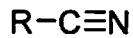
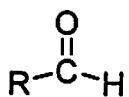
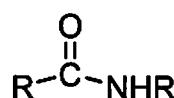
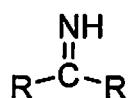
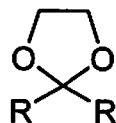
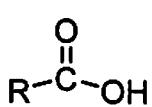


Spring 2019 Organic II Final Exam**100pts (graded as 150pts)****Name***If you do not want your graded exam placed in the box outside my office, then check here*

- 1) Identify the class of compounds (functional group) each of the following molecules belongs to. (10pts)



- 2) Put a cross through the molecule (above) that can serve as a *protecting group* for carbonyl compounds. (1pt)

- 3) Define the following terms. (4x2= 8pts)

(a) Kinetic Control

(b) Nucleophile

(c) Acyl Group

(d) Substitution Reaction.

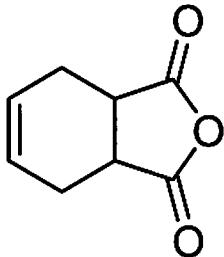
4) What is the definition of a “*Carboxylic Acid Derivative*”?

Provide one of the factors that influence the relative rates of *Nucleophilic Acyl Substitution* reactions for carboxylic acid derivatives (e.g. esters more reactive than amides).

Write the mechanism (*i.e. curly arrows*) and products for the reaction of an Acid Chloride with Water. (1+1+5pts)

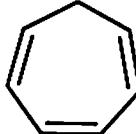
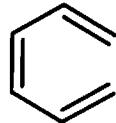
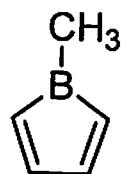
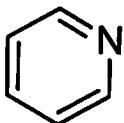
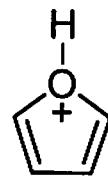
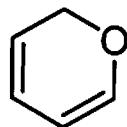
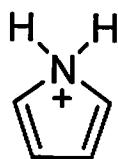
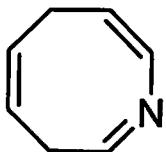
5) Write the mechanism (*i.e. curly arrows*) for the base catalyzed *nucleophilic addition* of water to acetone (propanone), producing the ketone hydrate. (5pts)

6) (1+2+2+2=7pts) The following molecule was produced in a [4+2] cycloaddition (Diels-Alder) reaction.



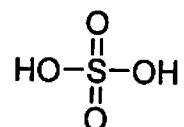
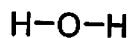
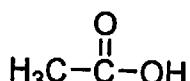
- a) The right hand side ring contains a cyclic version of what type of functional group?
- b) Draw the *diene* and *dienophile* which would react together to give this product, and then draw the mechanism (*i.e. curly arrows*) for this reaction.
- c) Draw the molecule produced if the above molecule reacted with an excess of water.

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

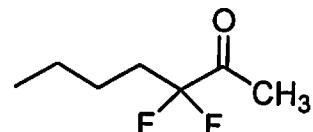
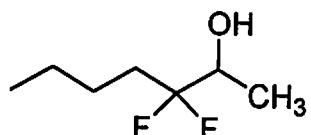
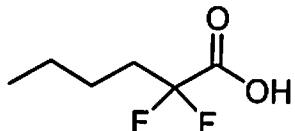


8) Circle the *strongest acid* (proton donor) in the following threesomes. (3pts)

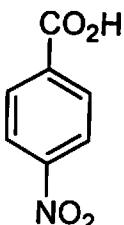
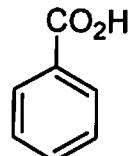
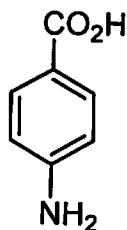
(a)



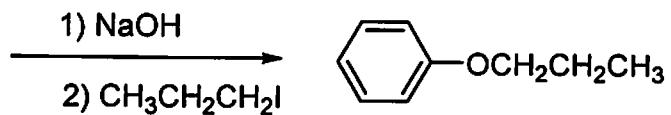
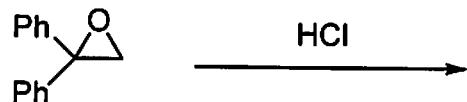
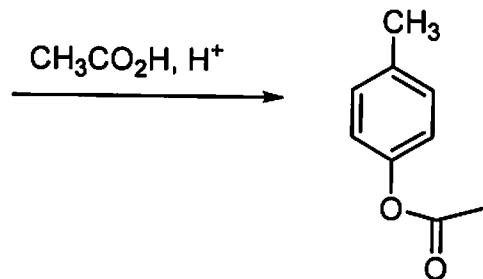
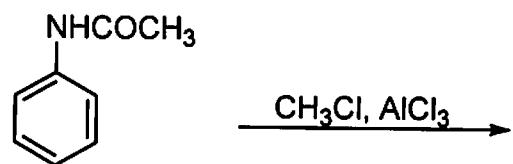
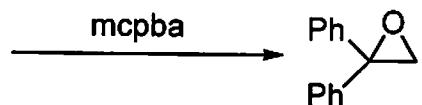
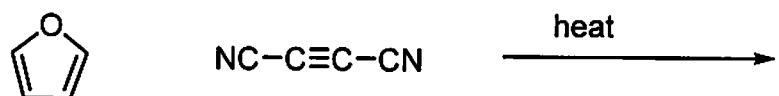
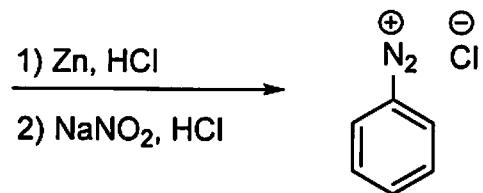
(b)



(c)



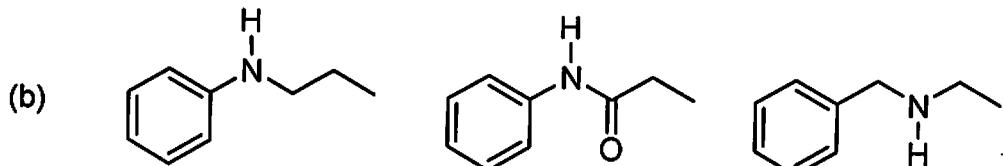
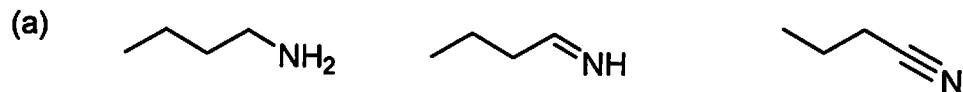
9) Fill in the blanks (either SM/products) for six of the following reactions.
 $(6 \times 2 = 12 \text{ pts})$



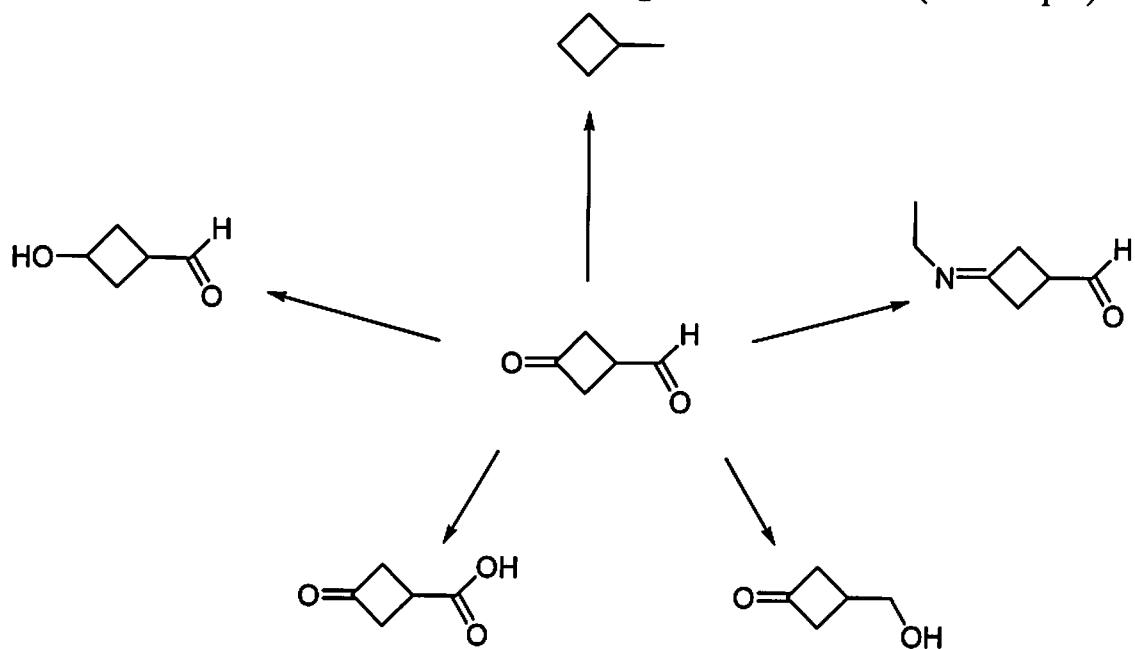
10) Give the products in four of the following transformations. (8pts)



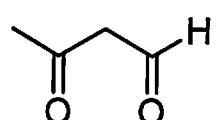
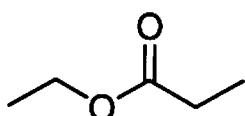
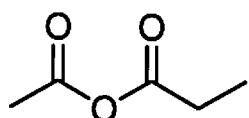
11) Circle the *strongest* base in the following threesomes. (3pts)



12) Give reagents for four of the following transformations. (4x3=12pts)



13) Name two of the following compounds in IUPAC form. (6pts)



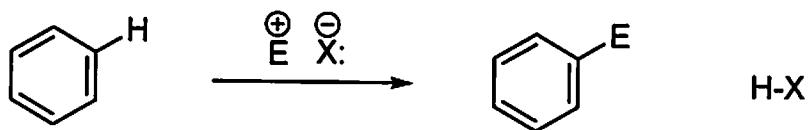
14) Draw in line angle (stick figure) form, two of the following named molecules. (6pts)

N,N-Diethylpropanamide

2-Fluoropropanoyl Bromide

2-Chloro-3-hydroxybutanoic acid

15) Write the mechanism (*i.e. curly arrows*) for this generic *Electrophilic Aromatic Substitution* of Benzene. (4pts)



*******Bonus question***** (up to 4 points)**

In the context of Organic Chemistry, what do the following abbreviations stand for?

IUPAC

PCC

S_N1

EAS

H	hydrogen	He	helium
¹ 1.0079	boron	⁴ 4.0066	neon
³ Li	boron	⁵ 10.811	¹⁰ 20.180
⁴ Be	boron	⁶ B	¹¹ argon
¹¹ Na	magnesium	⁷ C	¹² neon
¹² Mg	magnesium	⁸ N	¹³ F
¹⁹ K	potassium	⁹ O	¹⁴ Ne
²⁰ Ca	calcium	¹⁰ F	¹⁵ Nitrogen
³⁷ Rb	rubidium	¹¹ S	¹⁶ sulfur
³⁸ Sr	strontium	¹² Si	¹⁷ chlorine
⁴¹ Sc	scandium	¹³ Al	¹⁸ chlorine
⁴² Ti	titanium	¹⁴ Ga	¹⁹ phosphorus
⁴³ V	vanadium	¹⁵ Ge	²⁰ sulfur
⁴⁴ Cr	chromium	¹⁶ As	²¹ nitrogen
⁴⁵ Mn	manganese	¹⁷ Se	²² oxygen
⁴⁶ Fe	iron	¹⁸ Br	²³ chlorine
⁴⁷ Co	cobalt	¹⁹ Kr	²⁴ chlorine
⁴⁸ Ni	nickel	²⁰ Ar	²⁵ chlorine
⁴⁹ Cu	zinc	²¹ Si	²⁶ chlorine
⁵⁰ Zn	zinc	²² P	²⁷ chlorine
⁵¹ Ga	gallium	²³ S	²⁸ chlorine
⁵² Ge	germanium	²⁴ Cl	²⁹ chlorine
⁵³ As	arsenic	²⁵ Ar	³⁰ chlorine
⁵⁴ Se	sulfur	²⁶ S	³¹ chlorine
⁵⁵ Br	chlorine	²⁷ Cl	³² chlorine
⁵⁶ Kr	krypton	²⁸ Ar	³³ chlorine
⁵⁷ Cs	* * * * *	²⁹ F	³⁴ chlorine
⁵⁸ Ba	*	³⁰ Ne	³⁵ chlorine
⁵⁹ Lu	Lu	³¹ N	³⁶ chlorine
⁶⁰ Hf	Hf	³² O	³⁷ chlorine
⁶¹ Ta	Ta	³³ F	³⁸ chlorine
⁶² W	tautungsten	³⁴ Ne	³⁹ chlorine
⁶³ Re	rhodium	³⁵ S	⁴⁰ chlorine
⁶⁴ Os	osmium	³⁶ Cl	⁴¹ chlorine
⁶⁵ Ir	iridium	³⁷ Ar	⁴² chlorine
⁶⁶ Pt	platinum	³⁸ Ne	⁴³ chlorine
⁶⁷ Au	gold	³⁹ F	⁴⁴ chlorine
⁶⁸ Hg	mercury	⁴⁰ Ne	⁴⁵ chlorine
⁶⁹ Tl	thallium	⁴¹ S	⁴⁶ chlorine
⁷⁰ Pb	lead	⁴² Cl	⁴⁷ chlorine
⁷¹ Bi	bismuth	⁴³ Ar	⁴⁸ chlorine
⁷² Po	polonium	⁴⁴ Ne	⁴⁹ chlorine
⁷³ At	astatine	⁴⁵ F	⁵⁰ chlorine
⁷⁴ Rn	radon	⁴⁶ Ne	⁵¹ chlorine
⁷⁵ Uuu	ununtrium	⁴⁷ S	⁵² chlorine
⁷⁶ Uub	ununbium	⁴⁸ Cl	⁵³ chlorine
⁷⁷ Uuo	ununoctium	⁴⁹ Ar	⁵⁴ chlorine
⁷⁸ Uq	ununquadium	⁵⁰ Ne	⁵⁵ chlorine

*** Lanthanide series**

⁵⁷ La	⁵⁸ Ce	⁵⁹ Pr	⁶⁰ Nd	⁶¹ Pm	⁶² Sm	⁶³ Eu	⁶⁴ Gd	⁶⁵ Tb	⁶⁶ Dy	⁶⁷ Ho	⁶⁸ Er	⁶⁹ Tm	⁷⁰ Yb
¹³⁹ 91	¹⁴⁰ 12	¹⁴¹ 91	¹⁴² 24	¹⁴³ 9	¹⁴⁴ 36	¹⁴⁵ 86	¹⁴⁶ 25	¹⁴⁷ 92	¹⁴⁸ 93	¹⁴⁹ 93	¹⁵⁰ 26	¹⁵¹ 93	¹⁵² 93
⁸⁹ Ac	⁹⁰ Th	⁹¹ Pa	⁹² U	⁹³ Np	⁹⁴ Pu	⁹⁵ Am	⁹⁶ Cm	⁹⁷ Bk	⁹⁸ Cf	⁹⁹ Es	¹⁰⁰ Fm	¹⁰¹ Md	¹⁰² No
²³² 91	²³² 04	²³³ 04	²³³ 03	²³³ 01									

*** * Actinide series**²²⁷

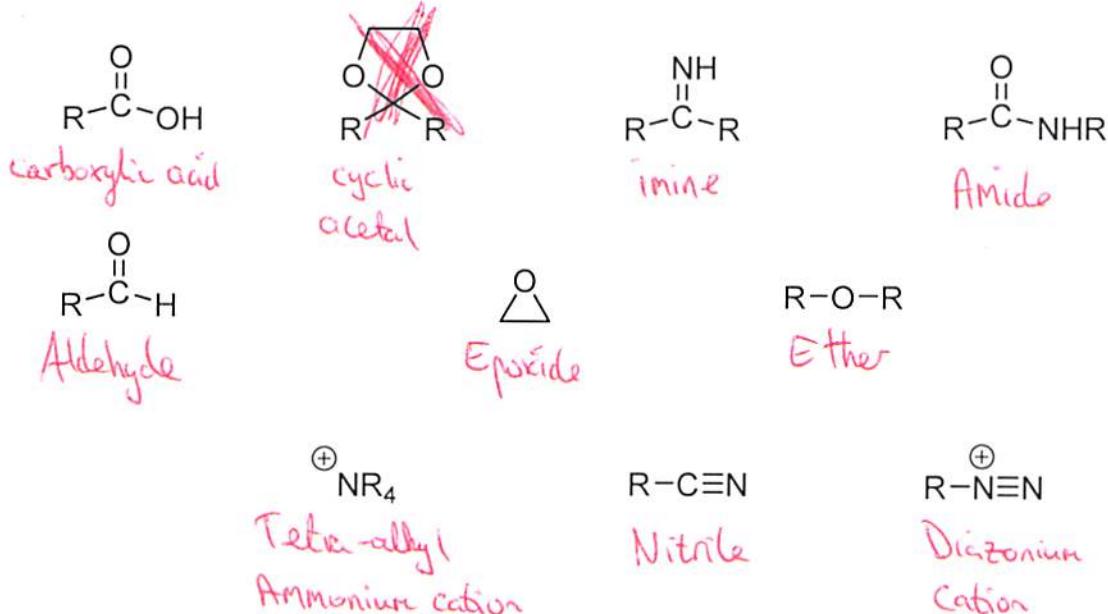
Spring 2019 Organic II Final Exam
 Name How Do You CATCH ROR?

100pts (graded as 150pts)

use the Ethernet!!!

If you do *not* want your graded exam placed in the box outside my office, then check here

- 1) Identify the class of compounds (functional group) each of the following molecules belongs to. (10pts)



- 2) Put a **cross** through the molecule (above) that can serve as a *protecting group* for carbonyl compounds. (1pt)

✓

- 3) Define the following terms. (4x2= 8pts)

(a) Kinetic Control *The speed of reaction controls the formation of major products.*

(b) Nucleophile *A two electron donor.*

(c) Acyl Group *The $\text{-}^{\text{II}}\text{C}-\text{O-}$ group.*

(d) Substitution Reaction. *Where 1 atom or group is exchanged for another atom or group.*

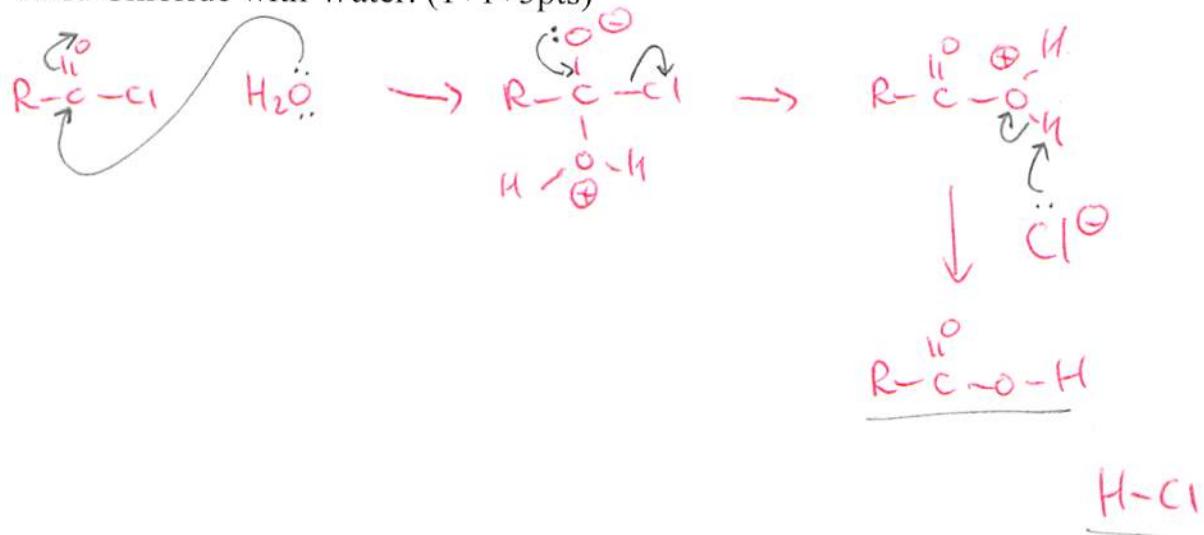
4) What is the definition of a "Carboxylic Acid Derivative"?

A species that can be hydrolyzed into a carboxylic acid.

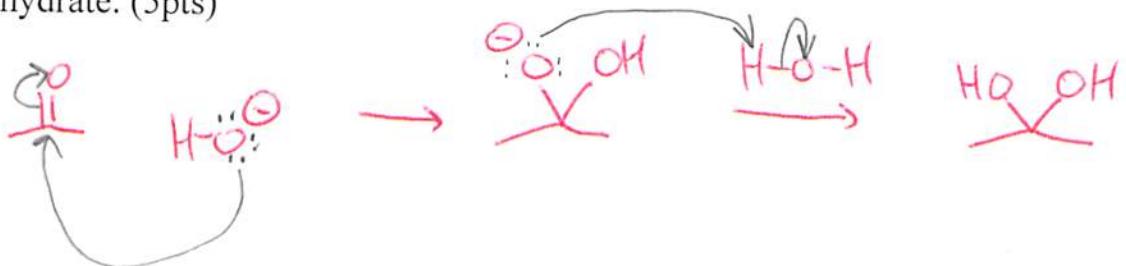
Provide one of the factors that influence the relative rates of *Nucleophilic Acyl Substitution* reactions for carboxylic acid derivatives (e.g. esters more reactive than amides).

- Leaving group ability
- Amount of resonance in the functional group.

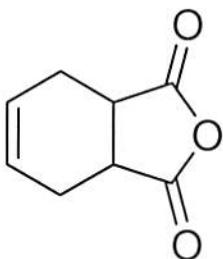
Write the mechanism (*i.e. curly arrows*) and products for the reaction of an Acid Chloride with Water. (1+1+5pts)



5) Write the mechanism (*i.e. curly arrows*) for the base catalyzed *nucleophilic addition* of water to acetone (propanone), producing the ketone hydrate. (5pts)



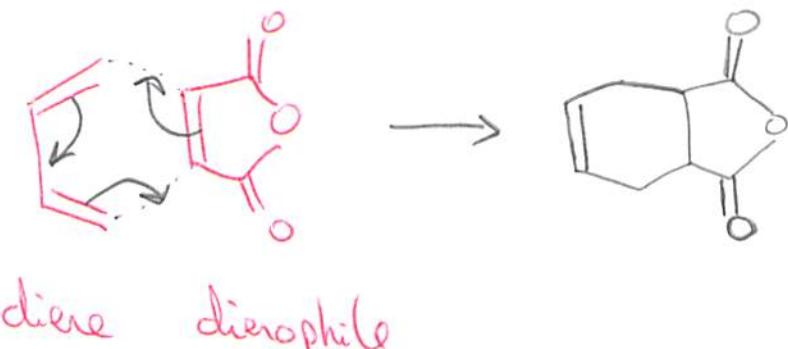
6) (1+2+2+2=7pts) The following molecule was produced in a [4+2] cycloaddition (Diels-Alder) reaction.



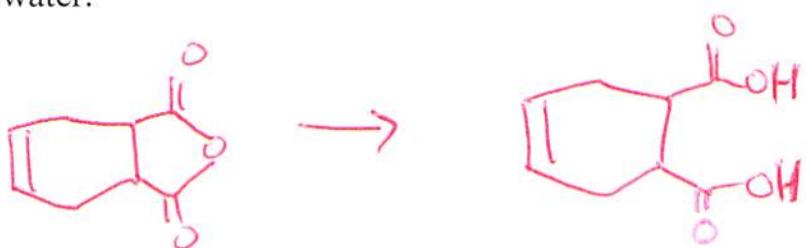
a) The right hand side ring contains a cyclic version of what type of functional group?

Anhydride

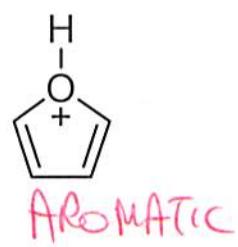
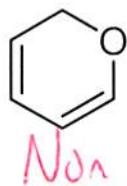
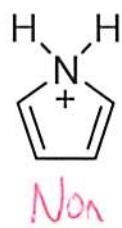
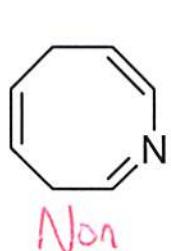
b) Draw the *diene* and *dienophile* which would react together to give this product, and then draw the mechanism (*i.e. curly arrows*) for this reaction.



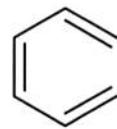
c) Draw the molecule produced if the above molecule reacted with an excess of water.



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

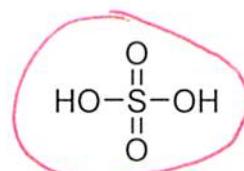
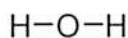
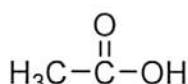


AROMATIC

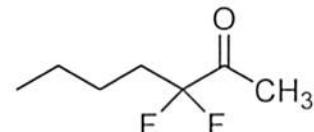
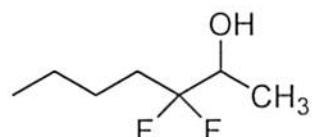
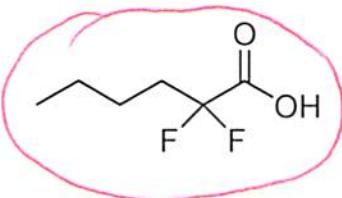


8) Circle the *strongest acid* (proton donor) in the following threesomes. (3pts)

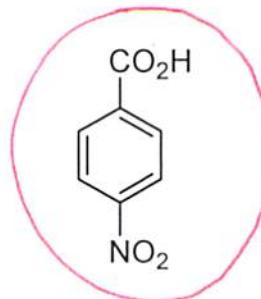
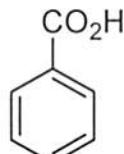
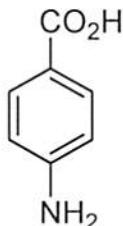
(a)



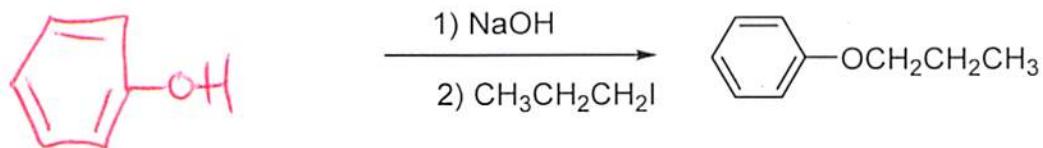
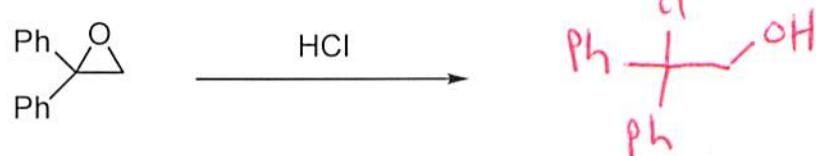
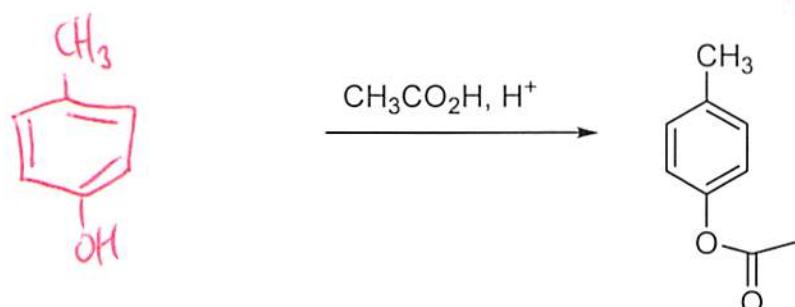
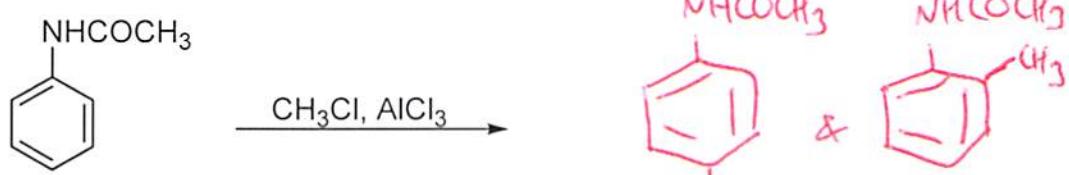
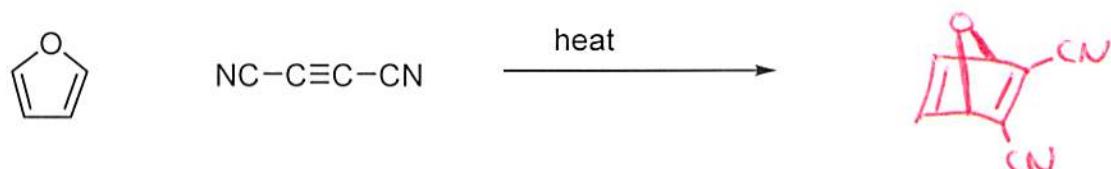
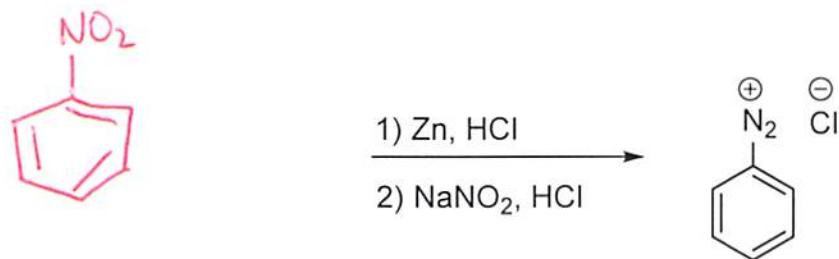
(b)



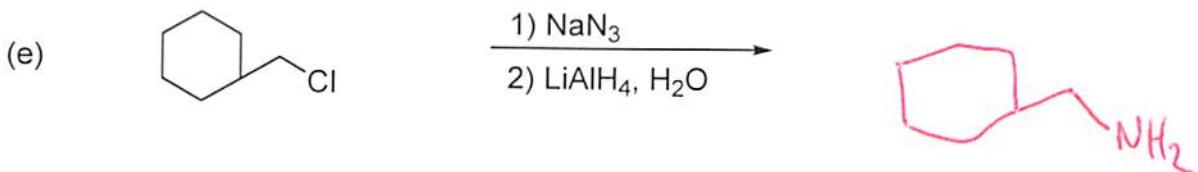
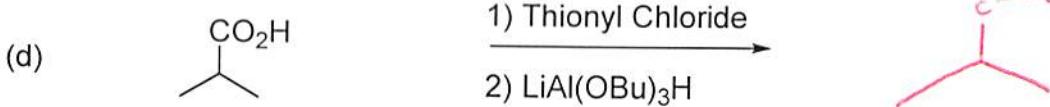
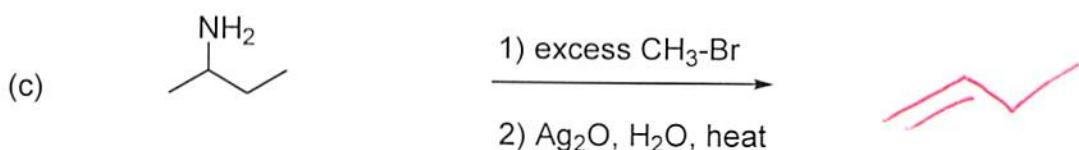
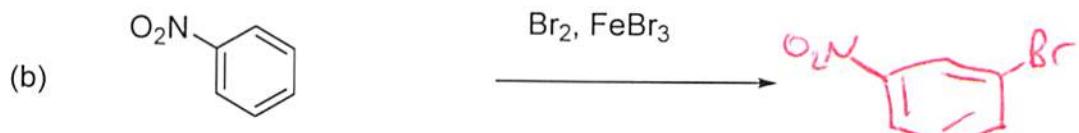
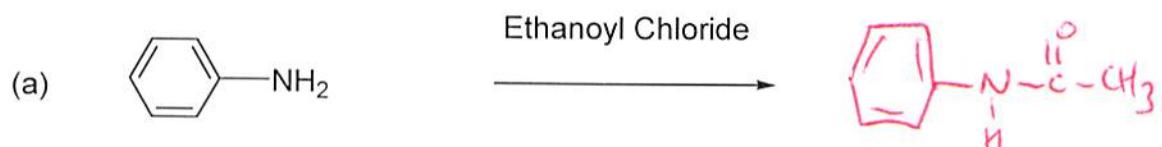
(c)



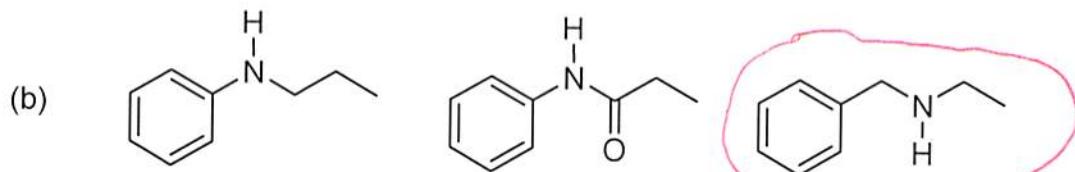
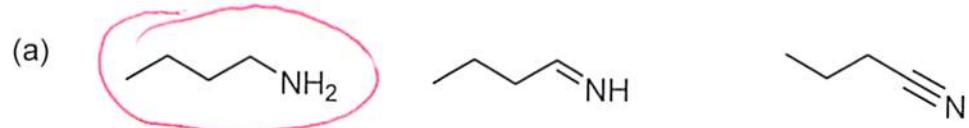
9) Fill in the blanks (either SM/products) for six of the following reactions.
 $(6 \times 2 = 12 \text{ pts})$



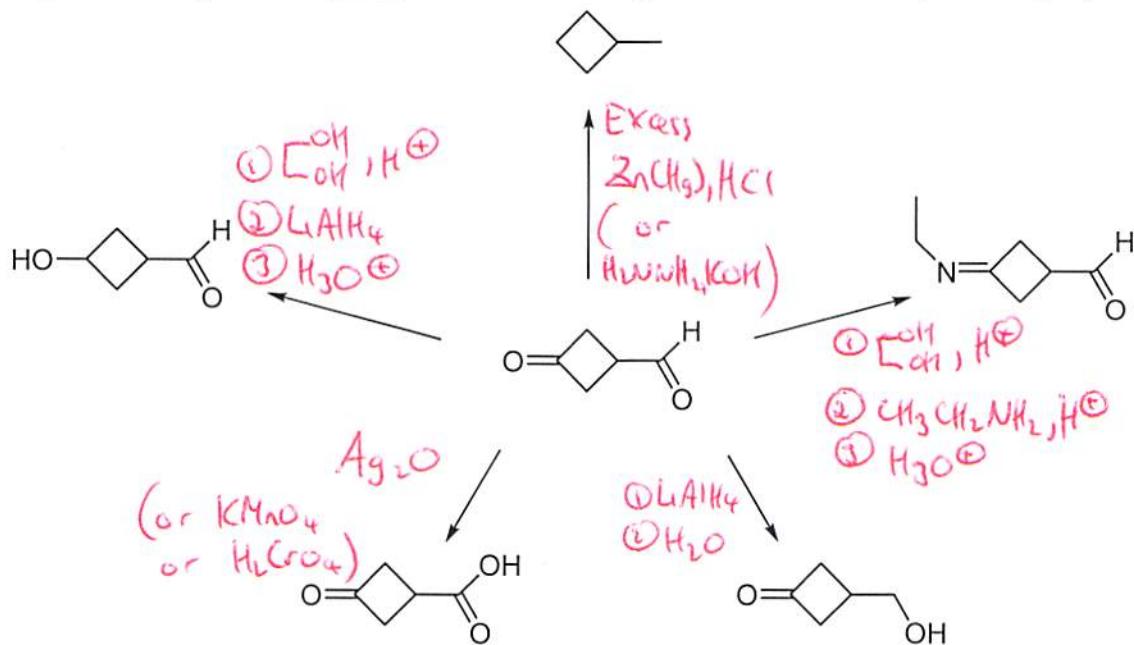
10) Give the products in four of the following transformations. (8pts)



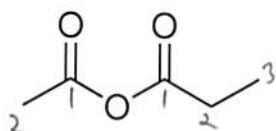
11) Circle the *strongest* base in the following threesomes. (3pts)



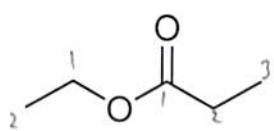
12) Give reagents for four of the following transformations. (4x3=12pts)



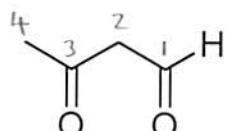
13) Name two of the following compounds in IUPAC form. (6pts)



Propanoic Ethanoic
Anhydride

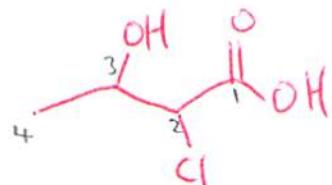
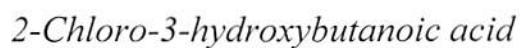
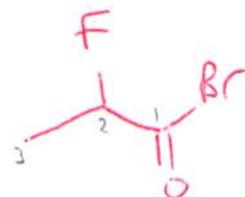
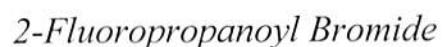
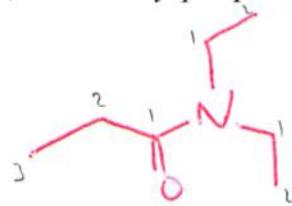
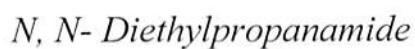


Ethyl propanoate

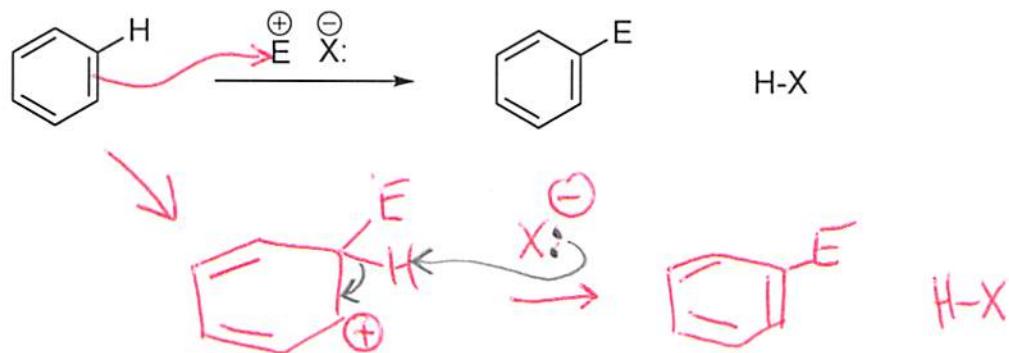


3-Oxobutanal

14) Draw in line angle (stick figure) form, two of the following named molecules. (6pts)



15) Write the mechanism (*i.e. curly arrows*) for this generic *Electrophilic Aromatic Substitution* of Benzene. (4pts)



****Bonus question**** (up to 4 points)

In the context of Organic Chemistry, what do the following abbreviations stand for?

IUPAC International Union of Pure and Applied Chemistry

PCC Pyridinium Chloro Chromate

S_N1 Substitution Nucleophilic Unimolecular

EAS Electrophilic Aromatic Substitution