UCSC, Binder Name_____

DO NOT WRITE YOUR NAME UNTIL TOLD TO START!

CHEM 8B Organic Chemistry II
EXAM 1, Version B (*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 each question carefully.** You will have the entire class period to complete this exam (1 hour, 35 min), but hopefully you won't need it! **Pay attention to provided point values and opportunities to skip parts of problems on pages 5 & 6 to use your time wisely.** You are welcome to use pre-built models.

Once instructed to start, write your last name, first initial at the top of each page.

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.

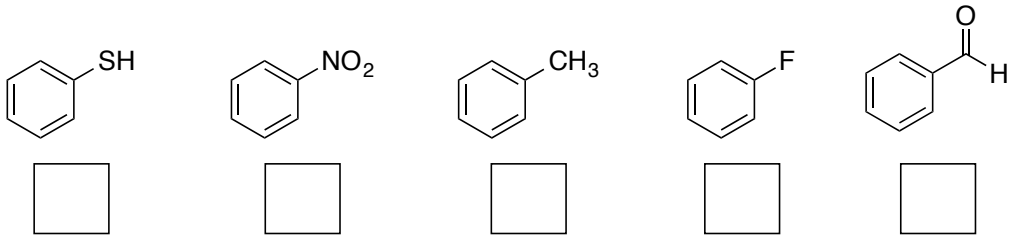
1 (26)	
2 (40)	
3 (25)	
4 (30)	
5 (30)	
6 (19)	
7 (30)	
Total	/ 200
	%

1. Fundamentals

(a) (*10 points*) Each substituent on the benzene rings below effects the **rate and substitution pattern in electrophilic aromatic substitution (EArS) reactions.** Indicate the effect of each substituent in the box below it using choices **(i)** through **(iv)**.

(i) ortho/para-activator **(ii)** ortho/para-deactivator

(iii) meta-activator **(iv)** meta-deactivator

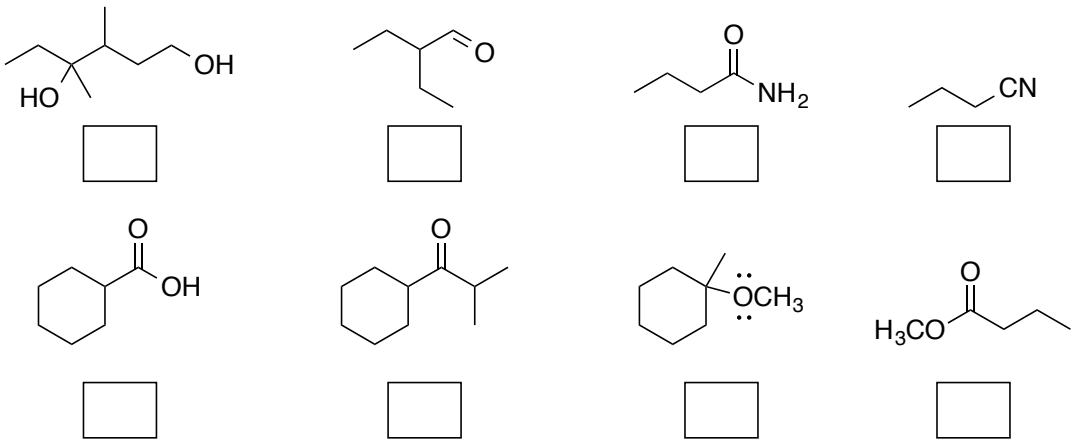


(b) (*16 points*) Indicate the functional group in the box below each using **(i)** through **(xii)**.

(i) acid anhydride **(ii)** acid chloride **(iii)** alcohol **(iv)** aldehyde

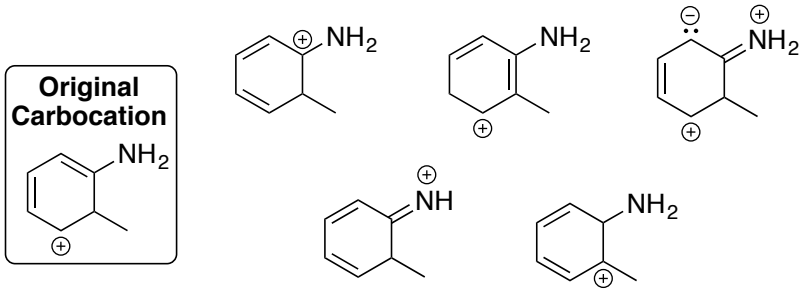
(v) arene **(vi)** amide **(vii)** amine **(viii)** carboxylic acid

(ix) ether **(x)** ester **(xi)** ketone **(xii)** nitrile



2. More Fundamentals & Nomenclature

(a) (*10 points*) **Circle all structures** that are valid resonance forms of the **original carbocation**.



(b) (*30 points*) **Draw structures** corresponding to the following names.

3-methoxy-1-hexene

Cyclopentane carbaldehyde

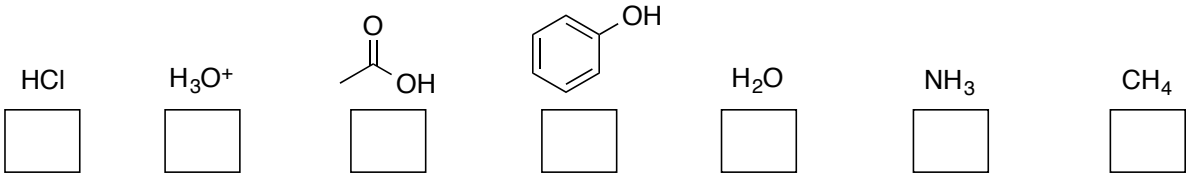
2-Hydroxy-4-oxoheptanal

para-methyl phenol

diethyl ether

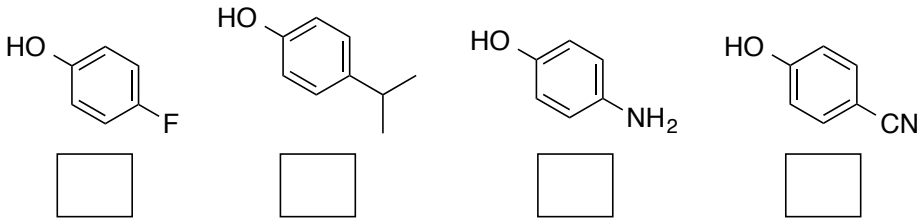
3. Acid-Base Chemistry

(a) (*7 points*) The following compounds are arranged from most (left) to least (right) acidic. Fill in the **pKa** values of each in the boxes provided.

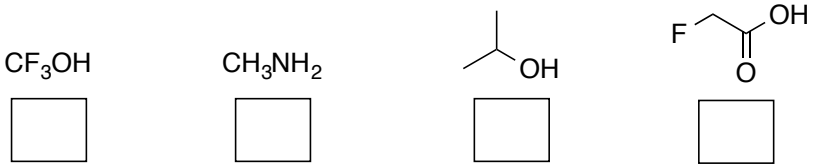


(b) (*10 points*) Rank the following sets of acids from **most acidic (1)** to **least acidic (4)**. Put your answers in the box below each compound.

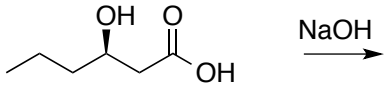
Set 1



Set 2

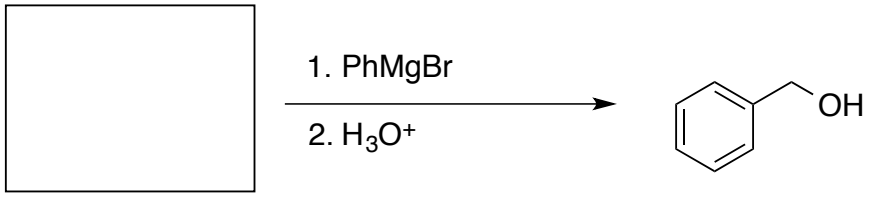


(c) (*8 points*) **Circle the most acidic proton** on the molecule below and draw its **conjugate base** upon reaction with sodium hyroxide. Assume exactly 1 mole of each is used.

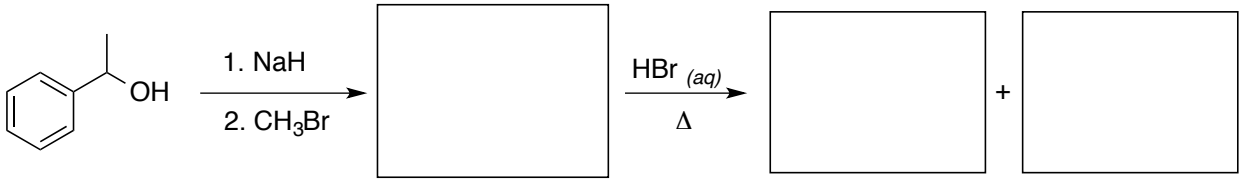


4. (*30 points*) **Single Step Reactions - Fill in the missing product or reactants in each reaction.**

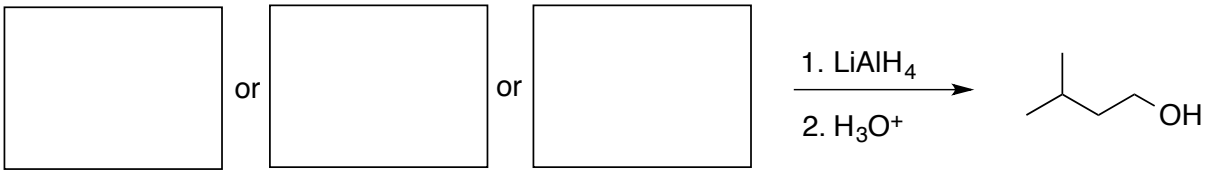
(a)



(b)

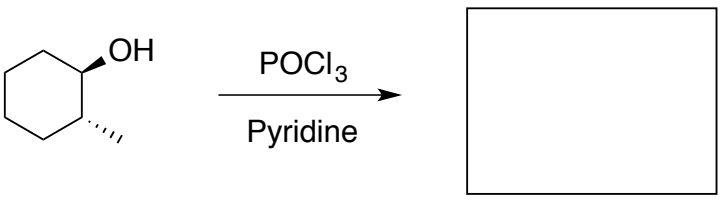


(c)

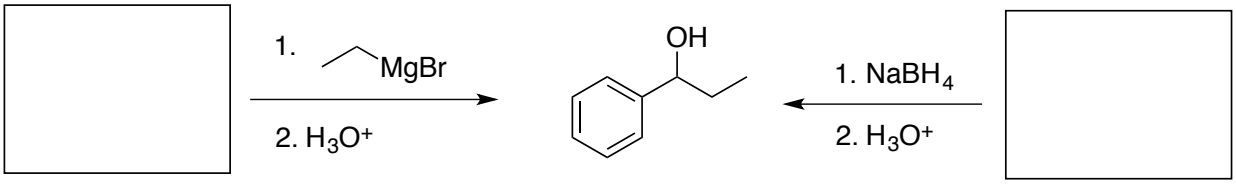


Draw structures of 3 different compounds that would react with $LiAlH_4$ to give this same product.

(d)

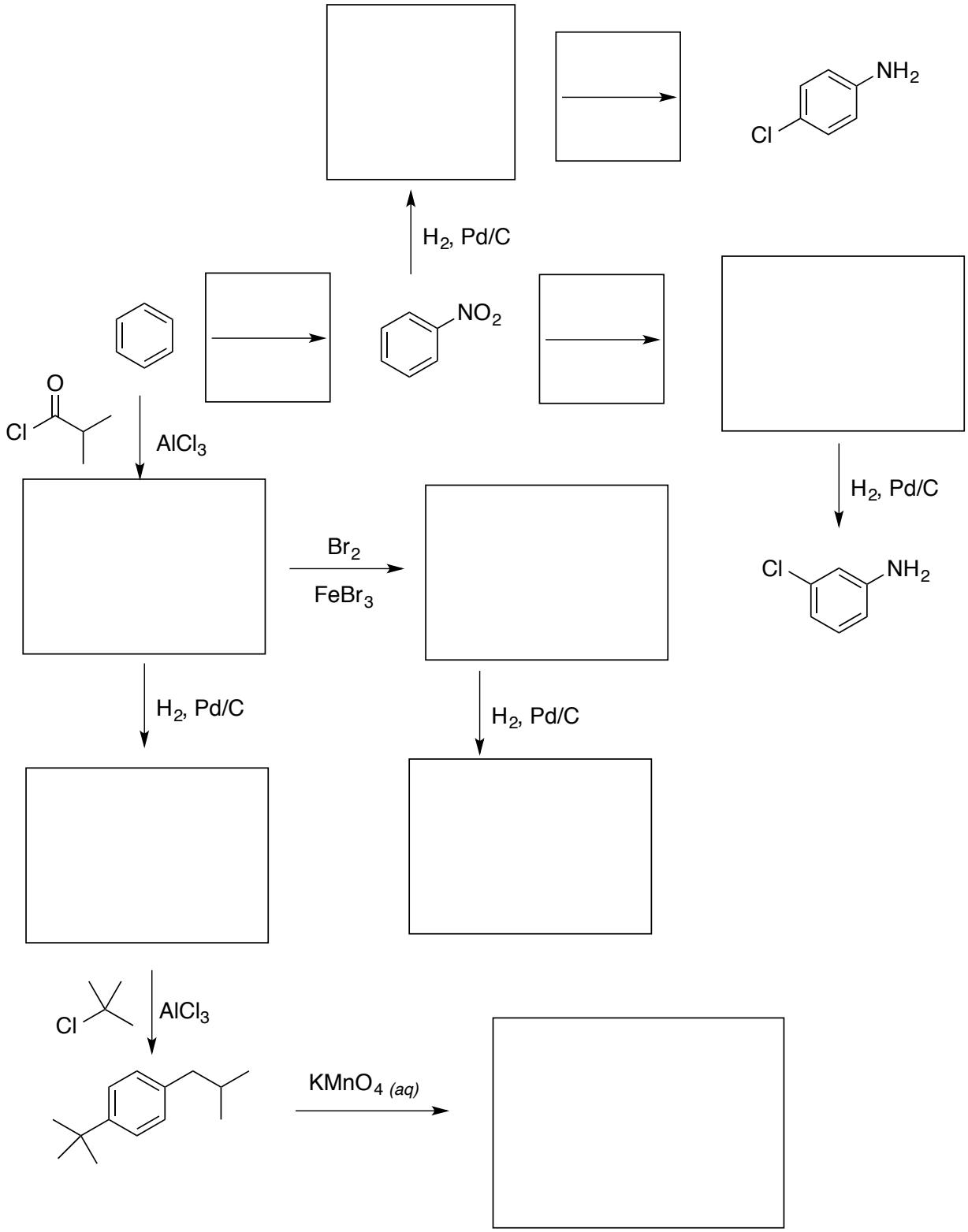


(e)



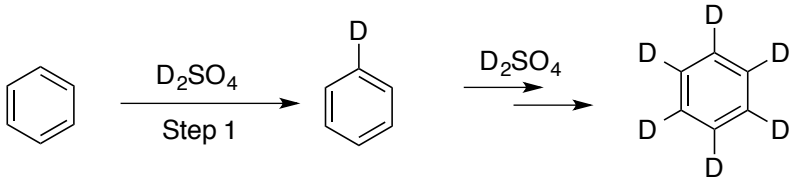
Draw structures of two different compounds that undergo different reactions to form the same product.

5. (*30 points*) **Reaction Puzzles** – Fill in the missing **reagents** and **products**.

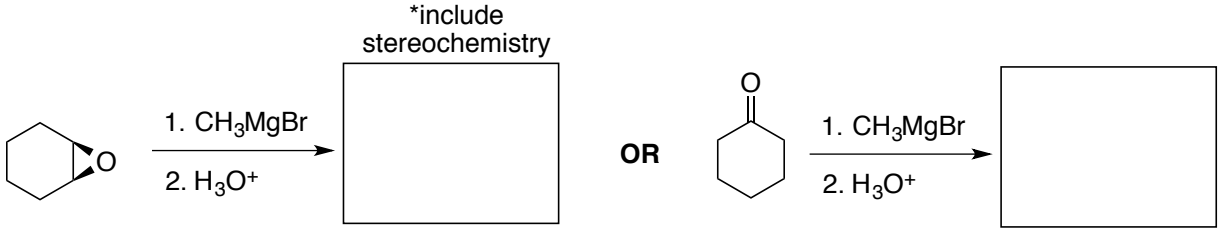


6. Mechanisms

(a) (*5 points*) When benzene is treated with D_2SO_4, deuterium slowly replaces all six hydrogens in the aromatic ring. Explain by showing the **mechanism for Step 1 of the reaction only**. Include the **reaction intermediate** and **curved arrow notation**.



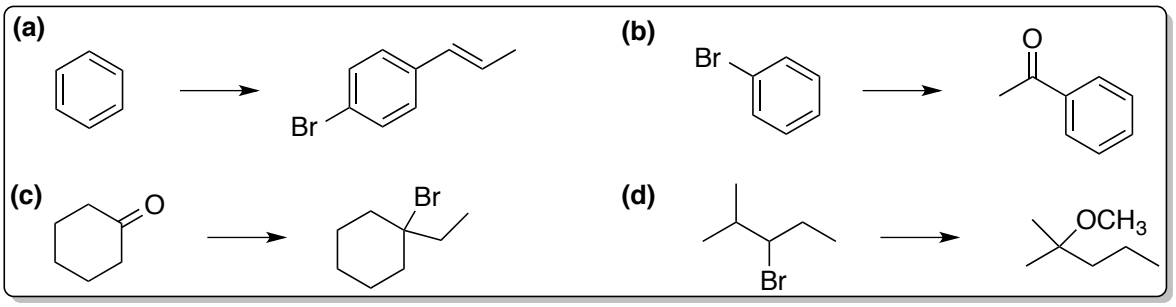
(b) (*14 points*) Methyl magnesium bromide is a powerful reagent for the formation of C-C bonds. **Choose only one reaction** below to complete and **draw its mechanism**. Draw the **product** in the box and include **intermediate(s)** and **curved arrow notation**.



Choose one reaction (circle it) then draw the mechanism below

7. (*30 points*) **Multi-Step Synthesis – Choose any two**

Carry out the synthesis of the indicated target molecules using the starting material provided and any other reagents or sources of carbon needed**. Show the product after each reaction.** No mechanisms. Partial credit is given where possible so if you're stuck, take a deep breath then work backwards and/or forwards.



CHOOSE TWO – CIRCLE THEM. PUT A LARGE "X" THROUGH THE REACTIONS TO SKIP.
YOU WILL LOSE POINTS IF IT IS UNCLEAR WHICH PROBLEMS YOU ARE CHOOSING!