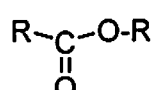
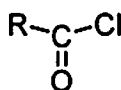
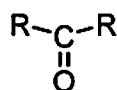
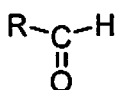
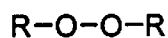
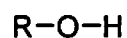
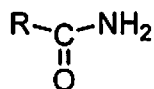


Name _____

1) Identify the class of compounds (functional group) that the following molecules belong to. (8pts)



2) Draw a Lewis structure **including lone pairs** for the following similar but different species. (8pts)

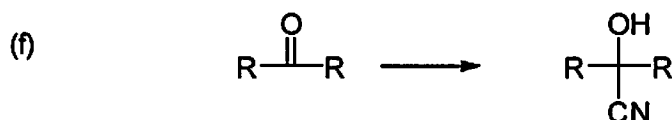
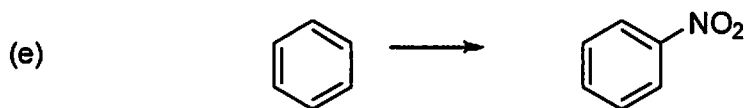
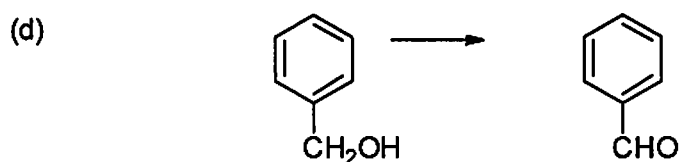
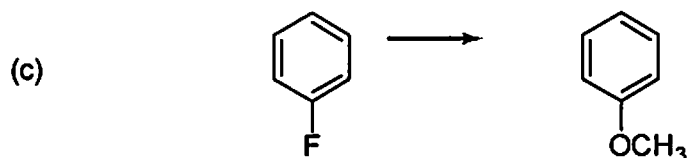
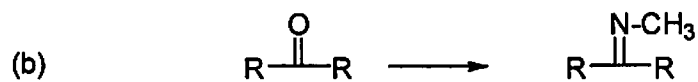
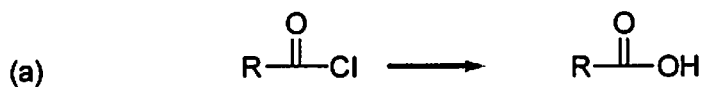
Nitronium Ion NO_2^+

Nitrosonium Ion NO^+

Nitric Acid HONO_2

Nitrous Acid HONO

3) Identify the general class (*addition / elimination / substitution / condensation*) of each of the below reactions. (6pts)



4) Define the following terms. (3x2=6pts)

CONCERTED REACTION

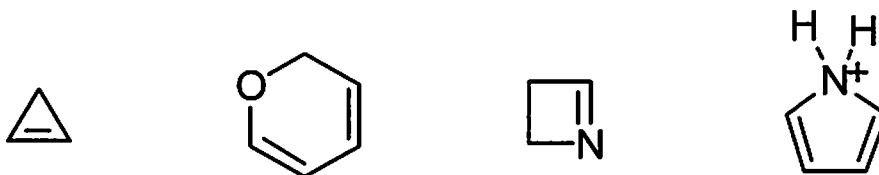
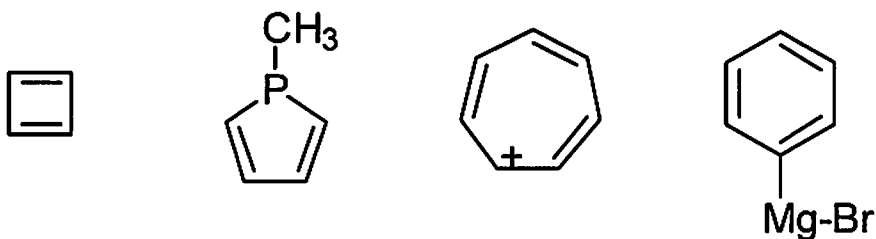
ENDO RULE

THERMODYNAMIC PRODUCT

5) Give one use of Molecular Orbital theory. (1pt)

6) Draw two Lewis resonance structures for a carboxylate anion RCO_2^- and the *curly arrows* that interconvert them. (2+2=4pts)

7) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (8pts)



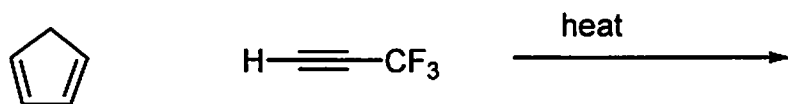
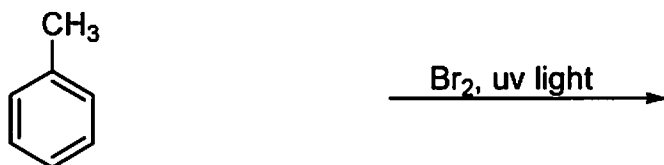
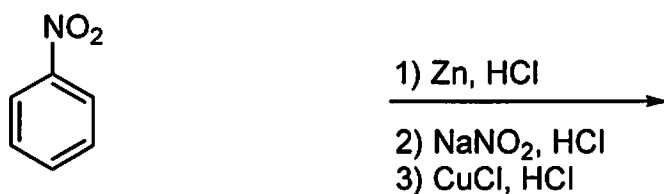
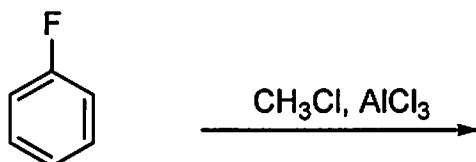
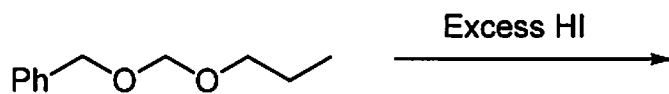
8) Circle the more stable species in these pairs. (4pts)



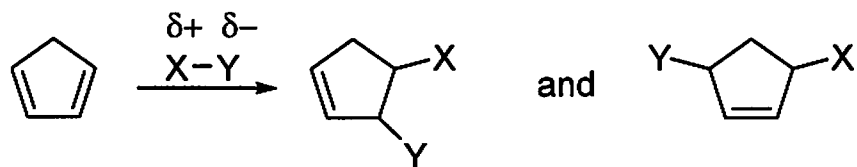
9) (4pts) Write the mechanism (i.e. *curly arrows*) for the reaction of:



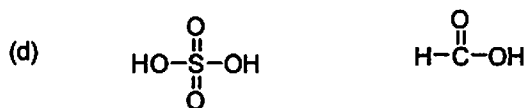
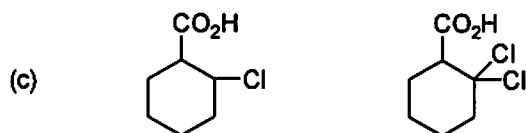
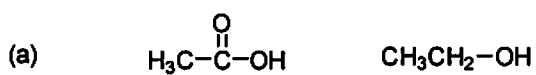
10) Give the products in six of the following reactions, paying attention to regio/stereochemistry where applicable. (6x2=12pts)



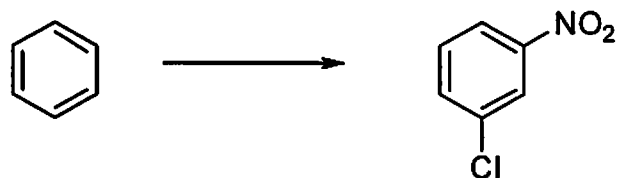
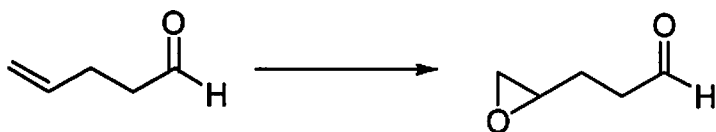
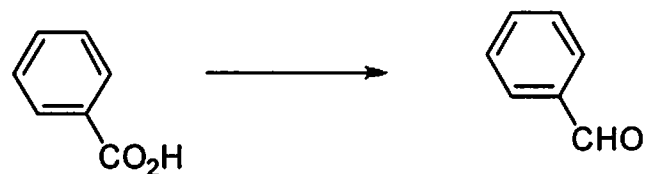
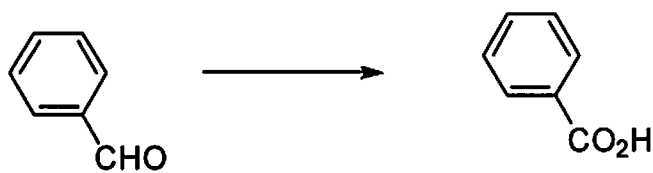
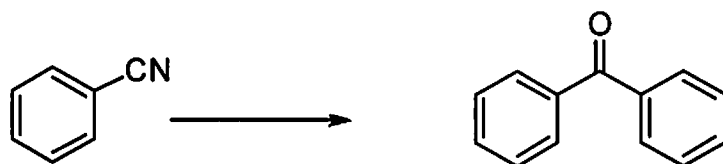
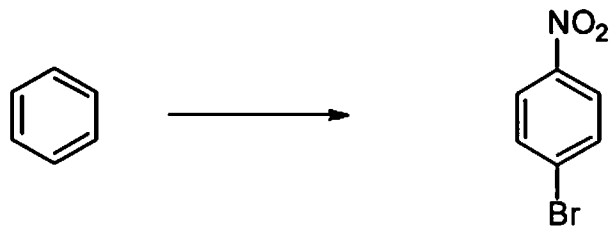
11) (4pts) Draw the mechanism (*i.e. curly arrows*) to show how both products are generated in this electrophilic addition using the polar reagent X-Y.



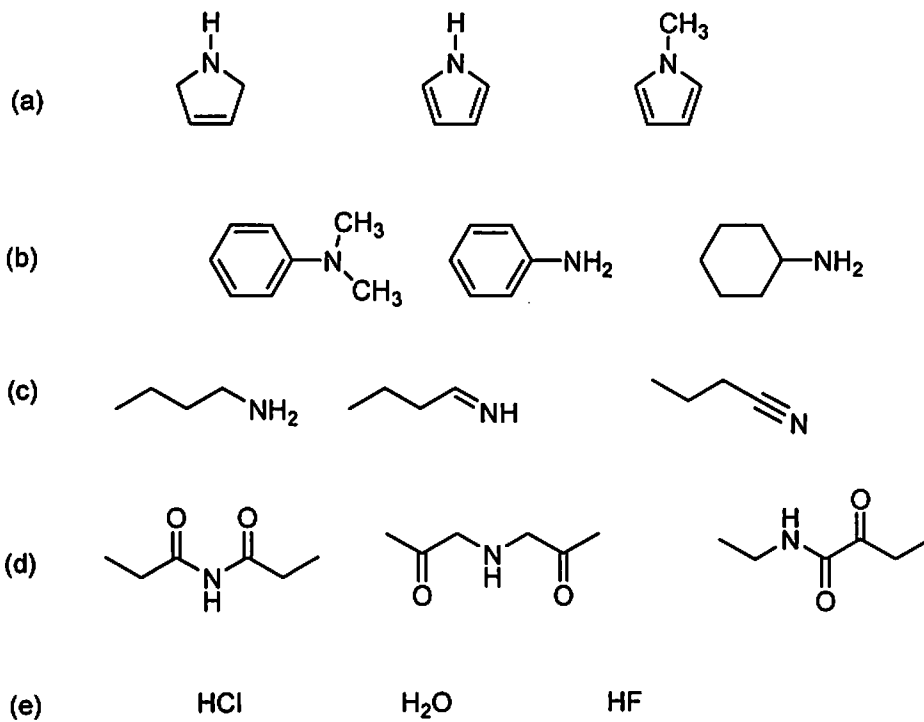
12) Circle the *stronger acid* in the following pairs. (4pts)



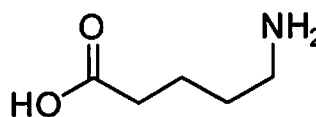
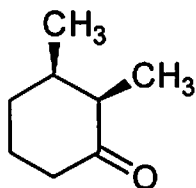
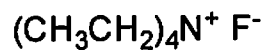
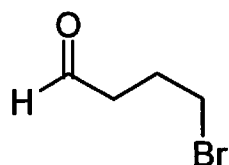
13) Give reagents to accomplish **five** of the following transformations.
(5x2=10pts)



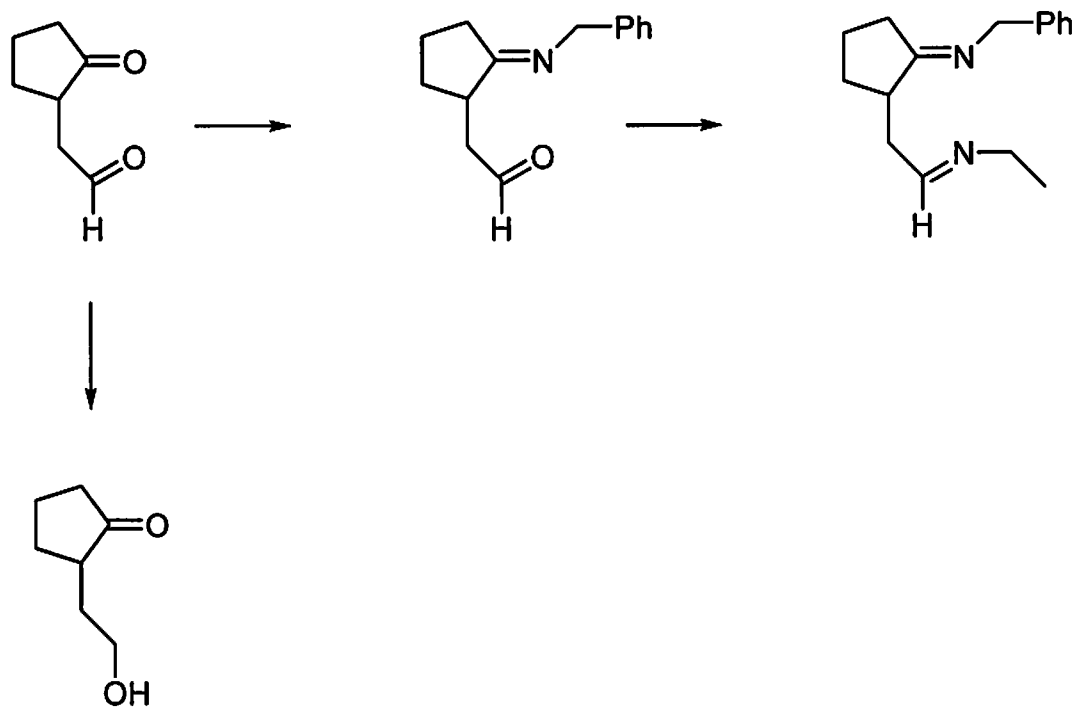
14) Circle the *strongest base* in the following threesomes. (5pts)



15) Name the following compounds in IUPAC form. (2+2+3+3=10pts)



16) Give reagents for the following transformations. (6pts)

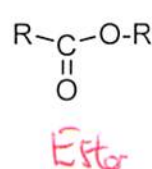
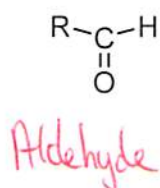
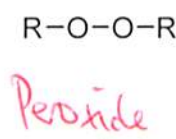
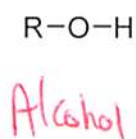
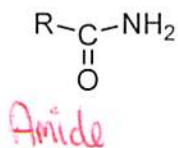


******Bonus question****** (up to 3 points)

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

Name AGENT

1) Identify the class of compounds (functional group) that the following molecules belong to. (8pts)



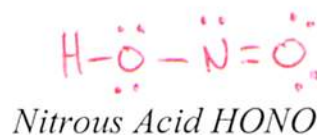
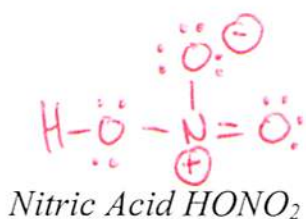
2) Draw a Lewis structure **including lone pairs** for the following similar but different species. (8pts)



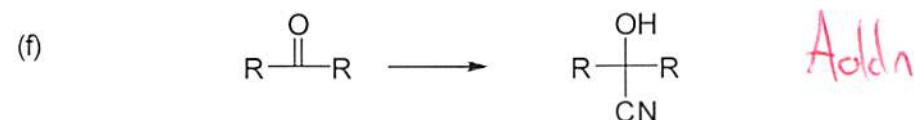
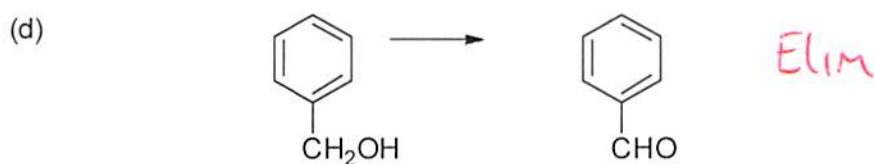
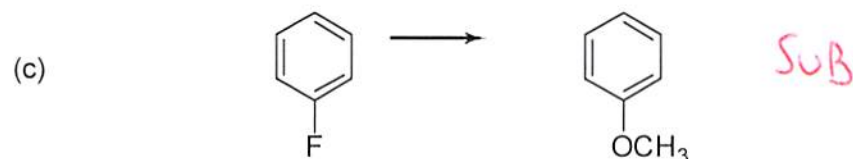
Nitronium Ion NO_2^+



Nitrosonium Ion NO^+



3) Identify the general class (*addition / elimination / substitution / condensation*) of each of the below reactions. (6pts)



4) Define the following terms. (3x2=6pts)

CONCERTED REACTION

A reaction that occurs in a single step.

ENDO RULE

A substituent will prefer to go into the ENDO position in a Diels Alder reaction if the substituent of the dienophile has a π bond.

THERMODYNAMIC PRODUCT

The most stable possible product.

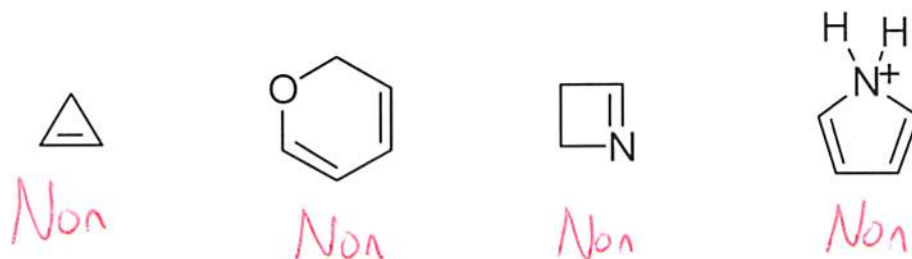
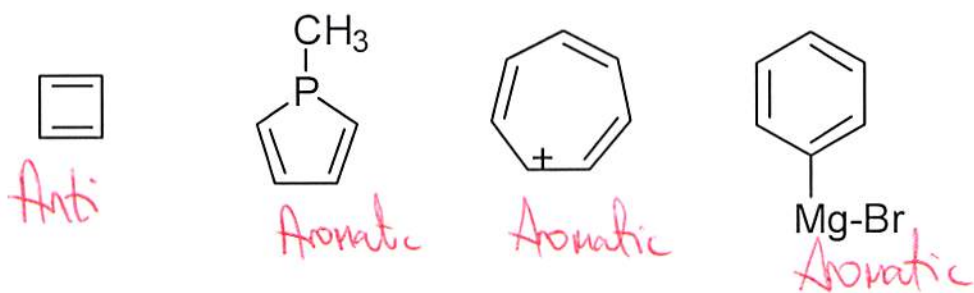
5) Give one use of Molecular Orbital theory. (1pt)

- conjugation
- delocalization of e^s
- resonance
- aromaticity
- aromaticity
- Woodward-Hoffman Rules.

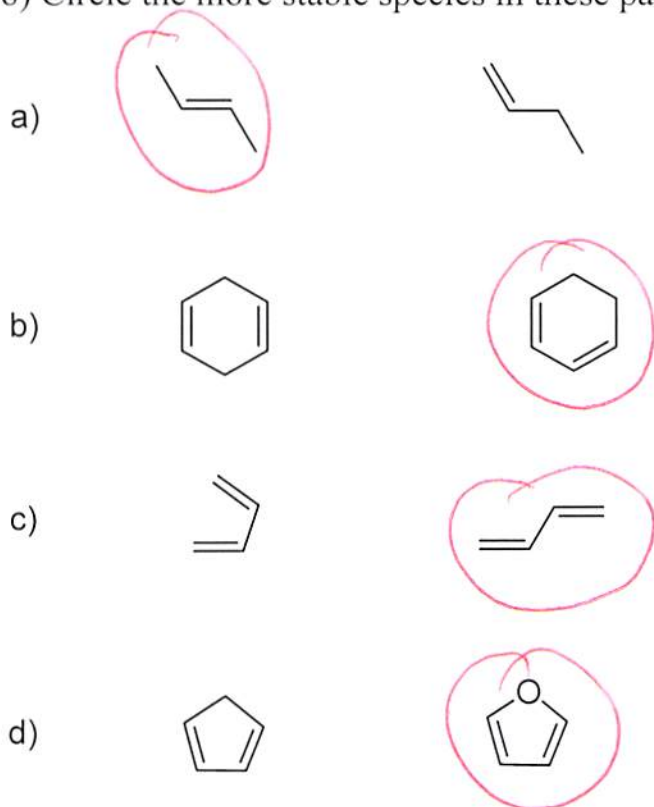
6) Draw two Lewis resonance structures for a carboxylate anion RCO_2^- and the curly arrows that interconvert them. (2+2=4pts)



7) Indicate which of the following molecules are aromatic, non-aromatic or anti-aromatic. (Assume all the molecules are planar). (8pts)

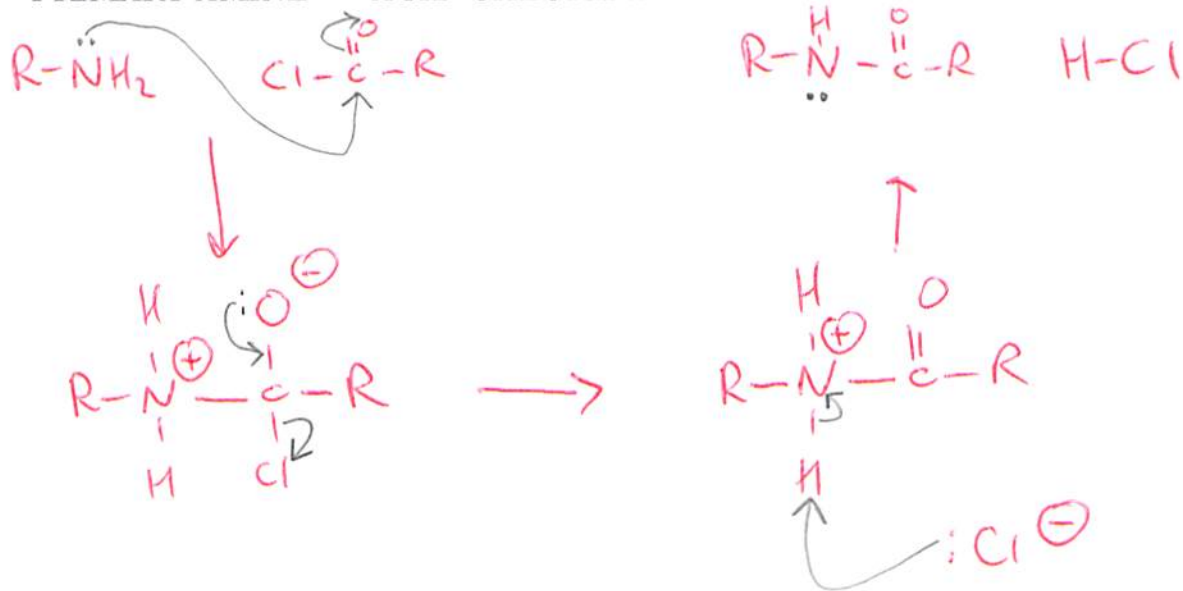


8) Circle the more stable species in these pairs. (4pts)

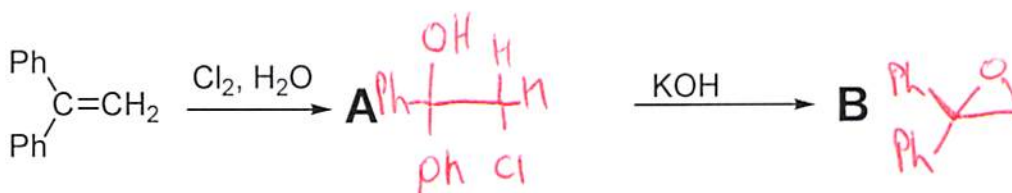
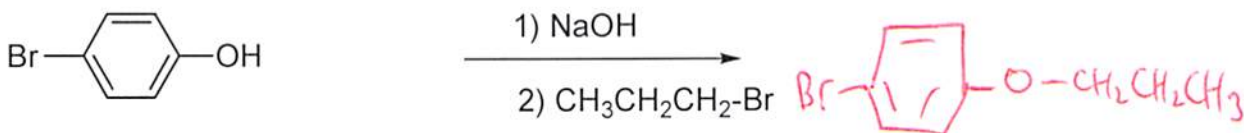
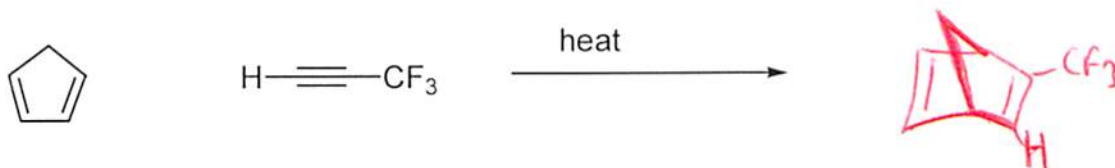
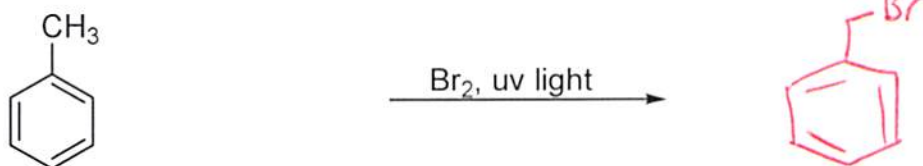
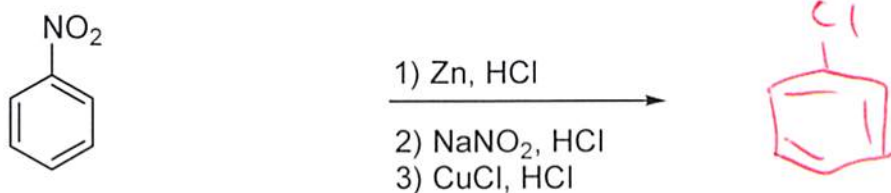
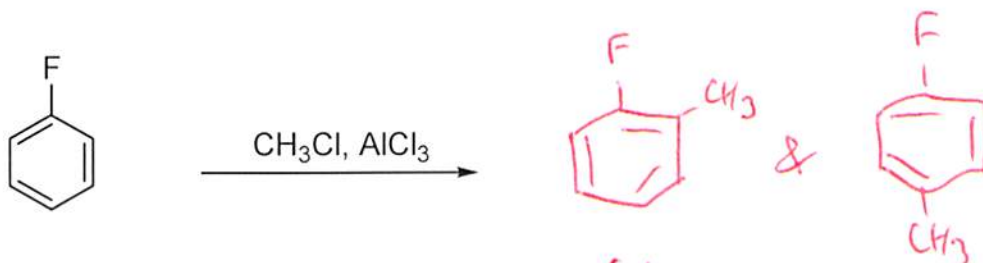
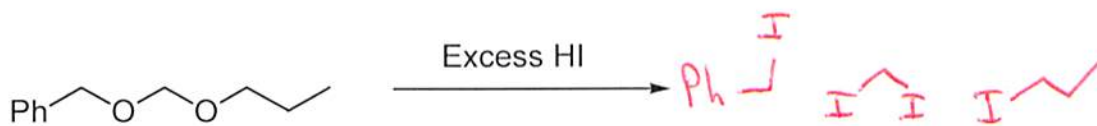


9) (4pts) Write the mechanism (i.e. curly arrows) for the reaction of:

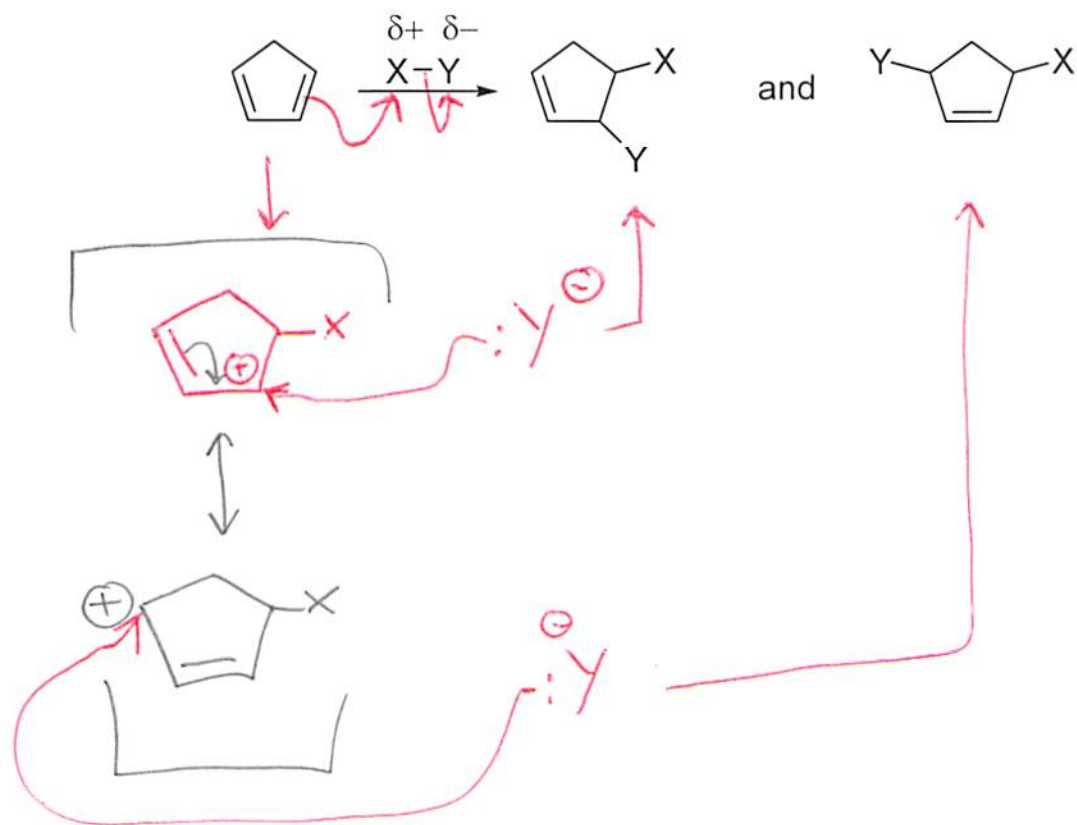
PRIMARY AMINE + ACID CHLORIDE \rightarrow AMIDE + HCl



10) Give the products in six of the following reactions, paying attention to regio/stereochemistry where applicable. (6x2=12pts)



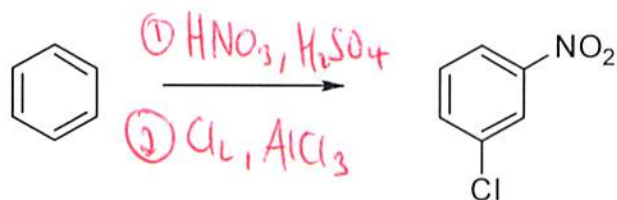
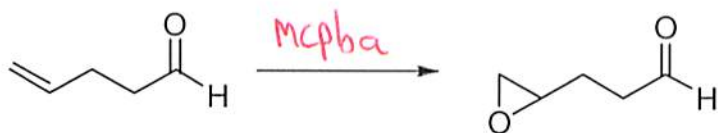
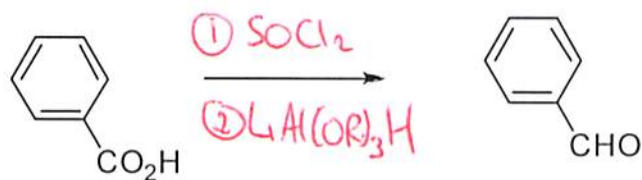
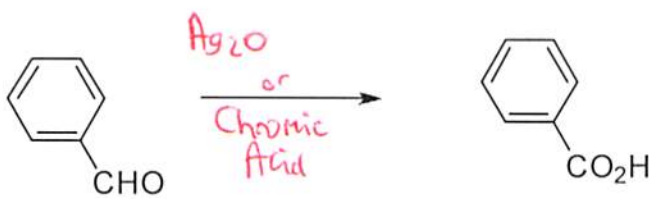
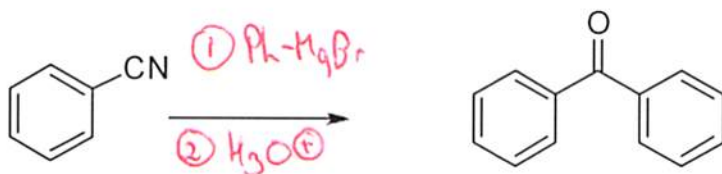
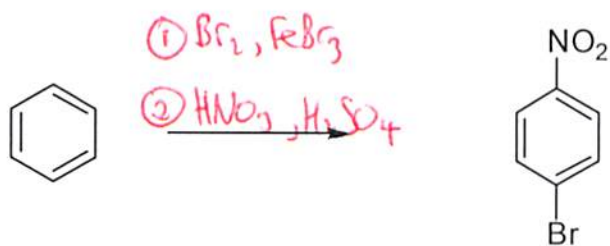
11) (4pts) Draw the mechanism (*i.e. curly arrows*) to show how both products are generated in this electrophilic addition using the polar reagent X-Y.



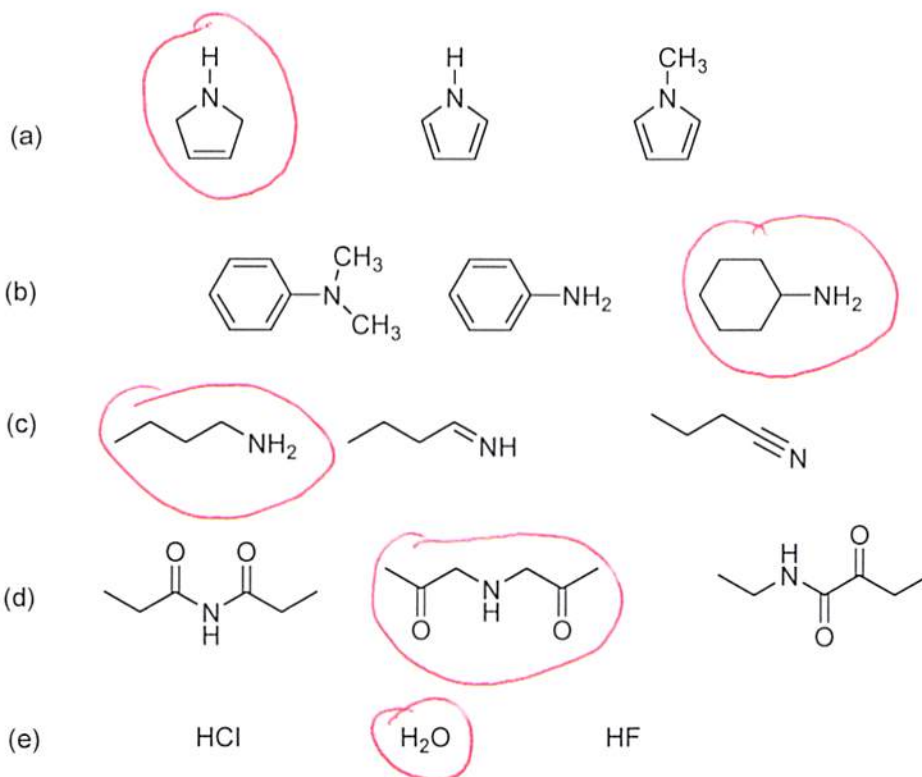
12) Circle the *stronger acid* in the following pairs. (4pts)

- (a) CC(=O)O CCO
- (b) FC(F)F(=O)O BrC(=O)O
- (c) ClC1CCCCC1C(=O)O ClC1(Cl)CCCCC1C(=O)O
- (d) OS(=O)(=O)O OC(=O)O

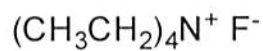
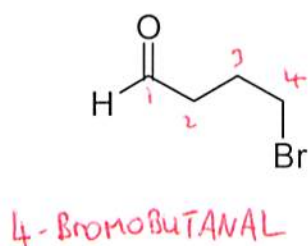
13) Give reagents to accomplish **five** of the following transformations.
(5x2=10pts)



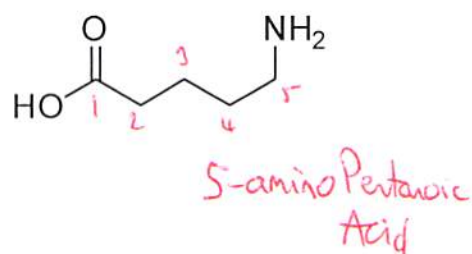
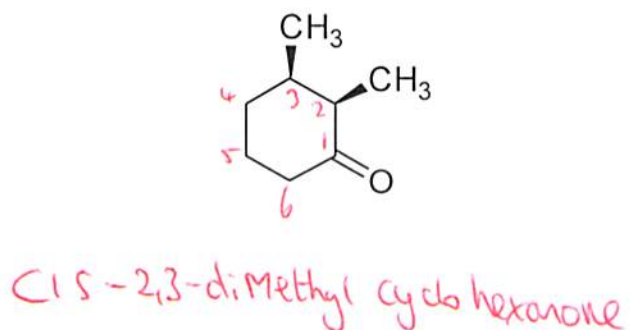
14) Circle the *strongest base* in the following threesomes. (5pts)



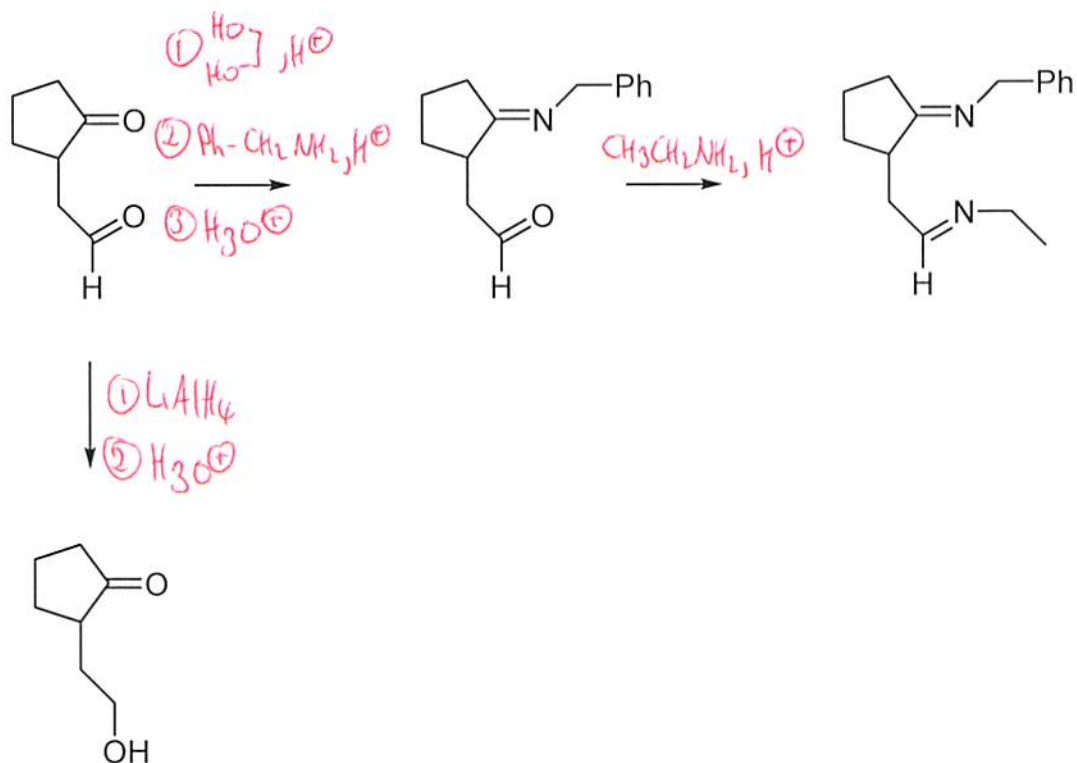
15) Name the following compounds in IUPAC form. (2+2+3+3=10pts)



Tetraethyl Ammonium Fluoride



16) Give reagents for the following transformations. (6pts)



*****Bonus question***** (up to 3 points)

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

- Help you get your degree.
- Get a job.
- Get into medical/dental/pharmacy/vet school.
- Make legal chemicals
- make illegal chemicals.
- ... etc.