

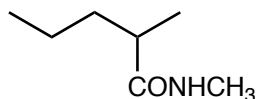
Problem Set Chapter 21

Organic Chemistry for
Life Sciences: CHM 224

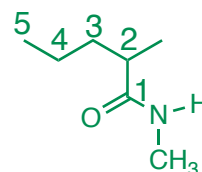
Name _____

DUE: Monday April 1 in class

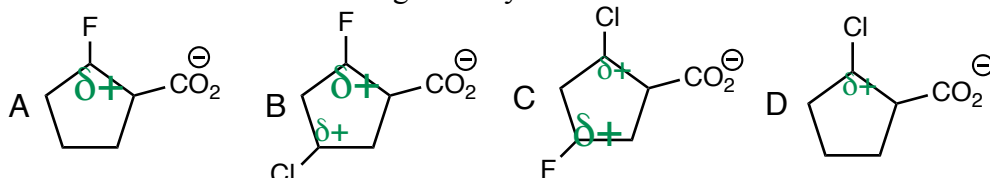
1. What is the IUPAC name of the following compound?



N-methyl 2-methylpentanamide



2. Which one of the following carboxylic acids is MOST acidic and which is LEAST acidic?

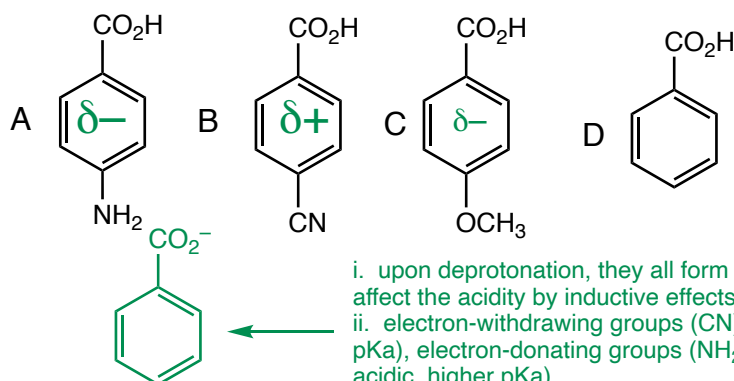


MOST: B

LEAST: D

- they will all form CO_2^- conjugate base upon deprotonation. The more the negative charge is stabilized, the easier it is to form and more acidic the starting acid
- The C-Cl and C-F bonds are both polar, but the C-F bond is MORE polar than the C-Cl bond and will therefore induce a larger $\delta+$. The larger $\delta+$ stabilizes the CO_2^- to a greater extent. The closer it is to the CO_2^- , the more stabilizing~!

3. Which one of the following compounds will have the highest pKa and the lowest pKa?

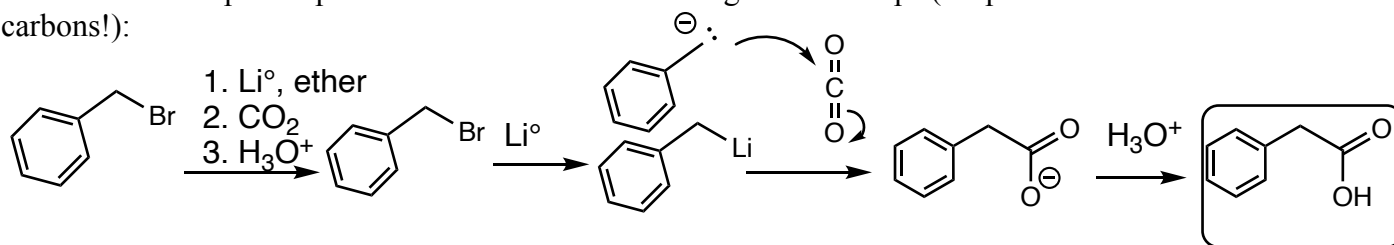


highest pKa: A

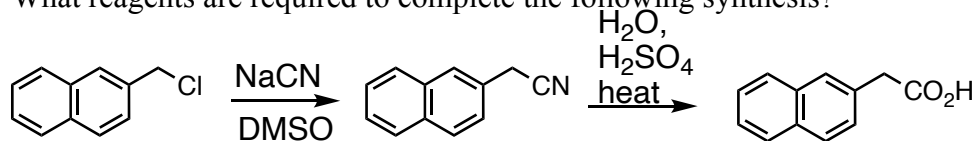
lowest pKa: B

- upon deprotonation, they all form negatively charged CO_2^- group. The substituents affect the acidity by inductive effects
- electron-withdrawing groups (CN) stabilize the negative charge (= more acidic, lower pKa), electron-donating groups (NH_2 , OCH_3) destabilize the negative charge (=less acidic, higher pKa)

4. What is the expected product for each of the following reaction steps (keep track of the number of carbons!):



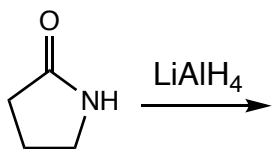
5. What reagents are required to complete the following synthesis?



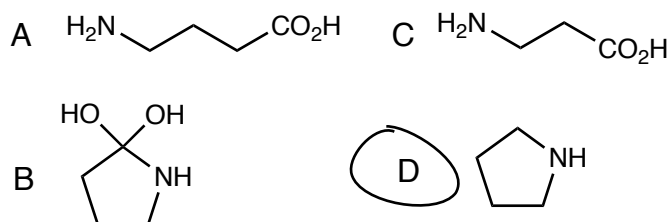
$\text{S}_{\text{N}}2$ reaction to form nitrile

hydrolysis of a nitrile to form a carboxylic acid

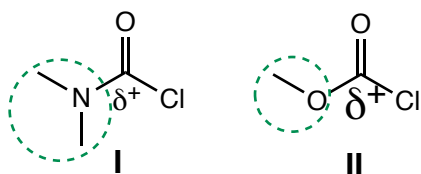
6. Which of the following is the product expected from the reaction below:



• reduction of an amide with LiAlH_4 produces the corresponding amine

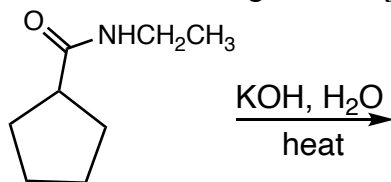


7. Which of the following compounds is expected to react faster with a nucleophile? Briefly explain.

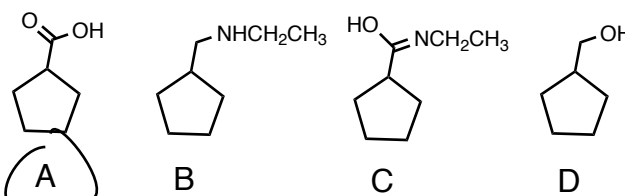


- the Cl is the same on both molecules.
- they differ by the groups on the left (circled in green)
- I has an $\text{-N(CH}_3)_2$ group, II has an -OCH_3 group
- The $\text{-N(CH}_3)_2$ group is a stronger electron donating group than the -OR group.
- Therefore, the δ^+ on II will be greater than that on I
- reaction with nucleophiles will occur faster on the molecule with the larger δ^+ (i.e., I).
- Additionally, the larger $\text{-N(CH}_3)_2$ group will inhibit attack of a nucleophile on the carbonyl more so than the smaller -OCH_3 group

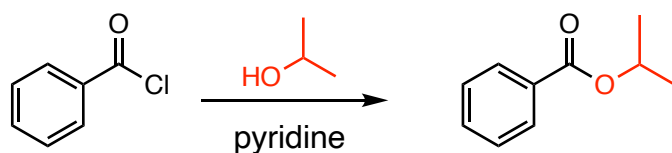
8. Which of the following is the major product of the reaction below?



• these are hydrolysis conditions for an amide which leads to the parent carboxylic acid



9. What reagent(s) is required to complete the following reaction?

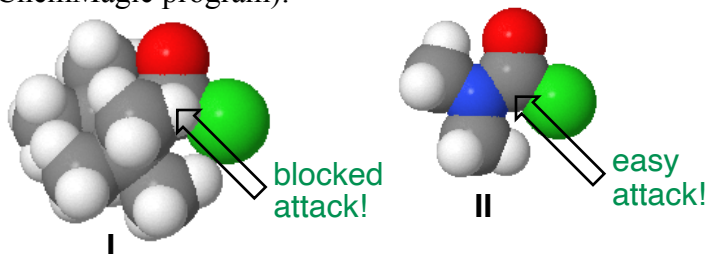
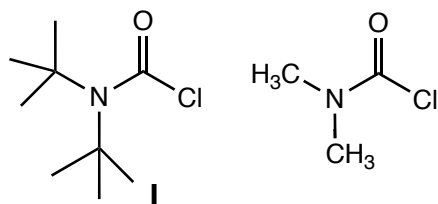


acid chloride

ester

- esters are formed by reacting a carboxylic acid derivative (in this case the acid chloride) with an alcohol
- pyridine is included to trap the HCl byproduct that is formed

10. Despite having similar δ^+ on the carbonyl groups, compound II was found to undergo reaction with nucleophiles at a much faster rate than compound I. Briefly explain this observation (HINT: try drawing the two molecules as space filling models using the ChemMagic program):



As can be seen in the space filling models the tert-butyl groups block attack of a nucleophile at the carbon of the carbonyl group on compound I. The methyl groups of compound II do not sterically hinder attack as much as the much larger tert-butyl groups. Therefore, reaction on II is faster than on I