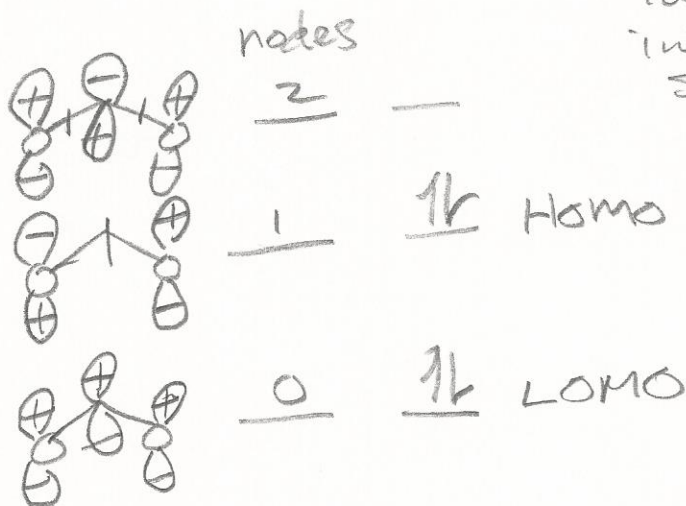


9. (3 pts) The HO group of the carboxylic acid is:

- a. sp<sup>2</sup> hybridized
- b. sp<sup>3</sup> hybridized
- c. a hydrogen bond donor
- d. a hydrogen bond acceptor
- e. all of the above
- f. a, and c
- g. b, c, and d

10. (4 pts) The benzene ring is typically considered to be an electron accepting group that can stabilize radicals and anions. Draw the acid base equilibrium for benzoic acid in water to form the carboxylate. Draw the MO diagram for the carboxylate anion and use your diagram to explain why the acidity of benzene is not much greater than that of acetic acid.

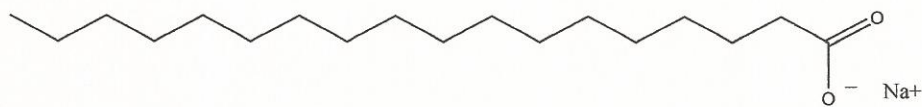


The LUMO has mixing into the benzene  $\pi$  system but the HOMO of the carboxylate anion does not since there's a node where the benzene is connected.

11. (3 pts) The order of reactivity at the carbonyl carbon for a carboxylic acid derivatives is:

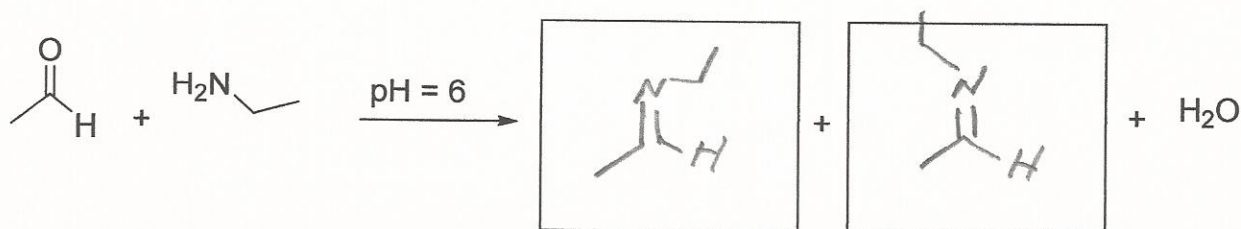
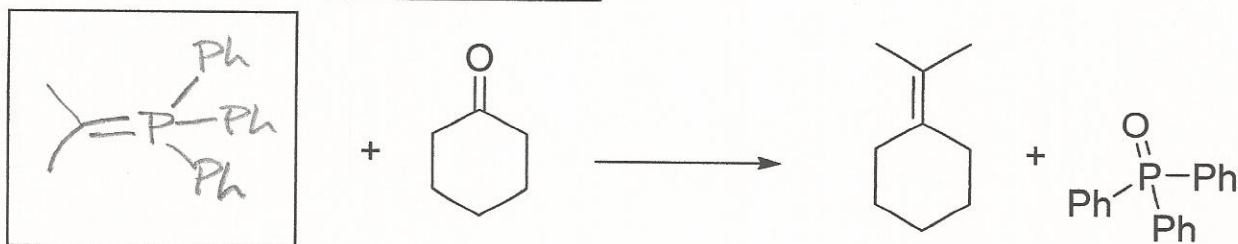
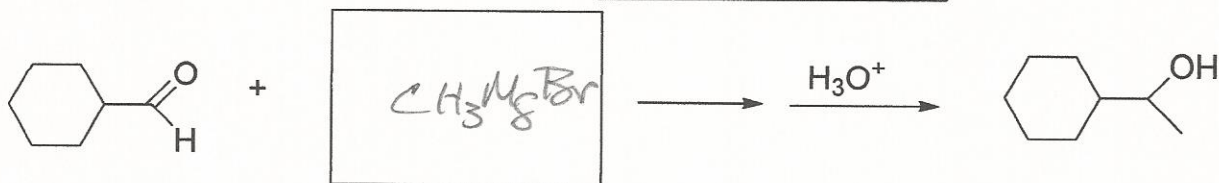
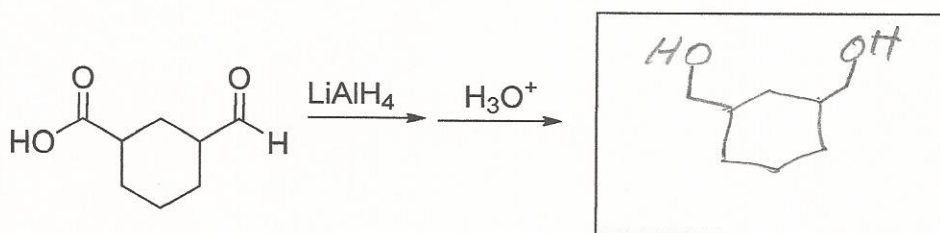
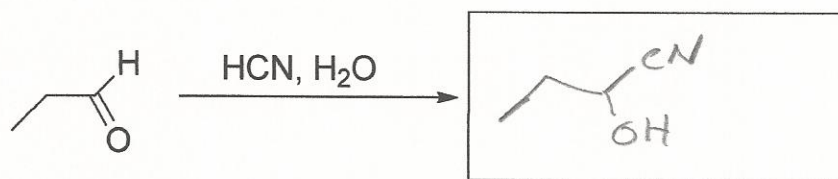
- a. ester > amide > acid chloride > anhydride
- b. amide > ester > anhydride > carboxylic acid
- c. acid chloride > anhydride > ester > amide
- d. ester > anhydride > amide > acid chloride
- e. anhydride > ester > amide > carboxylic acid
- f. none of the above

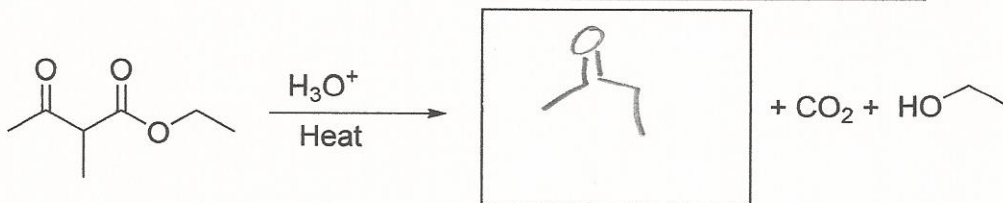
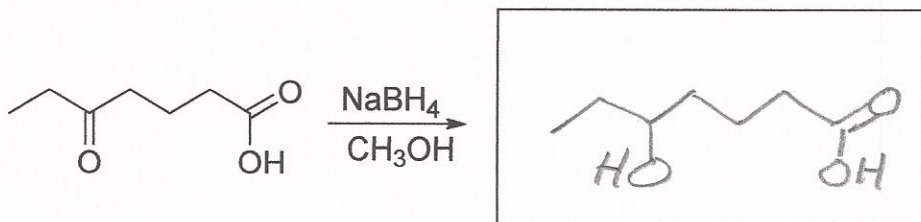
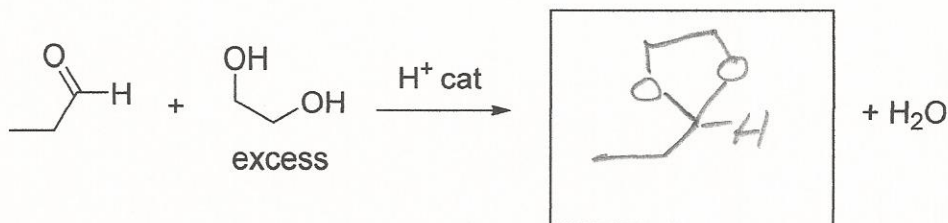
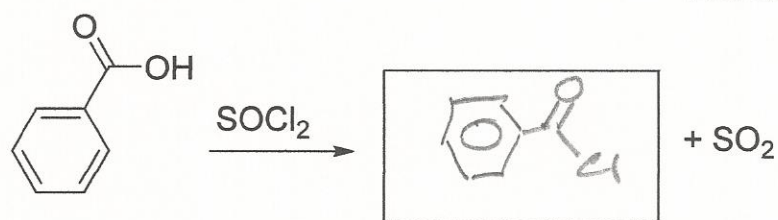
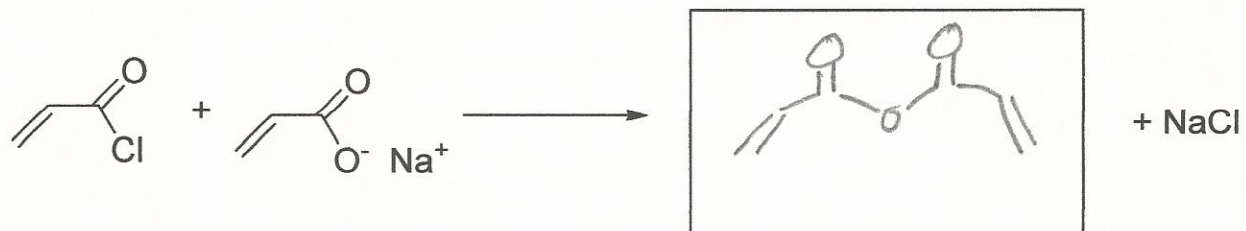
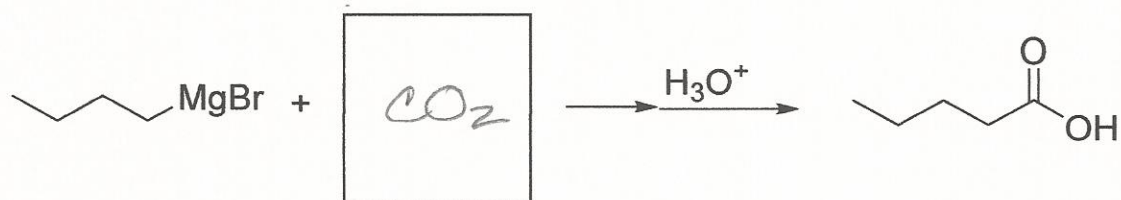
9. (3 pts) the molecule drawn below is an example of a:

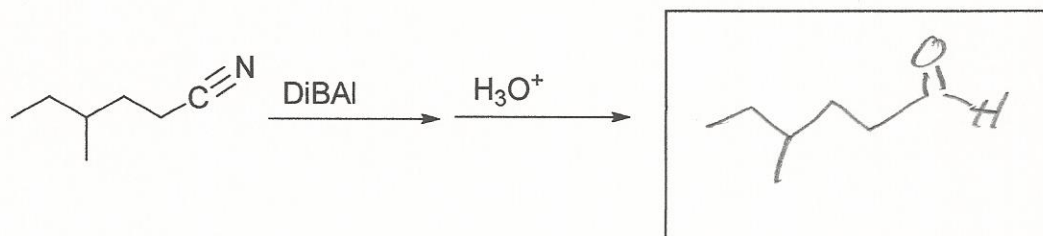
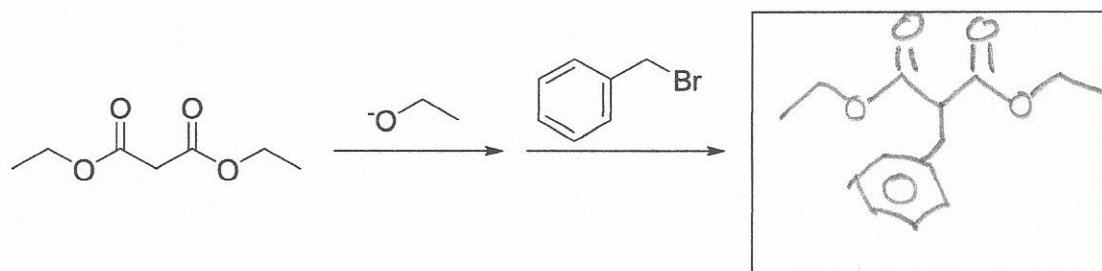


- a. Wax
- b. Soap
- c. Triglyceride
- d. Phospholipid

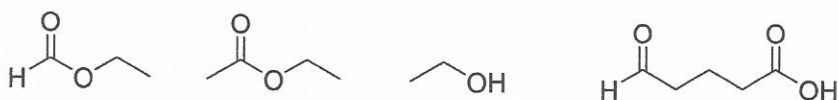
10. (56 pts) for the reactions shown below fill in the box to complete the chemical equation. Draw only organic products.







13. (12 pts) Using only the organic molecules drawn below and any other non-organic reagents that are needed draw a synthetic scheme for the preparation of **A**.



2 pts for each step right.

