbonding (4.5pts).



NON-BONDING



ANTI-BONDING



BONDING

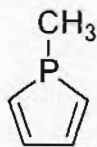
9) Draw two Lewis resonance structures for a carboxylate anion RCO_2^- (4pts).



10) Which one is more stable (2pts)?

Both the same energy.

11) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (15pts)



AROMATIC



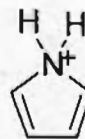
ANTI
AROMATIC



Mg-Br
AROMATIC



NON
AROMATIC



NON
AROMATIC



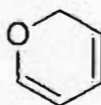
AROMATIC



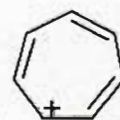
ANTI
AROMATIC



NON
AROMATIC



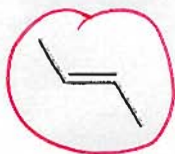
NON
AROMATIC



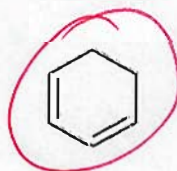
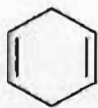
AROMATIC

12) Circle the more stable species in these pairs. (8pts)

a)



b)



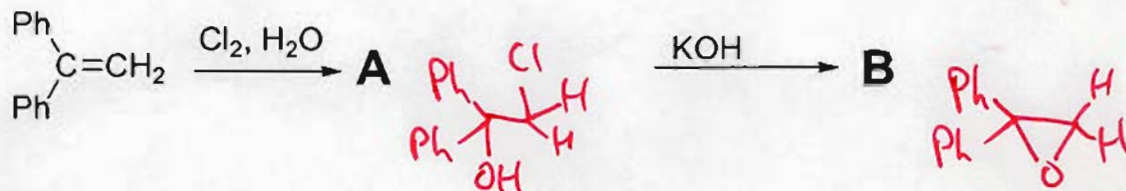
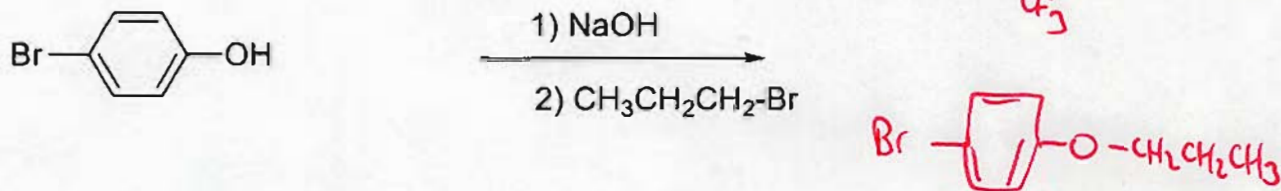
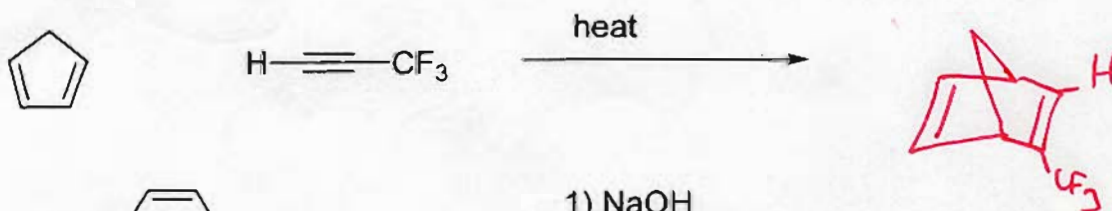
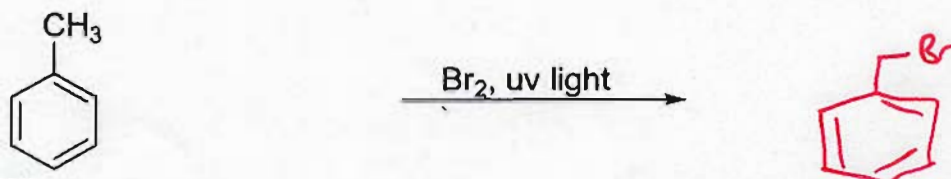
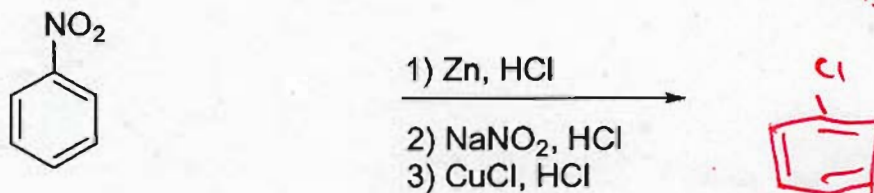
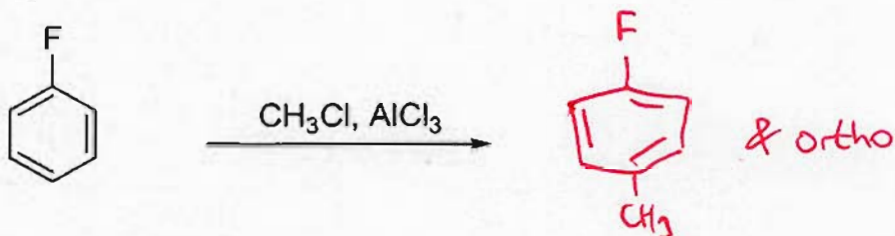
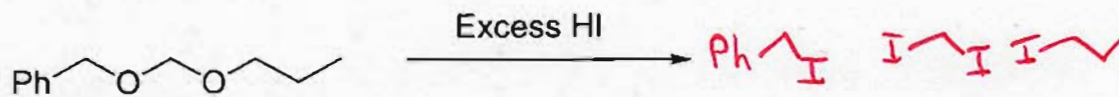
c)



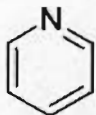
d)



13) Give the products in six of the following reactions, paying attention to regio/stereochemistry where applicable. (18pts)



14) The below heterocycle is pyridine, and it is 6 π Hückel aromatic.



Explain why there are 6 π electrons (2pts)

There are 3 π bonds = 6 electrons.

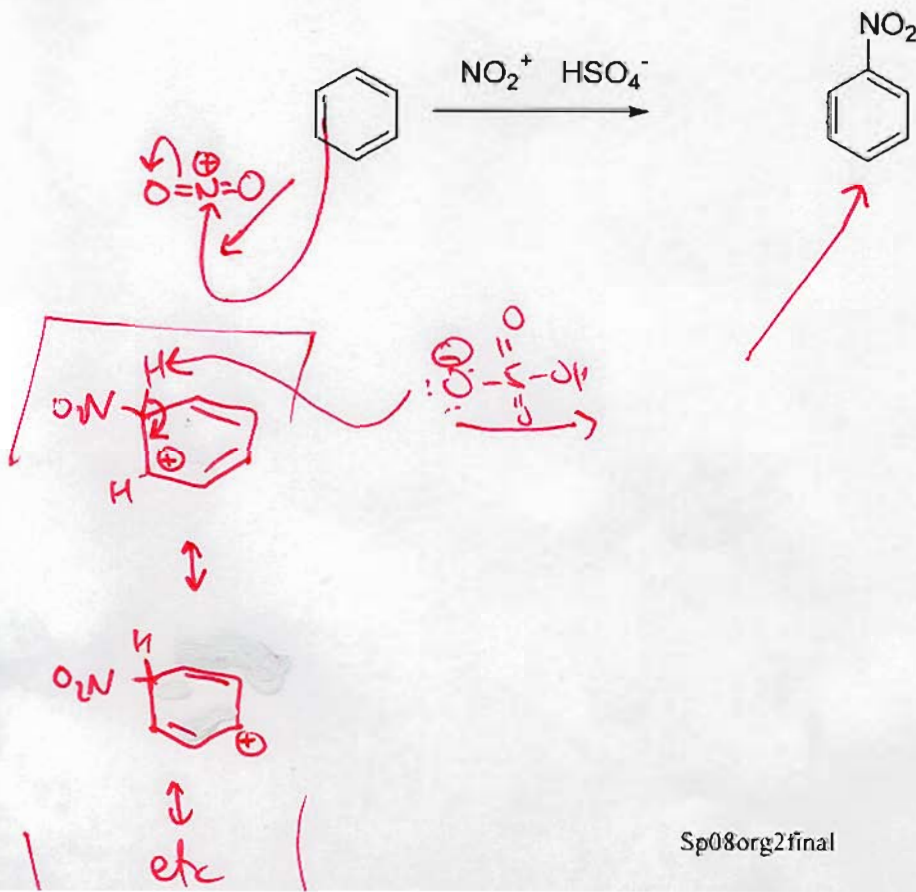
What is the hybridization of the 5 carbons in the ring (1.5pts)

sp^2

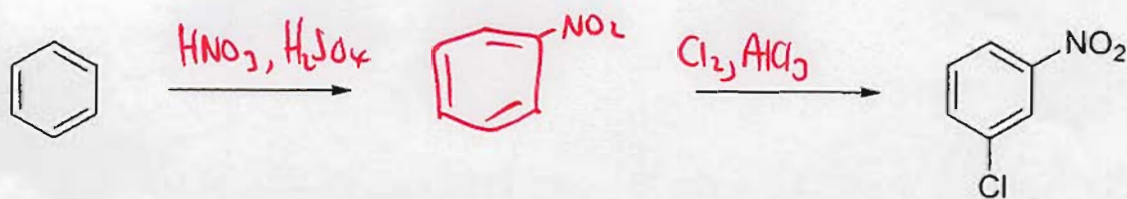
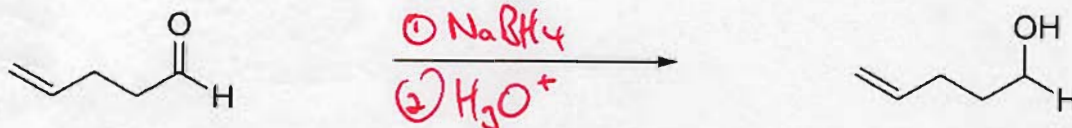
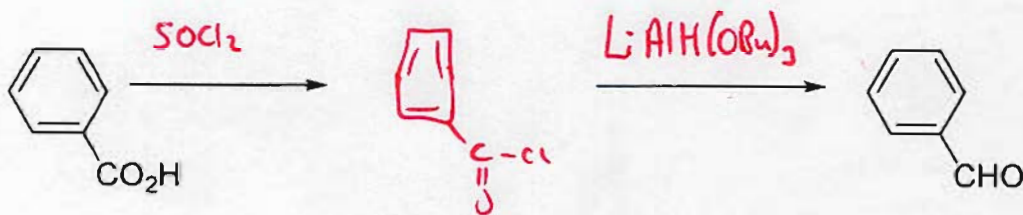
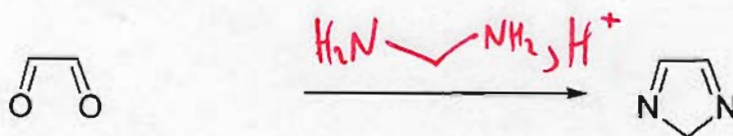
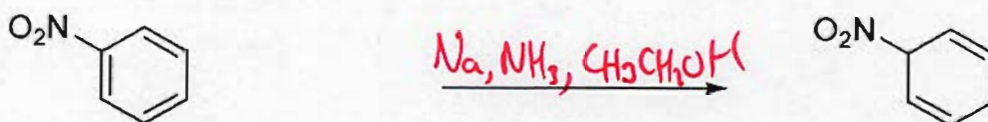
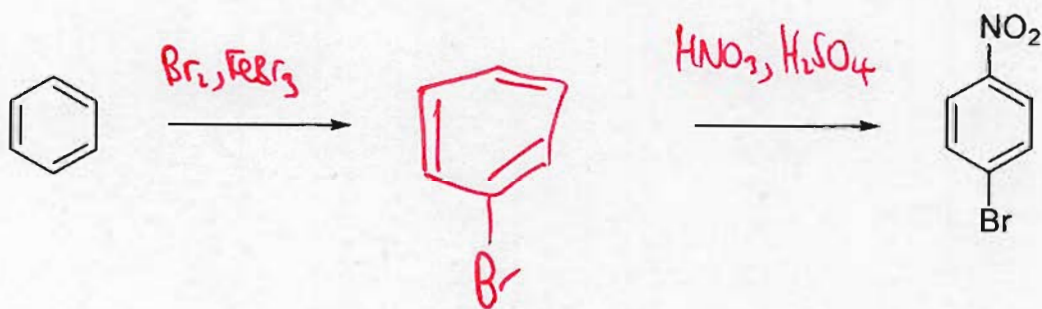
What is the hybridization of the Nitrogen atom (1.5pts)

sp^2

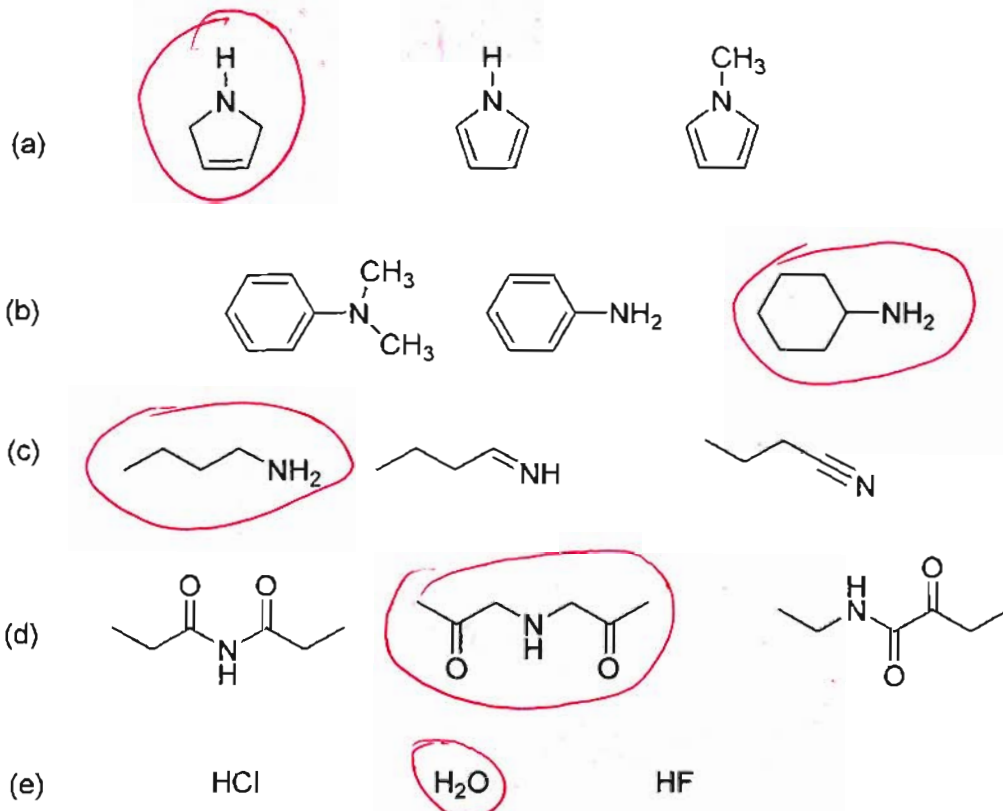
15) Write the mechanism for the electrophilic aromatic substitution reaction below. (8pts)



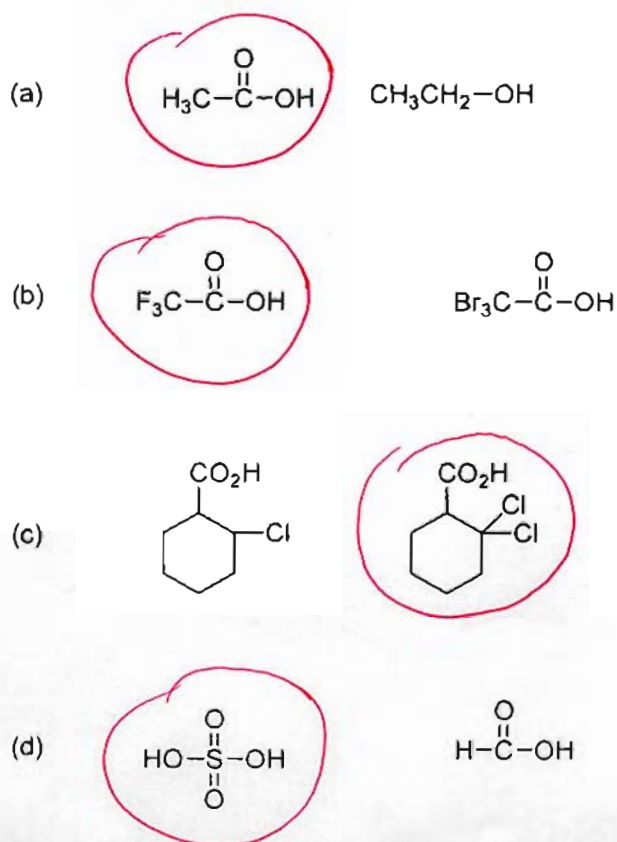
16) Give reagents and conditions to accomplish **five** of the following transformations. (15pts)



17) Circle the stronger base in the following threesomes. (10pts)

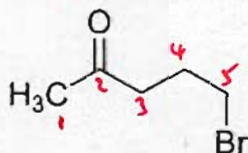


18) Circle the stronger acid in the following pairs. (8pts)

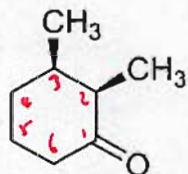
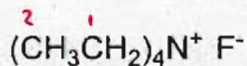


19) Name the following compounds in IUPAC form (14pts).

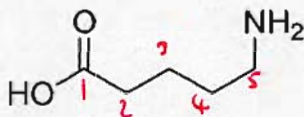
5-Bromo-2-pentanone



Tetraethyl Ammonium
Fluoride

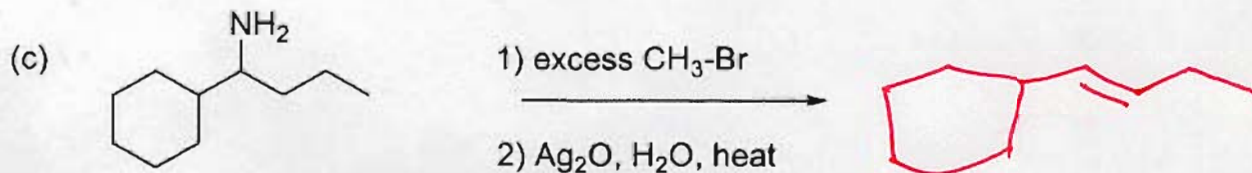
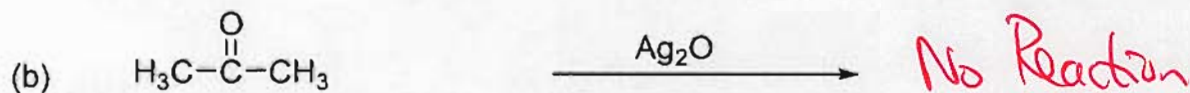


cis-2,3-dimethyl
Cyclohexanone

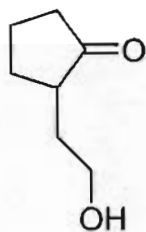
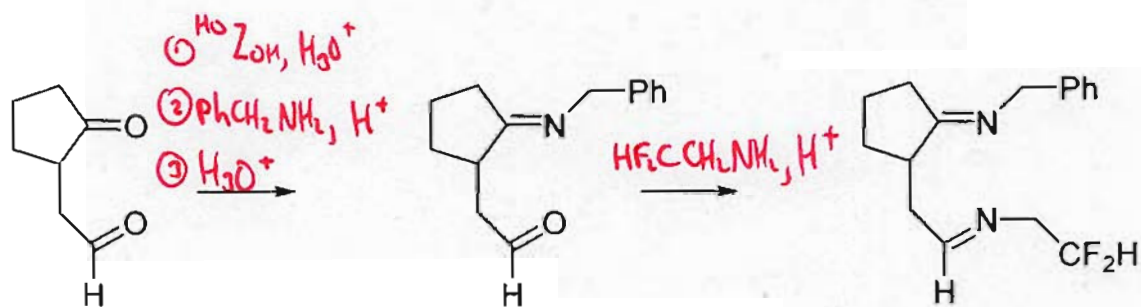


5-aminopentanoic Acid

20) Fill in the blanks for two of the following reactions. (6pts)



21) Give reagents for the following transformations. (9pts)



22) Give the mechanism for **two** of the below conversions. (16pts)

