UCSC, Binder Name_____

Section _____ TA _____ SID _____

CHEM 108B Organic Chemistry II
EXAM 2A, Winter 2016 (*200 points*)

In each of the following problems, use your knowledge of organic chemistry conventions to answer the questions in the proper manner. **Be sure to read all questions & instructions carefully, paying special attention to directions to skip parts of problems.** *Choose which problems to skip rather than doing every problem, otherwise you may run out of time*. ***Make sure it is crystal clear which problems should and should not be graded.*** Write your last name and first initial on the top of every page. For two extra points, draw a picture of a cat pirate on the back of your exam, just so I can see who's reading. You will have the entire class period to complete this exam (approximately 2 hours), but hopefully you won't need it! You are welcome to use pre-built models.

Keep your eyes on your own paper. Electronic devices of any kind are not allowed, including cell phones and calculators. Any student found using any of said devices, or found examining another student's exam, will be promptly removed from the exam room and at minimum will receive a zero on this exam. Such an incident may also be considered a form of academic dishonesty and reported to the UCSC Judiciary Affairs Committee.

1 (30)	
2 (25)	
3 (28)	
4 (25)	
5 (32)	
6 (30)	
7 (30)	
Total	/ 200
	%

Functional Group	**Suffix**
Acid chloride	-oyl chloride
Acid Anhydride	-oic anhyride
Carboxylic Acid	-oic acid
Esters	-oate
Amides	-amide

CHEM 108B, Exam 2A Last Name, First Initial _____

1. Nomenclature – suffixes for acyl derivatives on the cover page

(a) (*15 points*) **Draw structures** corresponding to **any three** of the following names. *Put a large "X" over the name and space you don't want graded.*

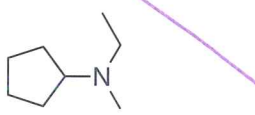
Phenyl benzoate

Isopropyl 2-methylpropanoate

Phenylacetaldehyde
(2-Phenylethanal)

2,4-Dimethylpentanenitrile

(b) (*15 points*) **Provide IUPAC names** for **<u>any three</u>** of the following compounds. *Draw a large "X" over the problems you do not want graded, otherwise the first three will be graded.*



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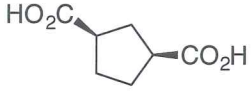

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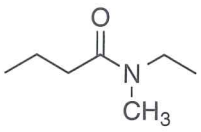

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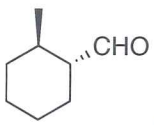

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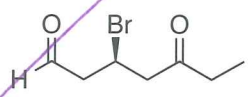


_____

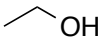
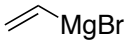
no name → structure W17

2. Miscellaneous Fundamentals

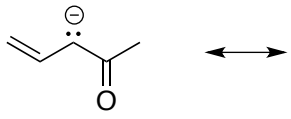
(a) (*5 points*) Fill in the blank.

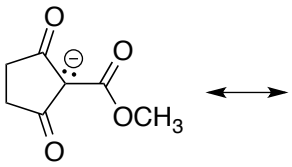
_____ is the underlying principle that explains most, if not all, of the reactivity patterns in organic chemistry.
(one word)

(b) (*10 points*) **Nucleophile vs. Electrophile.** Indicate whether the following functional group, type of compound, or reagent most often acts as nucleophile (N) or electrophile (E) in the reactions covered in this class.

Methoxide ion	**Acids**	**Bases**	**Carbocations**	**Cyanide ion**
☐	☐	☐	☐	☐
				
☐	☐	☐	☐	☐

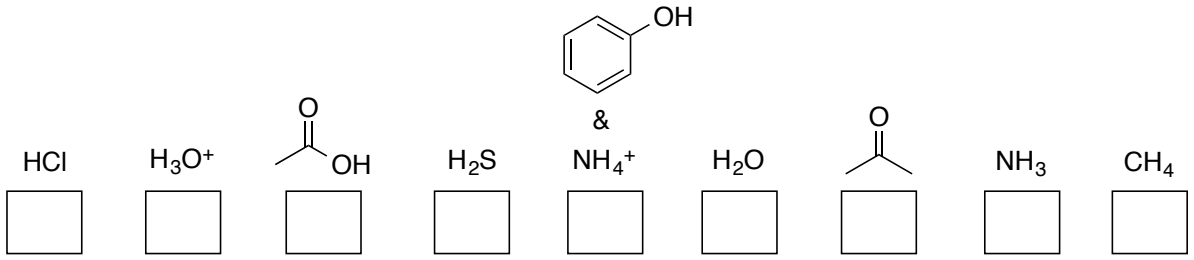
(c) (*10 points*) **Resonance.** Use *curved arrow* notation to indicate electron movement and draw *two non-equivalent* resonance structures of the compound below.



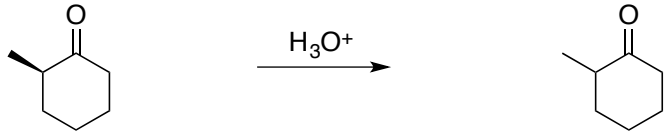


3. Acid-Base Chemistry

(a) (*9 points*) The following compounds are arranged from most to least acidic (left to right). Fill in the **pKa** values of each in the boxes provided.



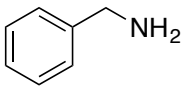
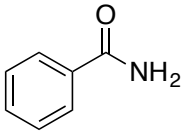
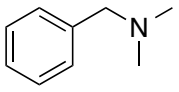
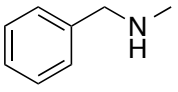
(b) (*11 points*) **Tautomers.** When optically active (*R*)-2-methylcyclohexanone is treated with aqueous acid, racemization occurs. Explain using **arrow pushing, intermediates, *and* <u>less than ten words</u>**.



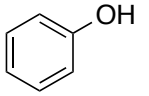
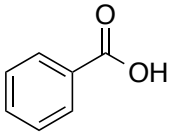
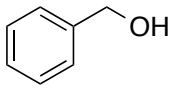
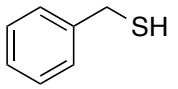
(*R*)-2-Methylcyclohexanone **(+/-)-2-Methylcyclohexanone** (racemic)

(c) (*8 points*) **Rank** the following sets in terms of acidity where **1 is the most acidic.**

<u>Set 1</u>

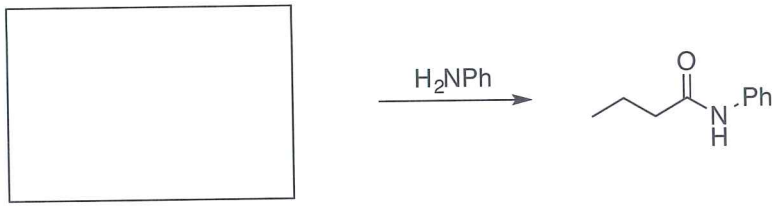
Circle your answer below ↓				
I	2	4	1	3
II	2	1	4	3
III	4	1	2	3
IV	1	4	3	2

<u>Set 2</u>

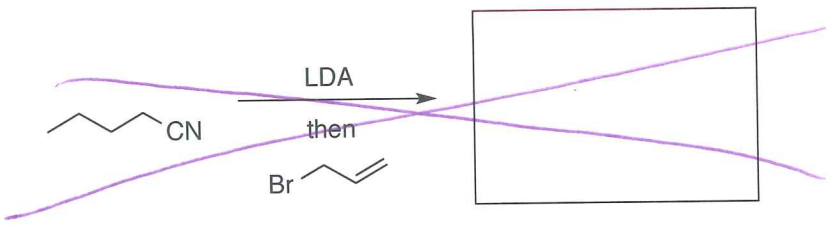
Circle your answer below ↓				
I	1	2	3	4
II	2	1	3	4
III	3	1	4	2
IV	3	2	4	1

4. (*25 points*) **Single Step Reactions** – Fill in the box with the reactant, reagent(s), or product. *SKIP ANY ONE REACTION with big "X" over the entire reaction, otherwise the first five (a-e) will be graded.*

(a)

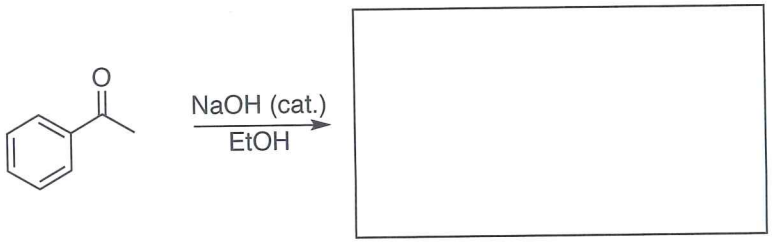


(b)

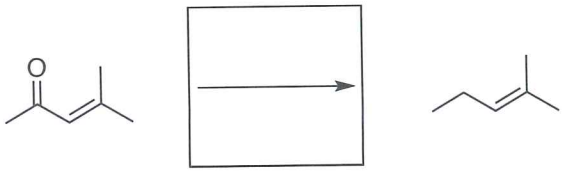


not covered WI7

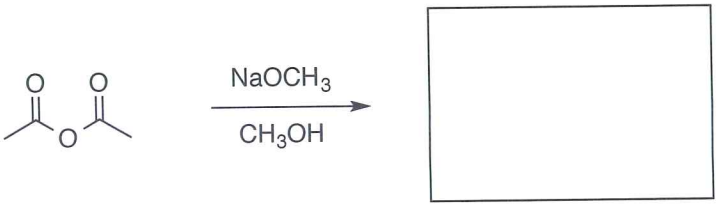
(c)



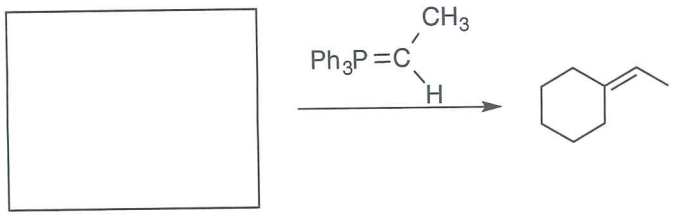
(d)



(e)



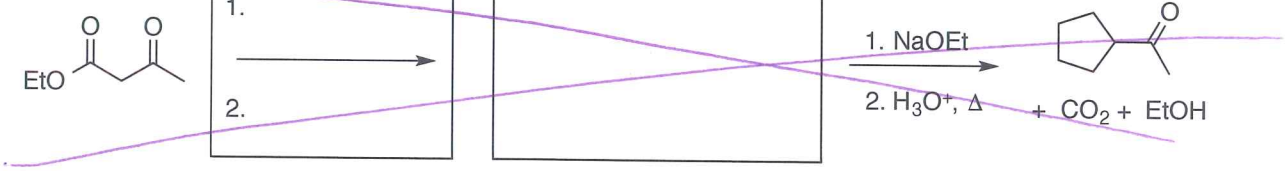
(f)



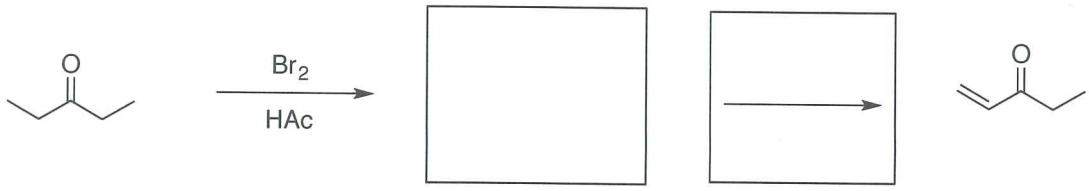
5. (*32 points*) **Mini Reaction Puzzles** - Fill in the box with the reactant, reagent(s), or product. *SKIP ANY ONE PUZZLE with big "X" over the entire reaction, otherwise the first four (a-d) will be graded.*

(a)

not covered w17

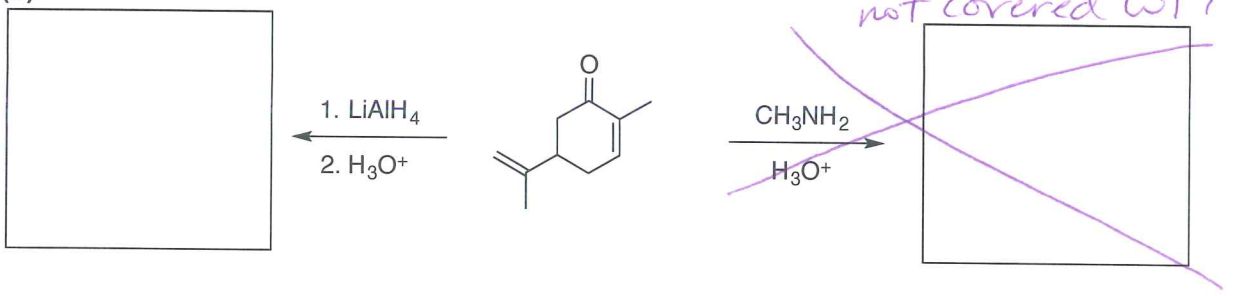


(b)

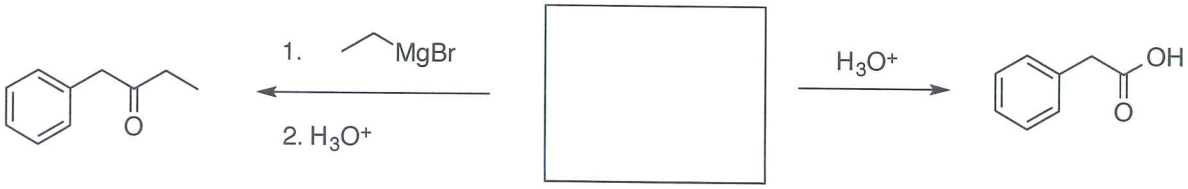


(c)

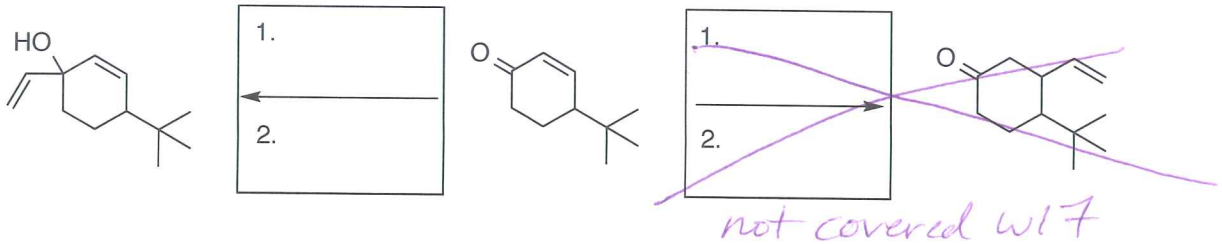
not covered w17



(d)



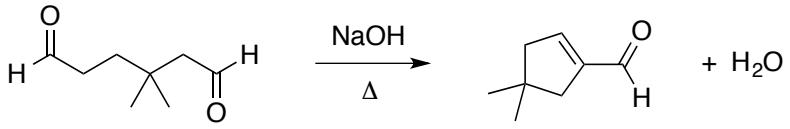
(e)



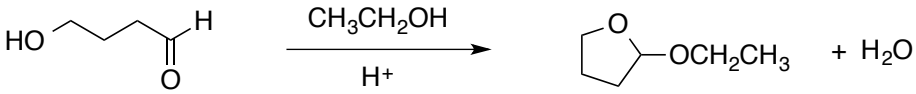
not covered w17

6. Mechanisms – Draw the full arrow-pushing mechanism for **all three reactions** below, including all arrows for acid-base reactions (no "PT"). Include all intermediates with proper charges circled for each step.

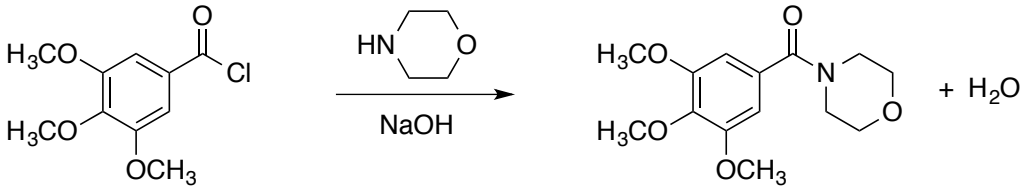
(a) (*10 points*) 4,4-Dimethyl-1-cyclopentene carbaldehyde is made through a **base-promoted intramolecular aldol cyclization** of the dialdehyde below. Show this mechanism.
Pro tip: number the carbons in the starting material & product.



(b) (*15 points*) The following **acetal** is made through an **acid-catalyzed intramolecular cyclization** reaction. The mechanism proceeds by **nucleophilic addition and dehydration** followed by second **nucleophilic addition**. Show this mechanism.



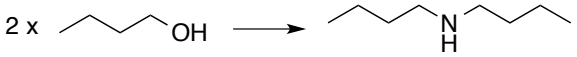
(c) (*5 points*) Trimetozine, a sedative, is prepared commercially through a **base-catalyzed nucleophilic acyl substitution** reaction between morpholine and the following acid chloride. Show the mechanism and feel free to abbreviate the aryl group as "Ar" in the intermediate(s)!



7. (*30 points*) **Multi-Step Synthesis -** Carry out <u>any two</u> of the syntheses below using the starting material provided and any other reagents or carbon sources needed. Draw the product after each synthetic step. No mechanisms.

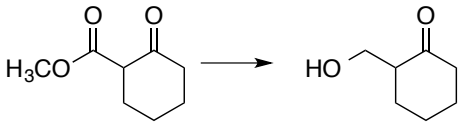
CHOOSE ANY TWO

(a)

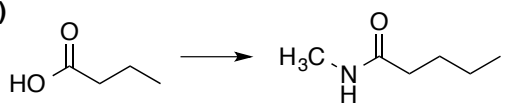


(butanol is your only source of carbon!)

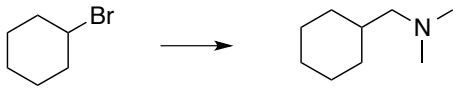
(b)



(c)



(d)



PUT A LARGE "X" OVER THE REACTIONS YOU ARE SKIPPING & DO NOT WANT GRADED