CHEM 8B W'17 Exam 1B, UCSC Last Name, First Initial _____

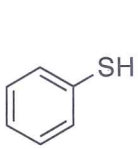
1. Fundamentals

(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)**.

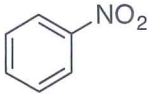
(i) ortho/para-activator **(ii)** ortho/para-deactivator

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

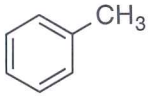
2 pts each



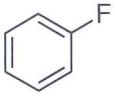
i



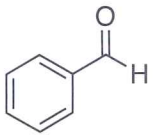
iv



i



ii



iv

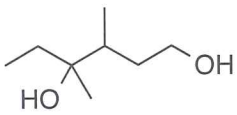
(b) (*16 points*) Indicate the functional group in the box below each using **(i)** through **(xii)**.

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

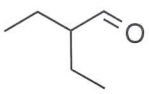
(v) arene **(vi)** amide **(vii)** amine **(viii)** carboxylic acid

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

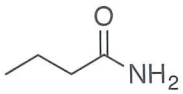
2 pts each



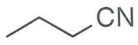
iii



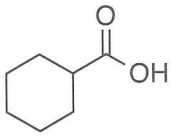
iv



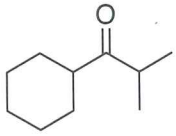
vi



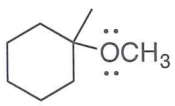
xii



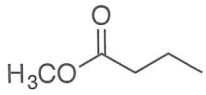
viii



xi



ix



x

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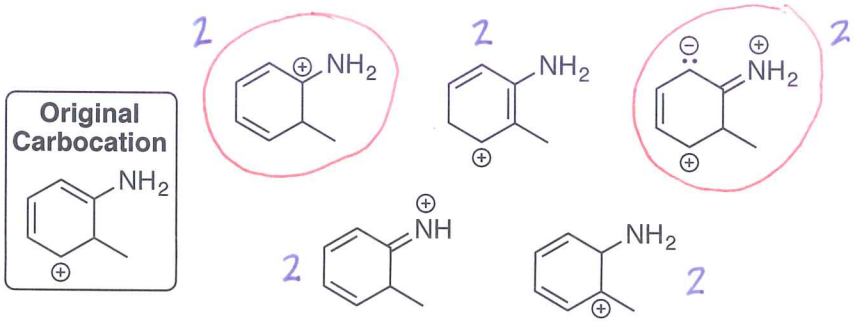
2. More Fundamentals & Nomenclature

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

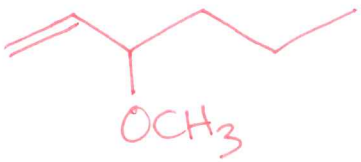


(b) (*30 points*) **Draw structures** corresponding to the following names.

6 pts each

3-methoxy-1-hexene

2 2 2

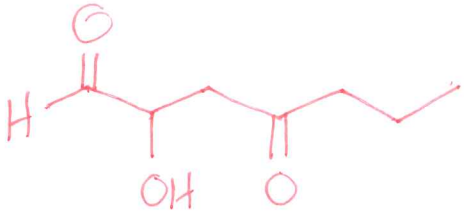


Cyclopentane carbaldehyde

1 2 1 2

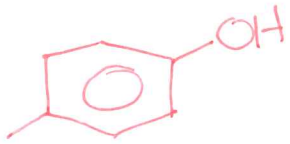
2-Hydroxy-4-oxoheptanal

2 1 1 2



para-methyl phenol

2 2 2



2 2 2

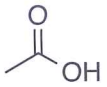
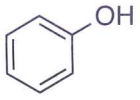
diethyl ether

2 40

3. Acid-Base Chemistry

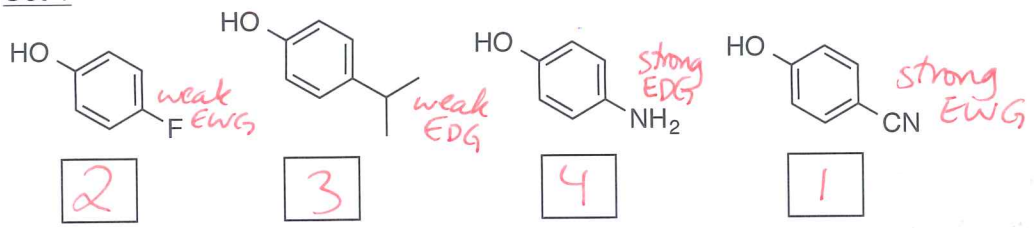
1pt each ±2 pKa units OK

(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.

HCl	H_3O^+			H_2O	NH_3	CH_4
-7	-2 or ∅	5	10	16	35	50

(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.

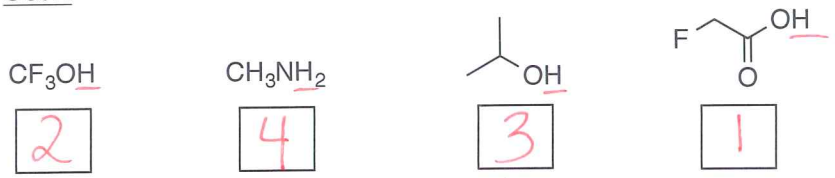
Set 1



2	3	4	1

5pts

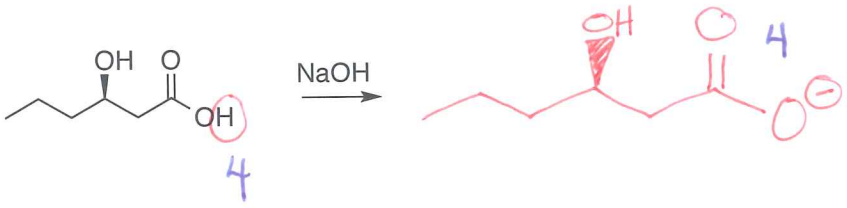
Set 2



2	4	3	1

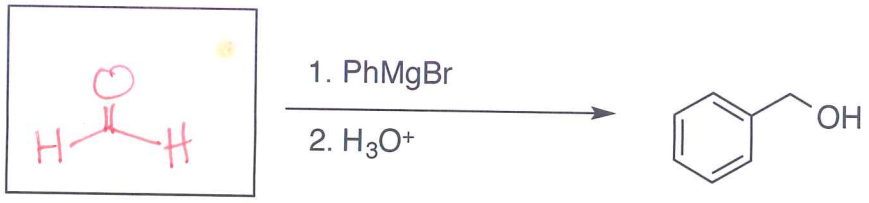
5pts

(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.

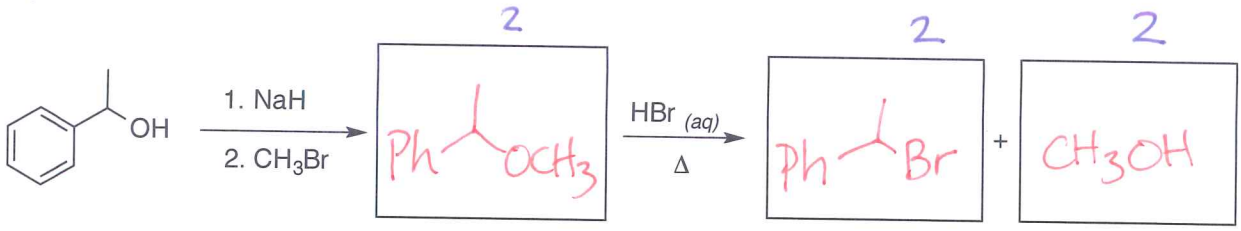


4. (*30 points*) **Single Step Reactions - Fill in the missing product or reactants in each reaction.** 6 pts each

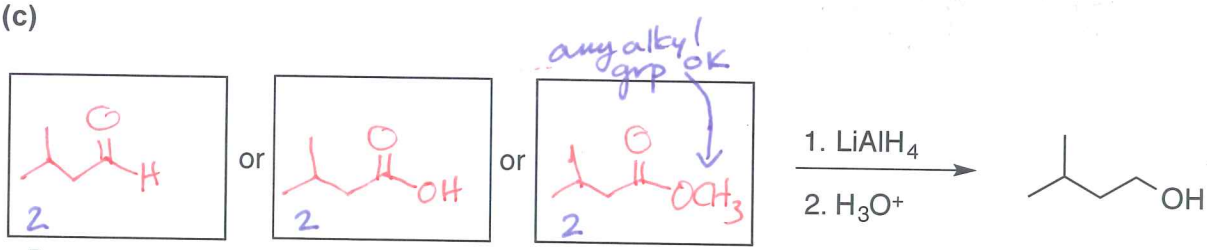
(a)



(b)

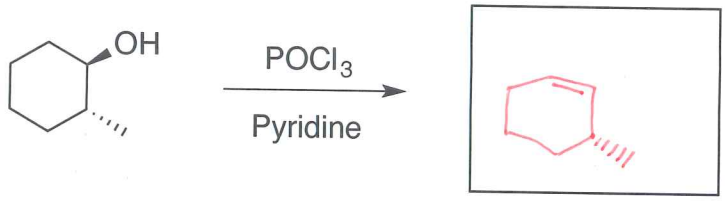


(c)

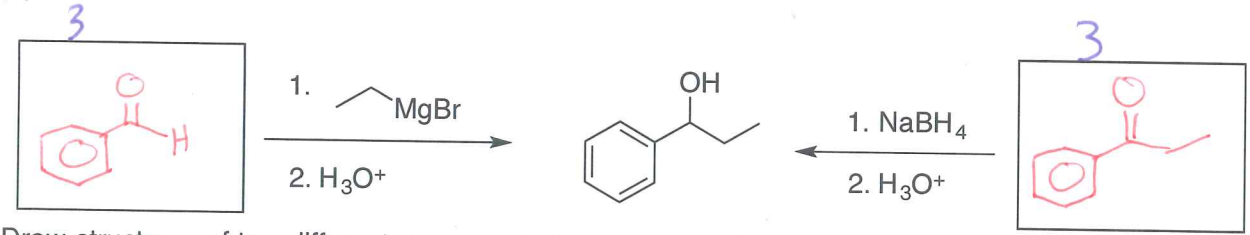


Draw structures of 3 different compounds that would react with $LiAlH_4$ to give this same product.

(d)



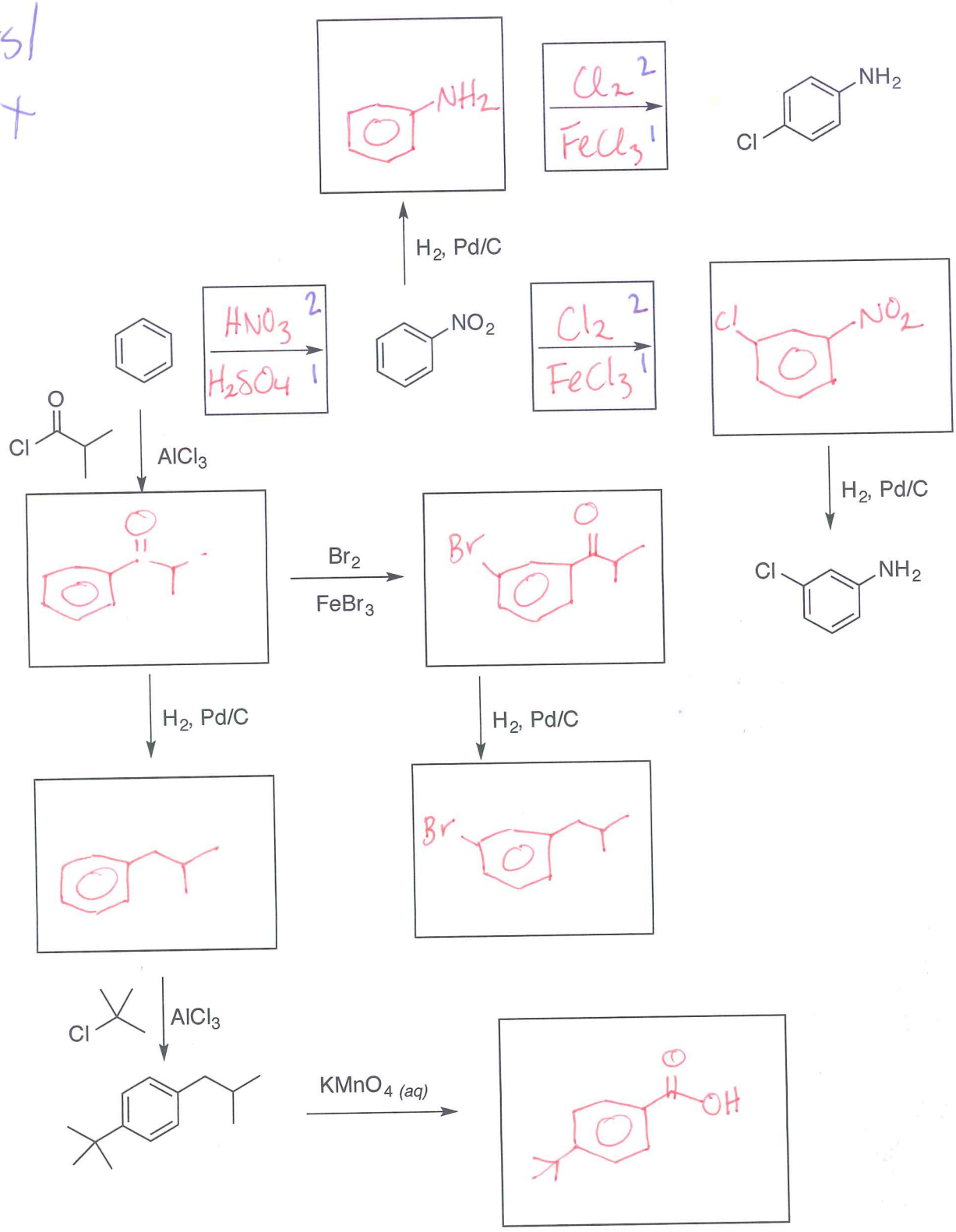
(e)



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**.

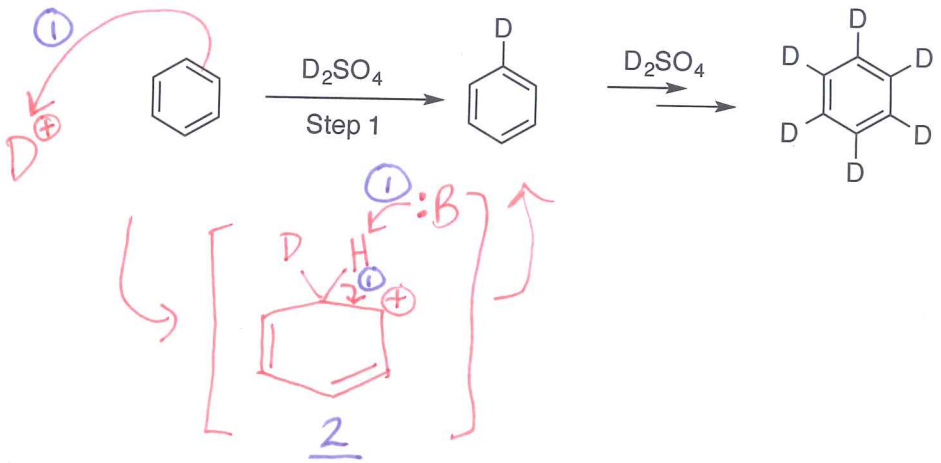
3pts/box



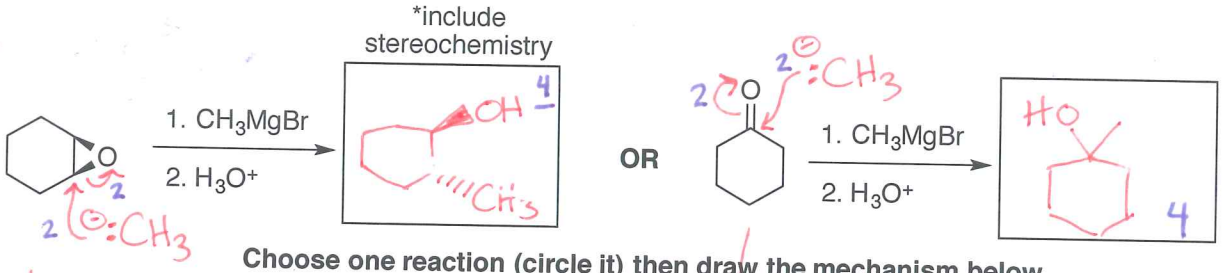
 Last Name, First Initial _____

6. Mechanisms pb same as VA

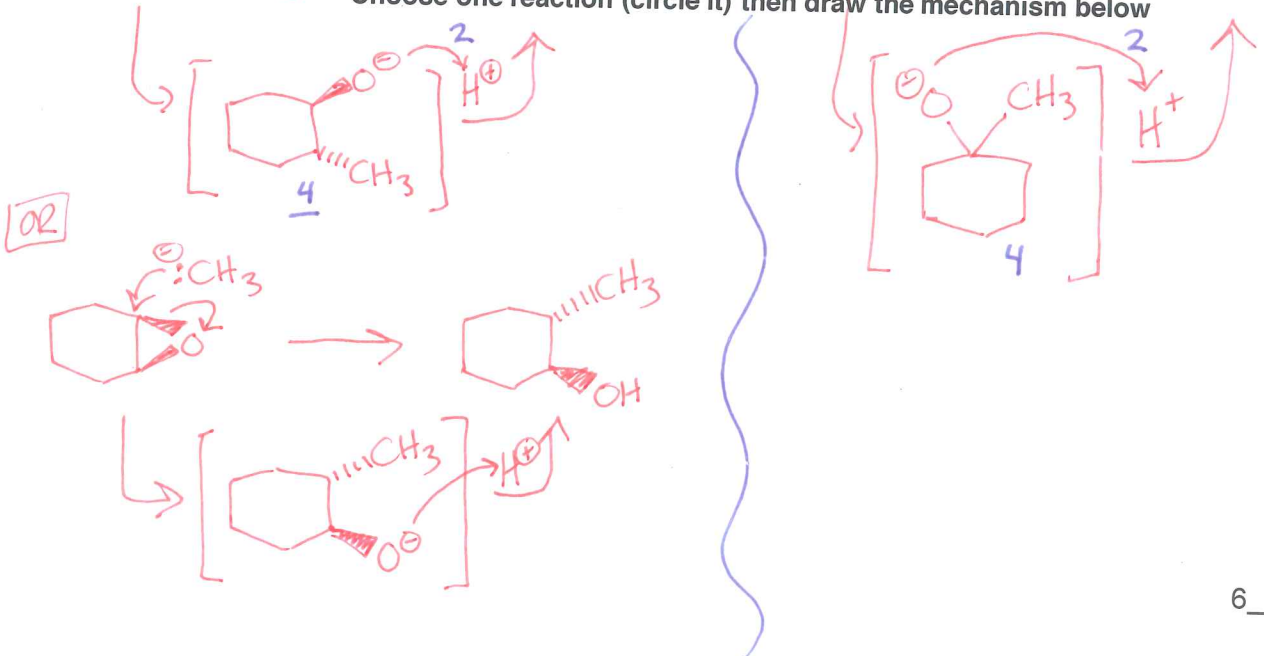
(a) (*5 points*) When benzene is treated with D_2SO_4, deuterium slowly replaces all six hydrogens in the aromatic ring. Explain by showing the **mechanism for Step 1 of the reaction only**. Include the **reaction intermediate** and **curved arrow notation**.



(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

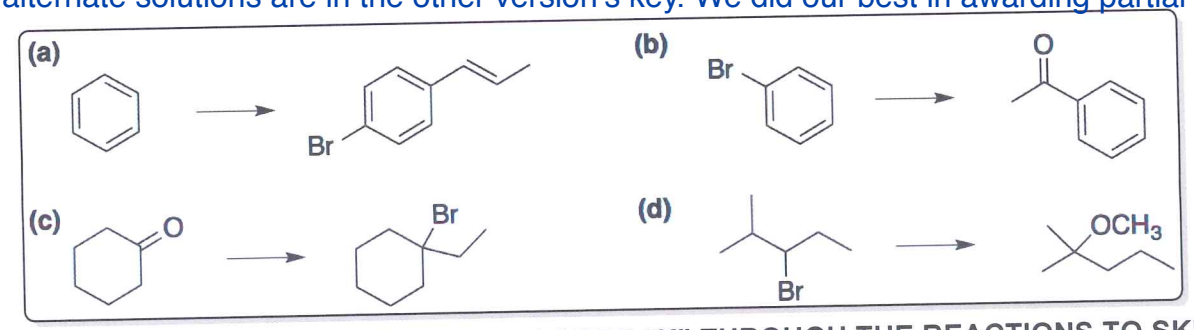


15pts each

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

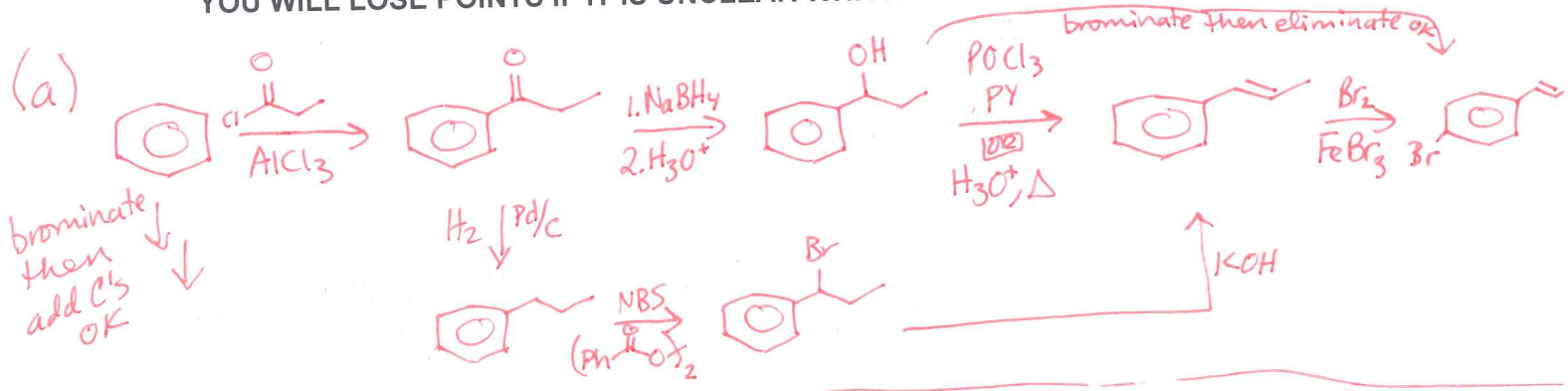
Carry out the synthesis of the indicated target molecules using the starting material provided and any other reagents or sources of carbon needed. **Show the product after each reaction.** No mechanisms. Partial credit is given where possible so if you're stuck, take a deep breath then work backwards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

Some alternate solutions are in the other version's key. We did our best in awarding partial credit.

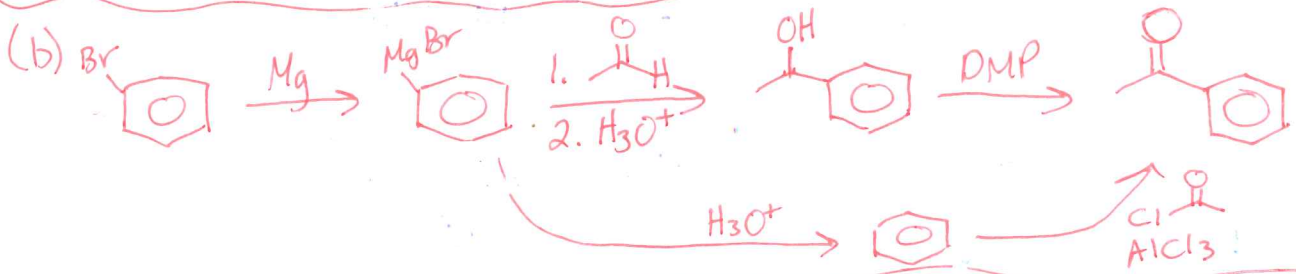


CHOOSE TWO – CIRCLE THEM. PUT A LARGE "X" THROUGH THE REACTIONS TO SKIP.
YOU WILL LOSE POINTS IF IT IS UNCLEAR WHICH PROBLEMS YOU ARE CHOOSING!

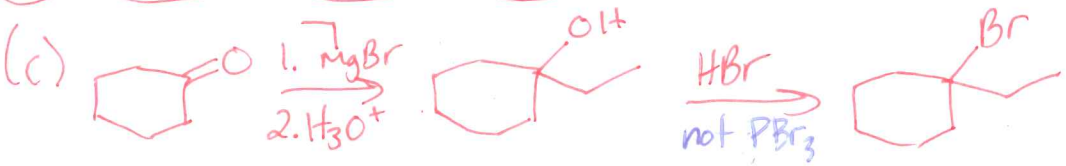
(a)



(b)



(c)



(d)