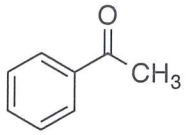
1. Nomenclature

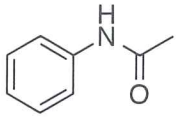
12

(a) (~~10~~ *points*) Each compound below contains an arene. **List the other functional group in each compound.**

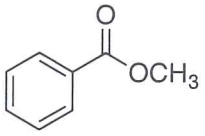
3pts each



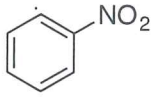
ketone



amide



ester

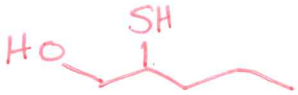


nitro

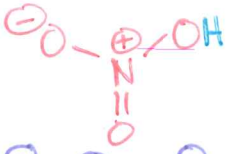
(b) (*20 points*) **Draw structures** corresponding to the following names.

5 pts each

2-Mercaptopentanol

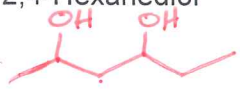


Nitric Acid (Lewis Structure)



3pts- charges

2,4-Hexanediol

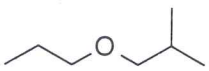


(*E*)-2-Ethyl-2-buten-1-ol

18

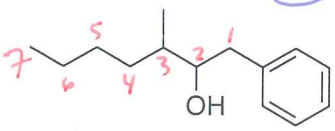
(c) (~~20~~ *points*) **Provide IUPAC names** for **any three** of the following compounds. "X" out the ones to skip.

6 pts each



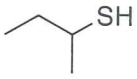
Propyl (2-methylpropyl) ether

Propyl isobutyl ether

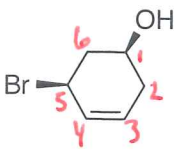


1-Phenyl-3-methyl-2-heptanol

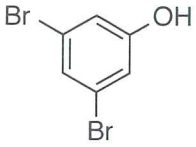
OK



2-butanethiol or 2-mercaptobutane



(1*S*,5*S*)-5-Bromo-3-cyclohexenol



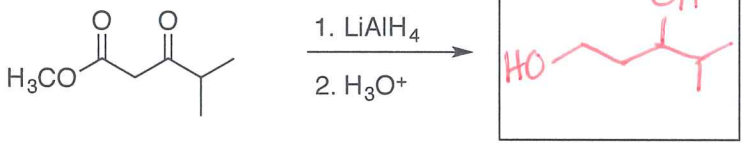
3,5-Dibromophenol

meta-Dibromophenol

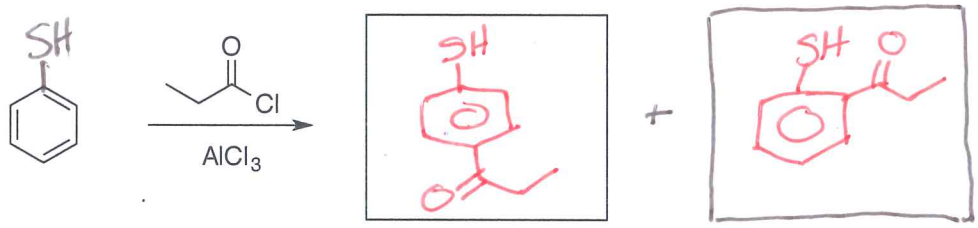
3. (*30 points*) **Single Step Reactions – Choose any five, skip any two reactions ("X" them out). Fill in the missing product or reactants in each reaction.**

6 pts each

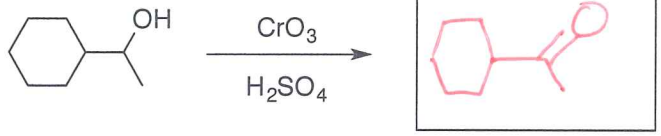
(a)



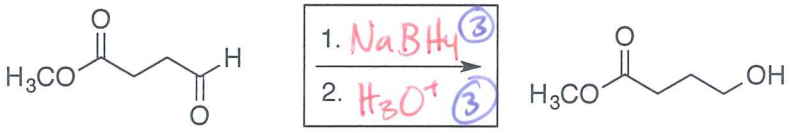
(b)



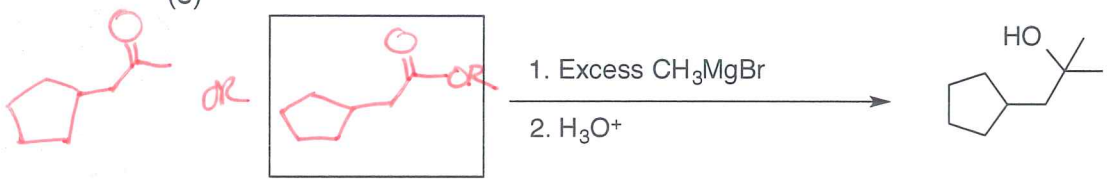
(c)

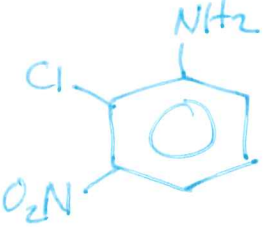


(d)

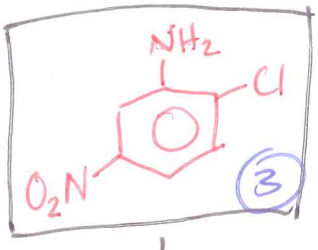


(e)



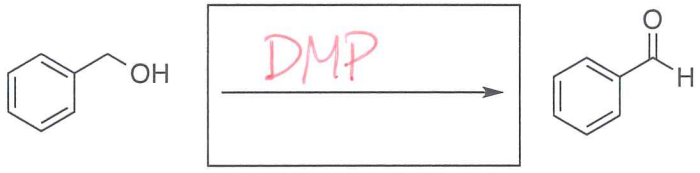


OR

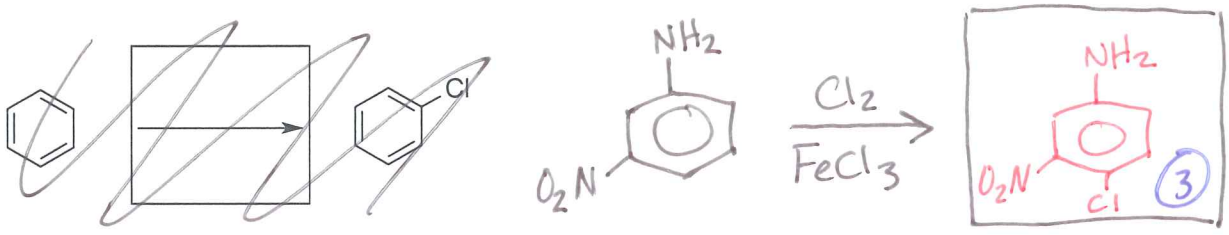


+

(f)



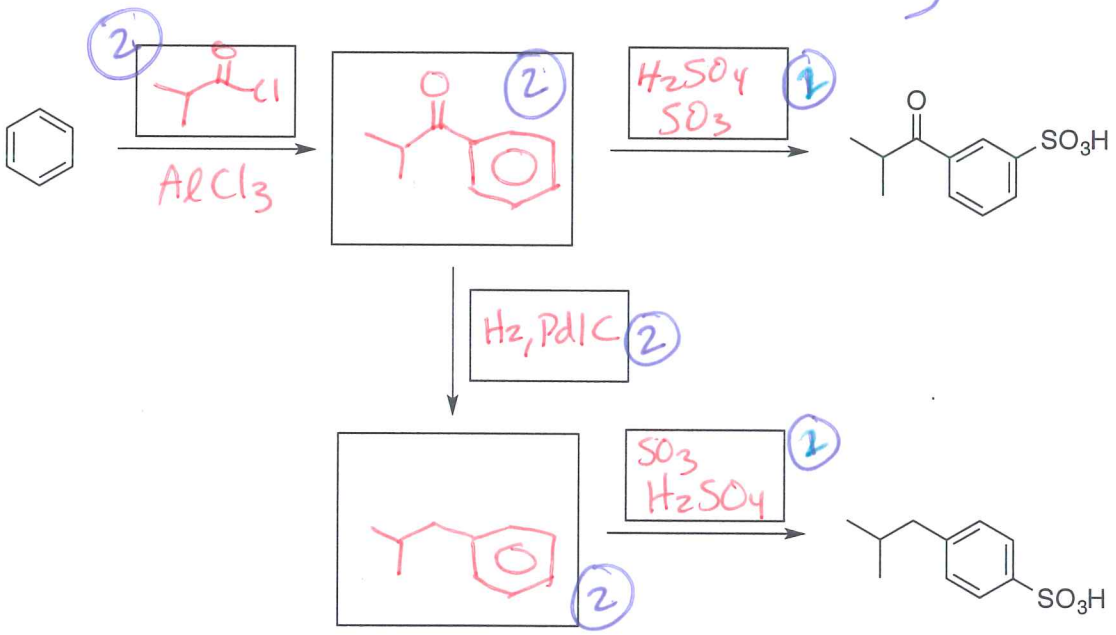
(g)



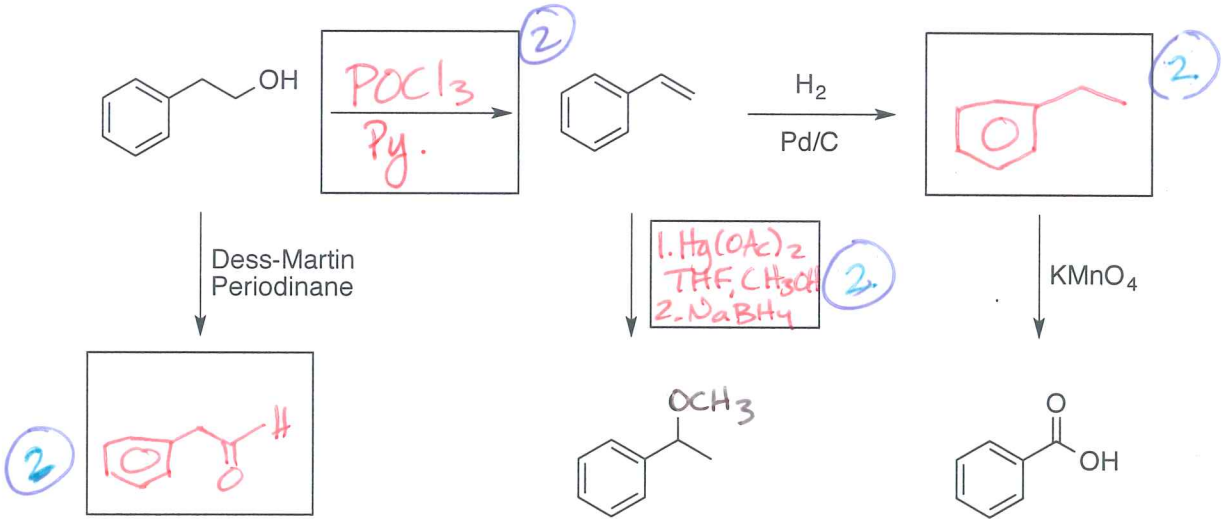
4. (*20 points*) **Reaction Puzzles** – Fill in the missing **reagents** or **product**.

Puzzle 1

*has to be FC 1st b/c $-SO_3H$ is a strong deactivator



Puzzle 2



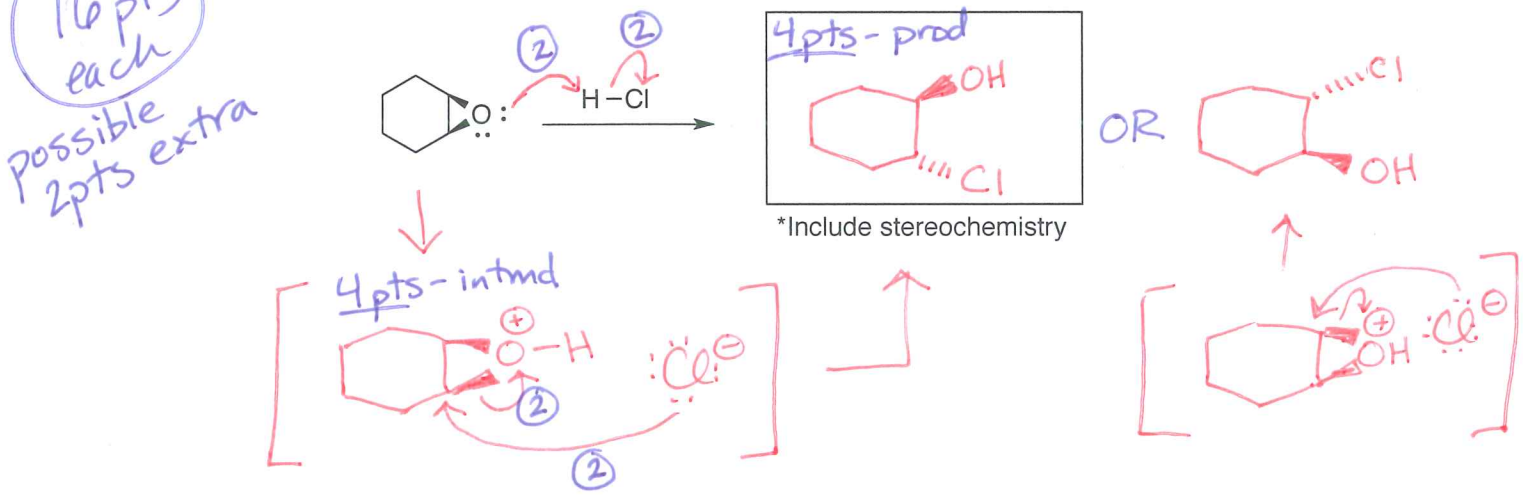
5. Mechanisms – complete any two mechanisms. skip one by placing a large X over the entire reaction, otherwise the first two will be graded.

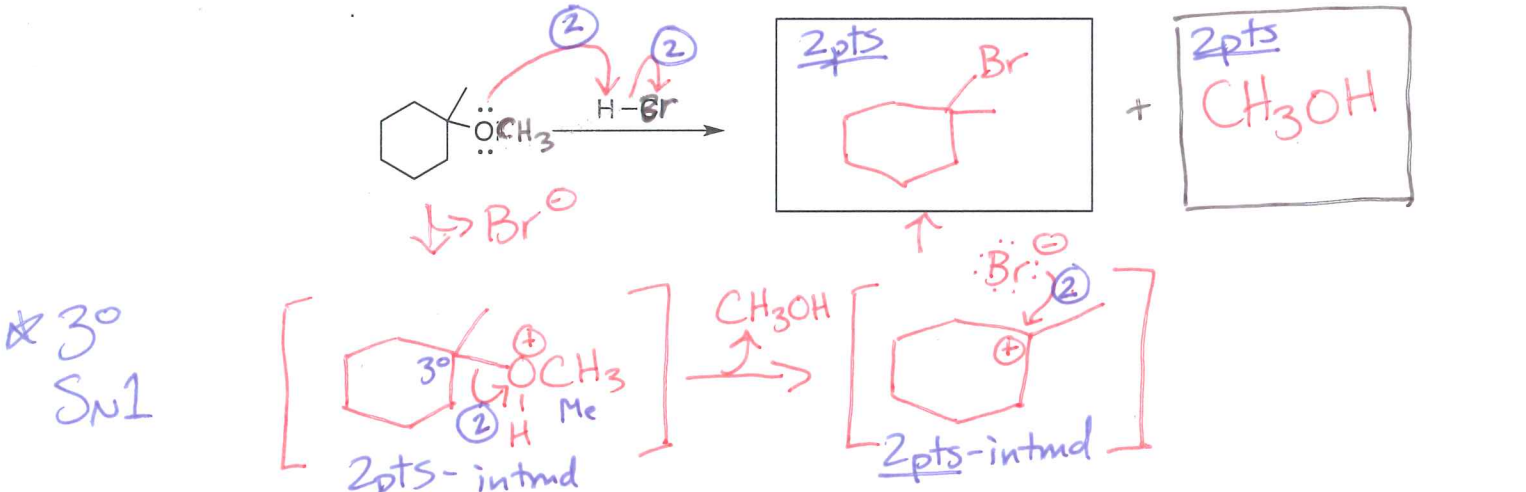
32

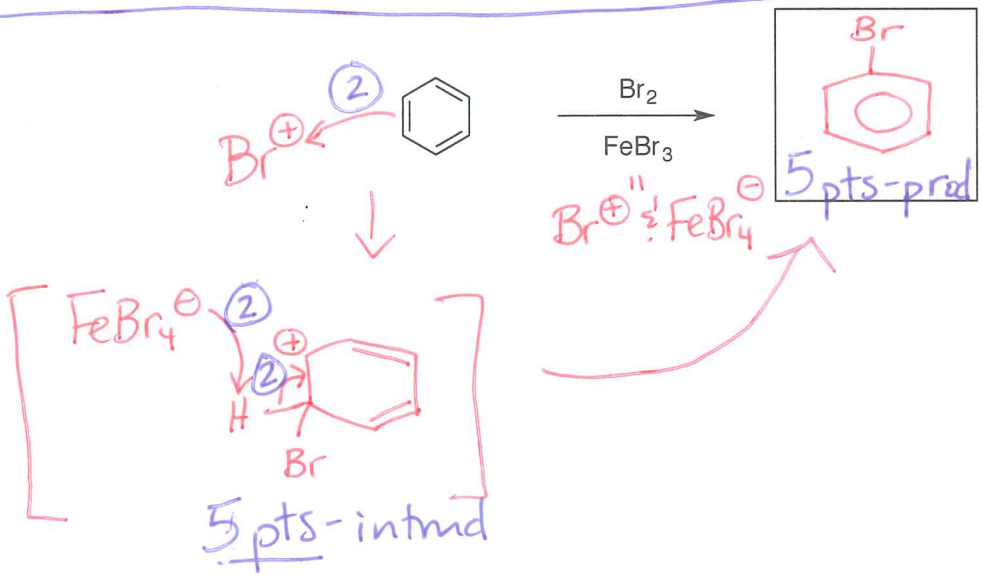
(~~30~~ *points*) Show the **product** and full **arrow-pushing mechanisms for any two reactions** (including all acid-base steps, no "PT"). Be sure to clearly indicate all **charged atoms** and **intermediates** after each step.

16 pts each

possible 2pts extra





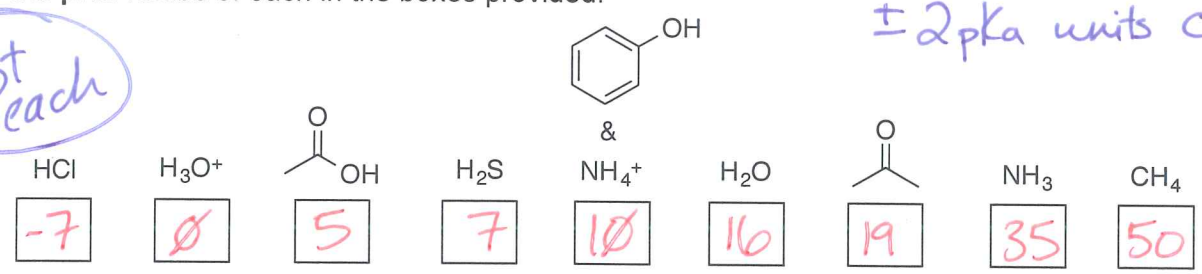


2. Acid-Base Chemistry

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

1 pt each

± 2 pKa units OK

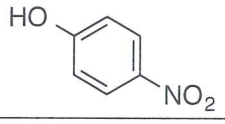
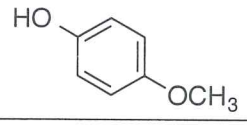
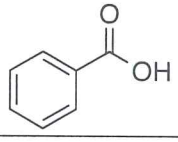
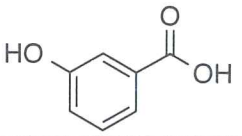


-7	Ø	5	7	10	16	19	35	50

(b) (*10 points*) **Rank** the following sets of compounds in terms of acidity where **1 is the most acidic.** Provide your answer by circling ranking options **I**, **II**, or **III**.

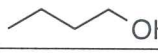
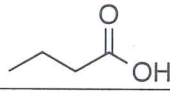
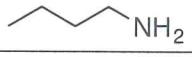
Set 1

5 pts

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

Set 2

5 pts

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

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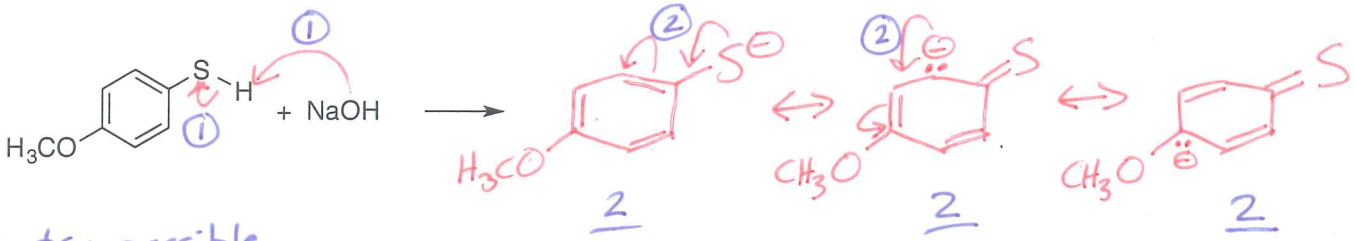
(c) (*11 points*) Draw the **products** of the following reaction and **two additional non-equivalent resonance structures** of the conjugate base. Include **arrow-pushing** for each step.

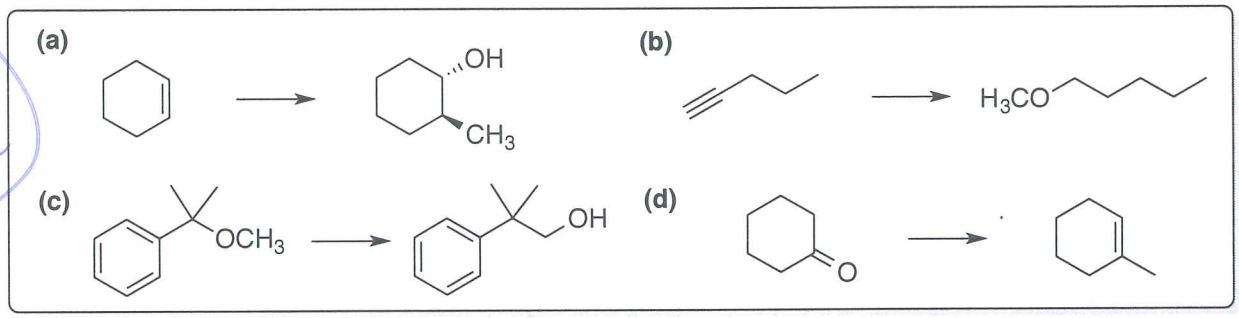


1 extra possible

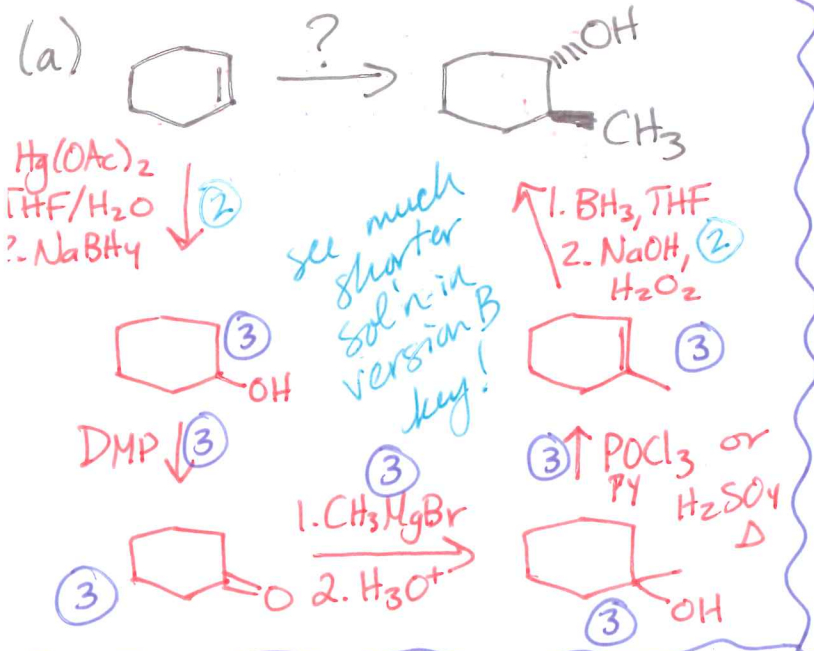
6. (*50 points*) **Multi-Step Synthesis – Choose any two**

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 your way backwards and/or forwards.

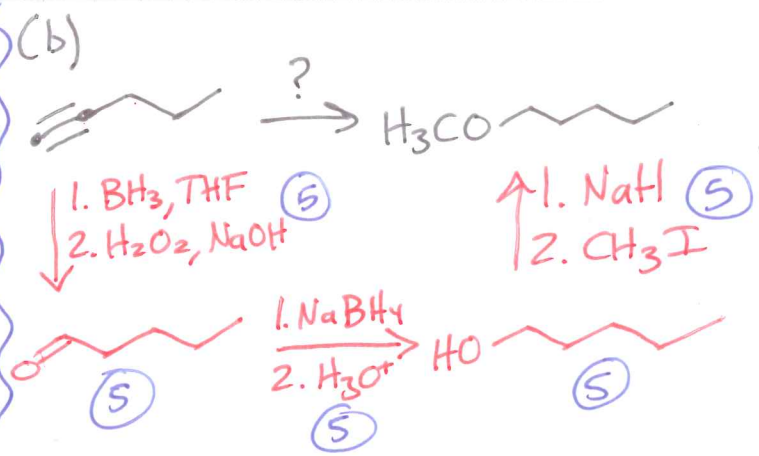
25 pts each



(a)



(b)



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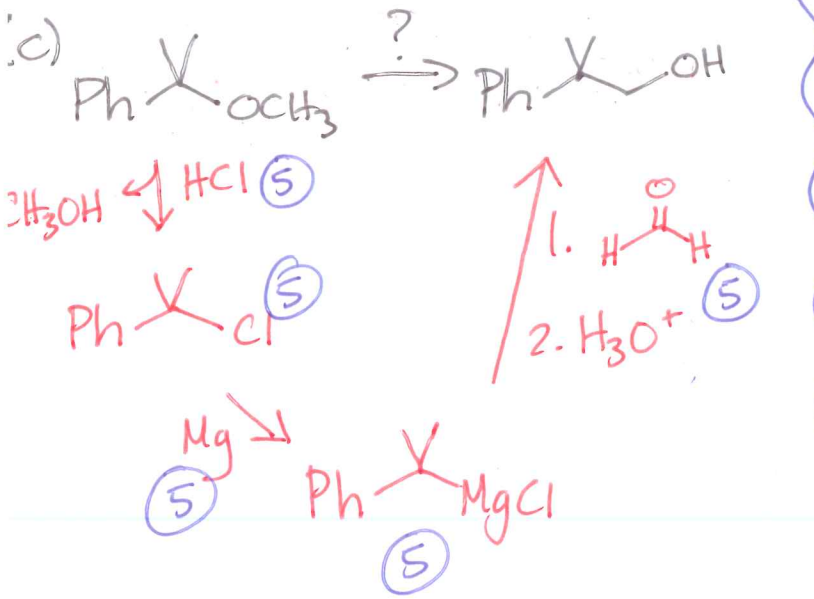

(d)