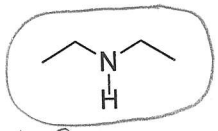
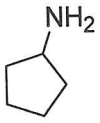
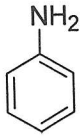
Key - Exam 2 - 3331
Summer 09 - Minger

1. Circle the best answer for each question. (15 pts)

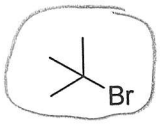
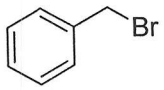
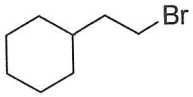
1a. Which of the following compounds **cannot** be reacted with a ketone or aldehyde (in the presence of catalytic acid) to form an imine?

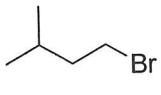





would form enamine

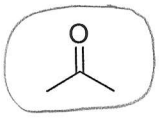
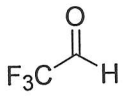
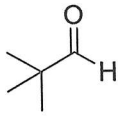
1b. Which of the following compounds is **not** a good choice to be an electrophile in a Williamson ether synthesis?



Electrophile must be 1° or methyl

1c. Which of the following carbonyl compounds has the **least** amount of hydrate present at equilibrium? Values of $K_{hydration}$ are given under each compound.

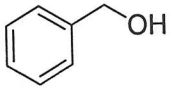
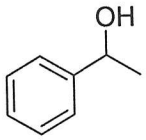




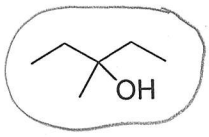
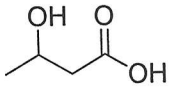
1.06 | 2.0 x 10^3 | 2.0 x 10^{-3} | 3.0 x 10^4 | 0.23

Smallest K

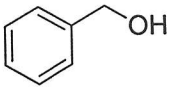
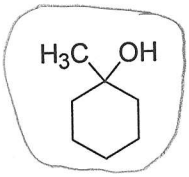
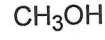
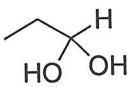
$K_{hydration} = \frac{[hydrate]}{[carbonyl]}$

1d. Which of the following alcohols **cannot** be made by reducing a carbonyl compound with a hydride reducing agent?

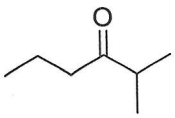



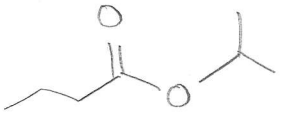
1e. Which of the following compounds **cannot** be oxidized to produce a carbonyl-containing compound?

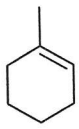





2. Predict the major organic product(s) of each of the following reaction conditions. If more than one stereoisomer forms, **draw them both.** (You do not have to indicate relative amounts.) (18 pts)

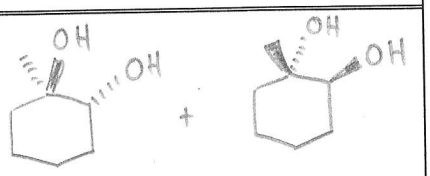


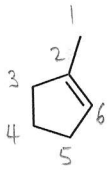
MCPBA



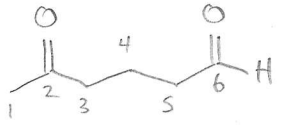


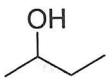
1. MCPBA
2. H_3O^+



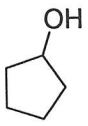


1. OsO_4
2. HIO_4

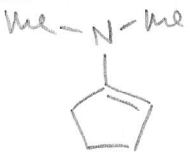


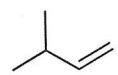


1. PCC
2. HCl (1.0 equiv)
   NaCN (1.2 equiv)

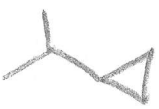


1. H_2CrO_4, acetone, H_2O
2. $HNMe_2$, trace H_2SO_4, molecular sieves

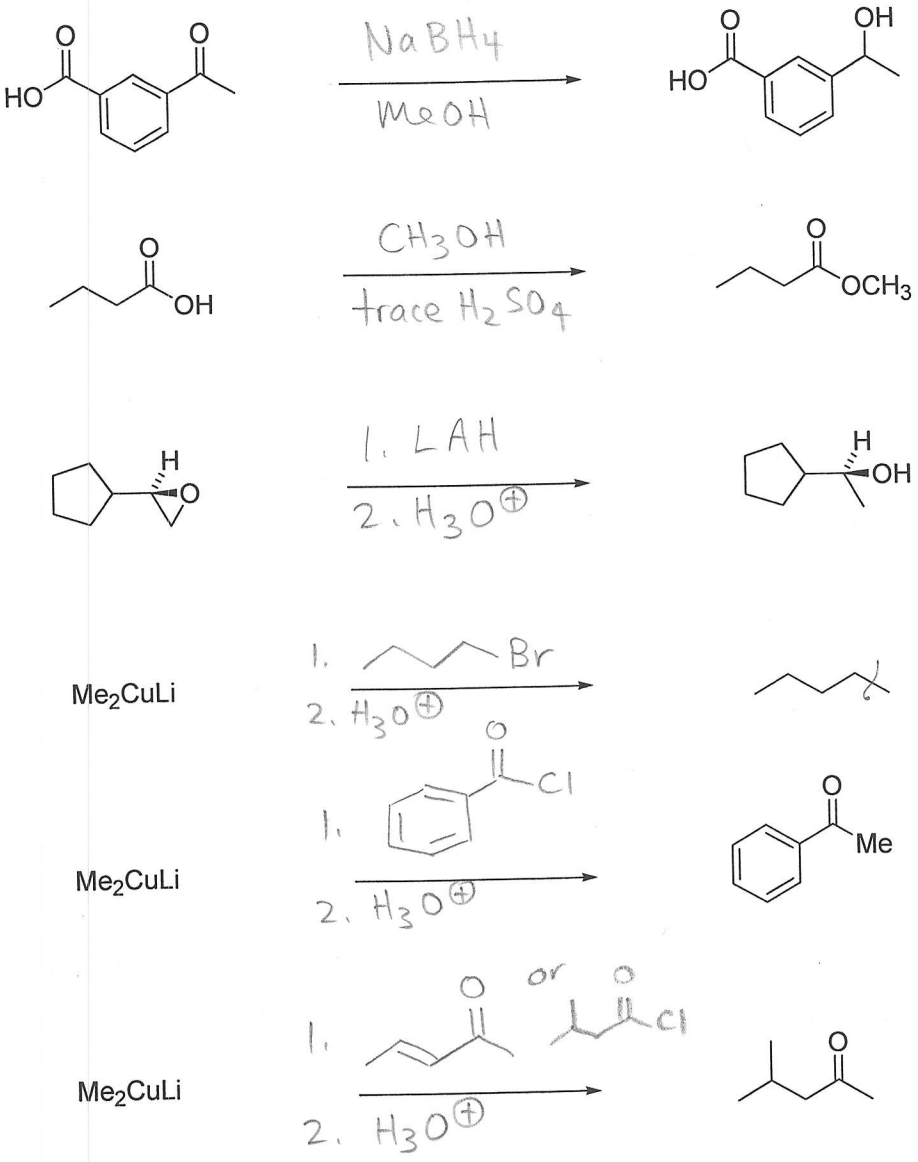




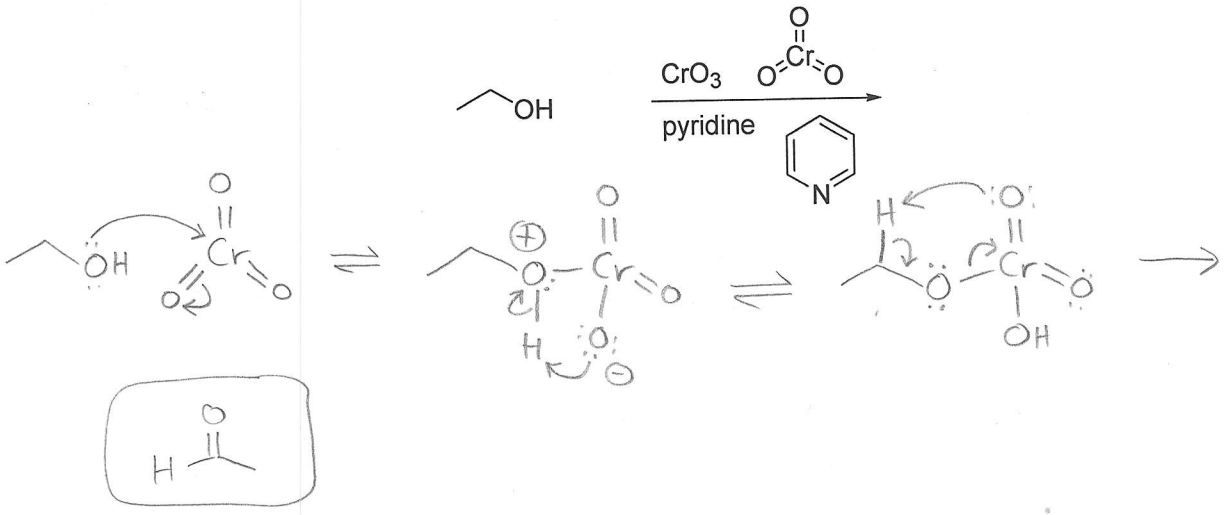
ICH_2ZnI



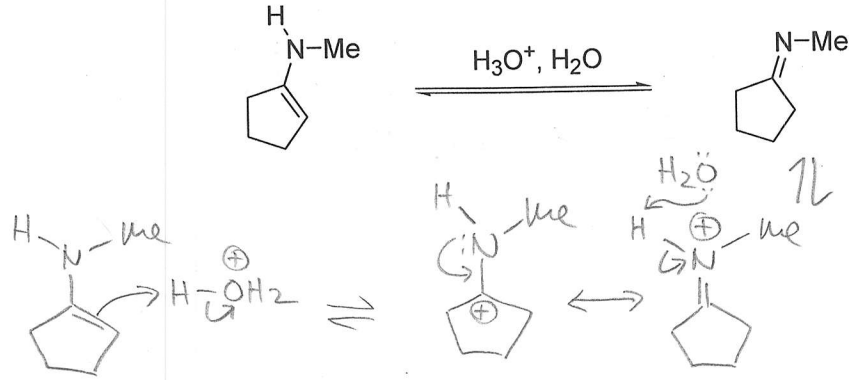
3a. Supply the missing reagents required for each of the transformations shown here. (18 pts)



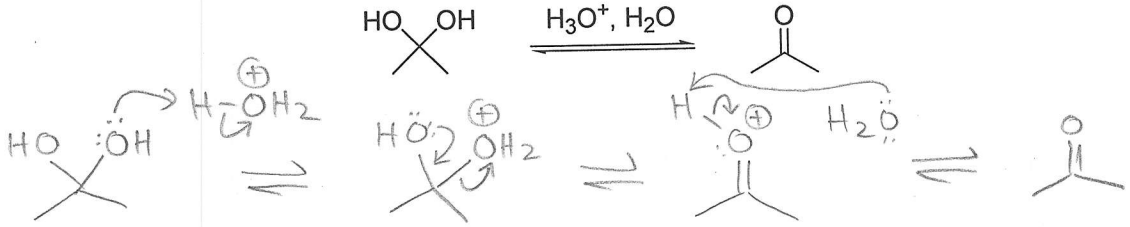
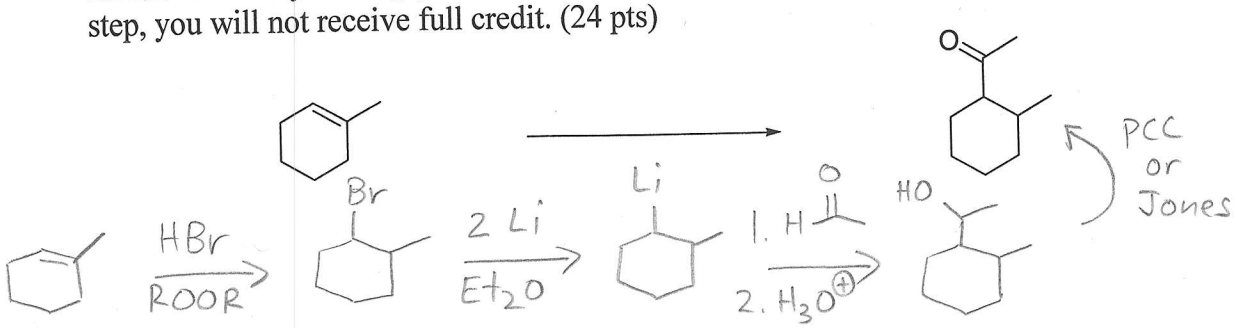
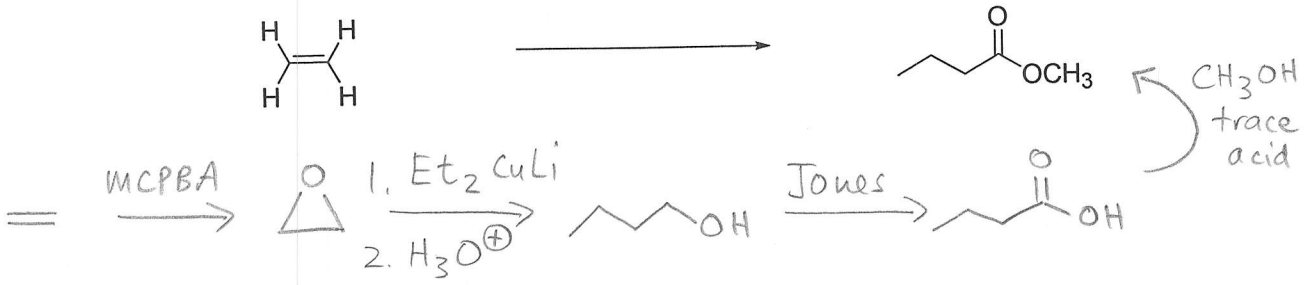
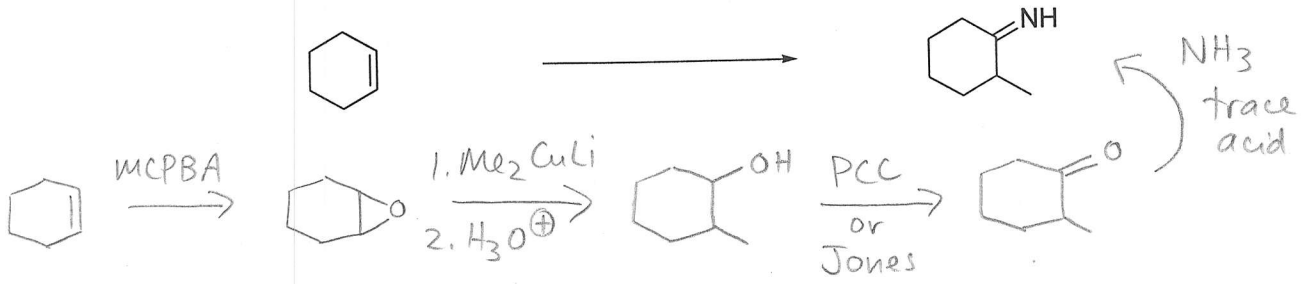
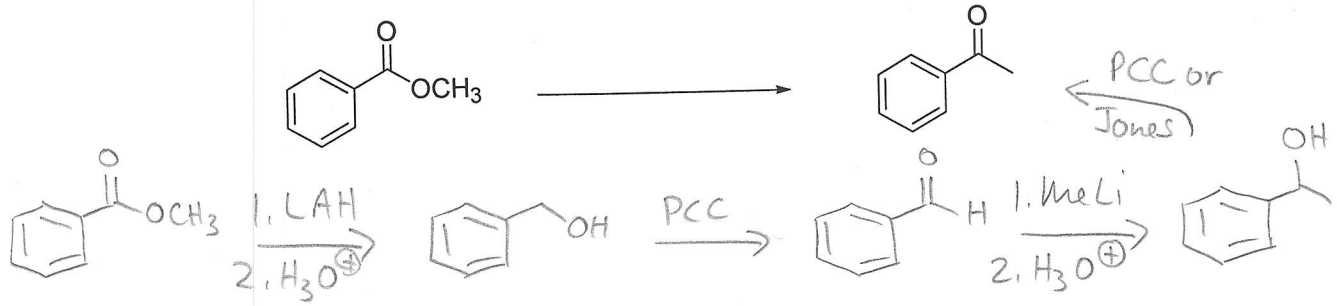
4a. Predict the product and draw a mechanism to illustrate its formation. Include all necessary lone pairs, curved arrows and non-zero formal charges for full credit. Structures of reagents are drawn next to their names. (10 pts)



4b. Enamines can isomerize to imines in acidic conditions. The product distribution at equilibrium is determined by the relative stabilities of the two compounds. Draw a mechanism to illustrate the transformation shown here (from left to right). Include all necessary lone pairs, curved arrows and non-zero formal charges for full credit (6 pts).



4c. Draw a mechanism for the transformation shown here (from left to right). Include all necessary lone pairs, curved arrows and non-zero formal charges for full credit (5 pts).



5. Design a multi-step synthesis for **any three of the following four transformations. CROSS OUT THE ONE YOU DO NOT WANT GRADED.** Provide the reagents needed for each step and the product of each step. Do not draw any mechanisms. If you simply write a list of reagents without showing the product of each step, you will not receive full credit. (24 pts)